Proceedings of the 45th Annual National Conference of the American Association of Zoo Keepers

August 18 – 22, 2019

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Thursday August 22, 2019

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

Dr. Susie Ellis and CeCe Seiffert
International Rhino Foundation

Abstract

Once found roaming from Afghanistan all the way through the Indonesian archipelago, Sumatran and Javan rhinos 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 67 animals in one site, Ujung Kulon National Park. Javan rhinos were declared extinct on mainland Asia when the last rhino was poached in Vietnam in 2010. Sumatran rhinos number fewer than 80 individuals spread across 10 small sub-populations. 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 report 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.

LEWA WILDLIFE CONSERVANCY – KENYA WILDLIFE SERVICE:

MOUNTAIN REGION VETERINARY UNIT

2017 ANNUAL REPORT

AUTHORED BY DR MATTHEW MUTINDA

EDITED BY GEOFFREY CHEGE

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List of Abbreviations

- HEC - Human Elephant Conflict
- HWC - Human Wildlife Conflict
- KWS - Kenya Wildlife Service
- Lewa / LWC - Lewa Wildlife Conservancy
- MVU - Mobile Veterinary Unit
- NRT - Northern Rangelands Trust
- SNR - Samburu National Reserve

I. PROGRAMME BACKGROUND

The Kenya Wildlife Service (KWS) – Lewa Wildlife Conservancy (Lewa) Mountain Region Veterinary Unit (MVU) is a service delivery vehicle and an emergency response team dedicated to providing timely and effective veterinary care to all wildlife in need in Northern and Eastern parts of Kenya. The MVU is supported by a recently established veterinary unit in the Meru Conservation Area. MVU consists of one veterinarian, Dr. Matthew Mutinda, from the KWS, and one driver from Lewa.

MVU prioritizes threatened wildlife species, such as black and white rhinos, elephants, Grevy's zebras, wild dogs, hirolas, and mountain bongos. MVU's work encompasses several areas, including:

- The Aberdares and Mt. Kenya National Parks, Buffalo Springs, Samburu and Shaba National Reserves;
- Private conservancies and ranches in Laikipia, such as Lewa, Borana, and Ol Pejeta Conservancy, and Solio Ranch; and
- At least 33 community conservancies operating under the umbrella of the Northern Rangelands Trust (NRT).

The 2017 Annual Report covers wildlife veterinary activities that took place in 2017. These activities include translocations, rescue operations, fixing of tracking devices on animals for research, and medical treatment of sick animals.

II. SUMMARY OF ACHIEVEMENTS

Through the MVU, Lewa and KWS improved the living conditions of wildlife in protected areas and adjoining communities. With its commitment to protecting and preserving wildlife, the MVU achieved the following in 2017:

- Clinical Interventions – delivered 112 clinical wildlife interventions to rhinos, elephants, Grevy's zebras, lions, and other species;

- Conflict Mitigation – successfully mitigated multiple potential incidences of human-wildlife conflict through the translocation of animals destroying property, or those in danger, to neighbouring conservancies;

- Veterinary Management Interventions - improved prey-predator population ratios to protect rhino and Grevy's zebra populations through temporary lion contraception; prevented the outbreak of diseases, and vaccinated 1,429 domestic dogs to mitigate the spread of Canine Distemper to wild dogs; fitted tracking devices on 14 wildlife for security monitoring and research;

- Innovation and Best Practice – continued with the Wildlife Apprentice Program to train new veterinarians on interventions for wildlife management; contributed scientific knowledge and research through published work in peer-reviewed journals.

The following sections provide a detailed report of the MVU's activities and progress made in 2017.

III. CLINICAL INTERVENTIONS

A. Clinical interventions per species

The MVU prioritized cases involving threatened wildlife species, where majority of clinical interventions involved emergencies that required immediate attention. The following list is a summary of cases that required the MVU's interventions in 2017, which will be discussed further in the report:

- Rhinos and elephants received 48% of the total wildlife intervention cases carried out within the year. Both species are abundant in the region and they are commonly affected by diseases and suffer from fractures and wounds from poaching attempts and territorial fights with members of their own species. Gunshot wounds from failed poaching attempts contributed to the bulk of these cases.

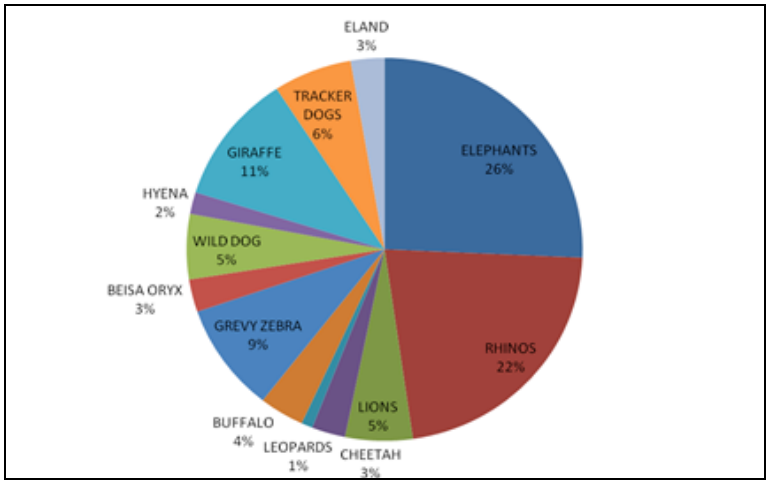
- Animals stuck in snares in community areas and the forested area of Mt. Kenya National Park were also common and required emergency interventions. Snares are targeted at small wildlife; however, bigger wildlife get injured and trapped in metal spikes, causing them harm.

- Disease outbreaks still remain a significant threat to endangered species. In 2017, there was a massive outbreak of Canine Distemper in the region that decimated a significant population of wild dogs in Laikipia County. Cattle transmitted diseases caused massive die-off of buffaloes and impalas in Mugie Conservancy in Laikipia. This may have been caused by infected cattle and wildlife feeding from the same pasture and water source.

- With NRT and other partners, the MVU rescued and transferred 13 elephant calves (less than a year old) to the Reteti Elephants Sanctuary. The survival rate of these calves at the elephant orphanage was about 60%.

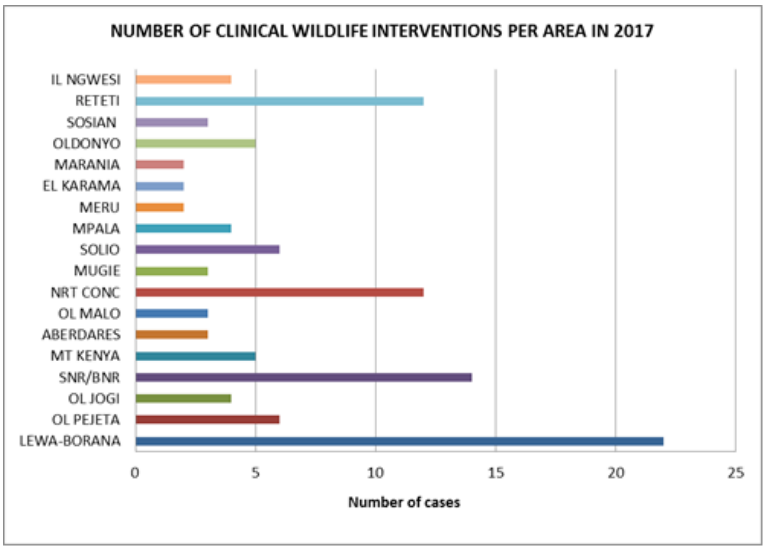
It is worth noting that Lewa closed 2017 without losing a single rhino to poachers in its conservancy grounds. This four-year streak of zero rhino casualties in Lewa since 2013 can be attributed largely to improved rhino monitoring and anti-poaching surveillance measures. An analysis of wildlife veterinary interventions in 2017 showed a 12% reduction in clinical interventions for gunshot wounds from poaching compared to 2016.

Chart 1: Percentage of MVU interventions per species in 2017



B. Clinical interventions per conservation area

Chart 2: Number of MVU Clinical Wildlife Interventions per area in 2017



The Lewa-Borana Conservancy recorded the highest number of clinical cases since it is the base of MVU. The Samburu landscape comes second with its large number of migratory elephants. NRT Community Conservancies had the third highest number of veterinary cases due to its various wildlife species that required urgent medical attention. The other cases were reported from areas with equally large populations of rhinos and elephants.

C. Reasons for intervention and types of treatment given to at-risk, injured, and sick animals

The MVU moved across Northern and Eastern Kenya to conduct wildlife rescues and medically treat animals. The table below provides a comprehensive overview of the reasons for MVU's wildlife interventions in 2017.

Chart 3: Reasons for MVU Wildlife Intervention in 2017

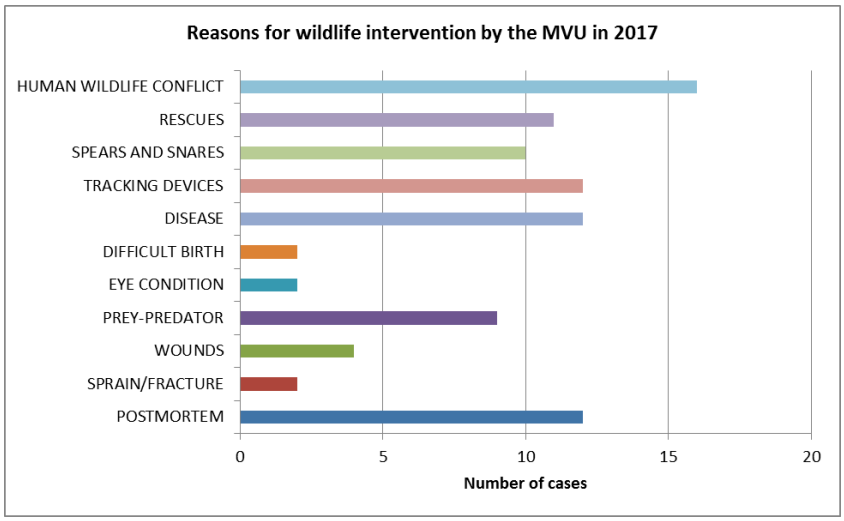


Plate 1: (L) A territorial male Grevy's zebra with a foreign object on its leg, which was removed successfully by the MVU. (R) Bullet wound treatment in a bull elephant

Plate 2: A poached black rhino and the bullet that was retrieved after postmortem

D. Restored health of sick and injured animals through medical treatments

Excessive hunting on the part of predators is a key factor in frequent MVU deployments. In Lewa and Samburu National Reserve (SNR), lions and cheetahs prey on Grevy's zebras at disproportionate numbers. Cheetahs, for example, prey on Grevy's zebra foals that are under one year of age. This predation leaves Grevy's zebras vulnerable to injuries or even death. In 2017, MVU has successfully treated a total of 27 Grevy's zebras that have been wounded and injured in prey-predator interactions.

Plate 3: An x-ray image showing the kinked posture between C3 and C4 of a Grevy's zebra foal

The MVU also conducted general health check-ups for other animals. In addition, a few animals that had complications while giving birth received appropriate care and support.

Plate 4: (L) The hind legs of a calf is seen hanging from the giraffe in labour. (R) A chimpanzee from the Ol Pejeta Conservancy receiving a health check-up

IV. CONFLICT MITIGATION

A. Mitigated human-wildlife conflict (HWC) through wildlife translocation

The MVU played a critical role in mitigating HWC—and potential injuries and deaths it can result in—by moving animals to other conservancy areas. HWC ensues from negative interactions between communities and wildlife. Examples include when animals get caught by snares targeted at smaller bodied wildlife, or when animals destroy properties in communities. Extended dry seasons further exacerbate HWC, since it intensifies competition for water and pasture, and scarcity pushes wildlife to look for food from lush community farmlands.

The MVU conducted several strategic translocations in 2017. In Leparua, a lion was moved after it killed 56 goats within 18 months. A buffalo, on the other hand, was moved from Kitchich Camp in the Mathews Ranges after it became a threat to the Camp. Six elands were also translocated from Ol Donyo Farm to the Sera Rhino Sanctuary to avoid further damage on a flower farm. The elands' gene pool at the Sera Rhino Sanctuary has since benefited from this new movement. Other animals translocated to the Sera Rhino Sanctuary included 14 oryxes. These animals were guided by a helicopter over a distance of 14 kilometers to shepherd them toward the Sanctuary. The fence was opened about 140 meters wide and was immediately closed after the push.

Plate 5: (L) A cheetah with a wire snare around its waist. (R) A buffalo translocated from Kitchich Camp to the Sera Rhino Sanctuary

Table 1: Translocations of wildlife facilitated by the MVU in 2017

Species	Donor	Recipient site	Number
Lion	Lewa/Leparua	Tsavo National Park	1
Buffalo	Kitchich Camp	Sera	1
Eland	West Gate	Sera	1
Eland	Ol Donyo Farm	Sera	6
Oryx	Adjacent areas	Sera	14

B. Enhanced wildlife GPS-tracking

Some of the wildlife under Lewa's protection are fitted with GPS-enabled collars which help in wildlife monitoring and research. Similar to how mobile phones work, the data received from these collars help conservancies determine wildlife's preferred habitats, migration patterns, diet, and sources of food and water. The GPS-tracking system also alerts researchers and security teams when a collared animal is in danger. In 2017, the MVU fitted varied GPS-tracking devices on 14 wildlife. These operations are normally sanctioned by KWS to ensure scientific merit and conservation integrity. Thus, only animals with pressing cases are permitted to undergo this procedure.

Plate 6: A lion fixed with a GPS-enabled collar

Table 2: Wildlife species fitted with GPS-enabled collars by the MVU in 2017

Species	Area	Institution	Number
Beisa Oryx	Nakuprat	NRT	3
Elephant	Baragoi	STE	1
Wild Dog	Marania	Mpala	2
Wild Dog	Ol Jogi	Mpala	2
Lion	Lewa/Borana	Lewa	3
Lion	Sosian	Lion Landscapes	3

While the technology-enabled GPS tracking system is a vital piece to protecting wildlife, an equally important process for the preservation of rhinos is ear notching. Ear notching is the process by which each rhino is allocated a permanent, unique national identity number on its ears. These marks facilitate efficient identification and monitoring of rhinos. In 2017, the MVU successfully ear notched five white rhinos within Lewa (Table 3). Among other wildlife, the MVU also conducted postmortems on dead rhinos to determine the cause of death.

Table 3: Black and white rhinos earnotched by the MVU in 2017

Location	Species	ID Code	Name	Outcome
Lewa	White Rhino	2585	Gilbert	Successful
Lewa	White Rhino	2593	Harari	Successful
Lewa	White Rhino	2588	Tulifu	Successful
Lewa	White Rhino	2601	Emso	Successful
Lewa	White Rhino	2603	Nasa	Successful

Table 4: Black and white rhino postmortem report in 2017

Area	Species	Sex	Cause of Death	Horn
OPC	Black	Male	Drowning	Present
Solio	White	Male	Poaching – Dart	Present
Solio	White	Female	Poaching – Dart	Absent

C. Reduced human-elephant conflict through trimming of elephants' tusks

Human-wildlife conflict is a common problem that occurs when wildlife and human beings compete for resources. Reports from Kenya indicate that majority of the reported HWC cases in the last decade are related to Human-Elephant Conflict (HEC) incidents. The most common incident that results in HEC, injuries, and loss of elephants lives is when elephants encroach on communities' farmlands and destroy crops. Different methods have been researched and implemented to prevent this around the world. At Lewa, while the conservancy has installed high-cost electric fences to separate elephants from communities, clever elephants have used their tusks to break through the fences to get to farmlands. As a stop gap measure to reduce the breakages of fences and prevent rising HEC incidents, the MVU partially trimmed the tusks of problematic elephants to reduce its impact on fences that border exclusion zones.

Another measure employed by the MVU was to translocate elephants from conflict prone zones to the safety of parks and conservancies. These interventions have reduced conflict with farming communities residing close to conservancies.

Table 5: List of elephants whose tusks were trimmed on Lewa in 2014 – March 2017

No.	Name	Age	Sex	Date de-tusked
1	Mjasiri	Adult	Male	22/02/2014
2	Keke	Adult	Male	22/02/2014
3	Monk	Adult	Male	27/11/2014
4	Tyson	Adult	Male	26/11/2014
6	Melo	Adult	Male	07/02/2015
7	Tony	Adult	Male	13/02/2015
8	Right Tusker	Adult	Male	19/10/2017

V. VETERINARY MANAGEMENT INTERVENTION

A. Improved prey-predator population ratio through lion contraception

Lewa-Borana has an estimated population of about 40 lions in a landscape, which is also home to 11% of the world's Grevy's zebra population, as well as 12% and 15% of Kenya's black and white rhino populations, respectively. Given that 25% of a lion's diet comprises Grevy's zebras, the hunt for these animals skews the proportion of lions to Grevy's zebras and even rhinos.

It was critical to control the lion population in the landscape through hormonal contraception. The MVU selected three prime breeding female lions between three to eight years old as targets for this intervention. From a vehicle, the lionesses were darted with tranquilizer to allow the Vet to subcutaneously administer a Gonadotropin Releasing Hormone implant. This hormone is designed with a slow-release formulation that releases deslorelin, causing temporary sterility lasting at least 24 months. This implant can also be reversed at any time.

Plate 7: (L) Veterinary Apprentice Programme participants Waqqas is seen on the left with an immobilized Grevy's zebra; (R) Sylvia attends to a lion receiving a hormonal implant

Plate 8: Progressive healing of a female Grevy's zebra treated by the MVU after a lion attack

B. Improved wildlife preservation through the Reteti Wildlife Rescue Facility

The primary goal of conservation efforts is to make sure wildlife remain in their natural habitat. Certain cases, however, are brought to the MVU's attention where an animal's continued stay in the wild could compromise its life. For example, an animal in question is brought to an Orphanage after all attempts to rejoin it with other herds have failed. The MVU picks up animals via a helicopter, a caravan aircraft, or by vehicle and takes them to the wildlife Orphanage. Here, rescued animals are hand-raised and serve as ambassadors for this conservation practice. In 2017, with the MVU's help, Reteti Elephant Sanctuary

received 13 elephant calves below one-year old. 60% of these calves survived at the facility. These elephants will be released to Sera's wilderness once it is determined that they are ready to rejoin the wild.

Table 6: Information on the 13 rescued elephant calves

Date	Name	Reason	Location	Sex
07-01-2017	Baawa	Drought		Male
11-01-2017	Kirimon	HWC	Ol Malo Ranch	Male
27-01-2017	Ilingwesi	HWC	Il Ngwesi	Male
21- 02-2017	Sosian	HWC	Sosian Ranch	Male
18-03-2017	Nadosoit	Well	Lodosoit	Female
05-04-2017	Natimana	Well	Nchoro Ngiro	Female
11-06- 2017	Warges	Separated	Sarara	Male
21-06-2017	Impala	Separated	Mpala Ranch	Female
29-06-2017	Kinya	Well	Kinya	Female
03-07-2017	Lchurai	Separated	Tale	Female
12-10-2017	Loisaba	Drought	Loisaba	Male
14- 11-2017	Lemorinjo	Abandoned	Kipsing	Male
18-01-2018	Kapai	HWC	Lenkolii	Female

Plate 9: (L) A rescued baby elephant is on its way to shelter via a helicopter; (R) A baby elephant arrives at the Reteti Wildlife Rescue Facility

C. Prevented the spread of diseases

Disease outbreaks remain a significant threat to endangered species. In 2017, a massive outbreak of Canine Distemper decimated a significant population of wild dogs in Laikipia County. Canine Distemper is a severe and often lethal infectious disease that affects dogs and a broad range of terrestrial and aquatic animals. It is caused by the Canine Distemper Virus (CDV), a Morbillivirus of the Paramyxoviridae family, which is an enveloped and pleomorphic virion with a helical capsid that is associated with a single, non-segmented RNA genome of negative polarity (Merck 2016). The virus can be transferred through direct contact with nasal discharges, oral secretions, and urine of infected animals.

With assistance from the MVU, the Canine Distemper and Rabies vaccination campaign in the immediate surroundings of Lewa and Borana Conservancy vaccinated 1,429 domestic dogs. This activity prevented the spread of the pathogen to other carnivore species while protecting the vulnerable apex predators in the region. Our hypothesis is that wildlife has no immunity to this pathogen, therefore, the CDV spreads much faster among their species compared to domestic animals. Domestic dogs may have an innate immunity due to previous outbreaks or from vaccination.

In a separate case, the MVU mitigated the spread of cattle transmitted diseases which caused widespread fatality among buffalos and impalas in the Mugie Conservancy in Laikipia. We suspect that the disease is attributed to the overlapping use of pasture and water by wildlife and cattle.

Plate 10: (L) Healthy wild dogs about to be tested for CDV; (M) An antigen detection kit for CDV; (R) A wild dog puppy with clinical case of CDV

Table 7: Results of wild dogs tested for Canine Distemper by the MVU in2017

ID	Date	Sex	Locati on	Sample	Distemper Ab	Distemper Ag	Distemper Ag2
Alpha male	19/07/2017	male	Ol Jogi	Serum	positi ve	Negati ve	positi ve
Wild dog 135		male	Ol Jogi	Serum	inconclusive	Negati ve	Negati ve
Domesti c dog			Loisaba	Serum	inconclusive	Negati ve	Negati ve
wild dog 142	20/07/2017	Female	Ol Jogi	Serum	positi ve	Positi ve	positi ve
Wilddog 141	20/07/2017	Female	Ol Jogi	Serum	positi ve	Positi ve	positi ve
Wild dog 141	21/7/2017	Female	Ol Jogi	Serum	positi ve	Positi ve	positi ve
Wild dog 115	9/6/2016	male	Ol Jogi	Serum	inconclusive	Negati ve	positi ve
wild dog 137	14/06/2016	Female	Ol Jogi	Serum	inconclusive	Negati ve	Negati ve
Wild dog 141	21/07/2017	Female	Ol Jogi	Blood	inconclusive	ND	ND
Wild dog 142	20/07/2017	Female	Ol Jogi	Blood	positi ve	ND	ND
Alpha male	19/07/2017	male	Ol Jogi	Blood	positi ve	ND	ND
Wild dog 141	20/07/2017	Female	Ol Jogi	Blood	positi ve	ND	ND
Zurie		male	Mugie	Serum	ND	Negati ve	Negati ve
Wild dog 1yr	21/07/2017	Female	Ol Jogi	Urine	ND	Positi ve	ND

D. Investigated diseases that affected livestock at the Mugie Ranch

The Mugie Conservancy, and in general in Northern Laikipia, experienced poor rainfall for the entire 2016 and early 2017. The area was dry and the quality of available grazing land was low in nutrition. As a result, the Mugie Conservancy only hosted 4,200 livestock– a drop from the 12,000 cattle recorded during the peak of herd movement during the land invasions in 2016 and 2017.

By the end of 2017, the tally of livestock mortality cases in the Conservancy was: buffaloes – 200; impalas – 150; hartebeests – 3; and oryxes – 3. It was challenging to collect the death toll for cattle and sheep due to their high mortality within and around the Mugie area. The wildlife and domestic cattle affected by a tick-transmitted, blood-borne pathogen further compounded the problem on livestock mortality in the region. Lewa investigated these cases to gain a better understanding of needed prevention measures for both wildlife and cattle in future.

VI. INNOVATION AND BEST PRACTICE IN WILDLIFE CONSERVATION

A. Launch of Wildlife Apprentice Programme

In 2015, Lewa established a Veterinary Apprentice Programme where newly qualified veterinarians and students spend time with the MVU's resident Vet. The programme aims to offer field experience that reinforces standard veterinarian medical training, allowing aspiring veterinarians to apply knowledge and exercise effective decision-making in remote areas. The two beneficiaries in 2017 were Sylvia Kinya, a graduating student from Chuka University, and Waqqas Khalid, a senior student at Bristol University. The students spent two months learning with Dr. Matthew Mutinda and were exposed to the field in Lewa and surrounding national parks and private conservancies. The programme aims to eventually pay its dividends through better wildlife veterinary care and improved animal welfare on a larger scale.

B. Contribution to Scientific Knowledge and Research

The observations gathered by the MVU from various clinical cases enhanced the conservation community's wildlife knowledge. In 2017 to the early months of 2018, Dr. Mutinda contributed to the following peer-reviewed published journals:

1. Guevara, L., Abdelgawad, A., Onzere, C., Greenwood, A., Davidson, Z., Bishop, R., Mutinda, M. (2018). Seroprevalence of Equine Herpes Viruses-1 and -9 (EHV-1 and EHV-9) in Wild Grévy's Zebra in Kenya. *Journal of Wildlife Disease*. Retrieved from: https://doi.org/10.7589/2018-01-003

2. Mutinda, M., Tunseth, D.A., Zimmerman, D., Crofoot, M.C., Hayek, S., Engel, J., Murray, Suzan. (2018). Biochemical Reference Intervals for Free-ranging Olive Baboons (Papio anubis) in Kenya. *International journal of primatology.*

These studies improve our understanding of the wildlife and the dangers that can potentially harm them.

VII. CONCLUSION AND NEXT STEPS

In 2017, the MVU was successful in protecting and treating wildlife. As a response to the rapid increase in land use, animal habitat conversion, and HWC in recent years, Lewa and KWS have significantly ramped up efforts to improve our approach to protecting both endangered species and human communities.

The MVU's next steps will focus on the two initiatives:

1. Build the capacity of the wildlife veterinarian services to respond more effectively and efficiently in an expansive landscape. Moving forward, we are looking into increasing the MVU team's capacity to readily respond to more wildlife veterinary emergencies in the region. This plan is part and parcel of acquiring new skills and continued self-evaluation on team competencies to help the MVU effectively fulfill its role. These vast landscapes should be easily accessed by flight for prompt and appropriate wildlife care.

2. Invest in facilities and equipment. The existing diagnostic equipment in the mobile clinic need to be upgraded in order to effectively practice evidence-based medicine. Moving forward, Lewa and KWS aspire to raise funds to establish a diagnostic laboratory based out of Lewa.

We greatly appreciate the continued support from individuals and foundations toward preserving our planet's endangered species despite numerous, complex challenges each year. The main funding to support the personnel, vehicle operations, and procurement of drugs and equipment was provided by The Pettus Crowe Foundation. San Diego Zoo Global improved our capability for wildlife diagnostics through provision of laboratory equipment and training. We also recognize the following supporters who provided various equipment for the MVU's operations - "Own Time-Own Dime" Training Team, Anne Pattee, Sean Hawkins, John Fitts, Maureen O'Keefe, Bridget Caldwell, and Norah Farnham. Lewa and KWS would also like to thank our fellow conservation partners, the Northern Rangelands Trust and Save the Elephants, for their continued collaboration and partnership. Once again, on behalf of the entire Lewa and KWS teams, we thank everyone for your support and look forward to our continued partnership!

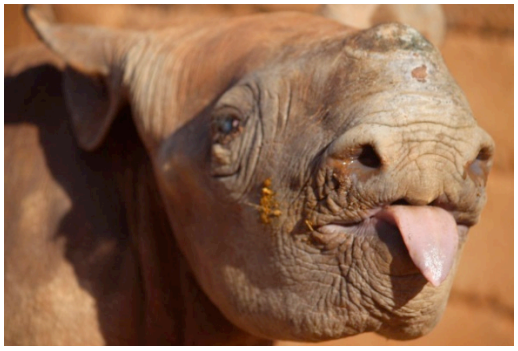
VIII. ADDITIONAL PHOTOS

Atypical inguinal growth in a Grevy's zebra

A healthy Grevy's zebra and foal

Surgical management of a wound in a Grevy's zebra

Snare removal in a Grevy's zebra



A happy black rhino calf post treatment

Massive horn in a black rhino

A snare on an elephant trunk

Snare removal on a white rhino

Action for Cheetahs in Kenya: A Decade of Cheetah Conservation

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Abstract:

AAZK Bowling for Rhinos initiated its support for Action for Cheetahs in Kenya (ACK) in 2010, just after the registration of the Carnivores, Livelihoods and Landscapes organization in Kenya. Although BFR funds assisted primarily in development of our field site in northern Samburu, cheetah studies have encompassed range wide monitoring and conflict mitigation. Local and international students and volunteers provide our staff with opportunities to build skills in conservation management at a community level. This presentation will update AAZK members on the status of projects and the benefits of the BFR funding for long-term cheetah conservation in collaboration with other local and international partners.



Photos: Sports competitions use ACK footballs supplied in partnership with Alive and Kicking; Cheetah cubs face threats to survival that include habitat loss and human wildlife conflict; Field survey teams rely on transportbut ACK vehicles are getting old and suffer frequent breakdowns.

INTRODUCTION

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

Action for Cheetahs in Kenya (ACK) began receiving funds from Bowling for Rhinos (BFR) in 2010 when we had only four employees and one project site in the Salama area of Makueni County. At that time we also just completed the first national survey of cheetahs across its entire Kenyan range. ACK operated as the "Cheetah Conservation Fund (CCF) – Kenya" program from 2001 – 2008 and was co-founded by Dr. Laurie Marker. Carnivores, Livelihoods and Landscapes

(CaLL) was registered in Kenya with ACK as the first project under its umbrella. ACK works in affiliation with CCF, Kenya Wildlife Service (KWS) and the University of Nairobi (UoN) along with other local collaborations.

Throughout the cheetah's range it is vulnerable to the threats that lead to wildlife population decline in general. The future of the cheetah is threatened by land fragmentation, loss of critical habitat and conflict with people. Prior to the CaLL/ACK program initiation, our focus of study was to determine the status of cheetahs on a range wide scale. We conducted focal projects in three regions (Nakuru, Laikipia and Machakos) where cheetah were known to live in communities with limited movement into National Parks and Reserves. After concluding that areas with cheetah extirpation had a very low likelihood of recovery we shifted our focus on conflict and land use change. In 2006, as we completed the first national survey, we opened our first field base in the Makueni area where cheetah were highly impacted by land sub-division.

It is estimated that overall cheetah decline is at a rate of 2.1% annually (Durant, 2017). We estimate the Kenya population to be 1200-1400 based on studies completed in 2007 (KWS, 2010). Kenya holds a cheetah population that is central to the whole of eastern Africa with continuity across the country. The trans-boundary issues with neighboring Tanzania, Uganda, Ethiopia, South Sudan and Somalia create a contiguous population facing similar threats (Durant 2016).

Today, ACK employs 25 Kenyans at two field sites with three departments – Research, Education and Detection Dog teams. ACK has three employees in higher education programs and supports between five and ten local and international university student projects annually. We work in two communities where over one-tenth of Kenya's cheetahs live within farming communities. We are one year into a second national cheetah survey using detection dogs to locate cheetah scat and field evaluations to compliment data with presence information. Our staff and students have now completed seven peer reviewed publications including five book chapters..

RESEARCH

In the both the Salama and Samburu study sites we have focused on conflict solutions and awareness of our individual responsibilities in environmental caretaking. Domestic dog and wildlife disease interface has taken a critical role in our actions including a rabies vaccination campaign. Recently a distemper outbreak is thought to have wiped out a large number of predators, combined with the effects of longer and more intense droughts. Our education campaigns use short films about predators to initiate the conversation of our role in a healthy environment.

Wildlife patrols showed a decrease in predators and prey after the return of the drought. Efforts in community conservation work in collaboration with the Meibae Conservancy, through the Northern Rangelands Trust to understand human impacts and mitigate drought related issues.

We continue to monitor the impact of the deterrent light systems implemented in previous years and we initiated a new phase of light studies including established systems and installation of 40 new systems in the Meibae Conservancy)

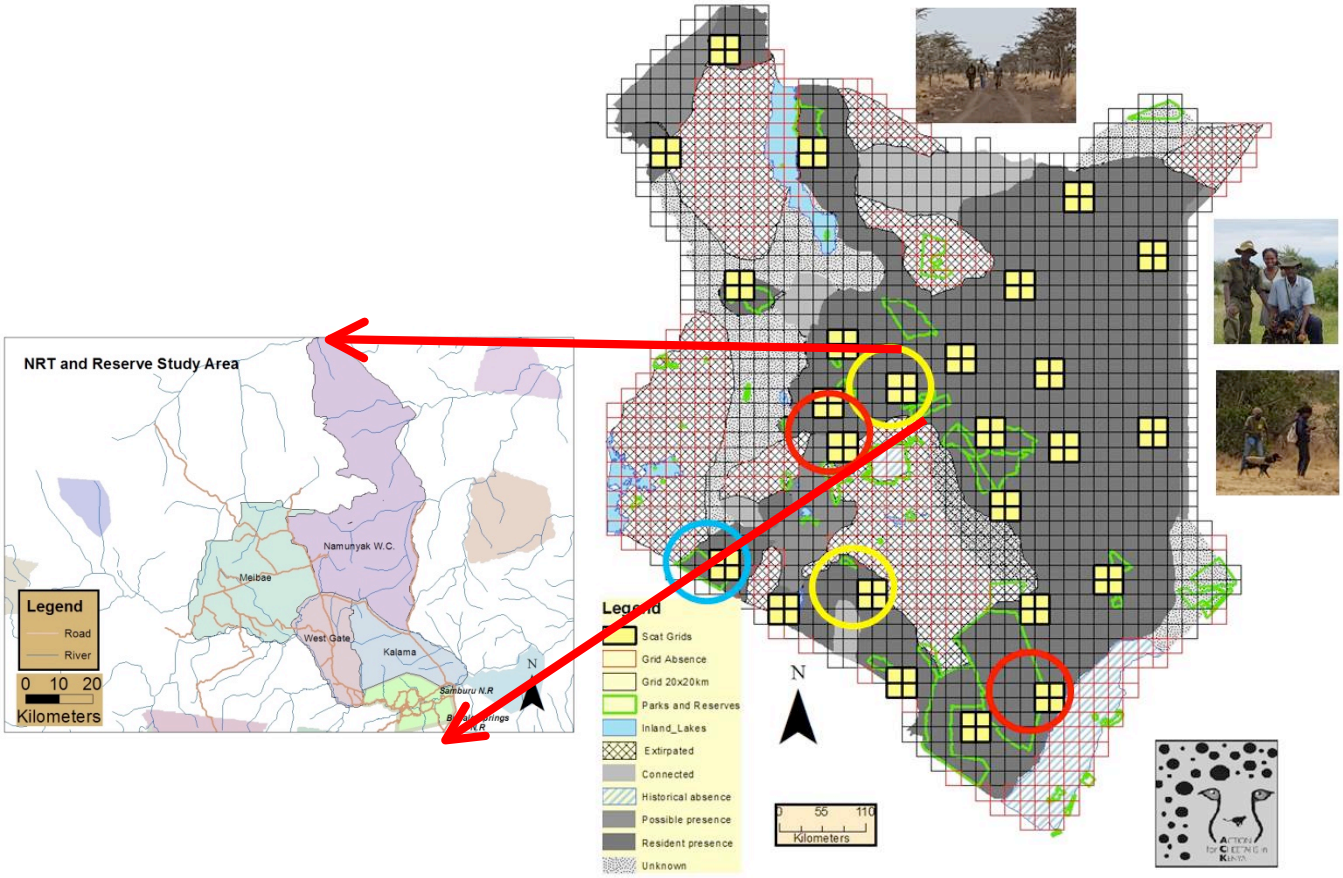

Figure 1: ACK National Survey research areas. Yellow squares indicate locations selected for scat searches with detection dogs. Yellow circles indicate ACK field pilot areas. Red circles are the locations searched in 2018 and the blue area is where scat samples were collected in the Masai Mara by the Mara Meru Cheetah Project Parnter.

Using results from pilot studies conducted in the last two years we initiated the national cheetah survey using a combination of surveys, interviews and the use of scat detection dogs to fill gaps in knowledge of cheetah distribution and population dynamics. One part of the study has used scat from a known population of cheetahs in the Masai Mara to fill in knowledge of paternal

pedigree where 85% of the population is known. The second section is the Samburu region where we will be able to map genetic corridors and relatedness of populations where we currently have no maternal or paternal knowledge.

AWARENESS AND EDUCATION

In 2018 and 2019 we reached over 2000 school children through videos about predators and school presentations. We completed edits to our primary school activity book. We held our International Cheetah Day football tournament and installed sport fields in five locations around the Meibae community. We also implemented a Takataka team in both study areas using the sports groups as a base to improve our personal responsibility awareness about solid waste management.

Our rabies awareness and vaccination campaign reached over 500 households vaccinating nearly 1000 dogs and cats. Using information from last year's student project we have developed more awareness materials for presentations at schools and community events. We have also partnered with Ewaso Lions to reach a broader range for increasing zoonotic disease awareness and prevention and to promote humane treatment of domestic dogs and cats.

CAPACITY BUILDING

Building capacity and setting up networks is important to assure staff are well equipped for being leaders in the conservation field. Several Kenyan and international students participated in training and coursework. Three University of Nairobi interns completed their BSc with ACK in 2018 in evaluations of awareness campaigns and in the use of detection dogs for field work. Two Masters students completed their thesis projects on infrastructure development and on use of DNA mapping for cheetah relatedness. Additionally three ACK staff are completing their education projects this year- Sara Omusula graduatied from Yale University with a Master of Science, Chris Lentaam is completing his file dproject for a certificate in conservation programme management and Noreen Mutoro completed the first phase of field work for her PhD

Photos: ACK staff trains rangers in use of equipment during field training; Our scat dogs have located over 150 cheetah scats in 6 of 25 identified search sites across Kenya; Scat dog, Warrior, surveys the area before beginning a search

ACK staff present their findings at conferences and workshops. Mary has been selected to represent the carnivore conservation interests in the National Rabies Eradication Committee, a Kenya national strategy for 2030 under the UN development goals through the Zoonotic Disease Unit (ZDU) at the University of Nairobi.

2017 – 2018 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. The funding from BFR is approximately one quarter of our full operation budget. The full operational budget for all of ACK programmes in 2018 was $168,614. Anticipated full operational budget for 2019 is $215,000.Below is the income and expense for 2018 - 2019 for the Samburu project and a portion of the national survey that is funded through BFR.

BFR INCOME 2017-2018

Received BFR 2018:	$ 46,168.00
Received BFR 2019:	$ 44,637.00
Total Available:	$ 90,805.11

BFR EXPENSES 2018 (January – December)

Meibae Conservancy Fee	$ 500.00
Field Officer Stipend and training	$ 15,155.00
Transport (Fuel, Insurance, Public service, Motorcycle	$ 5,600.00
Accommodation (Camping fees, lodging, food)	$ 9,500.00
Camp Construction and Maintenance	$ 1,000.00
Office Equipment and Supplies	$ 2,000.00
Community Programmes	$ 6,000.00
Genetic and Occupancy modeling	$ 8,000.00
Expenses 2018	**$47,755.00**

Expenses 2019 (January – June)

Meibae Conservancy Fee	$ 250.00
Field Officer Stipend and training	$ 7,000.00
Transport (Fuel, Insurance, Public service)	$ 3,900.00
Accommodation (Camping fees, lodging, food)	$ 1,300.00
Camp Construction and Maintenance	$ 1,000.00
Office Equipment and Supplies	$ 300.00
Motorcycle Fuel & maintenance	$ 1,500.00
Community Programmes	$ 1,900.00
Genetic and Occupancy modeling	$ 5,000.00
Expenses to Date 2019	**$22,150.00**

Balance as of 1 July: $20,900



Photos: During rabies campaign we also teach humane dog handling; School programmes use visual aids and videos to raise awareness about predators; Interviews help us to evaluate the success of education, awareness and community tolerance of predators.

PROJECT GOALS AND ACTIVITIES 2019

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: Continue to collect and analyse field data from transects and patrols at Salama and Samuru study sites.
b. Human Settlement Pattern: Complete analysis *of s*atellite images from 2008 – 2016 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:* Complete conflict mitigation tool kit for distribution in 2019, continue monitoring deterrent lights, and expand domestic animal health projects.
Goal 2) To understand cheetah health and habitat selection
a. *Monitor cheetah presence and movements through observation:* Continue to implement monitoring methods including direct observations, camera trapping, spoor counting and verification of public sighting reports. Use ArcGIS for analysis and comparison of annual and seasonal cheetah movements and corridor use.
b. *Determine habitat use of cheetahs in relation to vegetation and prey*: Use boma monitoring, Vegetation surveys and highway monitoring to report human impacts on cheetah status.
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

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Bowling for Rhinos Program Update

By: Kym Janke, Lead Keeper
San Diego Zoo
San Diego, California
Bowling for Rhinos Program Manager

A quick introduction to your BFR program team: Kym Janke is the program manager and has been involved in BFR since 2007; Matt Mills is the program vice-manager and has been involved in BFR since 2011; Kevin Shelton is our Conservation Partner Liaison and has been involved with BFR since it started in 1990; Lisa Haggadone is the Event Coordinator and has been involved in BFR since 2015; Selenia Murillo is the Conservation Resource Grant Coordinator and has been involved in BFR since 2017; we welcomed Jacqueline Weeks as the Communications Liaison this year! Finally we have the benefit of solid guidance and leadership from Nicole Pepo who serves on AAZK's Board of Directors and keeps us all in line!

Bowling for Rhinos continues to be AAZK's most successful keeper run conservation program. We should all be so proud that by the end of 2019 we will have raised over $8,000,000! Thanks to the amazing efforts of 90 chapters you helped raise $580,900.22 in 2018 for conservation efforts surrounding rhinos, cheetahs, and their habitats through our incredible conservation partners; Lewa Wildlife Conservancy, International Rhino Foundation, and Action for Cheetahs Kenya. BFR funds were also used to award the BFR Conservation Resource Grant to the Peregrine Fund and their Stop Poisoning Now campaign. They are working throughout eastern Africa to help prevent and abate the effects of wildlife poisoning. I urge all of our members to follow these organizations on social media to stay up to date with the important work they are doing in the field.

As the Bowling for Rhinos Program grows we are evolving and growing with it. Our goal is to enlist the support and participation of 100% of AAZK's amazing chapters! If your chapter holds a yearly Bowling for Rhinos event, we thank you for your continued support and achievements! If your chapter does not hold an event, we have only one question: Why not? Did you know that Bowling for Rhinos events do not have to involve bowling at all? The program team would love to speak with you and help you develop an event suited to your chapter, town, and audience. One of the main focuses of the BFR Program has been the development of tools that will help every chapter succeed. In 2018 we fell just short of our participation goal and saw 90 of 113 chapters donate to BFR, let's do better this year!

2019 has brought several changes to the BFR program. In an effort to streamline the registration process and ensure that the BFR program team was best able to support each chapter and their BFR events, a new registration deadline of May 1st was implemented. Emails were sent to every chapter based off contact information submitted in your chapter's recharter and prior BFR events, social media posts were put out, and an e-blast was sent to our membership informing everyone of the changes. 100% of the funds raised through the many BFR events held annually are used in conservation efforts; that is why we ask chapters to remit a registration fee before planning the event. This registration fee covers all the administrative costs associated with a charitable event of this size, rest assured that all the dedicated BFR program team members are

volunteers who want to see as much money go to conservation as possible! If the amount of money totaled from the registration fees exceeds the actual administrative costs then this surplus is put right back into the Bowling for Rhinos event totals for that year. The electronic registration form allows the BFR program team to ensure that we have up to date contact and event information so that we can better assist with any questions that arise.

Trip nominations were included with registration this year for the first time under the direction of AAZK's board of directors. This will allow AAZK to notify the trip recipients in a timely manner at the end of the year. We encourage chapters to hold fun filled events that raise the funds our conservation partners rely on and we incentivize this by offering each of the four highest raising chapters to nominate one individual who will receive a trip to either Lewa Wildlife Conservancy in Kenya or to Indonesia with our partners at International Rhino Foundation. Like last year, each chapter also had the opportunity to nominate one member who has made a difference in their BFR events for the Anna Merz Rhino Champion Award on the registration form. All chapters (with the exception of the four highest raising chapters) have the chance that their nominee will be randomly selected to win a 10 day trip to Lewa Wildlife Conservancy! We want to ensure that every chapter, no matter how large or small, has an equal opportunity to win a trip.

The BFR program team is excited to announce some changes to the trip award process in 2020. We realize that every AAZK member and chapter works hard to raise funds for Bowling for Rhinos but for a variety of reasons most events do not generate the amount of money needed for a nominee to be awarded a trip. We want to recognize the efforts of every chapter, while still encouraging chapters to raise the most money possible! That is why beginning in 2020 the two chapters raising the highest aggregate funds for BFR, who have completed registration on time and met the fund submission deadline, will be awarded a trip. The remaining two trips will be awarded based on a lottery system. Each chapter that meets both the registration and fund submission deadline will receive an entry into the lottery; additionally an entry will be received for every $1000 raised. By implementing this system chapters who raise more money will have more chances to win and we hope to encourage chapters on the cusp of an entry to push harder to reach the next thousand dollar threshold.

The BFR program team is also pleased to announce that we are recognizing two incredibly important conservationists and BFR partners by formally naming the trip awards. There will continue to be two available trips to Lewa Wildlife Conservancy in Kenya, herein named the Ian Craig Rhino Champion Award and the AAZK African Rhino Champion Award; as well as two available trips to Indonesia with our partners at IRF, herein named the Susie Ellis Rhino Champion Award and the AAZK Asian Rhino Champion Award.

We are working with our conservation partners to determine the best travel time frames for all five trips in order for our recipients to fully experience the destination chosen. These travel dates will be clearly explained on the trip nomination form included with registration and Anna Merz Rhino Champion Award nomination so that potential nominees can ensure they will be able to participate should they be awarded a trip.

We hope that chapters have found the BFR google drive to be a useful tool following their event registration. The BFR program team is hoping to grow this resource to better assist chapters in their fundraising efforts by providing access to information specific to how our contributions

impact the conservation actions of our partners. If there is something your chapter wishes to have included or information that would be helpful but is not already included, please let the BFR program team know and we will work to get it on the Drive. Unfortunately interest in the mentorship program proposed last year at conference was low but we would still be happy to help coordinate if interest increases. We hope that last year's BFR Summit allowed AAZK members the chance to network, get answers to questions, and hopefully sent them home with many great ideas on how to run a smoother, more successful event! We invite all conference attendees to this year's BFR Summit as the BFR program team are listening and responding to all suggestions!

Do you know a deserving individual or organization that is conducting research or conservation initiatives aimed at rhinos, their habitats, or the local communities? If so then please make them aware of the Bowling for Rhinos Conservation Resource Grant (CRG). BRF team member Selenia is working on establishing constant and open communication with the BFR Conservation Resource Grant recipients and has been working to increase the professionalism of the program through formal report templates and a revamped and updated application. Our goal is to make AAZK members more aware of the diversity of support BFR offers through this grant and increase the visibility of the conservation work accomplished as a result. The CRG is supported by 2% of funds raised through BFR and is awarded each year; this can make a huge difference to a research/conservation budget! Eligible projects not only include in-situ work but can also be based on ex-situ rhino conservation and research. Help us spread the word!

Do you have a suggestion or a comment on something you would like to see the BFR Program do or improve? Do you have an idea to increase participation in order to reach our goal of having every chapter support this worthwhile cause? If you do then please do not hesitate to contact any of the program team, we will be delighted to hear from you!

We are looking forward to the remainder of 2019 and see great things in store for 2020. As we all know, the rhinos need all the help they can get. With our diverse conservation partners focusing on rhinos, habitats, communities, and a wide range of wildlife it is so amazing to know that our efforts ARE making a difference. We couldn't do it alone and are excited to see what lays ahead!

The Zookeeper's Guide to Healthy Habits

PJ Beaven
ZooFit
Bellingham, WA

Introduction

In 2014, I was a zookeeper at Woodland Park Zoo in Seattle. Working with elephants was a dream come true. But it was wreaking havoc on my body, and to a degree, on my mind. My knees hurt, my back hurt, and I just didn't have the energy to do tasks where I used to excel- enrichment or patience in training sessions. All that changed when I decided to implement a fitness and wellness program. Because, how could I take great care of elephants if I wasn't taking basic care of myself?

The principles of Operant Conditioning, Enrichment, and Conservation became my pillars for a program I call ZooFit. With these practices, I made fitness a positive experience, I made it fun, and I made a difference in conservation efforts.

Many of us are acutely aware of the general benefits to establishing and maintaining a fitness and wellness program. Exercise and eating right provide us with better quality sleep, which in turn makes for a more productive day following. Sleep, exercise, and food that fuels us rather than fills us keeps us at our optimized best throughout the day- more energy, more mental clarity, less stress, and better moods. It also helps us combat serious health issues- cancer, heart disease, and diabetes.

But the importance of a fitness and wellness program for animal professionals is not a vanity issue. It is at its core an animal welfare issue, as well as a safety issue. We may want to improve our sleep habits, reduce stress, and prevent diseases. These benefit anyone. For animal professionals, fitness means doing our jobs easier, safer, and reaping other benefits.

Imagine lifting hay bales or feed bags with ease. Raking and other cleaning activities become easier. We have more energy, creativity, and time for our favorite projects like enrichment, training, or observations. Because we establish a healthy program suited to our needs, we are sick less often, meaning we can be here for our animals. And we WANT to be here for our animals. Not just because we love our job, but exercise and nutrition improve our moods. We are more patient, with co-workers and the animals.

But probably the number one benefit to a wellness and fitness program for animal professionals: exercise is considered the most important factor in preventing job related injuries. And for injuries we can't avoid, having a fitness program in place will help you bounce back easier and faster.

The ZooFit program keeps you moving and developing healthy habits through its three main pillars- Fitness Through Operant Conditioning- creating habits through successive approximation

and positive reinforcement, Enrichment- making fitness functional, fun, and engaging, and Conservation- connecting to the earth in a healthy way and seeing how our healthy habits can have a positive impact on the planet.
Even though many animal professionals have a strong understanding and background in training, it's a fun eye-opening experience to see how these principles can be applied to our own health and wellness. So, let's dive in.

Fitness Through Operant Conditioning

Operant conditioning is the learning philosophy which states behavior is learned through the association of the consequences which follow. For every action, there is a consequence which will increase or decrease the likelihood of the behavior occurring again. Reinforcement increases the likelihood, punishment decreases it. Shaping, where behavior is broken down into smaller steps, is an important lesson for those starting a fitness program.
By applying these principles of learning through operant conditioning and shaping, we can develop life-changing healthy habits by breaking them into smaller steps and using positive reinforcement to maintain these healthy habits and achieve our fitness goals. Not only are healthy habits more fun to develop, but they become long-term lifestyle changes rather than temporary quick fixes.

ABC's of Training

I love the ABC's because it really is the basics of training. A= Antecedent, the signal or cue to start a behavior. B= behavior, and C= consequence. Using the ABCs of shaping, we can quickly learn healthy new habits. Say you want to create a habit of drinking more water. For the antecedent, set an alarm on your phone or watch, or put post-it notes around locations you frequent. When your alarm goes off, drink a glass of water. The completed behavior earns a positive reinforcement consequence. This can be a simple pat on the back, a check mark in your journal or fitness tracker, or giving yourself a positive affirmation.
In his book, *Atomic Habits,* James Clear shows how positive self-talk boosts confidence and improves performance in behavior. Based on his research, all you need to improve the likelihood of continuing drinking water is a positive affirmation, such as giving yourself a high-five, or saying out loud "woo-hoo, I'm awesome".

Positive Reinforcement Vs Punishment

There is a consensus among animal behaviorists about which consequence is most effective. It is profoundly easier to teach an animal what you want them to do than to teach them by way of showing them all the behaviors you DON'T want. For this reason alone, reinforcement is encouraged and recommended when learning new behavior. However, it isn't just reinforcement, it's specifically positive reinforcement which is touted as best. Why is that?

Positive reinforcement is the receiving of something desired in response to a behavior, increasing the likelihood of that behavior occurring. With negative reinforcement, the learner avoids a punishment, or an undesirable consequence by performing the behavior. Avoiding punishment is an incredibly strong motivator in the moment. Think of a lion chasing a gazelle. The gazelle is highly motivated to run fast, but not for a long period of time. The gazelle will only run fast as long as it is threatened by a lion. No more, no less.

There is a significant difference between positive and negative reinforcement in a fitness setting. How would you feel if you worked hard to achieve your goals, whether it's running a marathon, losing weight, or lifting a certain weight (say a giant boomer ball unassisted), you finally get there, and nothing happens? No one congratulates you. You get nothing in return.

If you don't meet your goal, even if it is by a small margin, you are punished. You wanted to lose five pounds, but you only lost 4.5. With negative reinforcement and punishment, those 4.5 pounds don't matter. The only thing that does matter is the .5 pounds you didn't lose. How motivating would that be?

People practicing a fitness program are notorious for using punishment. We berate ourselves for not doing what we set out to do, guilt ourselves into doing what we think we "should" be doing. We have even been known to *withhold food*. If we wouldn't do it with our animals, why do it to yourself?

On the opposite side of operant conditioning we have positive reinforcement. How motivating is it to have every success, every step of your journey recognized, celebrated, and reinforced? If you don't quite hit your goal, nothing bad happens. You only focus on your accomplishments. Positive reinforcement is the best way to approach our fitness using operant conditioning? But how do we go about doing that?

Setting Yourself Up For Success

My first suggestion is a basic for animal training. It's how we have successful training sessions BEFORE we start the training session. We set the animal (and ourselves) up for success. We remove all distractions before the training begins. Rarely will there be a feeder puzzle, a bunch of toys, or other animals roaming around randomly during our training sessions (it happens, but it's rare, and we notice how distracting the other factors are to the animals). We can do the same thing for our fitness. Set yourself up for success. Set aside your exercise time, and turn off your ringer, or set alerts to silent, or off during your workout time. If you have trouble getting out the door to head to the gym on time, set yourself up for success by preparing your gym bag the night before. Place it right by the front door so it's easily accessible, and then grab it and go. You can make breakfast easier, too, by preparing overnight oats, or a casserole the night before. By having meals which can be quickly heated up in the morning on hand, you save time in the morning, and start your day off right.

Behavior Momentum

Getting started with fitness can be tricky. But so can training an animal. Using behavior momentum works great in both situations. Basically, behavior momentum is starting easy and small and building up to larger and more complex (Martin, 2014). This is slightly different than shaping, in that it usually occurs within one session, rather than a series of several learning/training sessions.

Using behavior momentum in your fitness can save you from injuring yourself, help motivate you to keep going, and help you work within your limits. Fitness professionals call it a "warm-up". Perhaps you've heard of it. Practice it.

In weight training, you want to practice several repetitions at a significantly lower weight before going for a new personal record. This build-up of weight does several things. It warms your joints and muscles, preparing them for your activity. It also pumps you up. If you could lift 50 pounds, you can try 60. Each success builds momentum to continue going.

You can even trick yourself into working out by practicing behavior momentum. "I'm only going to walk for 5 minutes", but by minute 4, you are enjoying the scenery, or you want to make it to the end of the road, or a slew of other motivators can help you to keep going. Let the momentum take you where you need to go.

Motivation in the Bank

Putting trust in the bank is the idea inspired from Steve Martin (2008) which promotes every positive interaction we have with our animals is like depositing trust in the bank. When we really need it, we can withdraw that trust without destroying our relationship. We can do the same with our fitness, but instead of trust in the bank, we are depositing motivation. Every time you complete a workout, eat a healthy snack or meal, or progress in developing a healthy habit is putting a little more motivation to continue on. On days you are tempted to eat unhealthy, or skip a workout, you can withdraw some of that motivation without killing your willpower. If you have a run of working out 5 days a week for over three months, notwithstanding extraordinary circumstances, how willing would you be to skip a workout? Such a winning streak is hard to ignore or give up.

Jackpots

I can't reiterate this enough- positive reinforcement is not a burger after the gym. But it doesn't have to be just hi-fiving yourself every time you make progress either. If you want to use eating a grand meal at your favorite restaurant as a reward, go for it. But make it motivating and reinforcing, not the endgame (Sdao, 2017). Let the meal be a celebration of your accomplishments and a bolster to continue on your journey. There are dozens of ways to reinforce your healthy habits without negating the hard work you have done by eating junk food or overindulging. From iTunes and Netflix binges, to massages and planning a vacation, make sure your reinforcement is appropriate for your behavior.

Differential Reinforcement of Other/Incompatible Behavior

I learned about Differential Reinforcements from Ken Ramirez's book on Animal Training. DRI/DRO are great ways to extinguish undesired behaviors in our animals. An animal can't lunge at your food bucket if they are laying down. It's difficult for them to steal another animal's food when they are hugging a tree. Using DRO/DRI is a fantastic way to break bad habits. Instead of punishing yourself for doing habits you wish to stop, implement an alternative behavior.

I quit smoking by replacing the cravings to smoke with an incompatible behavior- cooking. Whenever I had a craving, I grabbed a cookbook and tried something new. The end result was I got really good in the kitchen, and my cravings completely went away. Making these types of substitutions can help create healthy habits while eliminating the bad ones.

LRS- Least Reinforcing Scenario/Stimulus, or AC/DC

When an animal performs a behavior incorrectly, trainers have found a more effective way of communicating with the animal than with punishment.

An LRS, or least reinforcing scenario is not an ignore. We don't ignore our animals, especially when we are working with them. This is for our safety, and the well-being of our relationship. When trainers use an LRS, they acknowledge the animal by looking at them, in a neutral stance. The trainer is neither reinforcing nor punishing. By giving an LRS, the trainer effectively tells the animal "what you just did there will not get you reinforcement".

I believe you should not ignore setbacks or negative behavior in your fitness either. I refer to the LRS as AC/DC: Acknowledge, compassion, and data collection. Take every opportunity to learn from every scenario. Did you cave into temptation and grab a donut in the breakroom? Acknowledging it is the first step to preventing it from happening again. Did you skip a snack or meal before going to the breakroom? Is there a way you can avoid going into the breakroom, or at least make it fast so you don't linger and tempt yourself further? There is a huge difference between acknowledging and learning from your mistakes, and beating yourself up for making one. A slip is not going to topple all the progress you have made. In fact, a slip will make you stronger, in the future. As long as you learn from it. Show some compassion for yourself, just as you would with an animal in your care.

Going Back to Kindergarten

Going back to kindergarten is a great method for dealing with plateaus (Pryor). In a way, it's a little like behavior momentum, but rather than an in-the-moment tool to use, this practice goes back several steps in the training plan and starts over. The idea is when an animal is stuck, they are learning differently than we thought we could teach it. So, by going back a few steps to where the animal was succeeding, we can go about training and teaching in a different way.

If you are struggling with a certain aspect of your fitness, go back to the point you were successful. Perhaps you were doing great going to the gym 3 days a week, but increasing it to 4

proved to be a struggle. Go back to 3 days a week, and re-evaluate your plan. Perhaps you can't make it the 4th day because your work schedule is wonky. Use the time you are back in your success zone to find another way to get a 4th day in. Perhaps instead of going to the gym, you can hit the trail for a run. Maybe you need to do a workout from home one day a week. Or this maybe just a temporary problem which you can use behavior momentum to overcome, just stay at 3 days for a little longer.

Don't let a snag prevent you from your progress. Even if you are back in kindergarten for a long time, you are still doing a great job, better than when you first started.

Lowering Criteria

Another way to deal with a plateau, or challenging situation, is to lower the criteria. After an animal performs well for a veterinary examination, trainers often lower the criteria for a short time, to establish more trust in the bank, and build up momentum again with the behavior they might associate with a negative event.

Traveling is a perfect example of a time you may need to incorporate lowering criteria in your fitness. You may have full intentions of getting a full workout while you are away, either on vacation or for business. But you may not have realized there wasn't a gym, or that they wouldn't have the equipment you need. Perhaps after sitting all day, listening to paper presentations, you weren't prepared to be exhausted. Instead of falling off the wagon and not doing anything, simply lower your criteria. If you normally workout five days a week, bring it down a little and let yourself go with 3 days of working out. If you are following a strict caloric diet, but know you are going to be eating out every night, give yourself a little wiggle room, rather than berate yourself and starve yourself during what is supposed to be an enjoyable trip.

Conservation

Conservation fitness is my favorite part of ZooFit. What we eat, and how we move matters. Fitness is the way we bridge our conservation efforts with success. Connecting conservation to our fitness program creates a positive feedback loop. We feel good for taking care of ourselves, and doubly good for having a positive impact on the environment. When our motivation falters, we can stir more up by remembering it's not just about us, our actions have an impact on the planet.

Want to help orangutans and elephants in Asia? Eat healthy and avoid processed foods with conflict palm oil in them, and not only will you make a difference to Asian wildlife, you will have a healthier diet, and that will definitely help you achieve your fitness goals. You see the results of eating healthy, and the conservation action associated with it just reinforces you to continue eating right and avoiding processed foods. Saving animals becomes your outside source of willpower. It helps resisting tempting treats when it's not just about you (we can always justify a donut, am I right?). Saying no to foods with palm oil in them is a statement towards your commitment to conservation.

This connection can be made for a variety of healthy habits. Cut down on your carbon footprint by bicycling to work, or at the very least, errands which are close to home. Save polar bears, and well, every other animal on the planet affected by climate change, while improving your cardiovascular health. Walking can do the same thing. Your activity is reinforced by your improved health, and doing something significant to help the planet.
Cut unhealthy fast food out of your diet by meal prepping, and you get to help save forests from deforestation, and reduce single use plastics. It's a win-win-win, because you end up saving money by avoiding fast food, you eat better and feel better, and you make the world a little better, too.

ZooFit is about changing our mentality on fitness. Instead of "we have to", we change our mindset to "I get to". We get to make a difference in our world by taking care of ourselves. We work toward being better zookeepers, trainers, and animal professionals by practicing what we preach, and becoming the best versions of ourselves. Show the world it's not only possible to train animals amazing behaviors, but teach ourselves to achieve whatever we put our minds to as well.

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Zoo Keeper Talks, Public Engagement, and Professional Development

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Abstract: Each year over 190 million visitors go to zoos and aquariums, and so there is enormous potential to educate people about wildlife and conservation. Unfortunately, this potential is often not fully realized with visitors, especially those who are not on guided tours. One potential avenue to addressing this is through Keeper Talks. Zoo keepers are highly knowledgeable about and deeply invested in the species that they care for, but this alone may not be enough. Knowing a subject and knowing how to teach that subject are two different things, but keepers generally do not have formal training in education. This study begins to examine how keeper talks are currently given, the professional development and training that is currently available, and proposes ways to improve the effectiveness of keeper talks at educating the public and changing their attitudes and behaviors to be more conservation minded.

Introduction: Zoos and aquariums accredited by the Association of Zoos and Aquariums (AZA) are missing an opportunity to optimize their educational impact through their Keeper-Talks. These institutions strive not only to provide visitors with knowledge and an understanding of the interrelationship between wildlife and our place in the world, but also to instill an appreciation of conservation, foster a code of personal conservation ethics, and inspire pro-environment and pro-conservation behavior changes. Although the zoo keeper is knowledgeable about the specific species, and often the conservation work being done to help that species, we do not know how effective these talks are at informing the public and changing conservation attitudes and behavior long-term. Research suggests that visitors to Informal Science Education (ISE) environments learn best through the conversation-based Public Engagement with Science (PES) model; however, guides usually use a 'mini-script' that results in the mostly one-way communication typical of the Public Understanding of Science (PUS) model (Kelsey & Dillon, 2010). In contrast, PES focuses on empowering the visitor and mutual learning, the idea that scientists and the public can learn from each other, and aligns with the information contained on page 9 of The AZA Framework for Zoo and Aquarium Social Science Research (Association of Zoos and Aquariums, n.d.). The goal of PES activities in ISE is to increase understanding, foster changes in attitudes about scientific concepts and an individual's role in society, and to create a sense of shared responsibility and increased civic participation among visitors (Mccallie et al., 2009). Therefore, zoos aspiring to foster conservation attitudes and behaviors would benefit from adopting the PES model.

The purpose of this initial study is to examine which method, PUS or PES, is most prevalent in current keeper talks. Additionally, other aspects that impact the effectiveness of the talks and their accessibility will be examined. While working as a zoo keeper, intern, and volunteer at three different accredited facilities I did not have access to visitor education focused professional development. In addition, through my continued participation in AAZK I have found that other keepers either do not have access to or do not know about such professional development

opportunities. They, as I, learned to deliver Keeper Talks by watching other keepers deliver them in a lecture-based format. I was never taught how to deliver content following a PES-based model, and it is not something that is easy to do without guidance and experience. As such it would be beneficial to develop PES focused professional development for keepers, and to evaluate the effectiveness of the program both at changing how the talks are delivered and at improving visitor educational outcomes.

Methods: In order to conduct this research multiple AZA accredited zoos were visited in four different states. Talks were attended as a zoo visitor and videotaped for future reference. When possible the speaker as well as the entire audience were included in the frame, and when this was not possible the camera was panned back and forth in order to capture all of the visitors. As an observer, I did not ask or answer any questions during the talks. In total 47 talks were attended in 8 different animal categories, shown in *Table 1*. Some smaller categories were combined, such as hoof stock and elephants, so as to ensure the confidentiality of the individual keepers observed. The talks were then examined based on whether they contained a lecture component, feeding, training demonstration, guided questioning, and the topics covered. The percentage of time spent was examined in order to account for the wide range of talk durations. In addition to this, the position of the person or people giving the talk was documented. Issues related to the ability of the public to access the talks were also noted, as described in *Table 2*.

Table 1 - Keeper Talk Animal Types

Animal Categories			
Bird	6	Primate	7
Carnivore	7	Small Mammal	4
Contact (petting zoo)	6	Shows	6
Fish and Herpetology	3		
Herbivore (large)	8		47 total

Table 2 – Content of and Conditions at the Talks

Lecture
- Species
- Animal(s) in the collection
- Diet
- Habitat
- Exhibit
- Breeding
- Conservation

Training demo
- Explain what you are doing
- Explain why you do training in general
  - How it helps the animal
- Explain why you do this specific training
  - How it helps the animal

Questions
- Ask "Do you have any questions?"
- Ask a specific/guided question about:
  - Species
  - Animal(s) in the collection
  - Diet "what do you think ____ eats?"
  - Habitat
  - Exhibit
  - Breeding
  - Conservation
- Time spent before asking a question
- Time spent between asking each question
- Are questions asked by the public unprompted?

Accessibility issues
- Volume/hearing – is it easy to hear the talk? Do they use a microphone?
- Competing noises – people passing by, playground noise, music
- Space for a group of people
- Sight lines and proximity to the keeper and animals
- Wheelchair accessibility
- Timing and distance
  - are there multiple talks at the same time?
  - Is it physically possible to walk from one to the next in the available time?
- Ease in finding the location – is there a sign?

Results: Roughly 10% of the attended talks were given by interns or volunteers with the rest being given by staff. Those in the "shows" category were given by a mixture of keepers and education staff, while the rest were done by keepers themselves. Of all the talks, only those in the "shows" category used a microphone resulting in most being difficult to hear for at least part of the time. One of the talks did not involve any talking at all but was instead a feeding with zero public interaction. Several talks consisted of the keeper standing amongst the public, either on their own or after interns had begun speaking, without announcing their presence and without saying a word unless a member of the public noticed them and specifically asked them something. Roughly 70% of the time was spent lecturing or training without talking to the public about what they were seeing, with half of the talks only asking for questions at the very end. One talk consisted entirely of asking "do you have any questions?" a few times before leaving, with the entire "keeper talk" lasting less than three minutes. The longest was a training demonstration that lasted for 33 minutes as multiple animals in the same exhibit were trained, and multiple groups of people came and went throughout. None of the keepers asked had attended professional development focused on communicating with the public, and only a few had been presented with the opportunity to do so. Of those they were all interested in attending the training but could not because of monetary concerns. All of the keepers talked about learning to give the talks by observing other keepers, and several expressed concerns regarding how to incorporate conservation messaging into their talks.

Conclusion: While most of the keeper talks adhere primarily to the lecture-based deficit model the majority of the keepers questioned are eager to adapt their methods. Additional research is necessary to see how best to educate the public in this unique setting, with a mixture of short lecture pieces intermixed among many guided question pieces looking most promising. Whenever possible training or feeding should be included to maximize public interest, with the knowledge that this may require two keepers working together to be the most effective. There are several concerns regarding accessibility that should be addressed immediately by the facilities, particularly the lack of wheelchair access in some areas. The addition of a microphone is recommended to ensure that all visitors that want to listen to the keeper talk are able to do so.

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Working in an Active Construction Zone: A Lesson in Safety and Communication

Joe Nappi, Senior Keeper - Carter Giraffe Building, Mammal Department, WCS/Bronx Zoo

Introduction:

In August of 2017, it was discovered that a portion of the thirty-five year old concrete board drop ceiling of the Bronx Zoo's Carter Giraffe Building had collapsed overnight. While no animal holding areas were compromised, swift action was essential to ensure that no animals or staff would be at risk for potential further ceiling deterioration. Over the next three months, keeper staff worked around an active construction zone as the majority of the building's drop ceiling was removed. Several species were moved to other areas of the zoo during the project, and the zoo's herds of giraffe and zebra were managed in their outside holding yards and exhibits. Teamwork and communication were essential to keep all personnel and animals safe throughout the process. In addition to managing the animals and building in a completely different manner, the keeper staff also had to desensitize the animals to the new ceiling once the construction job was completed. Ultimately the ceiling project would successfully be finished just before the cold weather would begin to set in.

Keywords: Teamwork, Collaboration, Communication, Safety

The Bronx Zoo's Carter Giraffe Building was erected in 1982 and features approximately five acres of both indoor and outdoor exhibits. A variety of African species including giraffe (*Giraffa camelopardalis*), Grevy's zebras (*Equus grevy*i), spotted hyenas (*Crocuta crocuta*), African wild dogs (*Lycaon pictus*), aardvarks (*Orycteropus afer*), dwarf mongoose (*Helogale parvula*), and several African bird species are housed in the building. On August 16, 2017, keepers discovered that a portion of the thirty-five year old building's concrete board drop ceiling had collapsed overnight (Figure 1). Fortunately no one was injured, and no animal holding areas were compromised. Upon closer inspection of the heavy drop ceiling, it was found that there were stress cracks that could be found throughout the building, and it was only a matter of time before another section of the ceiling might buckle and fall. Several options for what to do with the ceiling were discussed. In the end it was decided that the majority of the concrete board drop ceiling would be removed. This would be a monumental endeavor, which would be especially tricky given the twenty-five foot tall ceiling height of the giraffe areas of the building. This project would require months of work and collaboration from a variety of departments around the zoo, as well as careful communication and teamwork amongst Mammal Department staff.

With the threat of more of the ceiling collapsing, quick action was taken to ensure that all animals were housed in a safe and secure area, several of which were removed completely from the Carter Giraffe Building. The Ornithology Department removed 1.1 White Faced Owls (*Ptilopsis granti*) and 1.1 Von der Decken's Hornbills (*Tockus deckeni*) from their indoor exhibits and re-located them to other bird holding areas around the zoo. 2.1 aardvarks were also moved to two separate Mammal Department installations. Many of the keepers that worked these areas had never worked with aardvarks before, and the Carter Giraffe keepers as well as

Mammal Department supervisors taught them the proper husbandry protocols for managing this unique species. One of the temporary aardvark holding areas had to be retrofitted to allow the aardvarks to be maintained on their reverse night cycle. The hyenas remained in the building overnight and were housed in different stalls depending on what areas were available and not under construction. The African wild dogs are housed in a newer wing of the building which did not require its ceiling to be removed, and the group of seventeen dwarf mongoose were all safely relocated to a back holding area away from the construction.

Fortunately the ceiling project began in mid-August, which provided us with warm evening temperatures allowing us to house our seven giraffe and five Grevy's zebra outside in their exhibits and off-exhibit holding yards overnight. With our herds now staying outside 24/7, we needed to install extra feed tubs in the giraffe exhibit to allow us to provide them with plenty of hay as well as their daily grain (Figure 2). An outside construction company started removing the ceiling immediately the day after the ceiling first collapsed. Keepers started coming in an hour early each day to get the animals situated so demolition and construction could begin promptly at 8 AM. During that one hour window, our giraffe bull and zebra stallion would be moved from their outdoor holding yards to stalls in the building to allow us to bring our giraffe herd off exhibit into the holding yard (see figure 3). This gave us the opportunity to service their exhibit, and replenish their hay and grain for the day. The giraffe, zebra and hyenas had to be put back outside within that hour. While it was a tight schedule, staying focused, safe and not rushing was heavily emphasized. The safety of the keeper staff and animals was more important than sticking to the tight construction schedule.

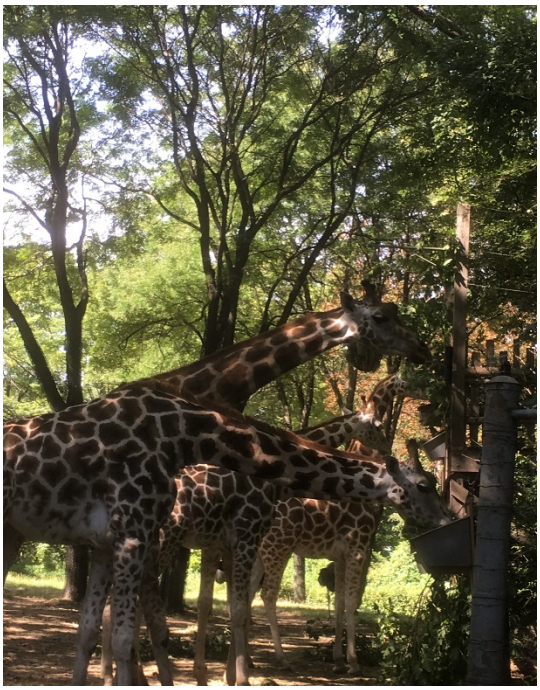
Communication was crucial during this often hectic time, especially for relief keeper staff that would run the building on the senior keeper's weekend. Written notes as well as the senior occasionally calling the relief keepers before she would go on her weekend were important steps needed to keep everyone up to speed on any changes that might have occurred throughout the week. Having an open mind and the ability to be flexible was also important. In addition to much of the building not having electricity and lighting during the construction project, there was also the constant presence of construction workers, loud noises, scaffolding all around the building and a lot of dust and debris which required the keepers to wear masks. Demolition and construction was regularly moving around to different parts of the building, which would sometimes change where and how we housed the hyenas inside overnight, as well is if it was safe enough to temporarily bring our male giraffe and zebra into their stalls in the morning. Quick thinking and flexibility was often required for keepers to change their game plan for the day on how the routine would be completed and how the animals were managed.

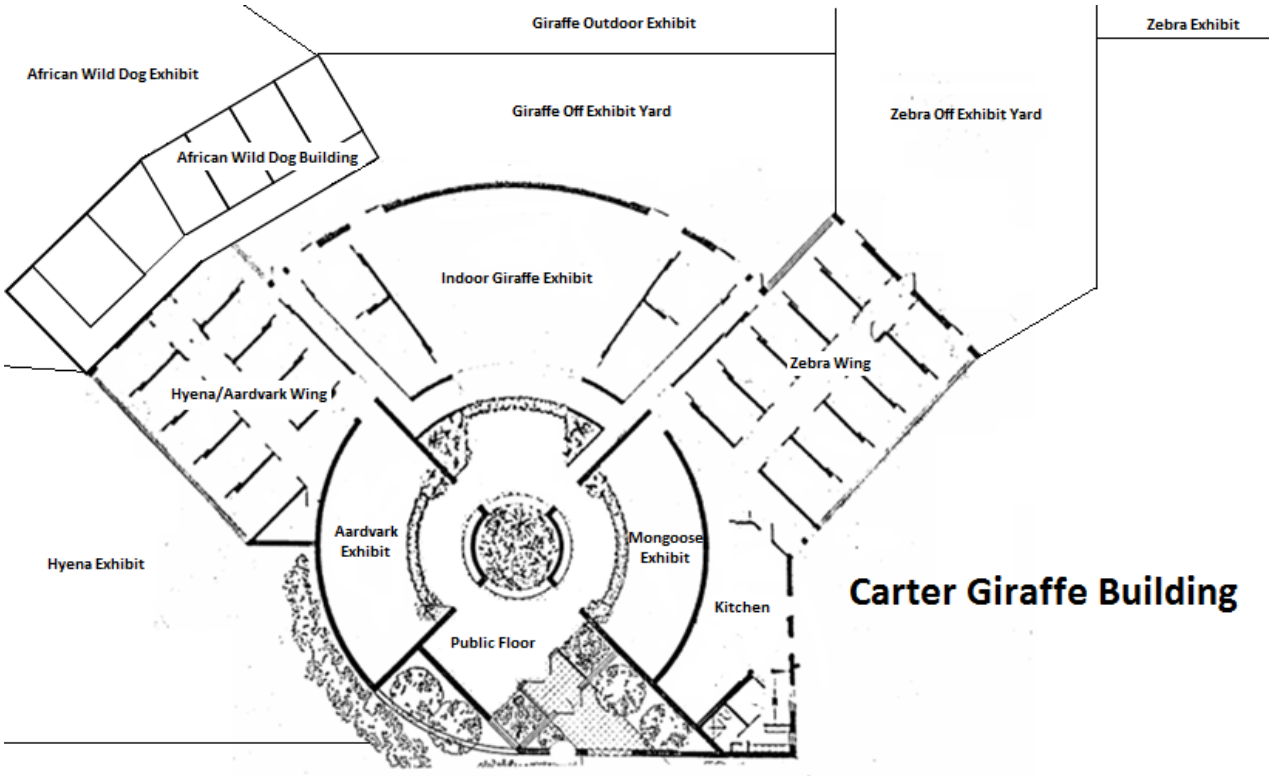
Once the drop ceiling was finally removed, the next task for the construction crew to focus on was spraying a fire retardant insulation on the ceiling, as well as painting it. As different sections of the building were completed, the keeper staff began preparing the different animals to come back inside and be comfortable with all the ceiling changes. This would be especially important for our giraffe and zebra herds, which are notoriously flighty animals. A potential incoming hurricane/tropical storm threatened to hit New York, and we did our best to desensitize the giraffe and zebra with coming into the building should the weather force us to house them inside overnight. The zebras were remarkably resilient and un-phased by the changes after spending a week out on exhibit. The giraffe were first given access to their stalls after being out

on exhibit for three weeks. Most of the giraffe came inside to investigate, although two of the more skittish females remained outside. We gave them access again the next day and all seven giraffe came into the building without a problem. With the indoor giraffe exhibit still under construction, the giraffe continued to live out on exhibit for several more weeks, but we at least had the peace of mind that we could bring them into their stalls if the weather should take a turn for the worst.

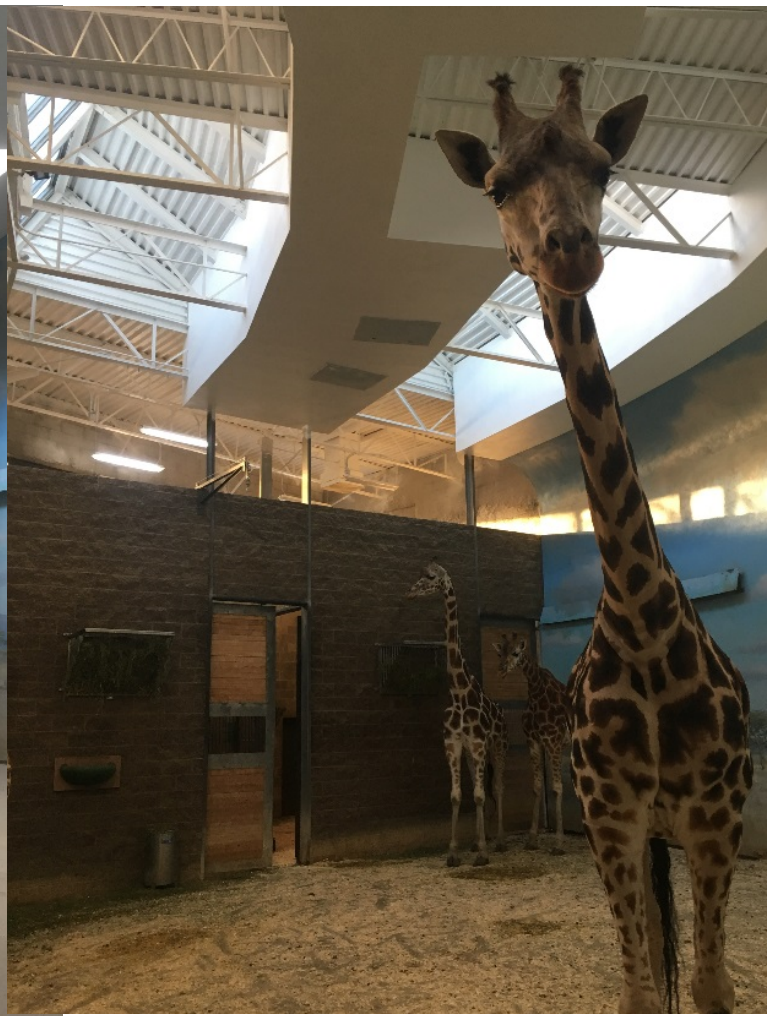
As the months wore on, temperatures began to drop. Typically we keep our giraffe inside if it is below 50 degrees Fahrenheit. As temperatures began to dip below 45 degrees Fahrenheit, we offered the giraffe hay beds on exhibit, should they have chosen to hunker down outside. Finally on October 23, 2017, the indoor giraffe exhibit ceiling work was finally completed and the entire herd was brought inside for the night. A cold front and storm with heavy winds would hit that evening, and we were very fortunate that the building was complete enough to house our animals once again. The building's routine slowly returned back to normal after that. There was still a lot of activity around the property as our electricians restored power and lighting around the building, maintenance workers helped clean the public areas and horticulture staff replanted the indoor public planters. The aardvarks and birds were returned to their exhibits after our machine shop braced some segments of the old ceiling that was not removed and the outside construction company finished their ceiling work on the public floor. The Carter Giraffe Building finally reopened to the public after over three months of construction work.

This often overwhelming project was truly a collaborative, zoo-wide team effort to ensure that all animals and staff were safe throughout the construction process. Communication and teamwork and an emphasis on working safely were a vital part of the process. Special thanks goes out to Mammal Department staff, including building point supervisor Brandon Moore, Keri Nugent who was the senior keeper of the Carter Giraffe Building at the time of this construction project, relief keeper staff that routinely worked in the building and the keepers that temporarily inherited the building's relocated animals. Additional acknowledgements go out to our electricians, machine shop, plumbers, maintenance and the operations departments that assisted us throughout the construction process. In the end it was this level of collaboration that helped to get the project done as quickly and safely as possible before the cold November weather would begin to set in.





Carter Giraffe Building



Going Green Saves Green
Reducing Operating Costs With Sustainable Constructed Wetlands

By

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Summary: Too often the decision for installing green infrastructure emphasizes social and environmental benefits of the Triple Bottom Line, when in fact an even stronger case may be made for the economic business case for going green. At Ochsner Park Zoo, in Baraboo WI, the cost to construct a subsurface horizontal flow constructed wetland to maintain the water quality of the 3,700 gallons pool in the black bear (*Ursus americanus*) exhibit was recouped within the first two years of operation. The savings will go on forever since it is based on annual reduction in maintenance costs of the pool.

Zoo Staffing: The Ochsner Park Zoo, in Baraboo WI, has a small staff of two full time keepers and two part-time keepers. The collection includes 27 different species totaling 60 individual animals housed in 15 different exhibits within the 3.5 acre zoo. In addition, zoo staff is responsible for the maintenance of the adjacent 15 acre park/picnic area which includes 3 shelters and 2 restrooms. Maintenance responsibilities of the park/picnic area include mowing of grass, snow removal, trash removal and picking up sticks that continue to fall from our canopy of mature red oaks. Any opportunity to reduce operating costs has a significant benefit on the operating budget of the zoo.

Historic Maintenance: Splashing, diving, swimming and bathing are activities that water features provide our animals, and the public loves them too. Unfortunately, they can require a lot of time to clean, scrub, and filter to keep the water healthy for our animals, and attractive for zoo patrons. The two Black Bears (*Ursus americanus*) have a nice big pool that holds about 3,700 gallons of water. Unfortunately, the original design didn't have any type of filtration system. Cleanliness was maintained by dumping and filling the pool two to three times a week (Figure 1). Each cleaning required a keeper to dedicate four to six hours out of their daily routine. This is time which could have been spent on the care of other animals in our collection. Labor alone cost the zoo $10,000 to $20,000 every year. In addition, the zoo spent hundreds of dollars each year for the over 60,000 gallons of potable water needed to fill the pool and associated sewer charges to dispose of the water from the pool.

Bear Pool Before and After a Week Long Bath

Performance Criteria: The Baraboo staff identified six objectives required for any new treatment system:

- simple to maintain
- accessible to keepers at all times
- not harmful to the animals
- cannot be damaged by animals
- cannot interfere with operation or maintenance of exhibits
- should not reduce the amount of space used by the public

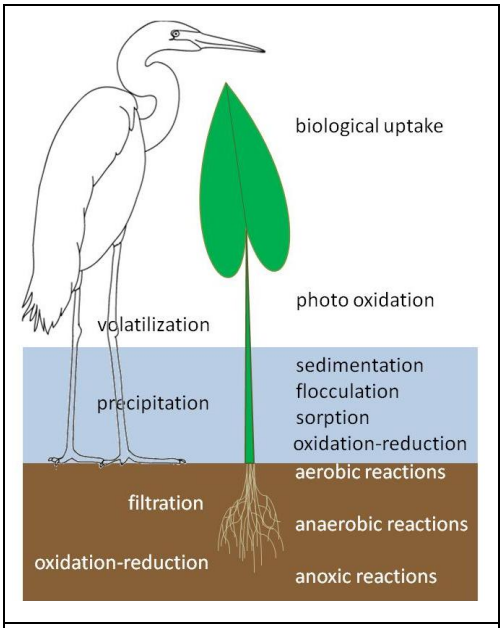

Figure 1. Cleansing Processes of Wetlands

Treatment Processes Wetlands: Wetlands have sometimes been referred to as nature's kidneys for their ability to purify waters. Figure 1 below identifies treatment processes attributed to wetlands. Engineers mimic these biological-chemical-physicals treatment processes designing large concrete and steel wastewater treatment plants. Unfortunately there is often insufficient space in a zoo setting to accommodate the necessary treatment devices that are necessary to maintain the water quality of an exhibit's water feature. The upfront purchase and installation costs followed by the ongoing cost of maintenance are further disincentives for their use. Constructed wetland treatment systems, on the other hand, are flexible in where they can be constructed and can be designed to target the removal of a specific type of pollutant. Therefore, they have been designed to treat dirty water from sources that range from animal and domestic wastewater, industrial wastewater, and stormwater runoff.

Constructed Treatment Wetlands: Constructed treatment wetlands fall into one of three categorizes shown in Figure 2, Free Water Surface, Vertical Flow and Subsurface Horizontal Flow.

In ***Free Water Surface*** constructed wetlands water passes over the ground in-between the stems of wetland vegetation and then discharged to the receiving water. These are sometimes referred to as Pocket Wetlands. Stormwater detention ponds are a variation of Free Water Surface wetlands that are designed with water depths of five (5) feet or greater. The depth of the water, how quickly water passes through the wetland, the density of the plant stems, the type of vegetation and the chemistry of the soil/water interface all influence the level of treatment that will be achieved.

Vertical Flow treatment wetlands also have water flowing onto the surface of the wetland but the main treatment process occurs as the water infiltrates and is filtered by the wetland soils. Underdrains are often used to convey the treated water to the point of discharge. Bioswales, biodetention and infiltration basins are all variations of Vertical Flow wetland systems. In the

Subsurface Horizontal Flow water enters an inlet gallery of larger stones that disburse water across the cross section of the wetland before flowing the length of the wetland through a gallery of finer gravel. Mesic prairie or wetland plants grow in a thin layer of soil covering the gravel bed. The micro-habitat created by microorganisms colonized on the stones and the deep roots of the overlying plants are capable of removing pollutants that may then be taken up by the plants themselves.

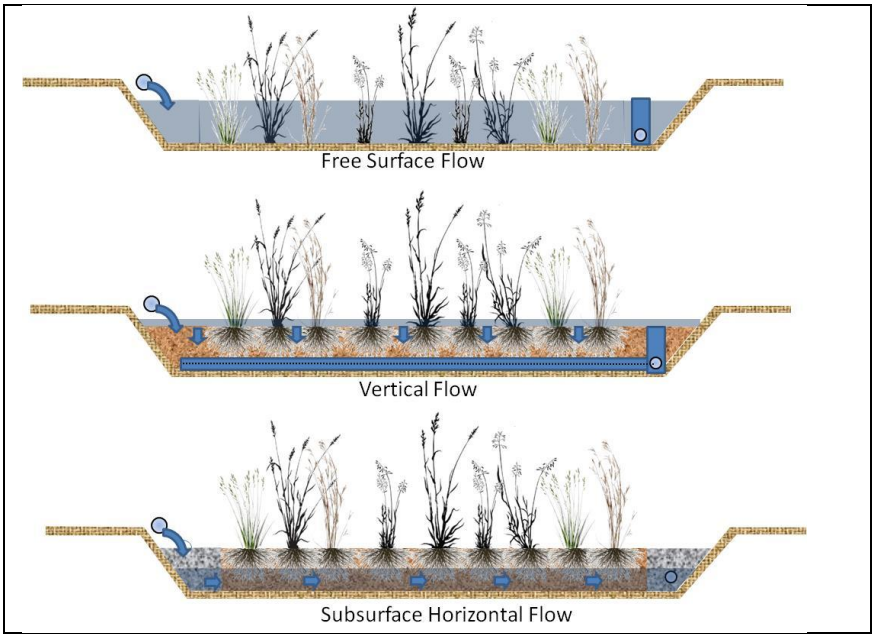

Figure 2. Categories of Constructed Treatment Wetlands

Recommended Treatment System: The Prairie Treatment System was felt to be superior to a more traditional Free Surface Flow or a Vertical Flow treatment system. Zoo staff preferred to have the treatment system outside of the bear enclosure so that they maintained access to the fencing for training of the bears (Figure 3.) and routine maintenance of the enclosure fencing. The narrow landscaped area between the exhibit enclosure and the viewing rail measured only three (3) feet. Stability of the steep side slopes of a Free Surface Flow or Vertical Flow treatment system would be an ongoing maintenance issue. The continuous wet surface of these alternatives would restrict keeper access to the parameter of the enclosure. A further concern was the possible growth of unsightly algae, odors and mosquitoes created by the surface water and decomposition of wastes and nutrients. Monitoring and removal of Cattails (*Typha sp.*) and common reed (*Phragmites sp.*) invading the wet soils of the Free Surface Flow and Vertical Flow systems would be a new and ongoing maintenance responsibility.

Figure 3. Training Bears at Enclosure Parameter

Designed to fit within the narrow landscaped area between the exhibit enclosure and the viewing rail, the Subsurface Horizontal Mesic Prairie Treatment System measured three (3) feet wide by

25 feet in length (Figure 3). The total depth of the excavation was three (3) feet. The cross section consisted of an impermeable liner; approximately 30 inches of ¾ inch washed gravel and then covered by approximately 10 inches of topsoil. Courser gravel was placed at the inflow end of the trench to disburse water across the cross section and then again at the discharge end. Water is fed to the treatment system by gravity. After passing through the gravel, water is collected in a pit and then pumped back to the pool. The whole volume of the pool is set be filtered one to two times per day.

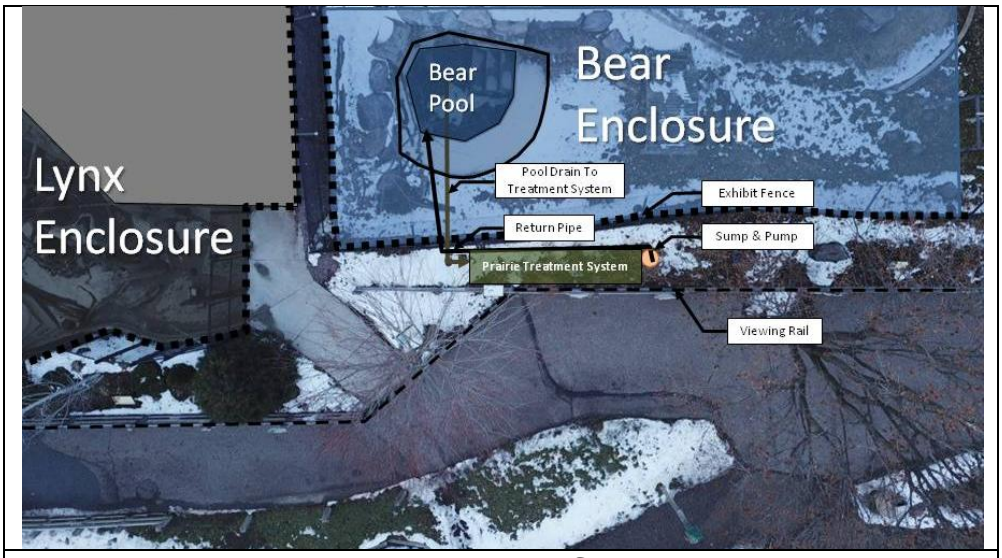

Figure 4. Prairie Treatment System Location

City Parks Department staff and equipment, including zoo staff (Figure 5), dug the trench, laid the liner, placed the gravel and soil, installed the native plantings and installed the sump pump over approximately a three week timeframe. John Ferris, PE provided the engineering and construction oversight of the Prairie Treatment System.

Figure 5. Construction of Prairie Treatment System by Zoo and Park Staff

Figure 6 Treated Pool Water

Testing Results: The micro-habitat created by microorganisms colonized on the stones and the deep roots of the prairie plants are removing pollutants from the water from the pool. Prairie plants take up available nutrients before the water is returned to the pool. On July 14, 2017 water from the Bear pool was tested for the 5-Day Biochemical Oxygen Demand (BOD_5), Total Ammonia Nitrogen, Total Nitrate Nitrogen, Total Nitrate Nitrogen, Total Phosphorus and Total Orthophosphate. Ammonia, BOD_5 Nitrite and Orthophosphorus concentrations were all below detectable levels of 0.040, 4.0, 0.040 and 0.090 mg/L respectively. The numbers for Nitrate concentrations were in the range of 0.20 to 0.32 mg/L, significantly below the federal and state drinking water quality standard for nitrates, which can be up to 10 mg/L. Total phosphorus concentration came back at around 0.020 to 0.029 mg/L which meets the surface water quality standard for stratified and not stratified lakes and reservoirs which can be up to 0.030 to 0.040 mg/L total phosphorus described in Wisconsin Administrative Code NR 102.06. This data demonstrates why the water in the pool appears clear. These analytical results are validated by the clarity of the water from the pool (Figure 6).

Project Costs: Due to the clarity of the water that is maintained by the Prairie Treatment System, the bear pool is not drained until the fall of the year. An unexpected benefit has been that the pool now serves as nursery to tadpoles for our toads and tree frogs. There is some slight algae growth on the walls of the pool, but it is easily scrubbed clean when time allows. Being able to be flexible when cleaning occurs has been a huge help in managing staff priorities.

One of the most shocking details about this new system was the low cost and the ease of installation. Total cost of the project was $7,500. The full installation cost was recovered in the first two years of operation in just the avoided labor cost of maintenance. This is vital for a free, city owned zoo.

In fact the cost to the zoo was much less. Labor to construct the system was absorbed by the Parks Department and Engineering costs were donated by Mr. Ferris. Alliant Energy Foundation provided a $1,750 Community Grant which paid for construction materials and the educational signage (Figure 7). With this new way of filtering pools, conserving water, and allowing for an educational moment, we realized this is beneficial information we could share with other zoos. Due to the success of the Bear system the Baraboo Zoo has plans to construct a second Prairie Treatment System for its new Otter Exhibit in 2019 and a third for its new Beaver Exhibit, also in 2019.

The authors would like to express our thanks to Tori Spinoso, curator for the Ochsner Park Zoo for her leadership and roll in constructing the project.

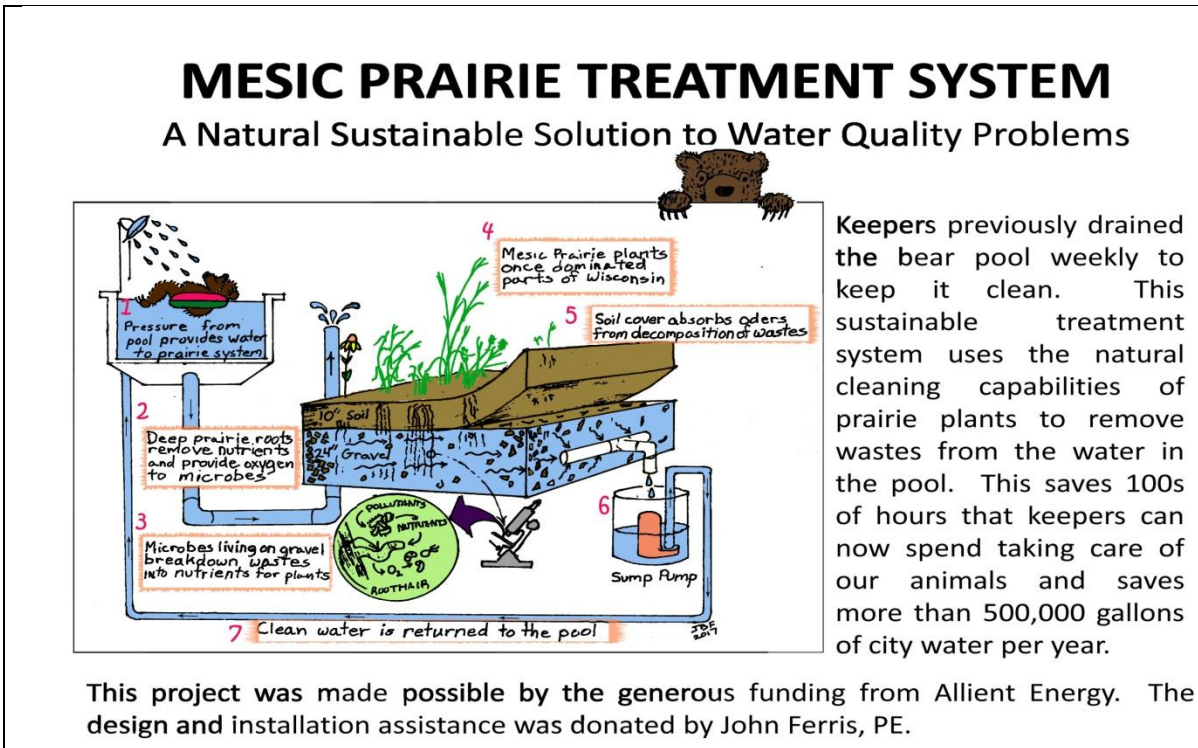

Figure 7. Informational Signage at Bear Enclosure

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Keeping Mable Able: Welfare Assessments Assisting in Animal Care

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Abstract: In the summer of 2015, Mable, a two-year-old female Nigerian dwarf goat, began to show bilateral forelimb lameness. Various treatments were tried including medication, therapeutic walking, and laser therapy, but her lameness and osteoarthritis continued to progress. A last treatment was attempted using custom leg braces to stabilize her carpal joints. As is common when approaching end-of-life decisions, we began an ethogram to document her declining mobility in conjunction with radiographs and goniometry. The behavior set included negative indicators (lying down and leg lifting) along with positive indicators (interacting with guests and playing). Her twin brother, Bentley, was observed for comparison. The ethogram revealed that Mable was more active while wearing the braces. Repeating the study semi-annually for two years has shown consistent positive behavioral indicators. Mable's osteoarthritis continues to progress and goniometric data shows that her joints are losing range of movement. Where these trends intersect will likely require us to make difficult yet necessary choices. The data alone does not define quality of life, but aids with quantitative decision-making; when we come to a determination it will be through a combination of scientific, behavioral, and emotional data that will facilitate making an end-of-life decision for a young animal with a serious, chronic, slowly debilitating health condition.

Introduction: Animal welfare is the measurement of an animal's physical, mental, and emotional states over a period, and is measured on a continuum from poor to good. However, animal welfare is not only for improving the quality of life of animals living in poor condition. Welfare assessments also inform the making of important decisions regarding an animal's care as circumstances change due to age, injury, or illness.

In the summer of 2015, Mable, a two-year-old female Nigerian dwarf goat (*Capra hircus*), began to show unilateral right forelimb lameness. She was only two years old at the time with a twin brother Bentley. Mable would stand with her right foreleg raised in the air (tripoding) or would be observed lying prone frequently throughout the day where the rest of the herd was active. Physical examination and radiographs showed osteoarthritis in the right carpus (wrist) but did not point to an obvious cause. While a definitive diagnosis was elusive, we began treating her symptoms with analgesics and anti-inflammatories.

Mable's symptoms continued to progress with more tripoding, lying down, left forelimb lameness, and began exhibiting a "dropped" appearance to her pasterns seen in Figure 1. Repeated radiographs showed changes in her joint, especially at the carpus, that pointed to osteoarthritis as the cause of her problems. In comparison Bentley showed no changes in his radiographs but proved a useful baseline to his sister going forward.

Figure 1. Dropped pasterns

Figure 2. Mable wearing carpal braces.

In addition to pain management we began cold laser therapy to reduce inflammation in her joints and commissioned custom braces to stabilize her carpal joints. Braces were applied in the morning each day once prescribed and removed in the evening (Figure 2).

Methods: 7.8 Nigerian dwarf goats live together in an area named Contact Junction within Kids' Zone department at Point Defiance Zoo & Aquarium. They share a small barn and fenced yard

with gravel substrate that surrounds a covered geodesic dome with openings where guests can pet through fence or feed timothy pellets from 9:30-11:00am and 12:00-4:00pm. At 11:00-12:00 on Friday, Saturday, and Sunday the feeding is suspended and guests can enter the yard and groom with goats with brushes. An ethogram was developed to track the occurrence of behaviors associated with discomfort from arthritis (Table 1). Bentley, her twin brother, was used as a comparison. Simultaneous sampling of Mable and Bentley was performed every 10 minutes from 11:00am to 3:00pm Friday, Saturday, and Sunday. Data was collected for five weekends for the first two data sets and 3 weekends for the third data set. These hours were chosen due to availability of a goat attendant who supervised guest and animal interactions as well as being the timeframe with the most goat activity.

TIME	Lying down	Standing	Standing w/ shifting legs	Walking w/ leg swing	Tripoding	Interacting w/ herd (calm)	Interacting w/ herd (active)	Climbing fence	Interacting w/ guests
11:00									
11:10									
11:20									
11:30									
11:40									
11:50									
12:00									
12:10									
12:20									
12:30									
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13:40									
13:50									
14:00									
14:10									
14:20									
14:30									
14:40									
14:50									
15:00									

Table 1: Ethogram of recorded behaviors

Results: After the first ethogram Mable already presented a very different picture when compared to her brother Bentley. Figure 3 shows how she spent more than a quarter of her

observed time lying down and almost a fifth of that time exhibiting an abnormal posture or gait. In contrast, Bentley was on his feet for most of the time which was representative of the rest of the herd.

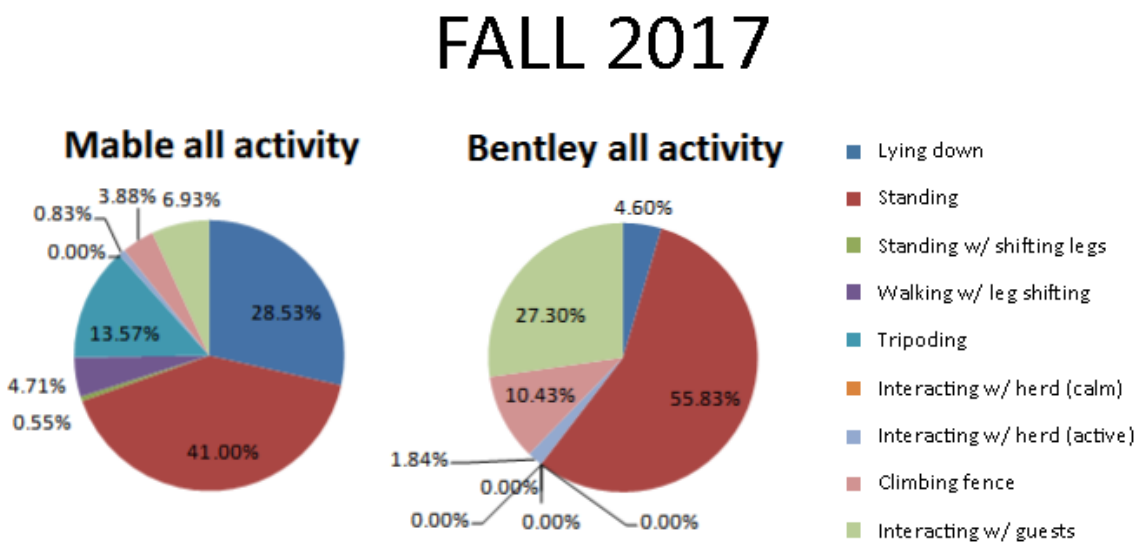

Figure 3. Comparison of Mable vs. Bentley for the first data set from October 6th to November 5th. Bentley began the ethogram two days after Mable.

Over the course of the first observational period there appeared to be a change in how often Mable was observed lying down. Anecdotally we felt that she exhibited decreased lameness after the addition of the braces and we observed a dramatic increase in how much she was on her feet and a possible decrease in abnormal posture and gait (Figure 4).

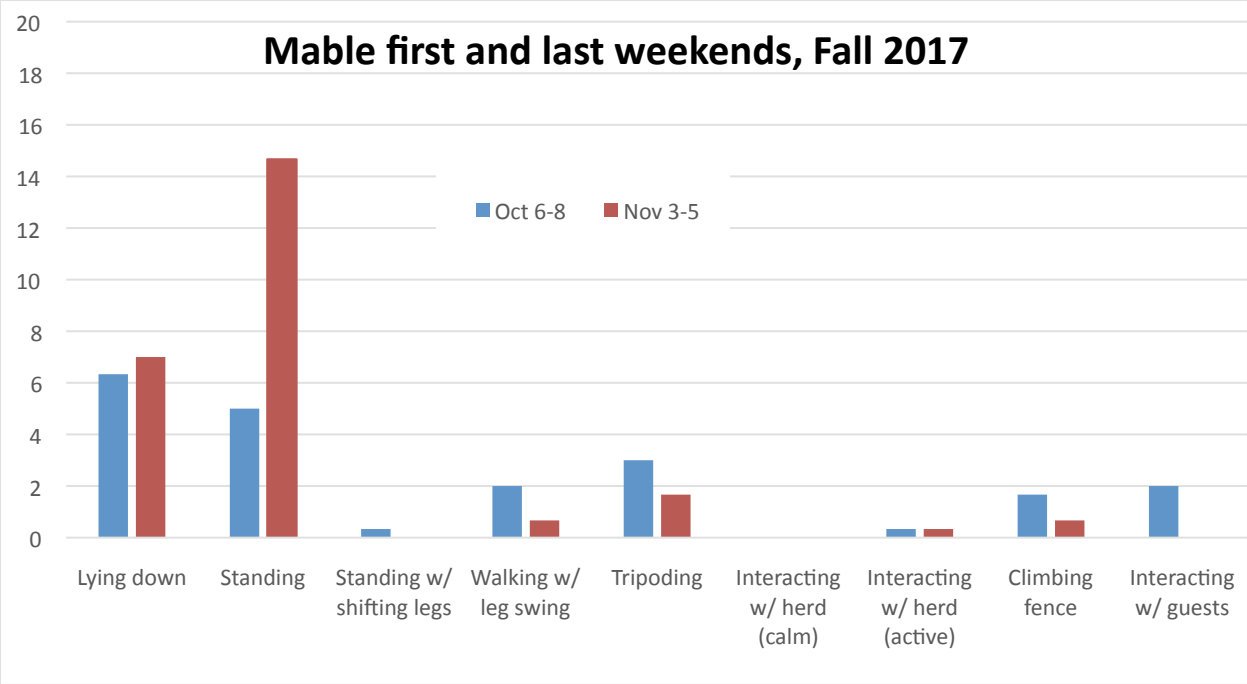

Figure 4. Number of occurrences of each behavior over the first and fifth weekends. Note, there was a partial recording day on October 7th for cold laser therapy for Mable.

Criticism of the time budget generated by the first ethogram was that it was conducted during the fall where rain and cold temperatures correlated to days of inactivity (lying down) and low guest attendance, providing an inaccurate snapshot of her behavior. Bentley remained active regardless of weather and spent most of the observed time on his feet.

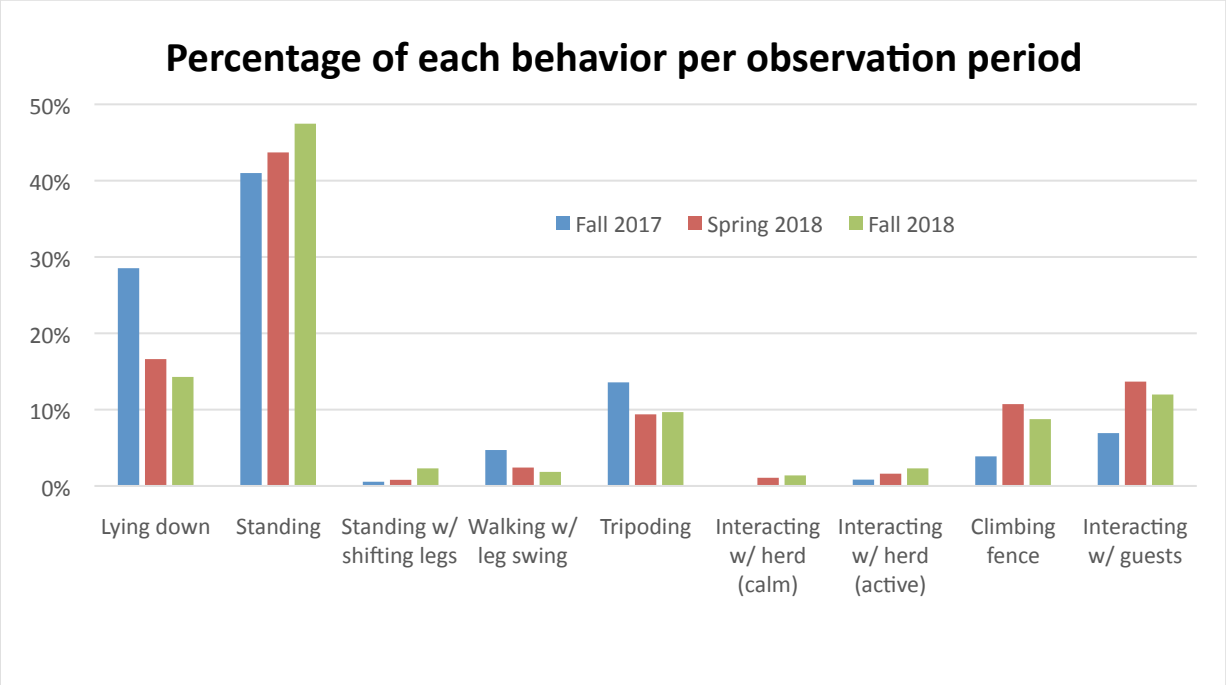

Figure 5. Results of all three ethogram sessions for Mable. Percentage of each behavior observed displayed because Fall 2018 comprised of only 3 weekends instead of 5.

The ethogram was repeated in Spring 2018 and the weather was like the Fall 2017. We found decreases in the negative behavioral indicators (lying down, abnormal gait, tripoding) and more time spent on her feet overall (Figure 5). Bentley remain unchanged in his behavior.

The third ethogram was taken for three rather than five weeks due to work constraints. The ethogram was repeated in one year from the first ethogram and appeared to show maintained changes in Mable's mobility (Figure 5).

Radiographs and goniometry were also recorded with each observational period. Radiology of her shoulder and carpal joints showed progressive osteoarthritis (Figure 6). Goniometry, numerical measurement of the range and motion in a joint as an angle, showed decreasing range of motion (ROM). ROM was measured as the difference between the angle of extension and flexion of a joint. Figure 7 shows decreasing ROM for many of the measured joints. Figure 8 shows how Mable's ROM in joints of concern compared to Bentley's.

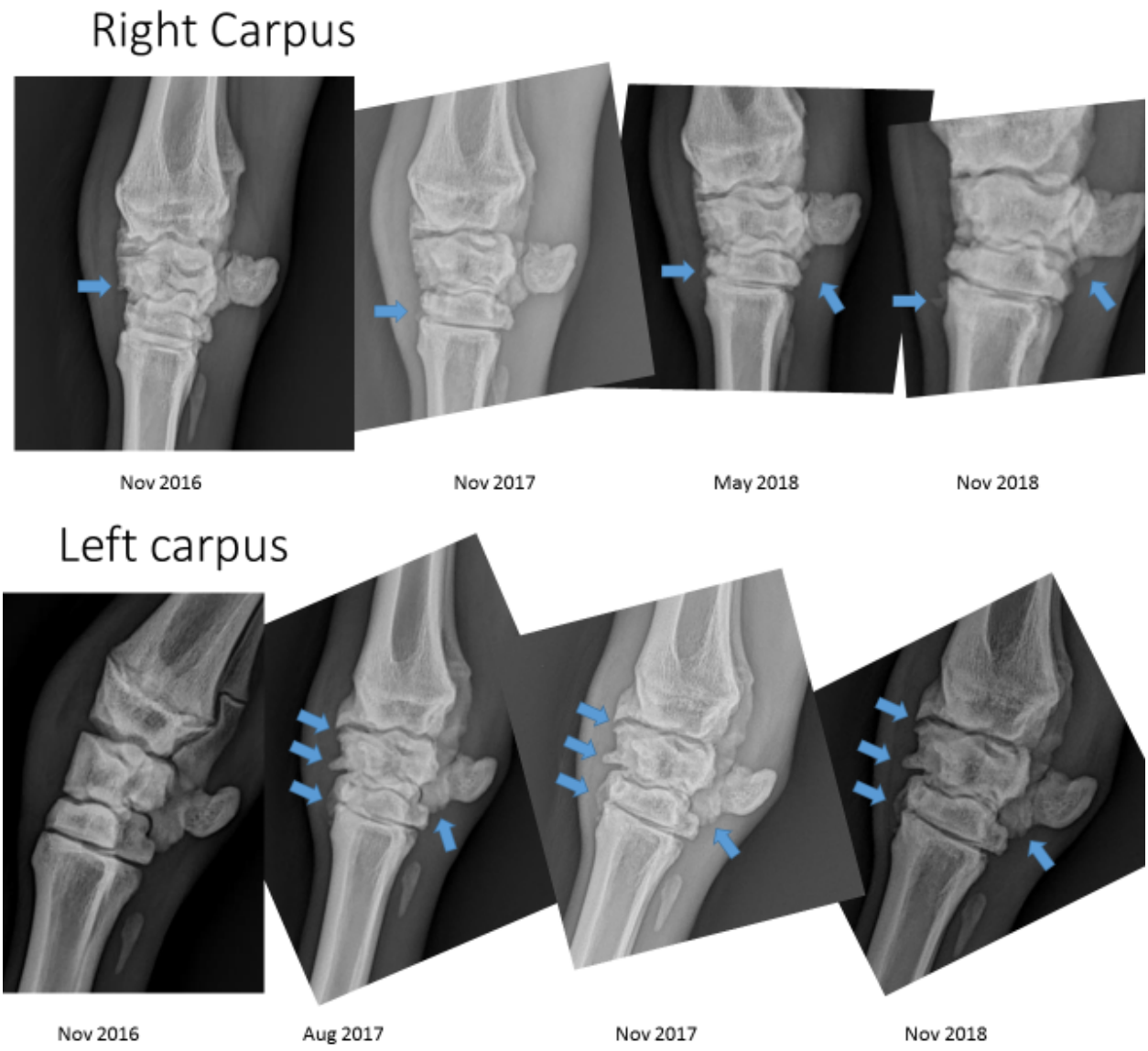

Figure 6. Changes in Mable's carpi due to osteoarthritis.

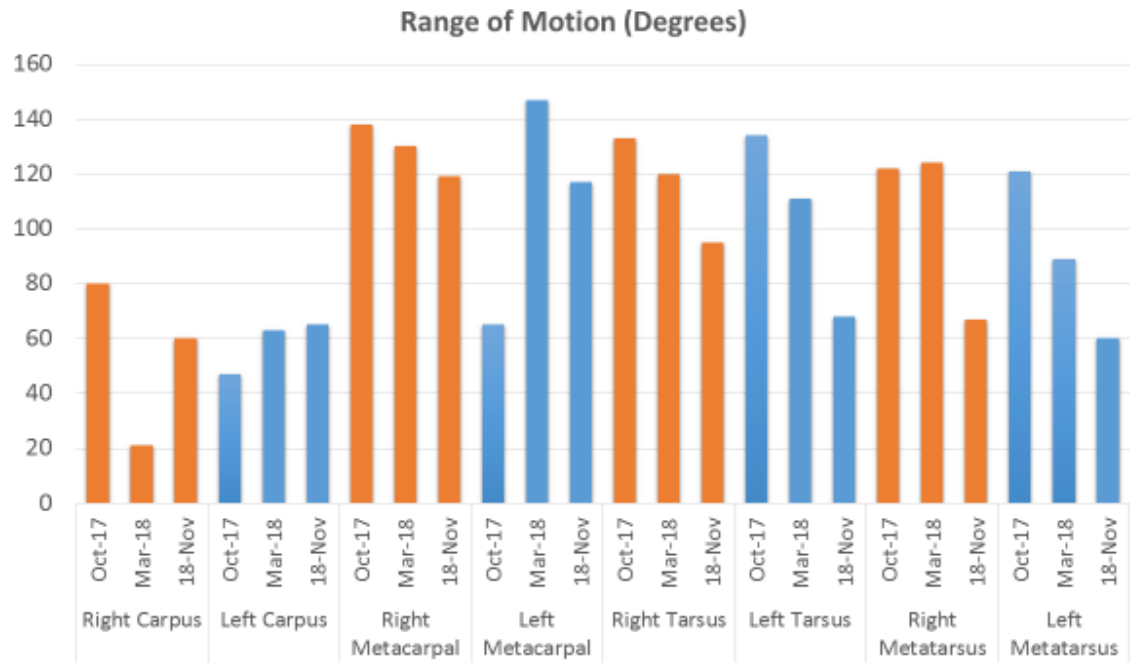

Figure 7. Range of Motion measurements for Mable over time.

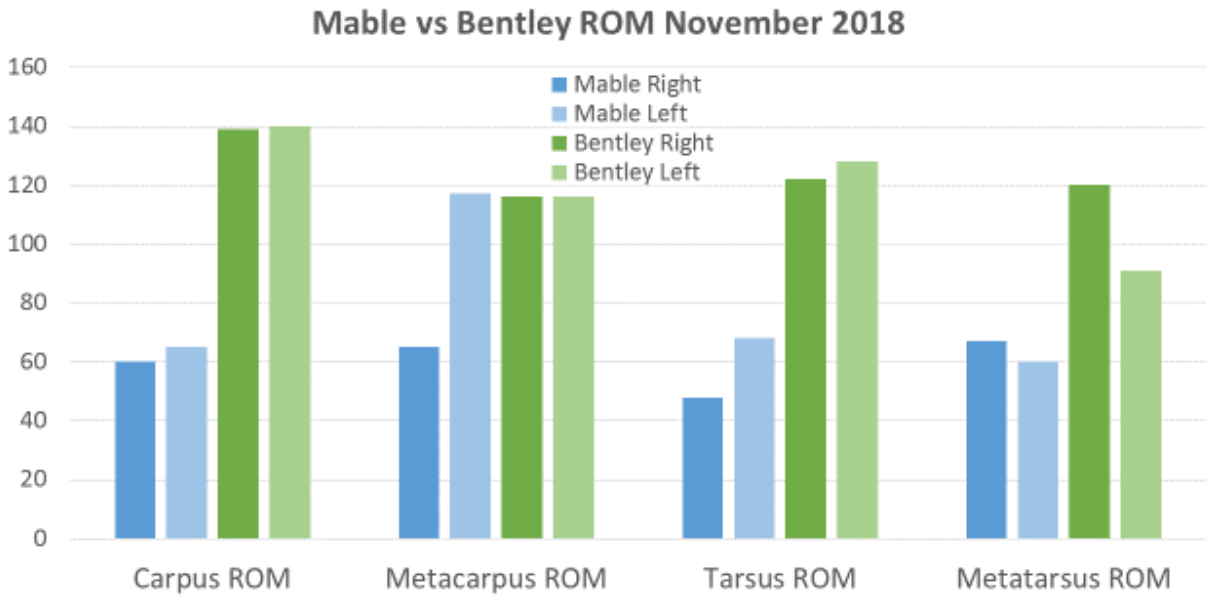

Figure 8. Comparison of ROM for Mable and Bentley.

Discussion: Because Mable was showing signs of improvement behaviorally while she was losing more ROM in her joints we were in the process of developing a scoring rubric with the hope to quantitatively rate Mable's declining health using multiple factors such as her observed mobility, degree of osteoarthritis, and ROM,. We were having difficulty determining how to

grade the severity of each factor without knowing the extremes. We have not experienced this situation in our herd before and so didn't have previous experience to refer to.

Before the next spring ethogram was to begin Mable developed a new symptom that warranted more scrutiny. While standing or walking her scapula were becoming more and more pronounced. We assumed it was because of the continuing changes to her musculoskeletal system. She continued to decrease weight bearing in the forelimbs (shifting weight to the rear limbs) and had reduced muscle mass around her shoulders compared to her cohorts, especially Bentley. Exam findings were suggestive of partial, bilateral scapular luxation. Because of the increasing potential for spontaneous dislocation of either or both shoulders and the reduced ability to compensate for a non-functional foreleg because of her osteoarthritis, the determination was made to humanely euthanize her before her quality of life declined any further.

Conclusion: Data collected with our ethogram provided evidence our efforts to positively impact Mable's welfare were fruitful. We observed a decrease in what we perceived to be negative indicators of her physical comfort. At the same time our continued close observation made us aware of her declining ROM in her joints and emerging indicators of scapular luxation.

While the timing to humanely euthanize Mable was earlier than anticipated, an early end-of-life decision was always likely to be made for her. It was probable that the osteoarthritis and decreasing ROM would eventually manifest as changes in her behavior. The new information of a more volatile event involving complete luxation of the scapula added urgency to evaluating her welfare. The availability of this information did not make the decision for humane euthanasia self-evident. There was an ethical question of being proactive versus reactive. Knowing that the potential consequence of inaction in this particular case was traumatic scapular luxation with lameness as a worst-case scenario or continuing slow decline at best motivated pre-emptive management.

There are many necessary yet difficult decisions we must make as animal caretakers but I have found this experience to be as close to being "right" as I've ever felt an individual keeper, as a team, and institution regarding an individual animal's care. There is an investment of time to setup the ethogram, analyze data, and schedule exams, but weighed against the benefit Mable provided as an animal ambassador, the improvement of her individual welfare, and extending her life with the greatest preserved quality of life possible it was well spent. Knowing we can come to a complete determination rather than an educated guess based on anecdotal evidence informs our future husbandry practices for better animal care in the future.

Kinesiology taping flamingos: "They've got legs… but sometimes don't know how to use them"

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Introduction

Regarding flamingos, Animal Care staff sums up the importance of healthy legs in saying "their legs are their life." Injuries and abnormalities in a flamingo's leg or foot can progress into debilitating lameness and interfere with daily activities. Several Caribbean flamingos (*Phoenicopterus ruber*) at the Columbus Zoo and Aquarium have exhibited leg abnormalities during growth spurts in the first years of development while hand rearing chicks or as a result of injury as adults (generally during breeding and nesting season or medical issues). Because corrective surgery presents risks, early detection of abnormalities paired with various therapies is crucial to help manage individuals without surgery. Deana Cole, PTA and licensed massage therapist is certified in kinesiology taping (KT) and started volunteering her time and expertise in 2010 to help complement the medical care of the Columbus Zoo and Aquarium's Animal Health staff and the daily care and observations of the Animal Care staff. KT therapy has become more prominent publicly since athletes in the 2008 and 2012 Olympics sported the tape (Williams et al. 2012), and evidence suggests kinesiology taping aids in increasing circulation, which promotes healing, decreasing inflammation, and providing pain relief (Kase et al. 2003), and has had success in correcting angular limb deformities in some bird species (Boon et al. 2009, Kozel et al. 2016). Deana had experience using KT therapy on humans, dogs and horses prior to adding another species to her regular patients: flamingos. With the direction and guidance of the Detroit Zoological Society for initiating the using KT therapy on Chilean flamingos in 2008, Deana helped utilize the newer type of therapy alongside the staff at the Columbus Zoo and Aquarium.

Flamingo Chicks

Since 2009, the Columbus Zoo and Aquarium has hand reared Caribbean flamingo chicks for the purpose of better flock management and allow for calmer individuals during hands-on routine exams in addition to decreased risk of predation in an open-topped habitat. Eggs are collected soon after laying and artificially incubated until hatching. From hatching, flamingo chick rearing staff closely monitors weight gains (adjusting formula amounts given accordingly), along with daily age-appropriate exercise sessions, including walking, running, and swimming. Any signs of abnormal leg splaying or rotation are discussed with the veterinarians at frequent routine exams as well as whether any additional therapy is needed at that time. Common abnormalities associated with growing chicks and juvenile flamingos include uneven growth plates in the tarsometatarsus (associated with the ankle joint), which can cause splaying of legs at the ankle, and rotation of leg joints, for which the Flamingo Husbandry Guidelines (Accessed 1 July 2019) advises adjusting diet, increasing exercise and if needed, surgical correction (Zollinger et al. 2005). Kinesiology taping is an additional therapy option to complement diet and exercise routines to provide extra guidance by manipulating tension strength of the tape, which can engage connective tissue, muscles, ligaments and tendons (Boon et al. 2009, Kase et al. 2003).

For example, a splaying leg (direction) at the ankle could be taped over the joint, allowing the body of the individual to counteract the elastic tension from the kinesiology tape, so that the growth is slowed on the faster growing side, and encouraging a more even rate of growth. Deana Cole has been involved in KT therapy for two Chilean flamingo juveniles and at least seven Caribbean flamingo chicks/juveniles hand reared at the Columbus Zoo and Aquarium. In two cases the individuals needed surgery, with one individual successfully recovered with moderate arthritis as an adult that was managed periodically with medication, hydrotherapy and kinesiotherapy taping. Most other juveniles with minor to moderate splaying or rotation were involved in KT therapy for several months to a year. The duration of KT therapy was more objectively determined using radiographs to monitor active growth plates in the tarsometatarsus and measure angles of abnormalities. For example, two juvenile flamingos in autumn 2016 were radiographed and recommended to start KT therapy in addition to hydrotherapy/exercise regimens. Acadia initially presented 9° valgus (outward or "knock-kneed") splaying on her right leg and 5° valgus splaying on her right leg in October 2016 (Fig. 1a), while Haleakala initially presented in September 2016 a 6° valgus abnormal splaying on her right leg and 7° valgus splaying on her left leg (Fig. 1b). Both were taped in such a way that on the medial side, tape was applied proximal (to the ankle) and pulled with slight tension distally since the tape recoils (Fig. 2). The lateral side of each leg was taped starting distal (to the ankle) with slight tension pulled towards the ankle. The mechanics behind this application of the elastic tape is due to the recoil of the tape when applied with proper tension. Individuals are all observed walking and resting with newly applied tape to ensure a level of comfort as well as mobility (Fig. 3) Juveniles were re-taped every 2 to 3 weeks with monthly radiographs to measure progress. In late December 2016, radiographs showed improvement for both flamingos, such that for Acadia there was little evidence of remaining splaying with 2° valgus splaying on her right leg and 1 degree on her left leg (Fig. 1c). Haleakala also improved by decreasing valgus splaying to 5 degrees on her right and 4° on her left (Fig. 1d). Although Haleakala continued KT therapy and hydrotherapy through May 2017, her angular splaying remained static and she had no dysfunctional issues moving throughout the outdoor habitat. Close observations by Animal Care staff combined with good communication with veterinary staff has been crucial to a successful chick rearing program and successful therapy program involving Deana for expertise administering kinesiology tape for best results.

Adults with Injuries or Medical Condition

Adult Caribbean flamingos also benefit from KT therapy, most often as a result of an injury or medical issue. Two individuals in our flock experienced trauma to the ankle, most likely relating to increased aggressive behavior of adult flamingos while forming pair bonds, and during breeding/nesting season, especially while establishing and defending a nest mound from other flamingo pairs. Initially veterinary staff examines the injury and determines if additional action is needed at that time. Typically these types of injuries are monitored and if lameness/swelling continues or progresses then antibiotics or pain medications are administered along with assessing bloodwork if necessary to rule out underlying illness. Individuals are reassessed after finishing prescribed medicines, to determine if treatment either temporarily resolves the issue or if inflammation and lameness of the joint becomes a chronic medical case. In our case, both flamingos generally continued receiving medication and veterinary staff recommended hydrotherapy in conjunction with KT therapy. Hydrotherapy consists of bringing two flamingos

(flock animals are generally calmer with a buddy) to actively swim for about ten minutes in a 12-foot-deep saltwater rehabilitation pool in the manatee building while manatees did not have access. One or two animal care staff are generally in the pool with the flamingos (depending on calmness and demeanor of individuals) to engage individual(s) needing therapy and guiding the direction of swimming while monitoring behavior, exertion, and overall safety to a successful session. These two flamingos, along with an adult that had surgical correction as a juvenile, tended to improve, but it became apparent in the following breeding/nesting season that these joint injuries would be chronic medical cases requiring therapy on a regular basis. In addition to hydrotherapy and KT therapy, veterinary staff eventually added laser therapy and joint fluid tap/steroid injection to reduce lameness.
In separate a medical case, one adult female flamingo was diagnosed with neuritis, an inflammation of nerves, in her leg resulting in lameness and atrophy of muscle mass of the affected leg. Through treatment of a combination of steroid medication, hydrotherapy and KT therapy (taping focused on inflammation and support), the issue was finally resolved 8 months later.

Ultimately individuals have different needs that are considered when the Animal Care and Animal Health staffs are deciding which therapy options are feasible to administer. In our experience, generally hand reared flamingos have been the best candidates for KT therapy. Therapy and treatment that involves handling more stressed individuals can increase the risk of additional injury, which emphasizes the importance for Animal Care and Animal Health staffs to discuss realistic options and goals for treatment.

Discussion

While the flamingo care staff continue to work closely with Deana for KT therapy of individuals, her list of zoo patients has grown since 2010. She has administered KT therapy for species including a 41-year-old white-naped crane (*Antigone vipio*), 2-day-old dama gazelle calf (*Nanger dama ruficollis*), and zookeepers, of course! Deana's certification and experience with KT therapy, along with dedication to providing her time and services for animals requiring extra care has built a solid relationship with veterinary and animal care staff at the Columbus Zoo and Aquarium. Because improper application of kinesiology tape can worsen the abnormality (especially in flamingo leg cases), having a trusted and experienced KT therapist is crucial. By recommendation, Deana has also consulted with the National Aviary to demonstrate and teach their staff about various flamingo KT therapy options that have been successful in her growing experience. KT therapy is not a "cure-all" treatment; rather it is used in conjunction with other therapies and/or medical treatment. Thus, good communication between therapist, animal care and veterinary staff is important to yield favorable results and adjust therapy treatment plans and goals. For example, an individual with an injury can initially receive medication and have KT applied with the goal of decreasing inflammation, and two weeks later shift to no medication and apply KT for support. Similarly, a growing flamingo chick's legs can present signs of splaying or rotational abnormalities and change rapidly during the course of a week, requiring active conversations and willingness to take action and shift plans as needed.

Having the best animal therapy/care team with a golden plan can set the foundation for a successful treatment, but the patient can react differently than planned and the team needs to be

prepared to adjust accordingly, and sometimes think outside the box. For example, it is common for flamingos to pick at kinesiology tape and first time KT therapy patients can even remove most of it within 48 hours after application. It can take some adjustment time to desensitize to the presence of the tape and elasticity, so a small piece of non-elastic tape is often applied to act as a "bite tab" to encourage picking at that piece instead of the functionally therapeutic kinesiology tape. Overall, the safety of the animal is important to consider and new KT therapy patients should be closely monitored as well as ensuring the animal is reacting appropriately after each KT application. Increased lameness, abnormal gait, or other behaviors associated with increased agitation are observations that may support changing the tension or other aspects of application of the kinesiology tape. However, once the individuals have acclimated to the presence of the kinesiology tape, it can potentially provide continuously therapy for up to 2 to 3 weeks, and some varieties of KT are more water resistant.

Concept of KT therapy is the same, but the techniques of tape application varies in directional pull and tension applied among different institutes, companies, and therapists, which can add to confusion or lack of significant evidence to the efficacy of kinesiology tape (Williams et al. 2012). While mixed results of studies due to these confounding factors, flamingos (and long-legged birds) possibly have more success with KT therapy due to the lack of large musculature in their legs, thus elastic tape is more engaging physiologically, yielding good results in our experience at the Columbus Zoo and Aquarium.

Conclusion

The Columbus Zoo and Aquarium flamingo care staff, veterinary staff and KT therapist are a successful team through aspects of creativity, continuous communication, and the ability to adjust plans to meet changing needs. Treatment of an individual can often encompass different techniques (medical, therapeutic, etc.) that might require change over time to produce the most favorable results. Successful KT therapy for flamingos in multiple zoos started through staff sharing ideas and innovating together, but has now incorporated even more species using KT therapy. This trend provides additional opportunities for Animal Care and Animal Health teams to share the process of using KT therapy in their particular animals' treatment plans.

Acknowledgements

An immense thank you to Deana Cole, whose direction, dedication, and generosity has continued our successful KT therapy use with flamingos. Your expertise and willingness to adjust to changing circumstances continues to create opportunities to better the welfare for animals in our care. Special thanks to our veterinary staff at the Columbus Zoo and Aquarium, who are providing amazing care for our animals, even the individuals that require more time and research regarding best treatment practices, as several of our long-legged friends have done. Lastly, the success of this team is completed with an incredible flamingo care staff. With their experienced observations and dedication to strive for the best care for each individual and the flock as a whole, along with the support of our Shores team, we are able to succeed in providing achieving our goals together.

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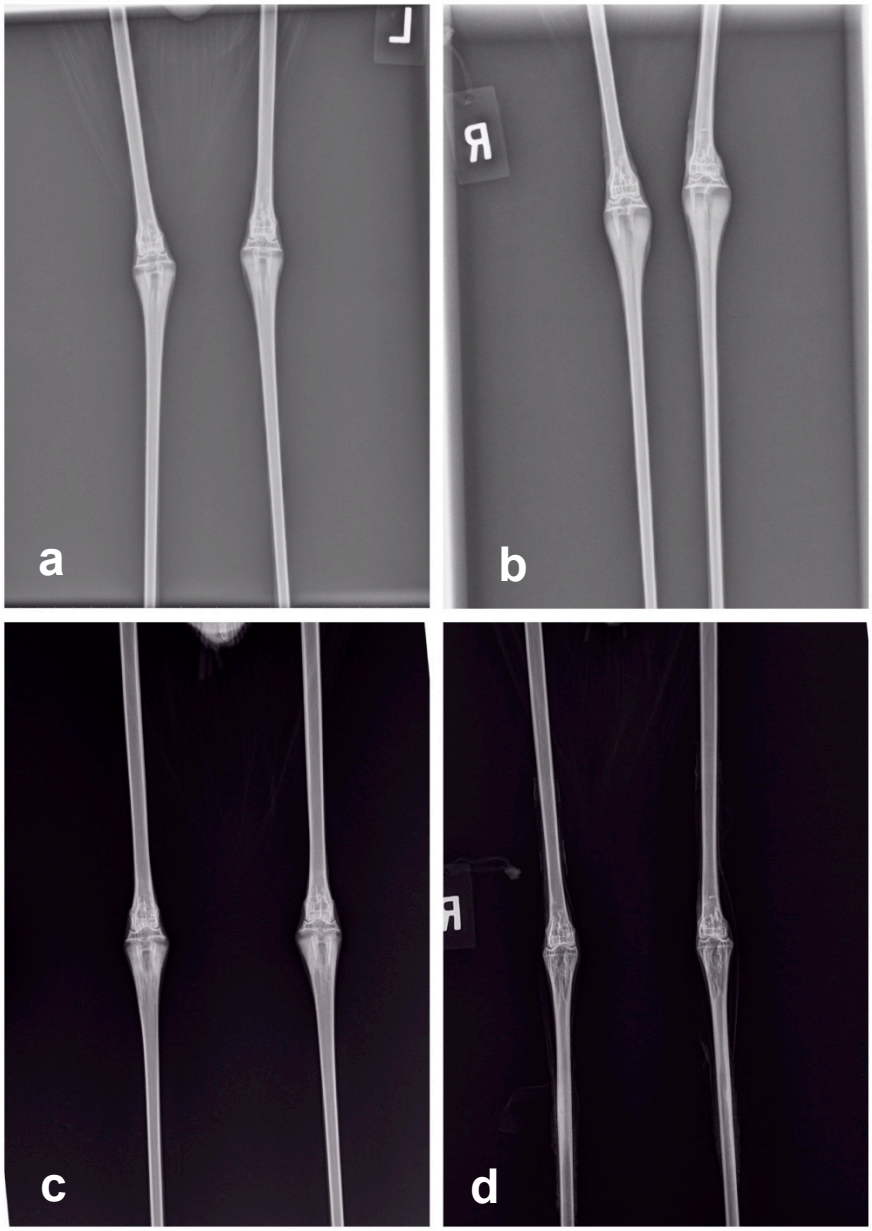

Fig. 1(a-d). Radiographs of legs of two flamingo juveniles as a measurement of angular deformities to compare changes over time while using therapies including kinesiology tape and hydrotherapy. Radiographs a and b of each individual were taken when KT therapy was initiated in October and September 2016, respectively, and then compared with radiographs c and d when KT therapy ended in December 2016 and May 2017.

Fig. 2. Direction for tension during application of kinesiology tape used to correct valgus splaying in both legs. Vet wrap and cloth sports tape were applied to protect top and bottom of kinesiology tape.

Fig. 3. Flamingo juveniles adjusting to newly applied kinesiology tape in the outside habitat.

Choice and Control in Training a Nile Hippopotamus

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Introduction

Adventure Aquarium is home to two female Nile Hippopotamus (*Hippopotamus amphibious*), Genny and Button. Training is an integral part of their day to day care. Training and maintaining husbandry behaviors allows us to properly care for both their physical and mental needs. From the beginning it was clear that these two hippos have very different personalities. This has caused the hippos to react quite differently to our approaches in training. While both hippos are extremely intelligent and successful during training sessions, Button proved to be much more cautious in particular situations. When presented with new training or enrichment Button is much more hesitant to engage quickly. One key example is Button's hesitance to be closed in the restraint chute in our holding area.

There have been many attempts over the years to increase Button's comfort with the chute. Progress was seen in many of these attempts but there was a recurring theme that caused a breakdown each time. Though she had more comfort in the chute, the movement of the rear door would cause her to regress. Each time we attempted to move the door she would immediately back out and would become less likely to enter in later training session. It seemed that any trust we had built would be tested each time we moved the rear door. We needed a way to move the door that did not come across to her as a surprise. We set out to relinquish our control of the training session and entrust it in Button. Instead of closing the rear door when we thought she was ready we ultimately left that decision up to her. By giving her choice and control over the situation she is now able to move at her own comfort level and have complete trust in her trainers. This paper will discuss the method used to give Button choice and control and how she is able to communicate her choices to her trainers.

Methods

In order to give Button choice and control we needed to construct a form of communication. A very clear form of communication needed to be established so that she could learn to express her decisions without any confusion. She has always shown an interest in her "target" behavior so we determined that would be a great way to start in order to set her up for success.

We conditioned a two-target system. One target would act as a standard target, and when she touched it with her nose she would be reinforced with three monkey chow biscuits. No other actions would take place. For this target, we created a target pole consisting of a blue and white pool buoy on a wooden dowel. This style target has been used for a long period of time that she is used to seeing often during training sessions. The second target was a metal, oval cake pan

with red electrical tape strips across it. This target was chosen since it had a drastically different look. When this target was chosen she would be reinforced with a much higher value reward, melon. This target, however, would elicit a consequence. When bridging Button for choosing the cake pan, another trainer would move a door using the hydraulic controls. We now had our line of communication figured out. Choosing the target pole meant no door movement and a reinforcement of three monkey chow biscuits. Choosing the cake pan meant door movement with a reinforcement of melon.

Now that we had our form of communication figured out, it was time to teach it to Button. First, we focused on the cake pan since she was familiar with the target pole. The cake pan was presented to Button in order to desensitize her to the new item. She was asked to target to the cake pan. She was slightly hesitant at first but quickly became comfortable with the new item. A few more session were done to ensure her comfort. We then presented both target simultaneously, two trainers were present and each presented one target. This is where we began to show that each target would have different reinforcement values. In order to eliminate bias, we would switch up variables. We would have different trainers hold the targets, switch who was holding each target midsession, and also having Button back up before the presentation of targets to make sure she was actively choosing a specific target and not just moving her head accidentally into a target. It quickly became clear that she knew that the targets would reinforce with different foods as she had many sessions in a row where she only chose the cake pan to receive the high value reinforcement.

All of these sessions were done outside of the chute so that she could comfortably learn the rules of communication. It is also important to note that the hydraulic controls for the doors in holding were also turned off up until this point. Over the years she has learned that we cannot move the doors unless the hydraulic motor is on. The motor creates a loud humming noise when running so it is clear to her when the motor is running. She took this even further and knew the doors could not move unless a trainer was at the hydraulic controls. These variables would also have to be slowly introduced into training sessions. It is at this point that we turn the hydraulic motor on during training sessions to slowly introduce this variable. We also began standing in the chute when presenting the targets through the rear door in order to slowly introduce the chute as a variable. Another change we made was having one person present both targets in order to simplify things. This created a one on one training situation and cut down on the number of trainers needed in order to conduct these training sessions.

Having the hydraulics on with a trainer near the controls did not seem to bother Button during these sessions so we decided it was time to start moving a door when she chose the cake pan to begin teaching her this critical component. We started by moving the furthest door from where she was but made sure it was behind her since we would be working towards moving the rear door of the chute. She did not seem to mind the movement of the door so we began to slowly open doors that were closer to her over the next few sessions.

With Button now showing comfort with the movement of doors, we opened the rear door of the chute to allow her access. The trainer would now present the targets at the front door of the chute. During the first session she came all the way into the chute and chose the cake pan. A distant door behind her was moved. Button reacted and backed out of the chute. She did return to the session and looked at the targets for a long time finally choosing the target pole. She then backed out of the chute again. We closed the rear door of the chute and presented the targets through the rear door. She quickly chose the cake pan. It was clear we needed to move in slower increments to build her comfort. We then began having the rear door to the chute open and presenting the targets from the side. This allowed Button to not have to be all the way in the chute in order to participate. We could then slowly move her further and further into the chute as time went on.

Button began coming all the way into the chute and choosing the cake pan with a distant door being moved. The next step was to have the rear door be the one that would now move once she chose the cake pan. The issue we ran into was that up until this point we had communicated to her that by choosing the cake pan resulted in a distant door moving. If we were to all of a sudden change the door we move to the rear door to the chute we ran the risk of catching her off guard and damaging our trust and line of communication. So in order to clearly communicate to Button that we would be moving a new door we took a step back. We started the session with Button out of the chute. When she chose cake pan we moved the rear door of the chute. During these sessions the rear door was actually in front of her and to the right so she could see it move but had no negative consequence for her since she was not in the chute. After several sessions of showing her that we were now moving the rear door and moved forward. We started the session with her out of the chute. We would present the targets once or twice and then open the rear door completely giving her access to the chute. The trainer would then present the targets through the side of the chute allowing Button to be partially in the chute when making her decision. The rear door would only be moved a small amount when she chose the cake pan rather than trying to close her completely in the chute.

She exhibited signs of comfort with the transition and chose the cake pan more often than not. However, the further she moved into the chute the more often she would choose the target pole. This, however, is still a great breakthrough in itself. In the past when Button would be uncomfortable, she would simply leave session. With the new method she now had an option that would allow her to stay engaged in the session but remain in control and comfortable. Quite often she would choose the target pool repeatedly very quickly and then hesitate for a long period before choosing the cake pan. She was showing us that she was weighing the risk and reward of these sessions. She knows that in order to get the reinforcement she wants there is going to be a consequence, but she has total control over the situation. We are still moving towards having her shut completely in the chute but Button is determining the progression at her own pace. Instead of the trainers setting a pace that may push her too quickly, Button is able to let us know what her comfort level is at and will progress when she is ready.

Conclusion

Handing over control of these training sessions and allowing Button to have a choice has greatly improved her progression towards this goal. In the past, there were likely sessions where she simply did not want to be challenged to this degree. Her response was to leave session. Now with this new method we have seen sessions where she chooses nothing but the target pole and plays it safe. By having this option she can participate in training sessions to the level of difficulty that she chooses. We have fewer days where we cause regression in this behavior simply because Button now has a voice in the matter.

By training Button to express choice during voluntary chute sessions, we have been able to change a behavior that was previously a potential stressor for her into a behavior that she has control over the pace and progression of. The chute is no longer a place where Button feels she needs to be on high alert. She now does many behaviors inside the chute such as filing her tusks and painting. There are days that we simply open the chute at the beginning of the training session to give her the option of entering it and she will now almost always choose to do training in the chute.

Even in behaviors not involving the chute we have seen a difference in not only how she participates in training but how we as trainers look at approaching her for training. We have found that rather than setting strict constraints on her training session that we would allow her the flexibility to train on her own time. This way of thinking has also been adapted with many of our ambassador animals by offering them choice as to whether they are used for education presentation by use of voluntary crating, thus further spreading the opportunity for choice and control throughout our animal collection at Adventure Aquarium. By opening this line of communication with Button we are better equipped to understand her needs and create a more beneficial training environment for both trainers and animals.

Ready, Set, Goat! Using Training and Enrichment to Increase Guest Involvement

Nikki Maticic, Animal Keeper
Smithsonian's National Zoological Park
Washington, DC

Introduction

The Kids' Farm exhibit at the Smithsonian's National Zoological Park is home to a variety of domestic animals, including: Miniature Mediterranean Donkeys (*Equus asinus*), Alpacas (*Lama pacos*), Cows (*Bos Taurus*), Goats (*Capra hircus*), Ossabaw Island Hogs (*Sus scrofa*), Domestic Chickens (*Gallus gallus*), Japanese Koi and Chanel Catfish (*Cyprinus carpio, Ictalurus punctatus*). Since its opening in 2004, the Kids' Farm has provided the opportunity for guests of all ages to interact with domestic donkeys, goats, cows, and alpacas. In 2016, our 1.3 goat herd tested positive for *E. Coli stx1* bacteria during a routine fecal examination. While *E. coli* is commonly found in our day to day environments, the *stx1* strand has the potential to make people sick via transmission through contaminated food or water or via contact with infected people or animals. All animals at the Kids' Farm were placed in a temporary quarantine until each mammal received three negative fecal test results. When the Kids' Farm was re-opened, the decision was made to have our 1.3 goat herd, consisting of 1.1 San Clemente Island Goats and 0.2 Nigerian Dwarf Goats, remain a no-touch species for the public. This left staff with a dilemma – how can we make a no-touch species appealing to the public in an area that focuses on animal and public interaction?

The Kids' Farm in Previous Years

Until 2015, the Kids' Farm hosted a Caring Corral (Figures 1 and 2), in which guests would be able to enter a paddock area to brush and pet the Farm's goats and donkeys. The Kids' Farm also allowed visitors to pet the cows, alpacas, goats, and donkeys through the fence while in their exhibit yards and in the barn (Figure 3). whenever the animals chose to come up to the fence. While the Caring Corral allowed visitors the opportunity to touch and make a connection with the animals, it was not the best setting for allowing keepers to educate visitors about the intelligence and importance of the animals at the Kids' Farm. Many of our animals at the Farm had some experience with training over the years, however a formal training program had not been in place in the recent years.

Figure 1: The Caring Corral. Guests would enter the wooden gate off of the main walkway to brush goats and donkeys at set times throughout the day. ©*Smithsonian's National Zoo*

Figure 2: An aerial view of the Caring Corral. Guests were only able to access this area when allowed by a keeper. © *Smithsonian's National Zoo*

Figure 3: The barn area at the Kids' Farm. © *Smithsonian's National Zoo*

<u>*E. Coli* Changes to the Kids' Farm</u>

After the *E. Coli* quarantine period, several changes were made to the Kids' Farm. While still touchable for our keeper staff and volunteers, our 1.3 goat herd was classified as a 'no-touch' species for visitors. This 'no-touch' rule, which is currently in effect, applies when the goats are on and off exhibit, walking to and from the barn, and while goats are training in the old Caring Corral area. A gate was installed in the barn to allow keepers to block off public access to the goat stalls within the barn and a secondary fence was placed in the goat exhibit yard to prevent visitors from touching the goats. Husbandry tools, such as brooms, shovels, wheelbarrows, and all enrichment items were designated as 'goat only,' and footbaths were placed outside of the barn stalls and exhibit yard (Figure 4). While the Caring Corral had been stopped prior to the *E. Coli* testing, the structure of the Caring Corral remained. Although signage and hand washing stations were in existence long before and continued to be used after the *E. Coli* testing, staff and volunteers began increasing verbal encouragement to guests about washing hands after touching animals during animal demonstrations. In addition to the hand washing stations, keepers began carrying around hand sanitizer bottles during animal demonstrations to allow guests easier access for cleaning hands after animal interactions.

Figure 4: Specific tools for use in cleaning the goat stalls, indicated with yellow tape. ©*Nikki Maticic.*

Changes to Goat Management

The Kids' Farm goat herd, specifically our 1.1 San Clemente and 0.2 Nigerian Dwarf Goats (Figure 5), had always been very social and hands-on with keepers and volunteers. Staff wanted to ensure that the goats continued to receive such interactions with keepers and volunteers despite the changes to the Farm. Various brushes and scratch pads were added to the goat exhibit yard and barn stalls to allow the goats the opportunity to self-groom (Figure 6). In addition, keepers and volunteers increased their presence with the goats through offering more brushing and interaction opportunities. Keepers also strived to incorporate more enrichment for the goats as well, through additional puzzle feeders, tactile enrichment, and changing around parts of their exhibit (Figure 7).

Figure 5: Starting at the left, goats Mortimer, Marla, Fedora, and Fiesta. ©*Nikki Maticic*

Figure 6: The goat exhibit yard, featuring a playground and stumps for climbing. Additional enrichment objects as well as various scratching opportunities were added to the yard. ©*Nikki Maticic*

Figure 7: Fiesta and Fedora interact with a food-smear frisbee for enrichment. ©*Nikki Maticic*

The Kids' Farm primary trainer (Nikki Maticic, Animal Keeper), began implementing a training program with the 1.3 goat herd, comprised of 1.1 ten-year-old San Clemente Island Goats, "Mortimer" and "Marla" as well as 0.2 two-year-old Nigerian Dwarf Goats "Fiesta" and "Fedora", in May of 2017. Mortimer and Marla had participated in training in the past, including

target work and hoof work, however it had been several years since this training had been conducted. In contrast, Fiesta and Fedora had no training experience prior to the start of this new training program. Initial training focused on medical and husbandry behaviors, such as station, target, voluntary hoof lifts, and voluntary touch. Touch behaviors with Mortimer and Marla largely focused on the ability to touch a calloused area on their chests, which both goats were particular sensitive to having touched. (Figures 8 and 9).

Figure 8: Training an up behavior with Marla ©*Claire Morse*

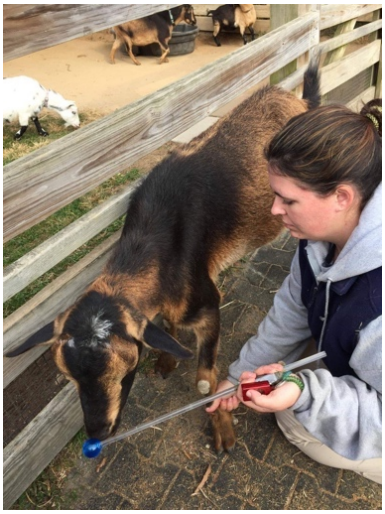

Figure 9: A keeper works with Mortimer on voluntary hoof lifts for medical exams. ©*Shayda Safikhani*

While all goats worked on voluntary hoof touches and lifts for desensitization towards hoof trims, Fiesta and Fedora had a much greater comfort level with being touched compared to Mortimer and Marla. This, in combination with their young age and desire to provide more stimulation for the goats, led to the decision to incorporate additional training behaviors with Fiesta and Fedora in the form of agility work. Work began using a dog agility jump (Figure 10) and quickly progressed to include an agility hoop, weave poles, additional station work, as well as additional behaviors such as hoof/ball work, spin, and walking upright. Fiesta and Fedora took on behaviors very quickly and agility training progressed to include Mortimer and Marla as well. While the Kids' Farm suffered the very unfortunate loss of Mortimer in the late summer of 2018, keepers have strived to continue expanding the goat training program to keep the goats active in their exhibit. Fiesta, Fedora, and Marla have been trained on a recycling behavior, in addition to their agility training, for public demonstrations as well. In this behavior, various non-recyclable items and one recycle item are lined up along the fence, and the goat is trained to target to the recyclable item when presented with the cue.

Figure 10: Fiesta works with a keeper on the agility jump. ©*Claire Morse*

Agility training proved to be a pleasing way for our guests to connect and learn about the goats despite the goats being untouchable. Although guests sometimes view the agility training as 'tricks,' these sessions allow keepers to educate guests that while medical training is prioritized, agility work can be done to keep the animals both physically and mentally active. The animals are keeping active in their exhibits and are mentally staying fit through the process of learning new behaviors. In addition, agility training with the goats allows keepers to assess joint health and activity levels. All training is carried out in the former Caring Corral area of the exhibit, allowing guests to view the goat training within a closer proximity, but not allow them to touch them. Training sessions allow keepers to educate guests that the positive reinforcement techniques used to train the goats are the same techniques used to train animals all over the zoo. Futhermore, these training sessions allow keepers to highlight the concept of animal choice, in that the animals can choose to participate in training sessions.

It has also proven to be a wonderful tool to help younger audiences connect with and understand some of the duties of animal keepers, as clicker training and agility work are often something they have experienced in their personal lives. Many times, children are able to relate to and make

the connection with the goat training they observe at the zoo to training they have done with their own pets at home. The recycling behavior training also allows children to learn more about recyclable items and promotes to our guests that recycling can be done very easily. The program has also allowed guests the unique opportunity to see and learn about the training process up close while also providing an educational opportunity for adults and children alike.

Changes to the Kids' Farm

The Kids' Farm hosts two daily demonstrations, both of which were formally referred to as "Meet a Farm Animal." In 2018, these demonstrations were 're-branded' and given the new title, "Meet a Farm Keeper." This change was important because it allowed keepers more of a choice in the types of demonstrations that could be hosted for guests. With the previous title, keepers were limited to demonstrations that solely focused on touching and petting an animal, as the title of the demonstration was often presumed to involve touching an animal. Demonstrations typically included bringing touchable animals up to the fence, taking our 4.0 donkey herd for a walk (Figure 11), or bringing out a chicken for petting. These touch demonstrations allowed guests to interact with an animal and for keepers to provide some animal facts. However, they did not allow for much variety in terms of the types of demonstrations we were providing to guests. Keepers were able to stand outside of an exhibit of a no-touch animal, such as the goats, to answer questions and deliver facts as a demonstration. However, in these types of demonstrations, guests often became disinterested quickly and/or unsatisfied with the lack of being able to touch the animals.

Figure 11: A keeper interacts with guests while taking the donkeys out for a walk for a public demonstration. ©*Shayda Safikhani*

With the new title, keepers were able to incorporate a greater variety of demonstrations, such as enrichment toss, a grooming session with the animals, a cow bath, a walk with our 4.0 herd of donkeys, animal birthday celebrations, training sessions, painting demonstrations and more, while still being able to offer the chance for the public to touch the animals (Figures 12 and 13). This change also allowed keepers to include more of the Kids' Farm residents in daily demonstrations. Prior to the change in the names, animals such as our goats and hogs, were not frequently featured in demonstrations as they did not allow guests the chance to touch the animals.

Figure 12: A young guest pets a chicken during one of the Kids' Farm daily demonstrations. ©*Jen Zoon.*

Figure 13: A painting session with an alpaca as a part of a public demonstration. ©*Shayda Safikhani*

Keepers could now offer demonstrations that focused on ideas other than touching, such as foraging demonstrations with the hogs (Figure 14), to allow guests to learn about and see firsthand, the adaptations and intelligence of the animals, versus solely learning about these facts while touching the animal. Enrichment items, such as browse pieces, frisbees with smeared food, or a forage bin (Figure 15) could still be offered by the exhibit fences to allow the animals to be closer to guests for petting. However, the concept of the animals being able to choose whether to be pet was something keepers could now explain to guests during demonstrations.

Figure 14: Ossabaw Island Hogs enjoy paper mache birthday-themed enrichment boxes during as a part of a public demonstration. ©*Nikki Maticic*

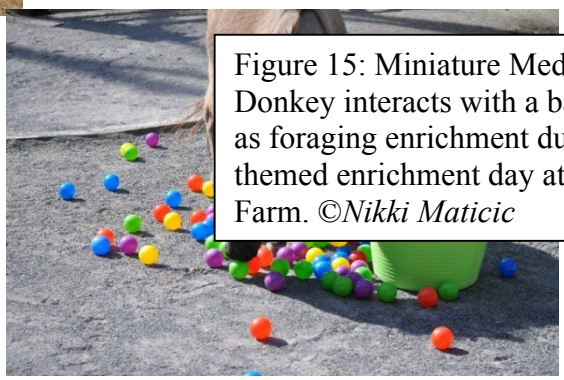

Figure 15: Miniature Mediterranean Donkey interacts with a ball pit offered as foraging enrichment during a themed enrichment day at the Kids' Farm. ©*Nikki Maticic*

Training programs with our donkeys, cows, alpacas, hogs, and chickens were all taking place prior to and during the implementation of the goat training program. Training sessions with these animals are now able to be used as demonstrations for guests to learn about how keepers can use training to care for the animals (Figures 16 and 17). This allows keepers the ability to host more frequent training sessions, rather than solely between demonstrations, with the animals in addition to being able to provide a larger variety to the animals' days and guest experiences.

Figure 16: Training an open mouth behavior with Miniature Mediterranean Donkey, Pat. ©*Sara Colandrea*

Figure 17: A keeper works with a Holstein calf on touch desensitization and target training in the cow restraint squeeze. ©*Natalie Sutton*

Looking to the Future

The Kids' Farm strives to continue to grow in terms of the variety of demonstrations offered to guests. In addition, we strive to continue broadening our enrichment and training programs for the benefit of our animals, but also to allow guests the chance to learn more about the animals. These demonstrations are crucial for allowing guests to connect with the animals not only at the Farm, but throughout the entire zoo. With thousands of visitors coming to the zoo each year from all over the world, the Kids' Farm is often overlooked by guests, especially those who raise farm animals. However, the Kids' Farm has proven itself to be a very important part of the zoo over the years, by helping guests of all ages to make connections with the animals through both touching and learning. With the zoo being in such a large city, there are many guests who visit the Farm and have never seen a live cow, chicken, or goat. The Farm is a wonderful educational tool to learn about what farm animals provide for humans, and to inspire them to develop a love for animals, and ultimately, learn that there is more to domestic farm animals than meets the eye.

Building Confident and Resilient Animal Ambassadors:

A Binturong Case Study

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Abstract

Training an animal to be an ambassador requires the animal to be comfortable with highly variable situations. The training requires the following criteria; structured and consistent, focused on adaptability to the specific nature of the animal; and creative and persistence to address any issues that may arise. Many animals are chosen as ambassadors due to the reliability and the nature of their disposition. Binturongs (*Arctictis binturong*), are known to present more challenges and require a bit more structure, imagination, and persistence to maintain quality in their role as ambassadors. The Downtown Aquarium Denver received Yuni, a 5-week-old binturong, as an animal ambassador in 2014. She has become a confident ambassador and is capable of working in many different settings from small, intimate meet and greets, to outdoor on-leash walks where she often ends up being surrounded by dozens of guests. Teaching Yuni to be confident in all situations was challenging, some of these include revamping our guest interactions as she grew, and there were behavioral breakdowns. Addressing challenges sometimes required starting at the basics and re-working the behavior through small approximations to find where the break down. Other times we needed to create a way to push past the breakdowns and work a new behavior. Yuni's behavioral changes required the team to continuously assess her training and adjust where necessary. As a result, Yuni continues to be a shining star at the aquarium in her role as an ambassador and gives guests great memories.

Introduction

Ambassador animal programs have become prevalent in zoos and aquariums. These interactive programs provide guests with an opportunity to have up-close encounters and connect with animals they may never see outside of a zoological facility. According to an informal survey presented to animal ambassador keepers, a typical ambassador program collection is commonly comprised of invertebrates, amphibians, reptiles, birds, and small mammals (Schmidt, 2018). Many of these ambassadors can be described as "grab-and-go" animals because they offer ease, predictability, and reliability for both staff and guests. Programs that present these animals encourage recollection of information.

According to Knapp and Yang, impactful and informational interpretive education programs are novel, have personal significance, incorporate activities during learning, utilize prior knowledge or misconceptions, and have visual imagery (2002). Personal

significance means that these animals are small and able to be handled with easy, and that guests may have had a personal encounter with them in the past. Activities usually involve touching or interacting with these animals. Guests may have prior knowledge about more common animals or misconceptions about animals such as snakes, spiders, or other invertebrates. Finally, visual learners are stimulated through the presentation of these animals in engaging settings.

However, there is one key feature that may be missing: novelty. Studies show that ambassador programs can be more impactful if the animals or the way they are presented are new to them. The Downtown Aquarium Denver is focusing on innovation and novelty with all the animals in their ambassador program.

Yuni's Story

Yuni arrived at the Downtown Aquarium in Denver, Colorado in September 2014 from a facility located in Idaho. Yuni was hand-reared by the animal care staff in Idaho until she was old enough to be rehomed at five weeks. During her first four months, she spent her days at the aquarium and her nights off property under the care of curatorial staff. The primary goals while she was young were socialization and desensitization. Through positive reinforcement the staff was able to foster her social and interactive personality. She was harness-trained with a figure-eight harness and was leashed walked 2x per day, with at least one social session, or "romp", per day. During these social sessions she was allowed to jump, run, and pounce playfully on trainers as a means to exert energy. Training evolved to include station, mark, sits, ups, jumps, shoulder walk on guests, targets, and voluntary nail trims (Refer to table 1 for complete list). Aside from behind-the-scenes training sessions with staff, Yuni was soon participating in a number of various training sessions in public spaces (Table 2).

Challenges and Solutions

While Yuni has proven to be a valuable addition to the ambassador team at the aquarium, raising her has not come without challenges. The most notable challenge came as Yuni grew. When Yuni was young, she was easy to manage in hands-on encounters. This included the choice to partake in running, jumping, and pouncing behaviors. Allowing this kind of social interaction was beneficial when Yuni was young because it built a trusting relationship with her trainers. In addition, it allowed for vast amounts of desensitization that ultimately built up her confidence. This social interaction not only took place with staff but also with guests. Yuni was trained to walk across the backs of guests in line. She was perched on guests' shoulders for photos, and was allowed to be playful with guests during meet and greets. While she was young, these encounters made incredible memories. However, as she grew larger the risk of accidental guest injury also increased.

In retrospect, allowing “romps” may have created obstacles that trainers had to overcome. The increased risks due to her size and strength resulted in restructuring Yuni’s guest encounters. In May 2018, when Yuni was four years old and 35 lbs when we decided to discontinue all “shoulder walks,” “play,” and “romps.” Any bouts of playfulness were redirected to novel stuffed toy items. Meet and greets were altered to encourage Yuni to explore the meet and greet room instead of actively coming in contact with guests. We added interactive climbing structures and redirected her away from guests with strong reinforcements. Over time, she lost interest in the guests, and shifted her focus to more interaction with her trainers and climbing structures. All guest interactions became trained behaviors.

During the summer of 2018, the staff at the aquarium encountered a new challenge when a Yuni refused to crate, which was necessary for public appearances or leashed training sessions. This challenge was addressed by allowing Yuni to exhibit her choice of refusing to crate by cancelling or modifying any pre-booked experiences. The training team started from scratch with the crating behavior by breaking it down to the very first approximation. The staff was quickly able to successfully crate Yuni within a few days by building resiliency in Yuni..

A third and on-going challenge the training team experiences is Yuni’s behavior changes with the seasonal changes and exhibits periods of low motivation. She commonly becomes disinterested in training during spring time. During training sessions, this often can result in playfulness, pouncing, and lack of focus. Additionally, during these periods Yuni becomes fixated on smelling and exploring her environment instead of focusing on her trainer. Redirecting her lack of focus onto more novel toys has remedied this problem. Most importantly, the lead trainers have focused on successfully training the staff on how to respond during these behavioral break downs. The turn-over process for being able to work with Yuni is as follows:

Turn over procedure:

1) **New trainer will begin observing sessions:**

    a. Trainer should be able to identify equipment needed, sD’s, behavior criteria, reinforcement amounts, and trouble-shooting methods.

    b. They should observe sessions in each setting: in enclosure, walks, meet and greets, photos, birthday, story time, appearance, stage, and off-site. During these observations, trainer will be demonstrating their knowledge of the animal by presenting to the public. They should also engage their co-workers in question and answer sessions to ensure they understand the training choices/procedures etc. If they find inconsistencies between trainers this should be brought to mammal meeting for group discussion.

    c. New trainers will begin working her in enclosure and socializing with her with experienced trainer. Trainers will begin reinforcement building in this setting. Once the trainer has

been cleared by the supervising staff on protected contact behaviors they are able to work these behaviors without supervision.

d. Trainer will learn back-up procedures and protocols including presenting to the public, emergency response, and safe public distance in various settings.

2) Trainer should then begin working the animal

a. First new trainer will take the leash part-way through the appearance/walk and then return the animal to experienced trainer. This step will be repeated until new trainer is comfortable. Initially the trainer may need to have food set in the hand, behind the back before bridging. This is to allow quick delivery of the food while she learns to be patient and wait for the food with each new trainer. As the reinforcement history increases, the need to have the food set in hand before asking a behavior will probably decrease. First walks should happen inside building away from public.

b. Second new trainer will take leash part-way through the appearance/walk and re-crate and unleash the animal.

c. Lastly new trainer will leash the animal, complete appearance/walk, then re-crate and unleash the animal

d. New trainer will complete entire appearance/walk in each setting. They will discuss and receive feedback after each session from experienced trainer.

3) Trainer will get signed off on the animal

a. When the new trainer feels confident and prepared to be signed off, they should let the assistant curator and/or curator know. Trainer will be signed off in each setting.

This turn over process requires many supervised sessions with Yuni's trainers and provides time to ensured that new trainers are familiar with behavior cues, precursors to undesirable behavior, and how to respond. The staff ultimately decided that two full-time trainers were to be present at every free contact session. Part-time staff, interns, and volunteers were able to assist in the role of back-up trainer by maintaining crowd control and talking to guests, however, the primary role of support and emergency response was fulfilled by full time staff only.

Aside from policy changes, the most successful strategy the staff has implemented is by offering Yuni choice and control through control indicators during every session. An animals' control over it's environment can act as primary reinforcement (Harris, Susta, 2016). Yuni has the following control indicators, or "stops," at each free contact session: (1) trainer asks her to station in the far back corner of her enclosure; (2) trainer enters enclosure to reinforce, then steps back; (3) second trainer asks her to mark at a designated location near the front door of her enclosure; (4) initial trainer then proceeds to secure her harness while second trainer reinforces from outside enclosure; (5) initial

trainer sets up crate, second trainer asks her to crate. At any point in this process, Yuni has the opportunity to leave the session without repercussion.

During walks or appearances when Yuni is on leash, she may lose focus and ignore her trainer. The trainer allows this, then proceeds to take the first opportunity to redirect or ask for a behavior to regain her attention and focus. Another common occurrence during loss of focus during training sessions is Yuni expelling energy and becoming playful. Trainers allow and encourage this to happen, but in a controlled manner. For example, if Yuni wants to run, pounce, and jump, her trainer may ask her onto their shoulders and position her in a way that they can ask her to jump back and forth from elevated structures They may also run with her and set her up to pounce on one of her toys. Yuni has also been trained that her crate is a "safe place", so in the event that a "scary" stimulus occurs she goes back in her crate and is rewarded by the trainer. These are a few examples of adaptations to our training style that has allowed her to experience a sense of control in her training sessions and has allowed her to continue to flourish in her ambassador role as she approaches her fifth birthday.

Trainer flexibility is an important part of these successes. Yuni's trainers have learned that some criteria may be loosened to achieve a successful session and that not all scenarios are "black and white." For example, when her enclosure is cleaned with a hose she may become more curious or suspicious of this change to her space. As a result, making the trek to her station in the far corner of her enclosure may be an ambitious ask. Trainers acknowledge that Yuni not going to her station is not an outright refusal but that there is a competing element that may be eliciting a stronger reaction than the focus required for the task at hand. Instead, they take any progress toward her station as a win for Yuni, reinforce, and move forward with the next step in her harness behavior.

Conclusion

Binturongs can present many challenges, especially when involved in an ambassador program. As they age and become larger and stronger, social interaction can be minimized by implementing interactive trained behaviors. Playfulness and can be redirected toward novel stuffed animals and by keeping training sessions high energy. Low motivation and disinterest have been issues seasonally, and have been addressed by giving Yuni choice by implementing control indicators in her sessions. Fearfulness has been controlled with successful desensitization and confidence-building. These adaptations in program protocols and flexibility in training style have resulted in a reliable ambassador binturong who will hopefully continue to create memories for staff and guests.

Appendix

Table 1: Behaviors and criteria

Behavior	Verbal Cue	Visual cue	Criteria	Applicable setting
Station	Station	Trainer at door	All four feet on platform in back of enclosure	Free contact in enclosure
Harness	Mark	N/A trainer with harness	Sits on table, calmly while trainer puts on harness	Free contact in enclosure
Unharness	Mark	Trainer waiting to remove harness	Sits on table calmly while trainer removes harness	Free contact in enclosure
Crate	Crate	Pointing inside the crate	All four feet in crate and turned around	Any
PC Crate	Crate	From outside enclosure, pointing inside crate, sometimes ask turn to get all of body in	All four feet including tail inside crate and stay until door shuts	PC
Target	Target	Presentation of target pole	Touch tip of ball with nose	Any
Come	Come	Flat hand with palm facing her, moving away from her. Put hand about a foot away from her head	She moves into the forward direction	Any
Stay				Any
Heel	None	Trainer stops moving	She stops next to the left side of the trainer or turns to face the trainer	Leashed walks
Up	Up	Thumbs up	Stands on back legs and reaches up	Any
Sit	Sit	Pointer finger pointed up with palm facing animal	Sits on rump	Any
Front Paws/nail trim	Foot	Finger pointed upward then tilted in the direction on either paw	Puts either paw against mesh and allows for manipulation and trimming of nails	
Rear paws/nail trim		Both hands open facing mesh	Stands on back legs on stump with front feet above center bar, allows for manipulation and trimming of rear nails	In enclosure

Shoulder	Shoulder	Presentation of trainer's shoulder	Climbs on to trainers shoulder	
Directional	Here	Pointer finger extended toward location trainer intends her to go	Goes to where she is directed	Any
Shoulder walk (Discontinued as of May 2018)	Come or here	Pointer finger extended toward location trainer intends her to go	Goes to where she is directed on shoulders.	Any
Jumps (mammal staff only)	Jump	Pointer finger extended toward location trainer intends her to go	Jumps all people in the line, ends by jumping onto an object or the trainer's back	Any
Sub Q injection	none	none	She sits on her mark, stays until injection complete (trainer distraction feeds)	Enclosure
Walking Weave	Weave			
Off-Leash Weave (in progress/on hold)	Weave	Pointing to first person in line	Weave in and out of public's open legs while they are standing side by side and return to trainer at the end.	Any enclosed space under stimulus control
High Five	High five	Left hand extended at head height	Puts left paw onto palm of trainer	Any
FC Paint (work in progress)		Paint on shelf and canvasses spread out	Train lures binty through paint then over canvasses.	TQ reserve 2
PC Paint (work in progress)	paint	Left hand finger gun tilt to left	She puts her paw up on the mesh while a canvass with paint slides underneath, she then puts her paw in the paint, trainer asks for paw again while second trainer slides blank canvass underneath	

Table 2: Training Sessions

Session type	**Application**
Social Session (DISCONTINUED AS OF MAY 2018)	In enclosed areas she is allowed choice to roam freely and social with trainers at her discretion. Play and pouncing can happen in these settings. Only signed off walkers can do play sessions and they will be trained on what's appropriate play behavior and when it's time to crate her if she gets too energized.
Free Contact Off-Leash	Basic behaviors such as targets, stations, mark, up, and sit can occur during these sessions. She must be under stimulus control and in a controlled area.

On Leash Walking	Free walk: guides the pace and location of walk. This walk is reinforced less than a controlled walk. Behaviors are not typically requested from her. Free walks are done without guest observation. Heavy reinforcement for following trainer or staying at trainer's heel.
	Controlled walk: Behaviors are asked more frequently. A controlled walk could be a stage show, photos, offsite, or walk with a large amount of public. Heavy reinforcement for following trainer or staying at trainer's heel.
Meet and Greet	During a meet and greet the binturong will be on leash at all times. She will climb on perches, demonstrate various behaviors, interact with enrichment, and be positioned for pictures with guests. She may also targe to a target pole, and "high five" guests from the perch position. Guests may touch tail when the binturong is in proper position and are directed by trainer.
Shoulder Walk (DISCONTINUED AS OF MAY 2018)	Guests will line up shoulder to shoulder. They will then place their hands on their knees making a flat surface for her to climb on. It is best to group similar sized people together. If you have only a few children and only a few adults you can space them in between adults – she may not walk on them. Otherwise the size change may be too much for her and she may scratch to grip on. The shoulder walk should end with her going onto trainer's shoulders.
Photos	Photos can happen in various settings. Guests can be on a chair, table, or stump with guests standing behind her.
Birthday	Have the kids sit in between the whale shark and octopus tunnel facing the back wall. Put the cart at the tail of the whale shark. She is able to have a free walk around on leash. Guests can take a photo with her.
Stage/ Show	Typically she will be uncrated from behind the stage and walked on to stage. Trainer will then move her directionally from one side of the stage to the other, asking various behaviors to demonstrate her natural abilities.
Off Site	Taking her off site typically involves a free walk. She is comfortable in a majority of settings.
Appearance	During an appearance she can be walked around the area and/or presented near her cart.

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Storm the Gates! Using Off-Exhibit Training Strategies to Expand Habitat Experiences

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Abstract
Vallarta Adventures utilizes birds, primates and pinniped species as ambassador animals that leave their exhibits to have contact with guests. These outreach programs provide education and conservation opportunities as well as mental stimulation for the individuals, improving animal welfare. Animals in Zoological environments have long been conditioned for off-site outreach programs. Our Sea Lion family is conditioned for open ocean interactive programs including snorkel, diving and beach walks. Macaws are trained for free flying and guest interactions and Squirrel monkeys are utilized in guest interactions, all outside of their exhibits. Off-exhibit training strategy challenges mostly revolve around fear of the new environment. Providing daily opportunities to experience the immediate environment outside of the normal exhibit with countless natural stimuli has helped condition animals to reliably leave and, importantly, return to their habitats.

Introduction
As part of the environmental education programs, different zoos and parks have done off-exhibit outreach programs with animals for years. When the physical barriers between the animals and people are removed, the reception of conservation messages can be improved with guests. Every time a person gets in touch with an animal their perception of animals and, in general, life and nature can drastically change. These activities are a great opportunity to promote empathy towards the animals, to get the society involved in the protection of the endangered species and to be aware of the current threats that wildlife is facing every day.

One of the major statements for animal welfare is to give the animals the opportunity to make decisions, choose and take control over the environment they live in. Vallarta Adventures believes that letting our animals out of their regular exhibits could be a great opportunity for enriching their daily lives. One of the main goals of environmental enrichment is to provide physical and mental stimulation and to promote natural behaviors. Perhaps, the best way to promote these kinds of behaviors is to introduce the animals to their natural environment. At Las Caletas we are adopting an open-gate framework where the animals can not only go out of their exhibits for an off-site program but go out by themselves and, in some cases, remain out of their habitats if they wish.

Slow and Steady: Sea lions

At Las Caletas our South American sea lions have been doing encounters for a few years in their pool. Little by little we have been increasing and diversifying the areas where these guest interactions take place. We decided to get them to the beach, to experience different substrata as they walk on the ground, the sand and of course get to swim by the beach.

We take the sea lions out of their pool, walk down the dock where they can jump into the sea. Once in the water they will follow a trainer on a kayak swimming to the Caletas Beach where they get to meet the guest. This track for the animals has abundant stimuli. They get to swim in a natural environment, feel the waves, explore amongst the marine life and then stand on the sand while they interact with the guests.

Image 1. Available paths for sea lions to choose during the first stage. The animals are able to stay in their pool, walk and jump in the sting rays pool or stay by the wooden path. 1: Gate from Sea lions pool to sting ray pool.

A way to improve welfare is to provide the animals with the options to choose and take control over their space. Once a day we open the gate that leads the sea lions to the stingray pool. The animals are free to decide to stay in their pool, to go out and stay on a wooden path taking a sun bath, or swim with the fish and the stingrays in a different pool (image 1). While this sounds like a simple statement, this required a big effort from the trainers to happen. When we first opened the gate the sea lions seemed to be shy and wary to walk out of their exhibit and they actually needed help to come out. Once they were out, they were still confused, looking at the trainers and waiting for commands to follow. They needed time and help to get used to using the space available without being in a training session.

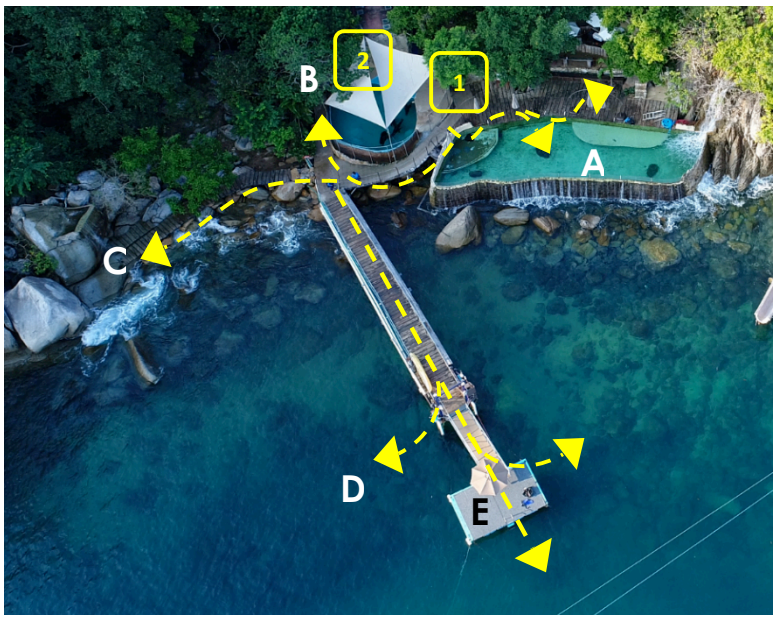

Image 2. Available paths for sea lions to choose during the second stage. Where: A: Sting ray pool; B: hallway to the trainers' office; C: artificial waterfall; D: beach; E: main dock. 1: Gate from Sea lions pool to sting rays pool; 2: Gate from sea lions pool to trainers' office/main dock.

The next step on the sea lions' journey is to gradually let them out to the beach, not following a trainer but by themselves. Our plan for the next stage is to open both of the gates and increase the available options for the animals to choose. In this case they can choose: to stay in their pool, go to the stingray pool, go up towards the trainers' office, walk down the dock towards the beach or to an artificial water fall (image 2). Since the animals will have access to the beach (a totally uncontrollable environment for us), a lot of work and safety measures are required. Many environmental factors such as the tide level in the moment the animals jump off of the dock are important to keep in mind. For this reason, during the initial stages of the project, trainers must be paying attention to what the animals do and where ~~do~~ they go. The main dock is blocked on the sides, so we can avoid the sea lions jumping over the rocks where the water level is not deep enough for them; a tide monitoring is suggested to prevent any possible accidents.

In any of the cases, a solid recall must have been trained in advance, so that calling the sea lions back to their pool is easier. As a basic safety measure, at Las Caletas Beach, Vallarta Adventures has several boats taking guests, staff and supplies to the beach. All of these boats are available with crew waiting on land and in the sea in case an animal gets lost.

Tree-hopping: Squirrel Monkeys

A couple of squirrel monkeys leave their enclosure one by one to do an encounter in the snack bar. They are leaded by their trainer from the night enclosure towards an aisle where they can jump on trees and decide the way they go through the pathway to the snack bar. No harnesses or leashes are required for the monkeys to arrive to their final destination and after interacting with the guests they are guided in the same way to go back into their enclosure.

Similar to any other behavior trained, successive approximations were required. They started going out wearing a pet harness and a leash for safety reasons since this area is surrounded by trees and people walking around. As they were feeling comfortable going back and forth though the aisle, the leash was removed and they remained on the trainer's shoulder. Nowadays, the harness has also been removed and both monkeys can climb to the canopy and jump from one tree to the next on their way to the area where the interaction takes place (image 3).

Image 3. Arboreal path to the encounter area. Monkeys can choose whether to go with the trainer or to jump and explore in the canopy. A: night enclosure; B: off-exhibit interaction area.

Image 4. Squirrel monkey going to the encounter area. During this moment they are free to explore through the canopy and hunt as they go to meet the guests.

Foraging is a very important behavior to be promoted in animals under human care since it can be frequently affected due to the manner that the diet is offered to the animals. While the squirrel monkeys travel from the enclosure to the encounter area, they have the opportunity to choose between traveling on their trainer's shoulder or to freely move by themselves. They can jump on the trees and move among the branches, hunt bugs and explore their daily path on a different height, having a completely different experience of the space. On the other hand, providing arboreal substrata for this kind of species promotes them to keep improving their physical skills and have proper mental stimulation (image 4).

Losing a monkey while they are moving through the trees could be a very scary situation for a trainer. Squirrel monkeys are small, light and quiet so, they do not make sounds while they move across the canopy. Trust is key with animal training. Trainers need a very strong bond with the animals in order to have the confidence to let the monkeys jump away from them and also to accept that on certain days the monkeys will prefer to explore in the trees longer than they expected and the way going back home can be long.

One (flying) step further: Macaws

Every morning a flock of 17 military macaws do a free flight from their night enclosure downhill towards the Caletas Beach where they interact with guests that are hanging out (image 5). Things get interesting when it is time to fly back home. Inside the enclosure, breakfast is waiting for them and that is only the beginning of the day. Those gates remain open for the rest of the day so as soon as the birds finished eating, they have the opportunity to fly out and explore the surroundings. From this moment on, there are no more scheduled guest interactions or training sessions, they have the power to decide what to do and where to go (image 6). Right before the sunset it's time to go back into the enclosure for the night.

Image 5. Flying area from the night enclosure to the beach. The macaws do a free flight above the sea before they perch on the shore. A: night enclosure; B: flying area; C: perch location

Flying through the forest canopy is an overwhelming enrichment for the birds. Our macaws not only have the opportunity to fly around the forest and exercise but to interact with different species of wild birds, forage and eat wild fruits that are different from the ones they get in their daily diets, explore between the trees and use their beaks for whatever they want to. Among the options the birds have while they explore the canopy is to keep interacting with their trainers. A few of them remain close to the office and the area where the staff is more active.

Similar to what we experience with other species, there are many safety concerns to have in mind. Caletas Beach is an isolated area that can only be reached via boat or walking from another beach. This helps us to have a quiet and safe environment for our animals. Nevertheless, we share this forest with natural predators (e.g. common black

hawks, gray-lined hawks, raccoons, badgers, feral cats, etc.) that is why we need to be sure all the birds fly back home when we need them to. In this beach there are also wild military macaws as well and they can interact with our birds. When the young birds are learning to fly downhill, sometimes they can be kidnaped by a wild flock of macaws, making the training process harder for both the trainers and the birds. And finally, since it is a long-distance flight and the beach is a little small, gliding could be hard for non-experienced macaws. A couple of times, macaws have become exhausted and have fallen into the sea. For those cases, the tour instructors on kayaks and paddle boards become a crucial part of the team to rescue the animals in the minimum possible time.

Image 6. Macaws' open enclosure. After having breakfast both gates remain open and the birds are able to fly outside and to return anytime for the next diet.

Every benefit has a cost. Letting our birds free to fly and explore their surrounding has meant that trainers have had to educate the staff of all areas to not feed the birds, to be respectful towards them and to be very patient and tolerant as well. At the beginning of this program, macaws found their own enrichment in the guests' areas by destroying plants and gardens, stealing salt shakers and sauce bottles, breaking the guests' sandals, and of course, stealing food from everyone. A very solid environmental education program is required to ensure free-flying does not become a problem for the animals, the staff and the guests.

Encouraging Other Trainers

Letting the animals out of their regular exhibits is perhaps one of the most enriching things we can do for them but it is also a tremendous responsibility that involves many safety concerns. We would like to encourage you to start working with your animals to expand their habitat experiences by modifying their relation with the space. We have found three crucial point in this process. First, to take the risk and trust your animals. It will always be better to start with the individuals that have the strongest bonds with the trainers. Second, to be sure that letting animals out of their habitats is allowed by the local and federal laws. And third, to be sure you do not get fired when your boss sees the animals out of their exhibitions.

These activities represent a great opportunity to enhance animal welfare, to improve training skills and to expand educational out-reach programs. They require a lot;

accidents may take place and the cost could be huge; but benefits are equally big for the animals since they can get to experience the best of both worlds.

Starting a Successful Behavioral Enrichment Committee

Abbie Doan and Peggy Hoppe

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ABSTRACT

Enrichment plays a key role in the welfare of the animals in our care. Oftentimes, new staff learns about enrichment strategies from fellow keepers or by trial-and-error experimentation on their own. It is easy to perpetuate 'bad habits' in enriching animal collections because keepers often don't get a formal lesson in proper enrichment techniques. Having a Behavioral Enrichment Committee (BEC) at an institution can help keepers learn strategies in effective animal enrichment via collaborative learning and knowledge-sharing between staff of varying expertise zoo-wide. A BEC can help by establishing an overarching enrichment philosophy which can assist keepers via goal-oriented planning, proper implementation and careful evaluation of environmental and behavioral enrichment. The aim of this presentation is to give insight on how to start a successful Behavioral Enrichment Committee at an animal institution.

The development of a Behavioral Enrichment Committee is becoming more standard practice for a zoo's culture. For AZA accredited facilities, the BEC is a required aspect of a facilities programming. Hosting a committee on a subject has it's downfalls as committees can easily falter by lacking specific direction and easily getting off track or lost in the bustle of programming. While keepers will unanimously agree that enrichment is a crucial component of excellent animal care, finding the additional time to develop a program can be daunting.

At the Indianapolis Zoo, we have had multiple reiterations of the Behavioral Enrichment Committee (BEC). The goal of having it be keeper led is noble but can create some unanticipated roadblocks along the way.

- Lack of time
- Lack of authority to create change
- Buy-in from area managers/curators
- Buy-in from all keepers in area
- Role/Input from non-collections departments

The main thing is that we all know where we want to end up, but getting there can be challenging.

LACK OF TIME

One problem is meetings were variable to try and cover most keepers' schedules and days off. The problem was that it was so variable that they were often forgotten due to lack of consistency in the schedule. We have found that alternating between two days of the week from month to month helps to

cover all work weeks. Perhaps the most helpful thing has been assigning a back-up keeper tasked with BEC coverage as a departmental responsibility. This was incredibly helpful in maintaining departmental representation zoo-wide.

LACK OF AUTHORITY

A trend that was occurring in our zoo was that the newest keepers were placed in the role of BEC representative. This likely stemmed from the fact that the committee has no pre-requisite or minimum experience level and, typically, newer staff has fewer projects that they've taken on so they have more time to go to meetings. The benefit of this trend is that incoming keepers often bring with them a excited sense of curiosity and eagerness to learn and expand their animal care knowledge. The result is a passionate person who has the drive to make adjustments or expansions to an enrichment program but, being 'low-man on the totem pole', lacks the authority to instill the needed changes back in their department. This does not mean that the most experienced keepers need to be the departmental representatives, what it told us was that the BEC needs to be treated as the main authority on the zoo's enrichment program as a whole and not as just a discussion board. As a result of placing the authority in the BEC, the plan brought back to the departments by the representatives should be shared amongst area keepers to get the whole department involved and then that plan should be adhered to.

BUY-IN FROM AREA MANAGERS CURATORS

An important part of executing change is making sure that the Area Managers and Curators are abreast of what is going on. Once enrichment items are approved vets, curators and area managers the rest of the process is largely left up to the keepers to implement. Our BEC has a Curatorial Liaison who helps to coordinate the BEC with the Keeper Chair and communicate with upper-level management. One important role of the Curatorial Representative is to help lift the BEC to a high priority committee that is taken seriously at all levels the zoo. Having a curatorial liaison that can assist with getting things approved and moving the committee forward. Curatorial liaisons are also helpful with making sure enrichment continues to be a priority in departments. They can work easier with other departments to get more people involved in their area of expertise. One example from our committee is that our Curatorial Liaison brought our zoo's researcher onboard and he is now assisting us with enrichment evaluation studies and possibly publishing articles.

BUY-IN FROM ALL KEEPERS IN AREA

Selection of the primary keeper representing a given department should be done carefully and should be the best fit for the role. BEC representatives should be the person most excited about enrichment strategies or the person who just wants to learn all they can in their career. The BEC should foster discussion amongst keepers from different departments, regardless of whether or not their species are at all related. Having a person who is excited and willing to share can help the group grow faster. Increased discussion leads to generation of ideas and a general improvement of the zoo's enrichment program overall. When this person goes back to their given department, it is possible that they can be met with barriers in implementing change. This goes back to the 'low man on the totem pole' experience and established keepers or managers may be resistant to change due to a perceived lack of time and resources. Everyone has different priorities that are all important to overall animal welfare. However, we must put enrichment at a high priority and set an atmosphere where this cannot

be avoided. This is where having the BEC backed up by all curators and directors can certainly help overcome those obstacles.

ROLE/INPUT FROM OTHER DEPARTMENTS

Our BEC had fallen into a rut where we felt as though the outcome of our meetings was limited to what holiday enrichment the Marketing and PR team would create for our animals. This was by no means a negative aspect of the committee, because we felt that this reached our guests and got them incorporated in the animals' enrichment by celebrating holidays. The problem was that this seemed to be our only outcome of our monthly meetings. This prompted us to go back to the drawing board and establish what we felt our goals should be and what are the strategies we could use to meet those goals? Should we have a mission statement and a vision statement? We decided that, yes, the BEC should have a mission and vision statement. Setting goals was our next priority so we could see where we wanted to end up. We also found it helpful for each area to define their own goals that were more specific. Each representative was tasked with meeting with their area keepers and establishing goals. At our yearly kick-off meeting we all shared our goals. It was helpful to hear what all areas were dealing with and put some perspective on what we wanted to accomplish. This really set the stage for a team dynamic as well since we all felt a communal atmosphere after sharing. After adjusting the structure of our committee it was then easier to fold-in the input from non-collections departments into our own goals and mission.

WHAT'S NEXT FOR US

Our future steps in continuing to advance our BEC at the Indianapolis Zoo include establishing roles within the BEC. This gives people more opportunity for buy-in while also splitting up the responsibility a bit so that it all doesn't fall on the keeper serving as Committee Chair. Here are the roles we plan to establish and define:

- Curatorial Liaison
- Keeper Chair
- Area Representative
- Secretary

Creating job descriptions for each role can be a helpful step so that everyone knows what is expected of them.

Since we have brought on a Curatorial Liaison with previous BEC experience, we have seen the committee begin to flourish. Having experience from other institutions, be it serving on BEC or not, can be incredibly helpful in establishing a motivated and successful committee. Another continuing goal is to seek knowledge outside of our own committee. If someone doesn't come in with experience, great value can be placed in simply visiting other facilities and seeing what sort of things they do. If someone is able to attend workshops or conferences it can be a great way to instill a renewed sense of excitement that they can bring back to the committee. We have increased article sharing as well to give representatives a broader perspective of current practices in animal enrichment.

In the short time that we have been implementing these adjustments to our own Behavioral Enrichment Committee, we have seen improvements in engagement and involvement from all departments.

Live, Learn, and then Get Dirt: An Okapi calf's Struggles

Loren Berry, Hoofstock Keeper
Betsy Stringer, Associate Veterinarian
Denver Zoo
Denver, Colorado

Introduction

A male okapi calf (*Okapi johnstoni*), named Forest, was born at Denver Zoo on 4 December 2017, to an experienced dam named Kali. This birth was part of recommendations by the Okapi Species Survival® plan, bringing the Denver Zoo's okapi population to 3.2. This pregnancy was monitored closely by animal care and veterinary staff due to previous health complications with this dam after her first calf was born in February 2014. Upon review of the Okapi husbandry manual and recommendations from other facilities with successful births, a birthing stall was prepared with rubber matting and an approximately six-inch layer of pine shavings. Kali was housed in the birthing stall overnight for approximately two weeks prior to calving. Kali began showing signs of impending labor later in the day on 3 December 2017 with active labor beginning early in the morning on 4 December 2017. Labor and delivery were without complication and monitored closely by keeper staff. A male calf was born at approximately 0230 on 4 December 2017.

Initial Standing

After initial grooming and inspection from Kali, the calf began attempts to stand. The calf was standing on his own at 0309, just thirty-nine minutes after birth. After standing for a few minutes, the calf attempted to walk but fell and splayed with all four legs, resulting in sternal recumbency and was unable to correct himself. The calf remained recumbent for approximately three hours, despite multiple attempts to right itself, at which time keeper staff were able to shift Kali out of the birthing stall and assist the calf to a standing position. Despite having been in a splayed position for so long, once standing, he was steady on all four legs allowing keeper staff to let Kali back with him. Kali calmly approached the calf and began to groom him quite vigorously. He fell, splaying with all four legs again resulting in sternal recumbency. Keeper staff immediately began trying to shift Kali away but without success. The calf tried periodically to stand with encouragement from Kali but again without success. The calf was splayed for two hours before keeper staff were able to shift Kali away and get to him safely.

Once Kali was separated from the calf, an initial neonatal examination was completed. The calf overall was strong, bright and alert with some slight weakness in all four limbs from being splayed for so long. He was slightly dehydrated, based on tacky mucous membranes, and was given subcutaneous fluids. He had some minor abrasions on his chin and on the inside of his knees from his attempts to stand. Blood was collected, and the umbilicus was examined and treated with betadine. Because of the weakness in all four limbs, he was unable to stay standing

without falling into a splayed position. The decision was made to hobble his front and rear legs to provide support and help strengthen his tendons. Hobbles, created using four-inch-wide Elastikon, were wrapped around the front legs between the elbow and the carpus and on the rear legs between the stifle and hock.

1.0 Okapi "Forest" after the hobbles were applied.
Photo Credit: Loren Berry, Hoofstock Keeper, Denver Zoo

In attempts to aid in traction for Forest, a large amount of, but not all, pine shavings were removed from the stall, exposing the rough surface mats underneath. Kali had been vocalizing and bumping the adjacent stall door during the examination, which lasted approximately an hour, but once reunited, she was calm and attentive to Forest. She focused attention on his hobbles and did lift him slightly when grooming around the rear leg hobble. Kali's behavior was closely monitored for any signs of aggression toward the calf. There was none exhibited, and they both settled in with one another.

Due to Forest's inability to stay standing, he was unable to nurse within the first eight hours. It was decided to allow him more time for nursing now that he could stand and move around with assistance of the hobbles. However, Forest was beginning to appear weak by late morning. He was putting himself into very awkward positions when lying down and turning his head backward toward his flank. He was separated from Kali at 1200 to be reexamined and supplementally fed. He seemed more stressed and anxious during this separation from Kali when left alone in the stall by himself. He would try to run, then fall and had difficulty correcting himself. As soon as keeper staff entered the stall, Forest immediately approached and seemed to settle down. Keepers stayed in the stall and assisted him into a resting position. Forest tried to stand a few times but once keepers sat with him, he settled quickly and his body relaxed.

1.0 Okapi "Forest" resting after assistance from keeper staff into a resting position.
Photo credit: Vickie Kunter, Assistant Curator Hoofstock, Denver Zoo.

Feeding

Following guidelines from the Okapi SSP® and husbandry manual, Forest was supplemented with Land-O-Lakes bovine colostrum replacer at 1230. A bottle was initially attempted, but he would not suckle from it and was instead tube fed. Because Kali had again been difficult to separate from him, as expected, they were kept separated for few hours so he could be monitored and more easily accessed if needed, after the supplemental feeding. After the feeding, Forest remained standing for about 40 minutes and began to walk around the stall on his own for an additional 45 minutes. He made several attempts to lay down, however, the hobbles made it incredibly difficult for him to position his legs in a normal sternal position. After multiple failed attempts on his own, he was assisted to a sternal position by keeper staff and rested for 25 minutes. A second bottle was attempted at 1530, but again Forest would not suckle on the bottle and was tube fed.

1.0 Okapi "Forest" being tube fed with bovine colostrum replacer at 10 hrs. old
Photo credit: Denver Zoo

Since Forest had been up and moving around a fair amount on his own throughout the afternoon, it was decided to remove the front hobble. Forest immediately splayed as he was still weak in his limbs. The hobble was re-secured, and he was given some time to ambulate around the stall. He seemed to be getting accustomed to the hobbles, maneuvering well on his own, and was reunited with Kali. Although Forest seemed to be doing better toward the end of the day, he was found splayed again in the stall at 1800. He was assisted to a standing position by keeper staff but could not keep his front legs from splaying due to the front hobble becoming loose as the Elastikon stretched. With direction from veterinary staff, the hobbles were tightened to aid in more stability. Additional substrate, sand, was also brought into the barn and added to the stall after it warmed up under the barn heater (December in Colorado). Enough sand was added to the stall to form a five-inch layer with an additional four-inch layer of pine shavings on top. The tightened hobbles and addition of a very thick substrate made a remarkable difference. If he began to splay, he was now able to correct himself before becoming completely recumbent. He was observed getting up and down on his own as well.

It was hoped that with some food in his stomach and his legs under him, Forest would be able to nurse and begin to bond with Kali. By 1630, at 14 hours post birth, he had still not nursed. Kali was exhibiting some general agitation but still encouraged him to nurse. Despite the lack of nursing, the two seemed to be bonding well and it was decided to leave them alone and monitor overnight, reassessing first thing in the morning.

Forest was bright, alert and appeared stronger the next morning, 5 December 2017, suggesting he had nursed. Recorded video footage confirmed attempted nursing at approximately 2030 and successful nursing at 2053! Nursing continued in the morning and was visually confirmed by keeper staff at 0735 on 5 December 2017, and continued for an hour in spurts of 4-11 minutes each. Kali was incredibly patient and would reposition herself for him to be more successful. Although nursing was a positive thing, there was still the concern that because he didn't nurse within the first six hours postpartum, there would not be passive transfer of immunoglobulins. If there was a failure of passive transfer, this could result in fatal infection.

1.0 Okapi "Forest" nursing successfully
Photo Credit: Loren Berry, Hoofstock keeper, Denver Zoo

A neonatal examination was completed later in the morning. Forest was much stronger in his legs than the first day, enabling the hobbles to be removed so he could test his own strength. He was a little wobbly but strong and controlled enough to leave the hobbles off. With the hobbles removed, he was able to move his limbs in a more natural manner when laying down and standing up. Additional sand was added to the adjacent stall to provide more room for both Kali and Forest. The additional thick substrate and space seemed to encourage his mobility which further strengthened his limbs.

Failure of Passive Transfer

Even with his improved strength, Forest's blood work confirmed failure of passive transfer despite colostrum administration and nursing from Kali successfully overnight. Blood work was indicative of infection/sepsis and lack of maternal antibodies. Forest was started on antibiotics for the infection. A plasma transfusion was the best option for treatment. Veterinary staff began contacting other institutions with hopes that there was banked okapi plasma available. Columbus Zoo had obtained a plasma sample through a trained blood draw behavior with one of their female okapi on 28 November 2017. They graciously donated the plasma for Forest. It was overnighted in preparation for a transfusion the next day.

1.0 Okapi "Forest" receiving plasma transfusion
Photo credit: Denver Zoo

Forest continued to nurse successfully throughout the day on 5 December 2017 and remained strong and bright. A plasma transfusion was done 6 December 2017, under manual restraint per the blood work results from 5 December 2017. Forest did well throughout the hour-long procedure with minimal struggling. Post transfusion, Forest was reunited with Kali and nursed within the first few minutes. However, Forest would not lay down for several hours post plasma transfusion but still remained bright, alert and strong. Kali seemed agitated by the shavings where the procedure had occurred and spent a lot of time smelling and pacing the area. Keeper staff removed the soiled shavings, and Kali settled down quickly and allowed Forest to continue nursing. A positive glutaraldehyde test 24 hours post-transfusion confirmed successful treatment.

Left Forelimb Deviation

Forest continued without issue post-transfusion until the night keeper found him splayed at approximately 1830. His respirations were fast and heavy, and his body was trembling. His left forelimb was bowed out at the carpus. Night keepers assisted Forest to standing, and he was able to stay standing and correct his limb position. His left forelimb was visibly weaker than the other three. Video cameras were still in place and provided excellent information. Forest had lost his footing in the doorway of the two stalls most likely since the substrate was lower there, as the door jams if it is too high. The video recording showed that Forest had actually splayed an hour before anyone saw it. In his attempts to right himself, he moved halfway across the stall on his sternum, while splayed, until he wedged himself up against a wall and was found by night keepers. It is likely that in his struggle to stand, he stretched the ligaments of the left carpus. Forest was able to maintain a standing position and was reunited with Kali. He nursed almost immediately.

Upon a follow-up physical examination, the morning of 7 December 2017, it was noted that although Forest was able to get up and down on his own, he has a slight lameness on the front left leg, and the carpus appeared deviated laterally at times. The leg had normal range of motion, and there was no noticeable swelling at the site. There was no joint dislocation, and he was able to bear full weight on the leg.

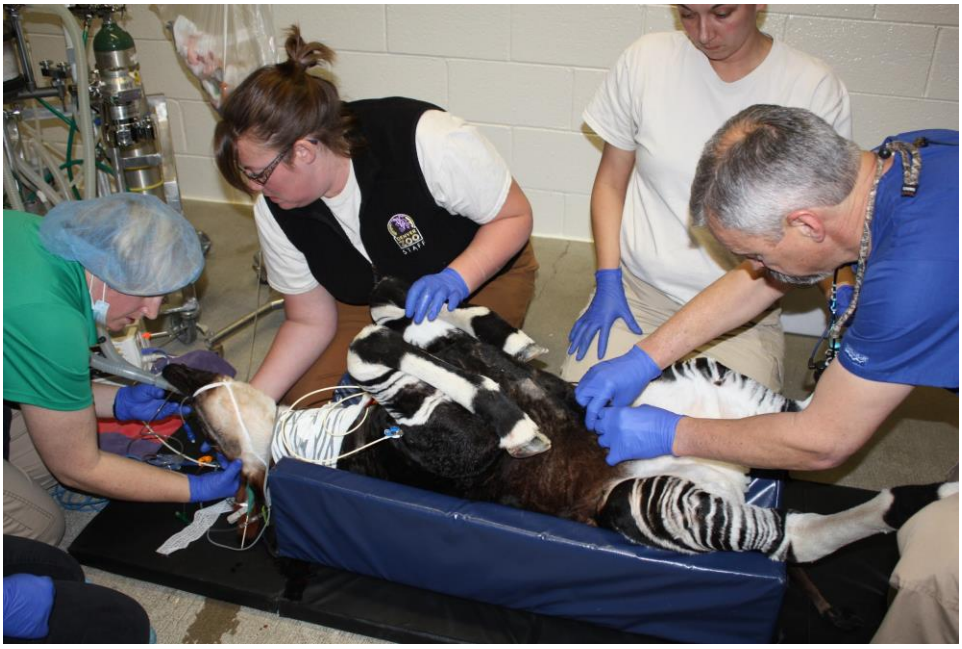
Umbilical Hernia

During the exam, a defect was noted in the abdominal wall when rechecking the umbilicus. The defect was approximately 2 cm in diameter where the umbilical stalk remained. Forest did not seem bothered by palpation at the site. Although the umbilicus was within normal limits on initial neonatal examinations, it is probable that the malformation was exacerbated by the long duration of splaying and attempts at standing within the first few days of life.

The abdominal defect was diagnosed as an umbilical hernia that was not reducing in size as Forest grew. Forest was very tolerant of keeper and veterinary staff palpating the area on almost a daily basis. Forest did not seem bothered by the hernia until 18 December 2017 (14 days old and 60 lbs.) when he was observed slightly lethargic and breathing rapidly in the stall. He reacted with body tremors when the umbilicus was touched. Soft tissue was appreciated within the subcutaneous skin at the hernia site. Blood work was done for additional diagnostics, and he was treated with antibiotics and pain medication. Most likely, it was entrapment of omentum or other abdominal tissue. His breathing and lethargy improved within a few hours of initial onset.

Forest continued to display a mild reaction to further palpation of the hernia site over the next few days. The hernia site did not appear to be closing on its own and it was determined, in consultation with a large animal surgeon from Colorado State University, that surgical repair of the hernia was necessary. Surgery took place at the barn on 10 January 2018 without

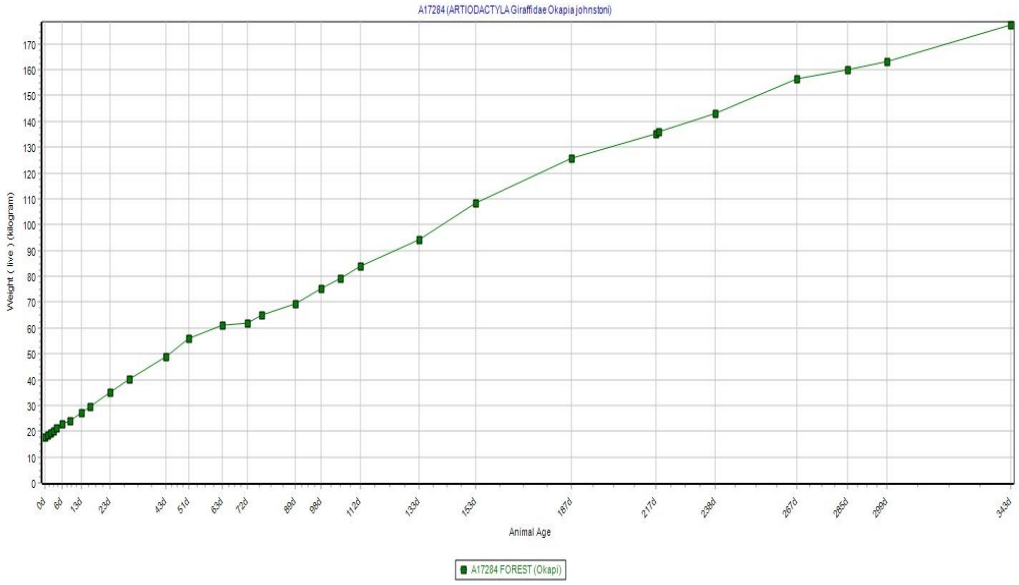
complication. During surgery, it was determined by the surgeon that the hernia would not have resolved on its own. There was an active blood supply through the umbilical artery/vein and thick connective tissue within the umbilical ring. Forest recovered from anesthesia without complication and was reunited with Kali shortly after. Keeper and veterinary staff were able to monitor the suture site without complication as it healed.



1.0 Okapi "Forest" umbilical hernia repair surgery
Photo credit: Denver Zoo

Relationship Building and Growth

Due to all the medical struggles, it was very important to keeper staff to work on and maintain a positive relationship with Forest. He became a little standoffish as he aged but seemed to always have curiosity when it came to the keepers. Forest began showing interest in his mother's training sessions at 15 days of age by observing and approaching the training areas. Training with okapi at Denver Zoo is done through restricted contact, using operant conditioning with positive reinforcement.



Growth chart for 1.0 Okapi "Forest" at Denver Zoo
4 December 2017 -- 28 November 2018

As Forest grew, he began participating in relationship building with keeper staff through continued training. He was within normal ranges for all growth stages according to the Okapi Husbandry Manual. He completed training behaviors for target, shifting, scale and body tactile. Through training, regular weights were recorded and results of his pre-shipment tuberculosis test were obtained at the training areas.

1.0 Okapi "Forest" demonstrating scale behavior
Photo credit: Jenny Callaway, Hoofstock keeper, Denver Zoo

Conclusion

Despite the multitude of initial complications, Forest prospered. With many thanks to Columbus Zoo, the plasma transfusion was successful and supplied Forest with the necessary antibodies. The hobbles were successful at managing his weak limbs and the hernia repair was successful and posed no further issue. He formed a positive relationship with keeper staff and participated in training sessions both with Kali and on his own. Following the recommendation from the Okapi Species Survival Plan®, he was successfully transported to the Sacramento Zoo in November of 2018 where he continues to thrive.

Special Thanks to:

The Hoofstock Team at Denver Zoo
The Animal Health Department at Denver Zoo
The Behavioral Husbandry Department at Denver Zoo
The Okapi and Veterinary Medicine Teams at Columbus Zoo
Dean Hendrickson DVM, Large Animal Surgeon, Colorado State University
Sacramento Zoo

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Husbandry Guidelines for the Okapi SSP® 2004 Association of Zoos and Aquariums

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"If you have knowledge, let others light their candle in it." -Margaret Fuller

Abstract: The American Association of Zoo Keepers (AAZK) International Outreach Committee (IOC) was established to provide training, resources, and opportunities for international animal care professionals to better provide for the animals within their care. With a current focus in Latin America, the IOC's goals of improving and increasing resources and training provided to international animal care professional is an on-going process involving several initiatives. These initiatives provide expanded access to the American Association of Zoo Keepers with translated resources, a travel grant program, and a sponsorship program. The headlining program the IOC has developed is a teaching program that is currently available to Latin American animal care professionals three times per year. These teaching programs currently are hosted at different zoological institutions across Mexico and are designed as mini-conferences with goals to expand to other Latin America countries. Subject matter specialists from the United States travel to these programs to provide lectures and hands-on workshops regarding a variety of zoo-related topics. The programs also provide an opportunity for Latin American animal care professionals to participate as speakers and workshop leaders. These teaching programs have reached over 500 participants.

The IOC hopes to continue this valuable work within Latin America with the development of new programs and expanded opportunities for animal care professionals. With the amount of on-going programming the IOC offers throughout Latin America, there are opportunities for U.S. animal care professionals and AAZK members (especially Spanish speakers) to participate in a variety of ways.

Introduction

The American Association of Zookeepers has decades worth of experience across every taxa managed in American zoos with countless individuals working tirelessly to improve the welfare of animals under their care. These zoo professionals are passionate about their careers and their responsibilities and AAZK provides a national platform where this wealth of information can be discussed and shared. The International Outreach Committee (IOC) was established in 2016 by the American Association of Zoo Keepers (AAZK) with the primary purpose of exploring and identifying the professional development needs of the international animal care community and to provide educational and mentorship resources that support advances in the field of animal

husbandry. The IOC can expand the vast knowledge and skills of the membership and association across international borders though the committee's current programming and future goals.

Mission and Goals

The International Outreach Committee's mission is to strive to provide resources, training opportunities, and continuing education in the Latin American zoological community through AAZK professional development material, AAZK Committee Programs, AAZK National Conferences, and to support worthwhile international programs focused on advancing the animal care profession. During the early formation of the committee, ground work was laid to establish the following main goals of the committee:

1. Develop a professional relationship with Latin American zoos, aquariums, animal care facilities, and professional associations.

2. Provide assistance and guidance to increase professional development opportunities for animal care staff.

A robust plan was developed to address the mission and goals established by the committee. Four main projects were initiated by committee members:

1. Latin America travel grant to AAZK National Conference
2. AAZK member sponsorship for international keepers
3. Teaching program for Latin American animal care professionals
4. Translation of AAZK courses, workshops, and presentations into Spanish

Latin America Travel Grant

The establishment of the Latin America Travel Grant provides the necessary funds to allow animal care professionals at Latin American Zoos to travel to the annual AAZK National Conference. This grant is valued at up to $2,000 and helps the recipient cover the costs of travel, lodging and other necessities of attendance that otherwise would prevent Latin American keepers from attending. Securing funding through AAZK National was only the first step of many that would see this grant opportunity realized.

Once the funding was secured, a system for the application, evaluation, notification, and disbursement of funds needed to be developed. The application process involves applicants submitting the necessary application materials to the IOC instead of the normal avenue of submission directly to the AAZK Grants Committee. This was due to the need for translation of the application materials into English since the application itself is available in Spanish and the majority of applicants will submit their application in Spanish. Once received by the committee, the application material is translated to English and provided to the AAZK Grants Committee for scoring along with ratings for each applicant. Once the Grants Committee scores and ranks the applicants, a winner is selected and ratified by the AAZK Board of Directors. Winners are

notified by the IOC in Spanish and a committee representative begins to assist the recipient with the next steps of planning their attendance.

The final aspect of the grant program that involved many discussions and trials to approve was an effective and efficient method to distribute the funds to the recipient. Not only were funds required to be distributed in pesos, AAZK National was also faced with distributing funds in another country. One stumbling block to overcome was developing a way to provide the funds to the recipient before travel and hotel accommodations could be booked. Many Latin American animal care professionals live on small salaries and are unable to pay for a $500+ plane ticket on their own without the grant funds. With collaboration from IOC committee members and AAZK National, a system has been developed where a proportion of the grant funds are distributed to the recipient after the award announcement to aid in booking travel and hotel accommodations. This is the first year of this system and it is proving effective at meeting the needs of the grant recipients.

While in its infancy, this grant program has provided opportunities to three Latin America keepers to attend the AAZK National Conference. One recipient attended the conference hosted by the National Chapter of the American Association of Zoo Keepers in Washington, D.C., and two recipients are in attendance at the 2019 National Conference hosted by the Indianapolis Chapter of the American Association of Zookeepers in Indianapolis, Indiana.

AAZK Membership Sponsorship Program

The IOC AAZK Keeper Sponsorship Program was designed to connect AAZK chapters and international keepers to provide sponsored AAZK professional memberships for international animal care professionals. The Keeper Sponsorship Team recruits interested AAZK chapters to sponsor a one-year professional AAZK membership. These chapters are then matched with a Latin American animal care professional that is identified from a list of interested individuals that have been recruited from Teaching Program participants, connections through Latin American zoological associations, or other related paths. Once Latin American keepers are matched with a sponsoring chapter, the IOC keeper sponsorship team aids in communication between chapters and their sponsored international keepers.

The membership sponsorships are able to provide additional resources to Latin American animal care professionals that may not otherwise be available. Even though the cost of an annual membership is within the budget of most American animal care professionals, that is not always true with their Latin American counterparts. Not only are the resources of a paid membership highly beneficial, the sponsored keepers can begin to feel connected to a larger network of other animal care professionals

AAZK IOC Teaching Program

The Teaching Program was developed to provide training for animal care professionals in Latin America. Many keepers have not received any kind of formal animal care training as there are no current programs designed for zoo keepers. The Teaching Program has been able to fulfill that much needed niche.

The Teaching Program not only provides a means for training keepers, but it has also become a platform for Latin American keepers to share their knowledge and to open the communication lines amongst keepers in the field. These keeper-based programs have given the attendees a chance to network and develop connections that will help them grow professionally, and to learn how to become active members of their organizations.

The IOC has organized four Teaching Programs in different parts of Mexico and has worked with over 400 participants during those programs. The program features IOC and AAZK members, along with keepers from other U.S. institutions, sharing information through oral presentations and workshops in a mini-conference setting. The beauty of the program is that Latin keepers are also encouraged to present posters and oral presentations, thus developing a culture of professionalism and communication, something that has not been traditionally available. The Teaching Program aims not to be a one-way stream of information. One thing central to working in the animal care field is that there is no one way of doing something, yet we all have the same goals. Being able to learn about animal care from our Latin American colleges has been interesting and awe inspiring as well.

To say that the program has been amazing not only for attendees but also for committee members and other instructors that have participated, is an understatement. The ability to share information that will not only help improve the care of animals in facilities through Latin America, but also help an animal care provider grow professionally is a feeling that is hard to describe.

The next program is scheduled for October 2019 and another program is targeted for early 2020. Our hope is to continue offering at least 3 Teaching Programs each year with more and more input from both North and Latin American animal care professionals.

AAZK IOC's Teaching Programs provide an opportunity for all of us to fulfill our mission and vision as active AAZK members: to advance excellence in the animal keeping profession, to foster effective communication beneficial to animal care as well as professional development and personnel connections that advance animal care.

Translations

The International Outreach Committee focuses efforts on translating materials from English into Spanish and and vice versa to increase the availability of materials to Latin American animal care professionals. AAZK teaching materials, including webinars, courses, proceedings, presentations, and other materials are collected and translated from English into Spanish. Materials from the AAZK Annual Conference are translated as well and sent to the Latin American Travel Grant recipients to assist them in planning and preparation for the conference. Materials may be translated in partnership with other organizations, including ALPZA, AZCARM, or IOC, to further communication and the exchange of resources between both organizations.

Materials are translated in order based on priority. Spanish speakers on the committee divide translations projects and work individually before exchanging translations with each other to

proofread and edit. Materials are then passed on directly to the requesting entity or stored in the IOC's resource library. The translations can be used later to further the exchange of materials with other zoo keepers.

Conclusion

The International Outreach Committee has implemented a variety of programs and resources to better serve animal care professionals abroad and connect them with the professional membership of the American Association of Zookeepers. The IOC hopes to continue this valuable work within Latin America with the development of new programs and expanded opportunities for animal care professionals. With the amount of on-going programming the IOC offers throughout Latin America, there are opportunities for U.S. animal care professionals and AAZK members (especially Spanish speakers) to participate in a variety of ways. Interested individuals can contact the committee at ioc@aazk.org.

Action for Chimpanzees - Reducing Trafficking in West Africa through International Collaboration

Lianne Crouthers, Development Manager
Pan African Sanctuary Alliance (PASA)
Portland, Oregon

Introduction

The Pan African Sanctuary Alliance and partner organizations are launching a new initiative to fight the rapidly escalating illegal trade in chimpanzees in West Africa. Illegal wildlife trade (IWT) continues to expand and has become one of the greatest threats to conservation, although more than US$350 million is estimated to have been spent to address this crisis in recent years (Biggs et al., 2017). Today, there is growing recognition that to sustainably reduce IWT, it is critical to engage communities that are at risk of participating in trafficking, local and international NGOs, and government agencies as collaborators.

Thus, the Pan African Sanctuary Alliance (PASA), the largest association of wildlife centers in Africa, and our partners are starting **Action for Chimpanzees, a multifaceted, region-wide collaboration to sustainably reduce the trade in critically endangered western chimpanzees.** The first component is a conference on 4 – 5 November 2019 in Conakry, Guinea, which will provide a crucial foundation for a long-term, cross-border initiative against IWT in the region.

Chimpanzees (*Pan troglodytes*), which were formerly found over large areas of West and Central Africa, are among the most iconic victims of the IWT crisis. Because of a number of factors including inadequate law enforcement and high prices for chimpanzees (particularly compared to typical incomes in rural Africa), the illegal trade in great apes is a low-risk and lucrative business. Thousands of chimpanzees are taken from the wild each year to fill the demand for pets, tourist attractions, bushmeat, and body parts, which generates up to US$6.4 million annually for those involved in the illicit supply chain (Clough & May, 2018).

Buyers of live chimpanzees are primarily based in China, the Middle East, the Commonwealth of Independent States (CIS), and various locales in Africa (Clough & May, 2018). While the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is intended to prohibit the international commercial trade in chimpanzees, traffickers continue to evade law enforcement. Today, chimpanzees frequent the live animal market with poachers killing up to ten adults for every baby captured (Hughes et al., 2011). High rates of habitat and population loss coupled with low birth rates and long time to maturity, make the plight of chimpanzees increasingly critical.

The population decline is most alarming with the West African subspecies (*P. t. verus*), now classified as critically endangered (Humle et al., 2016), with their population decreasing six percent per year and experiencing a **total decline of 80 percent from 1990 to present** (Clough & May, 2018).

Goal

The goal of Action for Chimpanzees is to curtail the illicit trade of western chimpanzees and prevent their impending extinction by forging collaboration among key stakeholders in West Africa and worldwide and implementing a multifaceted program that is coordinated throughout the region.

Methods and Objectives

Action for Chimpanzees was conceived by PASA and partner organizations, including the Chimpanzee Conservation Center (CCC) in Guinea, Tacugama Chimpanzee Sanctuary in Sierra Leone, Liberia Chimpanzee Rescue and Protection, and Akatia in Côte d'Ivoire.

For the first component of the program, we will bring together government agencies, sanctuaries, and other NGOs of Côte d'Ivoire, Guinea, Guinea-Bissau, Liberia and Sierra Leone, international organizations and agencies, private sector businesses, and other stakeholders at a **Conference on Western Chimpanzee Trafficking on 4 – 5 November 2019 in Conakry, Guinea.** PASA's partners based in the region have the local knowledge and contacts needed to ensure the relevant government agencies and organizations participate in the conference. Stakeholders in governmental and nongovernmental sectors, both in the region and worldwide, have expressed enthusiasm about the conference.

Conference participants will define challenges, solutions, and action plans that will reduce the space in which this illegal industry operates and that can stop the threats to western chimpanzees' survival. The conference will focus on cultivating collaboration among participants as well as developing practical projects that produce measurable results.

At the conference, we intend to achieve the following objectives:

- Confront the severity of IWT in West Africa, particularly the risk of extinction of western chimpanzees.
- Identify key contact people in relevant government agencies and engage them as partners in fighting wildlife trafficking.
- Collectively develop a multiple-year, cross-border action plan consisting of initiatives that will sustainably reduce illegal chimpanzee trafficking.

The conference will establish a foundation for the projects that comprise the action plan, as well as the partnerships needed to conduct those projects on a region-wide scale. These projects are expected to include the following:

An **investigation** into illegal wildlife trade activities will enable us to produce a comprehensive report on the hunting and capture of wild chimps, trafficking routes, and ports and border crossings commonly used for trafficking in Côte d'Ivoire, Guinea, Liberia, and Sierra Leone. We will identify gaps in enforcement and public awareness and priority communities and protected areas to target with other projects.

Based on the results of the investigation, we intend to develop and implement a practical plan for **strengthening law enforcement** by collaborating with enforcement agencies and organizations such as the EAGLE Network and INTERPOL. This is anticipated to include providing training to enforcement officials, particularly in under-resourced areas that are exploited by poachers and traffickers, such as land border crossings and sea ports where enforcement is currently lacking.

This will be complemented by **a region-wide public awareness program** that will increase community involvement and effect behavior change to reduce the wildlife trade. We will strategically place billboards in areas vulnerable to trafficking; use radio, television, and newspapers to reach people in rural West Africa; and use social media advertisements to engage individuals susceptible to participation in IWT.

Timeline

The conference will occur on 4 to 5 November 2019. We will launch the subsequent projects, which are anticipated to include investigation, strengthening law enforcement, and public awareness, after completion of the conference.

How to Help

Financial support is needed to make it possible to conduct the conference, as well as the subsequent projects.

Additionally, PASA and its partners are seeking collaborators who can help maximize the program's impact, for example by helping to develop objectives, create the conference agenda, and plan subsequent projects.

Contact Information

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Bringing Night Keepers Out of the Dark

Disa Skaff, Night Keeper
Denver Zoological Foundation
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As zookeepers, we are responsible for the full-time care of the animals in our facilities. While the animals live there 24 hours a day, we keepers individually can't watch over them all of those 24 hours. Not only because of labor laws, but also because we have lives outside of our jobs (or at least we try to). Facilities have different strategies for covering as many of those hours as they can, depending on the needs of the collection as well as budget. Different places stagger start times, have keepers working 10-hour shifts, or staff multiple shifts throughout the day. Many facilities adopt early and late-shifts, but far fewer have keepers working into and/or through the night. I am lucky enough to be one of these night keepers at Denver Zoo. Soon after I started three years ago, it quickly became apparent that my job was a mystery. We work outside of normal hours, in the dark, and often alone, which all keeps that mystery alive. Not only was I explaining my job to people I encountered outside of the zoo, but also to other zoo employees, including day keepers. The fundamental core of my job is to help day keepers take the best care of our animals, but if they don't know what we do for them, how helpful can we really be? My teammate and I had big hopes for being able to help the animal care teams in more ways, but before we asked them what more we could do, they needed to understand what we currently did. So I took it upon myself to spread the news about who we are and what we do.

What are night keepers?

Night keepers are not so much different from day keepers, but what we do can be. We get into night keeping after being day keepers, after a handful of years for some of us or after a nearly full career for others. At Denver Zoo most of our keepers are specialists with vast knowledge about the specific taxa they care for everyday. Because night keepers are checking on animals across the entire zoo and not just in one section, we need to be generalists with some knowledge of a variety of taxa. An important part of the start of our shift is reading the daily reports from the entire collection because we need to know what's going on and what to look out for while doing our checks.

Night keepers do many of the same tasks as day keepers, just sometimes to a different degree. Our primary focus includes routine checks of animals, turning off lights, feeding and medicating some animals, monitoring animals with health concerns, recovering from procedures or exhibiting "off" behavior, shifting in/giving animals access, checking life support systems, giving enrichment, and generally looking and listening for anything out of the norm. We'll also step in to assist with hand-rearing, provide extra care for geriatric animals, drive animals to/from the airport for shipments, do animal observations, and do anything day keepers ask of us that helps them out from checking a lock they can't remember locking to turning off fill valves for pools to monitoring expectant mothers.

Curious about the similarities and differences between night keeper duties at different facilities, I reached out to keepers at other zoos through Facebook. I learned that we do share similar responsibilities, particularly checking on the health and safety of the animals, feeding, medicating, giving animals access/shifting, and checking life support systems. There is, however, a variety of tasks that differ from facility to facility. For example, I don't do any diet prep or cleaning, but some night keepers help with that, or monitor the crews doing that work. Many of us help out with night events, but for some of us that entails answering questions and turning off lights once the event is over, while others are responsible for demonstrations or tours. One keeper commented that she felt she had low awareness of what the night keepers at her facility did, and her night-keeping co-worker responded that part of the reason people don't know what night keepers do is because it's constantly changing. I'd say this is true across the board. At a glimpse my job can appear pretty straightforward, but it actually changes at least weekly. Each night that I come into work, I don't know what happened during the day that might need my attention. Whether that's a disagreement between monkeys causing strife in their once peaceful co-habitation or the hatch of a chick that we are now hand-rearing, or an animal just not being themselves and needing a couple extra checks. It's a dynamic balancing act to complete all the checks and tasks I routinely do with the addition of short-term and day-of requests, and being ready to deal with any new problems that come up.

Improving Relationships

Denver Zoo has had night keepers for at least 25 years. As you can imagine, the position has evolved quite a bit since then. While I don't know the exact history of how it has changed, I do know that zookeeping as a field has evolved in that time. Also, with night keepers working on our own, we do have the ability to influence the work we do, so past night keepers have changed the position as well. My predecessors, the previous night keepers who had worked my shift, seemed to have kept to themselves. When I started, I got the impression that they were not always very welcoming of new or additional requests. There were definitely some keepers and teams who were more hesitant to ask us to do things based off the reactions they elicited with the past night keepers. My teammate and I worked on changing those attitudes because we genuinely want to do anything and everything to help out our day keeper counterparts.

This work started with building our relationship with day staff. My teammate, who had started in our position about 9 months before me, had been a keeper at Denver Zoo for almost 25 years before moving to nights, so many keepers knew her or knew of her. I came in fresh to Denver Zoo, and I was (and still am) eager to make friends. I joined our local AAZK chapter and started coming in for daytime meetings and trainings to get more face time with more keepers. I started a kickball team as a reason to hang out with more keepers outside of work. As I worked on building relationships with keepers and other zoo staff, I emphasized how much we wanted to be helpful to the day staff, and that slowly worked to re-brand the night keepers as an available asset eager to help.

Once I had settled into the job after significant training to learn the ins and outs of the whole zoo, my teammate and I started to look for more opportunities to help, particularly on the three days we overlapped. We reached out to the animal care teams for short-term

projects to work on when we had time and ended up helping with some data entry and enrichment building. While we got a couple small projects, we also got some requests for additional nightly tasks like feeding our Asian small-clawed otters (*Aonyx cinerea*) who weren't all hungry at the end of day resulting in unequal consumption of their last meal (mostly by one food-loving young male). We also started socializing with our domestic dog (*Canis lupus familiaris*) to provide her some enrichment and solve the issue of her just barking at us every time we walked by, which in turn set us up well when we started giving her anti-seizure medication nightly. As day staff became more comfortable and familiar with us, we started getting more requests to assist with meds, drop enrichment, and monitor animals. Though, some initial requests still needed tweaking to fit within our night. Part of the reason for that was because the day keepers still didn't fully understand what we do at night and how certain requests can or cannot fit in with what we need to do.

Education

Outside of talking to keepers and trying to explain all that we do, I really wanted to show them. Denver Zoo had an existing keeper shadow program, where keepers could request to shadow a different team for a day. The night keeper team, however, was not an option for keepers to choose. Fortunately, my request to add night keepers was quickly accepted. Since adding night keepers into the shadow program, we have had 12 people join us for a shift, including my curator and our Senior Vice President of Animal Science (my boss's boss's boss's boss), with more keepers signing up now that the weather is nice again. Not only have the keepers who have shadowed gotten out of the experience exactly what I'd hoped for, but they also came away with more. I had wanted keepers to get first-hand experience of what we do so that 1) they'll feel more comfortable making requests of us, and 2) so that they'd have some context into how those request could fit into what else we had to do. I solicited feedback from my shadows, and their takeaways were pretty much in line. First off, they all had their eyes opened to how much we actually do in terms of checking the entire zoo, and the amount of information we need to know in order to do those checks and be able to notice inconsistencies. They also mentioned the importance of communication, particularly because our shifts do not always overlap, so clear communication to us about what may be going on in their area as well as from us about what we are observing is vital. A third major takeaway was the knowledge of what specifically we do in their areas, and how that now informs what we can do for them. I had a blasts hanging out with new people and sharing how awesome my job is, and they got to explore parts of the zoo they may have never been in and see the zoo and their animals in a different light…or lack thereof.

In addition to giving the day keepers a hands-on option for learning about my job, I also wanted to share it with the entire staff. While we work the most with the animal care teams, we also work in tandem with many other teams during night events including security, events, education, and guest experience. Again, if they had a better understanding of what night keepers were doing, then they could see opportunities for how we could work together in the future. Luckily, we have quarterly all-staff meetings that often end with a video/presentation from an animal care team with updates about their teams/animals, so I signed up to present at one of those. Similar to the outcome from the shadow program, the presentation was able to convey everything I'd hope for and more. I

introduced our team, explained when we worked, how we worked, and everything we do sprinkled with pictures, videos, and an animal sound identification game. I got immediate feedback from people I had never met who had no idea the zoo had night keepers let alone all that we did while everyone else was chilling at home. I was asked to give my presentation to both our adult volunteers and our teen volunteers, arming even more people with information to share about how Denver Zoo commits to giving our animals the best care. To this day, almost two years after giving that presentation, I still have random staff members and volunteers coming up to me to tell me something they learned from my presentation or how they've used that information to educated guests.

Still Moving Forward

After putting two and a half years into this work, our animal care teams are more comfortable with us helping them and less concerned about inconveniencing us with their requests. Every time we get a new request, especially from a team/for an animal we previously haven't helped, we are more encouraged by the work we do. We're actually starting to address a new problem we'll soon encounter - too many requests for the time we have available. As our position continues to evolve, we took a hard look at all the things we currently do, and how we can modify that list to better accommodate more animal requests. When I was getting trained, the master task list for night keepers was a Frankenstein creation of years and years of additions and modifications by multiple people. It was actually very difficult for me to work off of because of the many different voices and styles mashed together into one document. With the input of my co-workers, I re-wrote that document based on what we were actually doing and formatted it in a way that curators and assistant curators could easily find what we do in their areas. The next step was to work with those managers to figure out what they actually wanted us to be doing. Many of them were not involved in the creation of those tasks way back when, and in some cases no one knew why we were doing some of the things we did. We worked with them to streamline our routine, eliminating redundancies and creating space for more animal-related tasks. We also sought their feedback on a formal request process that can reduce the amount of email back-and-forth we typically engage in when they make a new request.

I'm incredibly proud of the work my team does for the keepers and animals at Denver Zoo. With the recent hiring of new teammates, I'm excited for us to continue growing our position and finding more ways to help. I definitely have the best job in the world, and I'll tell anyone about it who'd like to hear!

Houston Zoo and Rice University: Partnering to improve animal care

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The Houston Zoo and Rice University's Oshman Engineering Design Kitchen (OEDK) have developed a unique partnership over the last ten years. Freshman undergraduate students enrolled in Introduction to Engineering Design are partnered with local clients and work to create solutions to real-world problems in the client's respective fields. The Houston Zoo has been a consistent client of the program since its inception due to the zoo's proximity to the university and the wealth of potential projects. This collaboration between students and animal keepers leads to unique and engaging experiences for animals. Rice University is fortunate to have complete funding for the program between institutional support, grants, and alumni donors at OEDK. Some donors become clients for the students while others support projects built for additional clients such as non-profits.

Each semester, a variety of clients attend the class and pitch a project idea. The students then rank the top five projects they'd prefer to work on and report on their skill in particular projects (crafting, electronics, coding). Next, the professors put them in teams of 4-5 students per project based on project preference and evenly matched skills. Each team is also assigned several mentors: a student teaching assistant who has taken the course previously, a student writing mentor who assists with written visualization, and a faculty mentor to guide them through technical content. The students meet with the client to understand the problem and receive exact design specifications for their project. The team completes research on the problem, finds

existing and failed solutions, and discovers opportunities for improvement. The team comes up with a variety of ideas, running each one through a decision matrix to decide which seems most feasible. Then they present the top few ideas to the client for feedback and one design is chosen. A proof of concept is built and shown to the client for approval before moving on to a real-scale version. It's a learning opportunity for the students in engineering concepts, teamwork, and professional communications with clients.

Many different animal departments within the Houston Zoo have pitched project ideas to the OEDK. For example, the hoofstock department has partnered with the OEDK to create enrichment ideas for various species such as giraffes, Baird's tapirs, giant anteaters, okapi, greater kudu, et cetera. Some devices have been incredibly successful from the start, some have taken several semesters of trial and error to perfect, and some ideas just haven't worked the way we had hoped.

One example of an idea that took several attempts to perfect is the hay feeders designed for our giraffes. These feeders have been in use for approximately seven years with almost no maintenance needs. The hay nets initially used to feed the giraffes were similar to those in photo 1. These nets resulted in a large amount of food waste so we asked the students to create another design that would lead to less waste. Additionally, we asked for the device to have a natural appearance and be easy to clean. The first design students developed was a bamboo-covered can with holes cut into it for the giraffes to forage through as seen in photo 2. The small holes and protruding bamboo limbs were intended to extend feeding behavior by obstruction. This design provided a more naturalistic appearance and allowed giraffes to exhibit some natural behaviors; however, a few challenges with the design included cleaning ability and hay-capacity prompted further design modifications. The following semester students addressed those challenges and developed the current design in photo 3. This design is a welded metal frame with dyed canvas straps in a weave around the frame to create foraging gaps for the giraffes.

Photo 1: Initial hay net

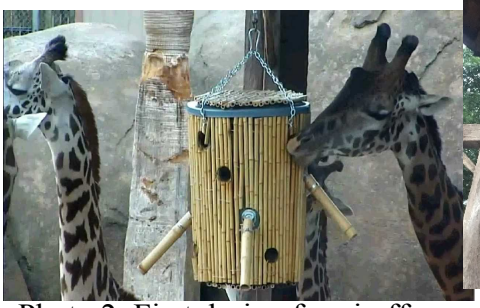

Photo 2: First design for giraffe hay feeder

Photo 3: Final design for giraffe hay feeder

In the fall of 2018, a team developed an enrichment device for tapirs that worked as planned from the start. Our department has many existing enrichment devices that are food or scent based. For that reason, we challenged the OEDK students to design a novel enrichment device for tapirs that did not fit that category. The students chose to create a device that would expand tactile enrichment for the animals. The device can be wrapped around a tree at variable heights and had multiple textures on it as seen in photo 4. The device also had locations for browse to be woven into it.

Photo 4: Tapir enrichment device with textured panels and browse holders (browse not pictured)

One of the challenges faced within this collaboration is the time limit of one semester per project. Complex designs often require simplification to be realized within that time frame. Some projects that needed further modifications are continued into future semesters with new students, as in the case of the giraffe feeder mentioned above. Other projects fail in reaching their goal but are still a learning opportunity for the everyone involved. At the end of each semester the teams present to fellow OEDK classmates and clients on the various challenges and successes within their project.

Other departments have also pitched projects ideas for the engineering students. The carnivore department asked them to create a motorized zipline for use over the lion exhibit. The goal was to create a design so that food or enrichment could be provided to the animals throughout the day without having to shift animals off exhibit (photo 5). A zipline would promote the lions to mimic natural hunting behaviors and utilize more of the exhibit throughout the day. The initial design

had some flaws: the zipline only traveled in one direction, it only had one speed that went too fast when items were within animal reach, and one end of the line remained in the animal enclosure. Zoo staff collaborated with OEDK students to refine the design over the course of several semesters so the current zipline can be moved forwards or backwards at variable speeds at keepers' discretion. The location of the zipline was also modified so both ends can safely be reached by staff, in case the situation arises where items need to be removed.

Photo 5: Female lion interacting with the zipline in action (photo credit: Kathy Watkins, Carnivore Supervisor at Houston Zoo)

The primate team has worked with the students to create a variety of enrichment items for both monkeys and apes. One of the successful designs is a water button for the chimpanzees to turn a shower system on for themselves in the summer. The button is located behind a panel and outside the animals' reach requiring the chimps to find a stick as a tool to utilize it. Other successful devices include puzzle feeders for smaller monkeys. Photos 6 and 7 show swamp monkeys exploring one device. OEDK students also created a go-pro case for monkeys to be able to carry around the go-pro so staff can have a monkey-eye-view of the exhibits. Not all these devices have been a success though; one device early in our collaboration was a puzzle

feeder maze designed for the orangutans, which was taken apart within minutes after they received it.

In conclusion, Houston Zoo and Rice University have formed a mutually beneficial partnership where students practice the engineering design process and the zoo diversifies its animal enrichment program. It has been incredibly beneficial for their students as well as for our zoo staff and animals. We have collaborated to build enrichment devices for a variety of species. The Oshman Engineering Design Kitchen is always looking for ways to expand and grow, looking for new client partners. The program makes adjustments as needed to improve. As we are moving into the second decade of our collaboration, we will now begin to modify, adjust, or improve upon previous designs to maximize their impact with the animals. Additionally, we are interested in expanding the offerings of these solutions to other zoos who would be interested in participating in future studies.

ZRA Training Certificate Program: Professional Education to Benefit You and Your Institution

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Abstract

The ZRA Training Certificate Program covers terminology, definitions, principles, concepts, professional practices and resources for those working in positions under the zoological registrar role regardless of title. The courses have been developed with comprehension, knowledge and application being at the core of the learning objectives. This presentation will summarize the topics covered and the values and benefits to anyone working in a zoological institution that has one or more of the duties associated with the registrar role. A primary goal of the program is to help those professionals that may not otherwise receive comprehensive training in the core areas of animal record keeping, records management, live animal transport, permits, transactions or biofacts/biological sample management. (ZRA partners with AAZK at their annual conferences to increase awareness about opportunities for training and other resources for professional animal keepers that may also have some of the typical registrar duties)

Introduction

Since its inception in 1984, the Zoological Registrars Association (ZRA) has been dedicated to the enhancement of zoos and aquariums through leadership, professional development, training, standardization and service to its members. From the 1992 publication of *Animal Records-Keeping* to the development of the AZA *Institutional Records Keeping* (IRK) course in 1998 to the launch of the Training Certificate Program (TCP) in 2018 ZRA has been instrumental in promoting records keeping best practices and educating the zoological world on the importance and execution of good record keeping. To this point all education was place-based and required the learner to travel. Much of the formal training of a registrar was done either at the IRK course or at the ZRA Annual Conference. As advancements in technology continued the opportunity to educate a larger number of people in a more economical way became available. The idea of on-line learning took hold and the TCP was born. ZRA partnered with San Diego Zoo Global Academy to launch the TCP on its online platform.

The original idea was to create a training program for zoological registrars to receive training on the six major areas of their position. However after looking at the proposed modules it became clear that without the restriction of a place based class other members of the zoological community could benefit from this instruction. They can receive the training on-line instead of having to travel to venues that they might not normally attend.

Training Certificate Program

Each module in the Training Certificate Program (TCP) covers terminology, definitions, principles, concepts, professional practices and resources. After completing the TCP learners will be able to describe, define, recall and apply the knowledge they have acquired. The TCP is divided into six modules. Each module focuses on an aspect of the registrar role.

Module 1: History and Established Tenets of Animal Records

Module 1 provides an introduction to animal records including their creation, management and function. The content focuses on the history of records at zoological institutions and the fundamental components of an animal record and Keeper Daily Report. This module provides a comprehensive review of the various types of records created and used in the zoological profession as it relates to the animal collection, why they are created, their function and purpose and how they are used in day-to-day decision making. This module will also explore the nine types of information to be included on a Keeper Daily Report. The nine types of information to be discussed are: animal identifiers, internal animal movements, census changes, sex identification or updates, social and reproductive behavior, medical treatment, body measurements, nutrition and enrichment.

Module 2: Records and Information Management (RIM)

Module 2 provides terminology, principles, concepts and best practices for Records and Information Management (RIM) and the skills and competencies required to manage all types of records throughout the information lifecycle. The RIM Module introduces the core essentials of professional records management that applies to the records management role regardless of the types of records being managed. Understanding the Life Cycle Concept and how to apply related professional practices to managing information is the key to ensuring all animal records are accounted for, appraised, scheduled, preserved and or appropriately disposed of throughout the normal course of

business. Technology now plays a pivotal role in managing records and information, Module 2 will cover core considerations for the transition from paper to electronic systems and identifies core resources and standards that can be used to facilitate that process.

Module 3: Transactions

Module 3 describes the various types of live animal transactions, best practices for managing workflow and documentation requirements, and standards for recording events. Efficient workflows and documentation help staff to conduct business in a way that ensures animals can be received on time, and in compliance with legal requirements, to facilitate exhibit openings or to meet annual breeding recommendations established by the many programs in place for species in human care. Module 3 covers standards for how to record the various types of animal transactions regardless of the specific data program being used. This module discusses the key principles of record keeping that should apply across all systems to ensure the integrity and authenticity of information.

Module 4: US Federal Wildlife Permits and Regulations

Module 4 provides an introduction to the various U.S. federal agencies and regulations that apply to wildlife in human care, regulated activities and related requirements (applications, permits and reporting) and related contacts and resources. The coordination and management of live animal transactions is a significant component of the zoological registrar role. The scope of legal compliance relevant to conducting live animal transactions is extensive and requires a no tolerance policy for gaps and oversights that can result in loss of permits and/or authorization to conduct activities core to a zoological institution (exhibiting, transporting, importing, exporting or breeding wildlife) and to avoid related fines and citations.

Module 5: Live Animal Logistics

Module 5 provides an introduction to the various options available to ship live animals (containers, container requirements, methods of transport, relevant Federal regulations and required documentation), and primary considerations for transport planning and coordination. Live animal logistics or animal shipping is a core duty in the zoological registrar role. Animals are shipped to and from zoological institutions on a daily basis and must be coordinated with a plethora of legal requirements, weather, commercial airline restrictions, transporter and staff schedules, animal health or welfare restrictions just to name a few.

Module 6: Biological Samples and Biofacts

Module 6 provides an introduction to the various categories of biological materials held in zoological institutions, including living and non-living tissues and biofacts, and defines records essentials and best practices for documentation and agreements. Best practices for biological samples and biofact collections are an area still evolving. Module 6 takes best practices for live animal collections concerning principles of collection management, loan agreements and other documentation requirements and recommends similar practices for biological samples and biofacts. This module also outlines standards for biofact physical preservation and security.

Conclusion

The TCP covers the core duties falling under the zoological registrar role but also introduces well established information on global best practices for RIM and makes recommendations for how to achieve best practices for biological samples and biofact collections – an area still underdeveloped in many zoological collections. The TCP helps the profession move beyond "self-taught" training to well defined and documented principles, concepts, standards and publications supported by best practices that can be applied by many different zoological institutions. The sooner an individual new to the zoological registrar role can take this type of training, the sooner best practices will become second nature. Offering this training online at a reasonable cost makes it accessible by the majority of those who need it. The TCP will not only help zoological registrars but it will also help any professional that is tasked with one or more of the Module topics. This course can be taken in its entirety or can be taken a Module at a time. The learner will have 30 days to complete a Module or 180 days to complete the course. At the end of each Module a test is administered and if the learner passes with 80% or better a Certificate of Completion will be earned.

Having resources, references and standards combined into one comprehensive program is extremely valuable to someone new to the profession. This comprehensive program provides support in leadership succession and is valuable to a long-time zoological registrar charged with developing a successor.

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www.zooregistrars.org/training

Driving the Awareness of Dholes:

Highlights of Their Husbandry, Training and Transport

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Introduction. The endangered dhole (*Cuon alpinus*) is a canid species native to Southeast and Central Asia. They have a striking red and white coat and can weigh up to 60 lbs. They can live in packs of up to 40 members and are known for their fierceness and tenacity by the people of their native countries. Their main threats are deforestation, the persecution by livestock owners, and the over-hunting of their prey species for the bush meat trade (Maisch, 2010). Little is known about this gregarious species and currently only four North American zoos have them. There are existing packs represented in 25 European zoos and nine Asian zoos. The European Association of Zoos and Aquariums (EAZA) recently re-published the dhole best practice guideline for use at European zoos (Maisch, 2019). Dholes are interesting and engaging and will participate in training and enrichment activities. With a limited number of zoos caring for dholes in the U.S., we are hoping to bring some awareness to zoos who are looking for an entertaining, exciting and charismatic animal for an Asian themed exhibit.

At the San Diego Zoo Safari Park, we have adopted a management style that will hopefully facilitate other zoos who would like to invest in dholes. We have been using husbandry techniques, training, and knowledge of natural behaviors to better understand this animal that has previously been difficult to manage. This paper will introduce the challenges of housing dholes and then follow three groups of related dholes that are driving the conservation of their species. We will follow the squeeze training for pre-ship examinations and the crate training preparation for moves to other facilities. Finally, we will touch on the dubious task of dhole introductions by looking at the case of two separate sister packs transported across the San Diego Zoo Safari Park and introduced in a larger exhibit.

Husbandry challenges. The keeping of dholes can be both challenging and rewarding. Dholes are usually shy almost skittish but can also be committed and bold. They are in a word athletic. They can climb a tree like a cat and can dig an intricate den like a meerkat. They run fast and can jump six feet off of the ground. They need high fences, a lot of space to move around, a dig barrier, and a pool for self-regulating their temperature in stressful situations. Their high activity level and acrobatics can make it difficult to determine what is play related and what is stress related. Also, their intricate relationships with other pack members make keeper observation time critical for managing this species.

Training. Training is an essential part of the successful movement of dholes, whether it be within a single facility or across the country. Training the animal to be comfortable in a transport crate long before the actual move greatly reduces their stress during the journey. However,

there are things that need to be accomplished before a transport. A primary training focus is to work with all of the dholes to accept the containment of a squeeze crate to prepare for a pre-ship examination injection. Once the injection is administered, the wall can be retracted, and the animal can either be released onto exhibit or left alone during induction.

In a pair of 4.5 year old male siblings, we started with desensitizing to the permanent squeeze (Figure 1) by leaving them access to it overnight. If in the area when the dholes entered the squeeze, the keepers would offer food re-enforcement for coming into the box. To train the behavior, we closed one side of the box and rewarded them for their full body being past the threshold. Then by using approximations, we were able to get duration of the hold. After putting the behavior on the cue “crate”, we were able to use a whistle bridge upon completion of the behavior. This behavior can then be used at their future destination. These behaviors sound simple, but when dealing with an animal who is very in tune with their pack, anything can become a variable.

Figure 1: A version of the squeeze. The top has a pull squeeze actuator that has teeth on bar to be able to “lock” into position. The side can also be open to allow the removal of an immobilized animals.

The same behavior of crating for a squeeze can be used to load animals into containers for transport. A double crate (Figure 2) is preferred as dholes seem to be more comfortable with a conspecific in proximity during transport. When moving an odd number, the keepers will assess which animal would be more comfortable riding alone.

Figure 2: Two double crates used to transport animals in pairs.

Animal transport. Our dholes travel with air freight and are accompanied by two keepers for the entire trip. This allows for them to be monitored throughout the trip. Dholes tend to overheat when stressed, so keepers can add water or fans mid-flight if necessary. The keepers arriving with the animals allows for the direct exchange of information with the receiving institution about the individual dholes, training and crating area ideas. This communication helps build a stronger dhole community.

Mild sedation or the use of anti-anxiety medication has been used in animal transports depending on the behavior of the animals and the duration of the transport. The SDZG Veterinary team has worked out doses of a combination of Amitriptyline and Alprazolam that have shown nice results of the animals remaining calmer, but still being alert and eating.

Animal introductions. Whether a single dog is being introduced to an existing pack or a breeding pair is being introduced for the first time, the possibility of a fight is real. Knowing the individual personalities and the pack hierarchy are critical when planning introductions. With time and the animal's comfort with its keeper, pack alliances start to immerge and compatibilities for future groupings become more evident.

Starting in the summer of 2017, the keepers at the San Diego Zoo Safari Park started working with two 2.5 year old sisters and a separate pack of their seven 1.5 year old sisters on crate training for a move to the other side of the Park. Though the distance was only two miles, the preparation of learning pack dynamics and the training for crating were just as critical as if it had been across the country. The two female packs were trained separately and were not introduced until they were moved to a ¾ acre yard attached to a six room holding area. It was decided that introducing them on neutral ground would avoid the individuals from establishing any territories before the full group was there. The first group to go to the new yard was the two older sisters. While they were in transit, the second group of four dogs was being crated. This second group consisted of the most dominant two and the least dominant two of the younger sister pack. They were released immediately to the first pair. The later introduction of the third group was uneventful. The two packs had always lived in the same area of the Park and in adjoining pens for the last year. Now eight months after initial introduction, they have been given the access to the three acre main exhibit as well. They occasionally have challenges in the middle ranks of the pack but seem to be getting along well.

Future of dhole conservation. Two brothers from San Diego were sent to another zoo in 2017 to be introduced to a female for the creation of a new pack that subsequently resulted in two litters of puppies. At the beginning of 2019, we sent four brothers to a second zoo as exhibit animals and two other brothers were sent to a third zoo for the formation of a new pack. These successful moves of dholes have created a significant opportunity for this species to gain awareness in U.S. zoos. More is being learned about this species and the husbandry, but the work with these eight males and the shipment process have been important parts of the next phase in the future management of dholes.

Conclusion. Increasing the number of U.S. facilities housing dholes increases public awareness of this mysterious species in this country while highlighting the challenges they face in their native countries. By learning more about their biology and behavior as we care for them in zoos, we are better prepared to help their wild counterparts.

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Beating the odds; using a guinea pig's cancer treatment to gain knowledge and foster empathy

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Introduction

Guinea pigs (Cavia porellus) in a zoological setting can play an integral role towards a zoo's mission. Point Defiance Zoo & Aquarium's mission is to practice and promote effective conservation on behalf of the world's wildlife. Domestic species such as guinea pigs serve the mission by connecting guests through physical touch which can connect that guest to a particular animal. Pepper, a domestic guinea pig, was an ambassador animal that exemplified this role. Pepper was adopted from the Foggy Creek Cavy Rescue in 2015. She was adopted from the rescue with her sister Cayenne and a father-daughter pair Bison and Nutmeg. These four individuals were housed together behind the scenes and were utilized for programming throughout the year. Our guinea pigs are examples of animals who were surrendered to rescues for various reasons. Their stories allow us to talk about smart pet choices and help to provide good options for guests to find potential pets through local shelters and rescues.

Diagnosis

As a part of Kids' Zone's protocol, our guinea pigs are handled regularly for programming and body condition scores. Keeper staff perform routine care for every guinea pig within the collection. This care involves whole body checks, cleaning of ears, trimming of nails and finally checking the genitals to ensure cleanliness and ruling out any abnormalities. Pepper had previous health issues that included urinary disease and eye abrasions. Given these issues and her age, Pepper was given a quality of life score twice a month. This ensured staff was able to monitor her health regularly. Kids' Zone keeper staff would also weigh her monthly to assess any potential changes in weight.

During routine husbandry, a keeper noted a "peanut sized" swelling below her chin on March 20th, 2018. Veterinary staff investigated the swelling to find multiple enlarged lymph nodes throughout her body. A biopsy of one of the lymph nodes was taken and revealed malignant lymphoma. After evaluating the bloodwork it was discovered that she also had leukemia. Lymphocytes were reported at an extremely high level of 45,778/uL (94%), a notable increase compared to her previous levels of 7,560/uL (72%) which was taken during a routine examination only three months prior. The normal range of lymphocytes for a guinea pig are 7,000-14,000/µl with percentages ranging from 30-80% (Carpenter, 2013). Six days prior to the discovery of the mass, Pepper had received a routine treatment for her urinary tract disease.

During this examination nothing was noted outside the realm of normal. Given this information, onset of the lymphoma and leukemia was acute. Other than enlarged lymph nodes no other clinical symptoms were observed.

Prognosis

Guinea pigs with lymphoma and leukemia usually show clinical symptoms of the disease at diagnosis. Some of these symptoms include lethargy, anorexia as well as an unthrifty coat. Many guinea pigs do not undergo treatment due to high treatment cost, their short life span and overall poor prognosis associated with the disease. (Quesenberry & Carpenter, 2012) Pepper was immediately started on an oral steroid (prednisolone) as a first line of defense while treatment options were discussed. Our veterinary team did a literature search for established lymphoma treatment protocols for guinea pigs without success. The veterinary team also researched survival rates in guinea pigs with lymphoma. The research showed poor survival indicating that the prognosis for Pepper was grim. Pepper's life expectancy was estimated to be anywhere from two weeks to two months after diagnosis, with a maximum survival time of six months. However, the maximum survival time was based on an intensive treatment protocol involving multiple intravenous chemotherapy treatments.

Treatment

When discussing Pepper's treatment and prognosis, her quality of life was of the utmost importance. A team of Kids' Zone keeper staff, veterinary staff, a curatorial manager, and a consulting veterinarian discussed multiple factors in determining the best course of treatment. Knowing the prognosis was poor, the team decided to use the "rescue" or second-line chemotherapy drug called Lomustine also known as CCNU. This particular chemotherapy drug is given orally and was known to have minimal side effects. The main side effect of the drug is myelosuppression which decreases the bone marrow activity resulting in fewer red blood cells, white blood cells and platelets. (ChemoCare.com, 2019) The drug; CCNU was a single capsule that was administered with a modified 1 cc syringe creating a "pill gun." The "pill gun" was found to be the most successful way to give the medication orally. This method created a relatively stress free process for Pepper. Once she consumed the pill, we offered her pieces of her favorite diet items to create a positive reward.

The CCNU drug was to be administered to Pepper once every three weeks. When the drug was successfully consumed, keeper staff would follow a treatment and husbandry protocol for proper handling and disposal of chemotherapy organic waste for the entire herd of guinea pigs. Most research showed that following this husbandry protocol for three days after treatment was sufficient; however keeper and veterinary staff decided to increase the duration to a five day protocol to ensure that the drug was completely out of her system. During this five day period the guinea pigs were off use for any programming to eliminate potential public exposure to the chemotherapeutic drugs. The guinea pigs were still housed communally during the treatment protocol. The chances of harm to the remaining guinea pigs was discussed but was considered to be so minimal that the risk of separating Pepper from her group was deemed more stressful than potentially contaminating the other members of the group.

The protocol was as follows: When handling Pepper or any of her bedding (fleece lined enclosure) or fecal material, gloves would be worn. All organic material would be thrown in the garbage as opposed to being composted. This was to prevent excreted CCNU from entering the composting cycle. All bedding was washed separately and in hot water to rid the bedding of any contaminated material. All food was moved off the fleece bedding to help prevent contamination with the feces.

Before receiving the second dose of the CCNU drug, veterinary staff scheduled an exam to repeat her bloodwork in order to ensure her white and red blood cells were at an appropriate level to receive the medication. At the time of the exam it was noted that she had a reduction in size for two of the lymph nodes with the other lymph nodes showing stability. Her lymphocyte count was now 12,556/uL (73%) compared with the 45,778/uL (94%) in March which was a significant improvement considering the normal guinea pig lymphocyte count ranges are 7,000-14,000/µl at 30-80% (Carpenter, 2013). These values indicated that she was responding well to the new treatment protocol. Due to the small size and conformation of guinea pigs, repeated blood collection is challenging, and in this case immobilization was required for each draw. The team elected not to continue to collect and recheck blood unless symptoms were reported. As she continued through her treatment her lymph nodes continued to decrease in size and keepers were able to count the weeks and months of her life as opposed to days.

Quality of Life

Keeper staff paid special attention to Pepper and her quality of life throughout the duration of her treatment. Her quality of life score was assessed daily once she began chemotherapy. She was scored by various full time keeper staff to ensure consistency as well as try to stay as non-biased as possible. The quality of life scoring was based on ten different factors. Keeper staff evaluated comfort, appetite, attitude, mobility, hygiene, appearance and weight, feces quantity, feces quality, social status and overall keeper opinion. Each category was given a 10 point score for a total of one hundred points. By evaluating her quality of life daily we were able to determine if there were any downward trends and therefore be able to reevaluate with veterinary staff to determine the next course of action on her case. Each time Pepper was examined by a veterinarian a quality of life score was done by that individual. This aided in the non-biased scoring and provided an opportunity for veterinary staff to evaluate her at that moment in time. Quality of life scores showed, with the exception of a few experiences, that her disease was not progressing and she was thriving on CCNU.

However; age, health and disease find their way into an animals life at some point and ultimately cause what all keepers dread. In February of 2019, now 10 months into treatment, Pepper began to show some small signs of illness. She presented with a small amount of blood within her mouth and minor weight loss. She was immobilized to perform a full examination. Her lymphoma was stable but veterinary staff discovered vulvar discharge. Bloodwork was taken and her lymphocyte count was now 600/uL (40%) which was well below the normal levels. These low lymphocyte counts could have indicated myelosuppression which is a potential side effect of the CCNU drug, but cannot be determined for certain.

Examination results showed she had a urinary tract infection. This infection was difficult for her to recover from. Pepper was now showing clinical symptoms of lethargy and hyporexia. Many treatments were performed during this time to include force feeding, pain management, antibiotics and subcutaneous fluids. On March 6, 2019 the staff originally involved in Pepper's treatment plan came together to decide if her quality of life had dropped below what we had determined was an acceptable score. Using the criteria we had previously set all parties knew that euthanasia was the right decision, even though the decision was a difficult one to make.

Once the results of Pepper's necropsy and bloodwork came back we were all surprised by the results. Her histopathology results showed she had succumbed to renal failure. Given the nature of this disease all parties knew that the possibility of the cancer returning was probable, so the fact that she did not succumb to the disease was remarkable. Keen observation skills and great communication between keeper staff and veterinary staff helped to provide Pepper a longer enhanced life because of the high quality of care given. Considering her initial prognosis, Pepper was able to thrive almost an entire year after her diagnosis. This was remarkable.

Pepper's purpose

The dedication of Point Defiance Zoo & Aquarium towards Pepper's case was incredible. She is a prime example that being a part of the zoos' animal collection meant she would receive the best care possible. Point Defiance Zoo & Aquarium not only supports our exotic species but also knows how important our domestic species are to our collection and to our guests. She received financial support which provided medications, physicals and dietary evaluations as well as the intensive time dedicated to caring for her while undergoing treatment. As zoo professionals; we are the examples that we need to set for our guests. Showing that a domestic guinea pig, a common species with a short lifespan still deserves the same care as others is meaningful.

Pepper's story is one of importance. Her story is not just important for the knowledge gained by veterinary and zoological staff but for many other reasons. Her role at the zoo was to showcase smart pet choices in a touchable and recognizable way. Pepper was used routinely for programs to include viewable training sessions for the public at our stage area. She along with her sister Cayenne would run across the stage in an adorable manner capturing the hearts of many. When she was diagnosed with lymphoma and leukemia we used her story to impart empathy to our zoo guests. She was used as an example of choosing a pet and being able to financially consider end of life possibilities. She was also an example of an individual undergoing a horrific disease who was able to beat the odds. She was relatable; there are so many individuals that have been touched by cancer is some way, whether personally, through a friend or family member or having a pet that has succumbed to the disease. Showcasing domestic and handleable animals can provide empathy and compassion for that individual. These domestic species can then open the doorway for their exotic and untouchable counterparts.

Pepper unfortunately is not the only member within our zoo collection that has been diagnosed with cancer. Currently Hanako, a female Asian Elephant is undergoing treatment for cancer in her foot. Hanako and Pepper were both featured in a post on social media showcasing both exotic and domestic species; big and small the care is the same. Showcasing Pepper's story and

the stories of other animals within our collection allows the zoo to engage its guests, helping them to be stewards of our world and imparting a love for the animals under our care and out in the wild.

Conclusion

Pepper's spirt was one of a survivor. Whomever met her immediately fell in love with her and her amazing story. She provided knowledge and inspiration for those individuals fighting the good fight and proved that no matter the species a chance at life can mean so much more than a few days or weeks.

Pepper has touched many lives and taught us compassion, positivity, understanding and the power of our observation skills. She is only one example of an animal that beat the odds. As keeper staff it is vital that we pay close attention to our animals daily and notice the "off moments." We are the front line defense in giving our animals the best care possible. It is also important to be able to share these stories with our guests. The more understanding our guests have of what we do and how much we care the more powerful our work can be.

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Sheep After Dark: A Fitness and Welfare Journey

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t

)18, the Animal Keepers at Family Farm at Woodland Park Zoo, in conjunction with the Animal Health Department and the Sound
ary Rehabilitation Center, have been using FitBark activity trackers to track the activity of two domestic sheep. The FitBark is a sm
hat attaches to the animal's collar and syncs through an APP to phones and tablets. It monitors activity levels and distance travele
'ere chosen because they are tractable and were above their target weights. The team is working towards correlating their activit
of weight lost in order to set an activity target for each animal. The fitness plan includes walks, running laps and an agility course
to working on weight loss, the 24- hour monitoring has allowed us to monitor their activity in the evening to determine if there r
ng affecting the herd (ie. July 4th noise) or a decrease or change in activity for an individual (lameness or injury).

ction

ily Farm at Woodland Park Zoo provides educational and recreational opportunities for zoo guests, especially young children. The
tive focus of the farm is centered on the relationships between humans and domestic animals, and the important roles these ani
ur lives. A big part of the Farm's mission is to get young children interested in and excited about animals. Providing up-close anim
nces in the Contact Area with 13.0 goats and 0.4 sheep who live together in two separate mixed herds helps achieve this goal. In
this program, the animals are worked with daily and the animals are tractable and desensitized to applied tactile. Because of this
ship, in 2018 when 0.2 twin 5-year-old female Dorper sheep (Sophia and Lauren) had exceeded their target weights keepers partn
mal health department to create a program to decrease their weight and track the activity for the program with a wearable fitnes
designed for dogs – the FitBark.

Participants

vo sheep are twin sisters and have lived together since birth, 5 years ago. These Dorper ewes were rejected by their first time mo
ttle raised in the rancher's kitchen. They arrived at Woodland Park Zoo in 2014 from a ranch in Eastern Oregon, the same ranch t
uired the Family Farm's two other sheep.

Sophia

Lauren

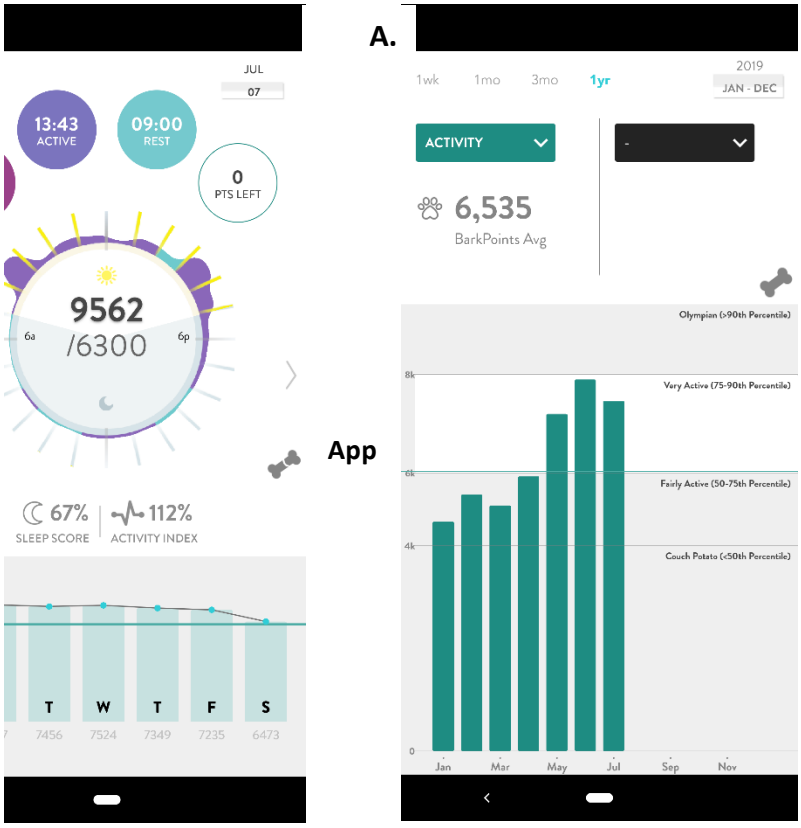


Figure 1: Screenshots of FitBark app data for 0.1 sheep, Laure Daily activity statistics and progress toward goals. B) Data ca graphed over time within the app. Lauren's activity has dram increased since implementing a keeper-directed exercise prog May 2019.

on

e FitBark is designed and calibrated for dogs, we needed to first ensure that the device could accurately record activity in sheep. I , the FitBark app records several types of activity data such as Activity Index, FitBark Score, Active Minutes, and Play Minutes. We to understand which of these metrics most closely resembled the observed activity levels of the sheep. A basic ethogram was us he behavior of both sheep during operating hours over two week period. During this time, the sheep's diet and activity were not to compile an accurate baseline of their daily routines. The resulting data confirmed that the FitBark was accurately recording ac ep and both the FitBark score and Activity Index metrics were similar to our observations, despite the limited hours in which obse ce compared to the 24-hour monitoring of the FitBark.

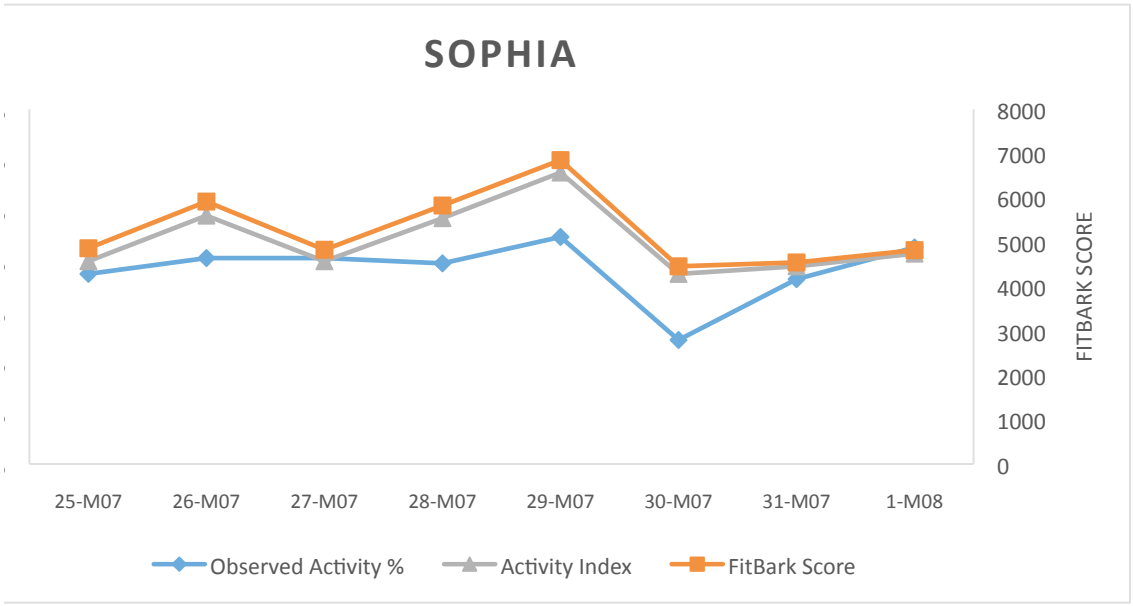
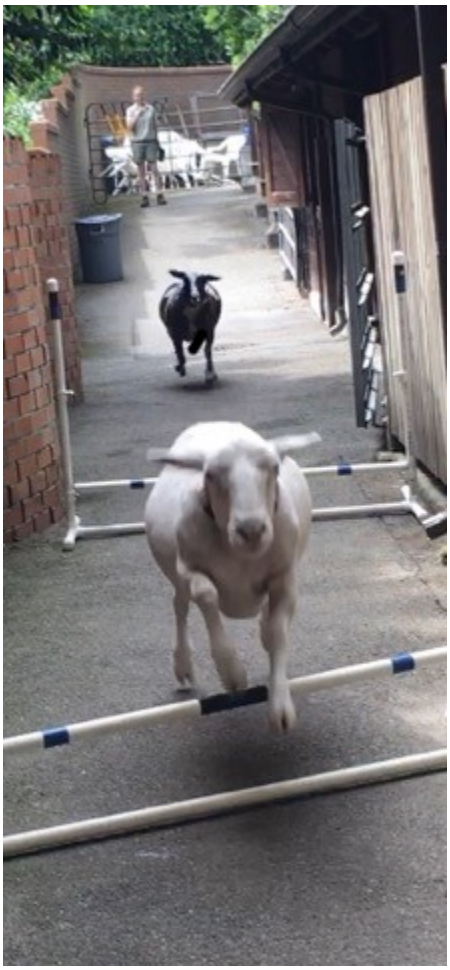


Figure 2: Validation data for the activity tracker in 0.2 sheep. Obse Activity represents the proportion time the sheep were engaged in behaviors based on live observati The Activity Index is produced by FitBark app and is defined as tod activity compared to recent week FitBark score is similar to "steps" and is the primary metric used by app. The FitBark data is similar to recorded by trained volunteers, indicating that the device can rel measure activity in our sheep

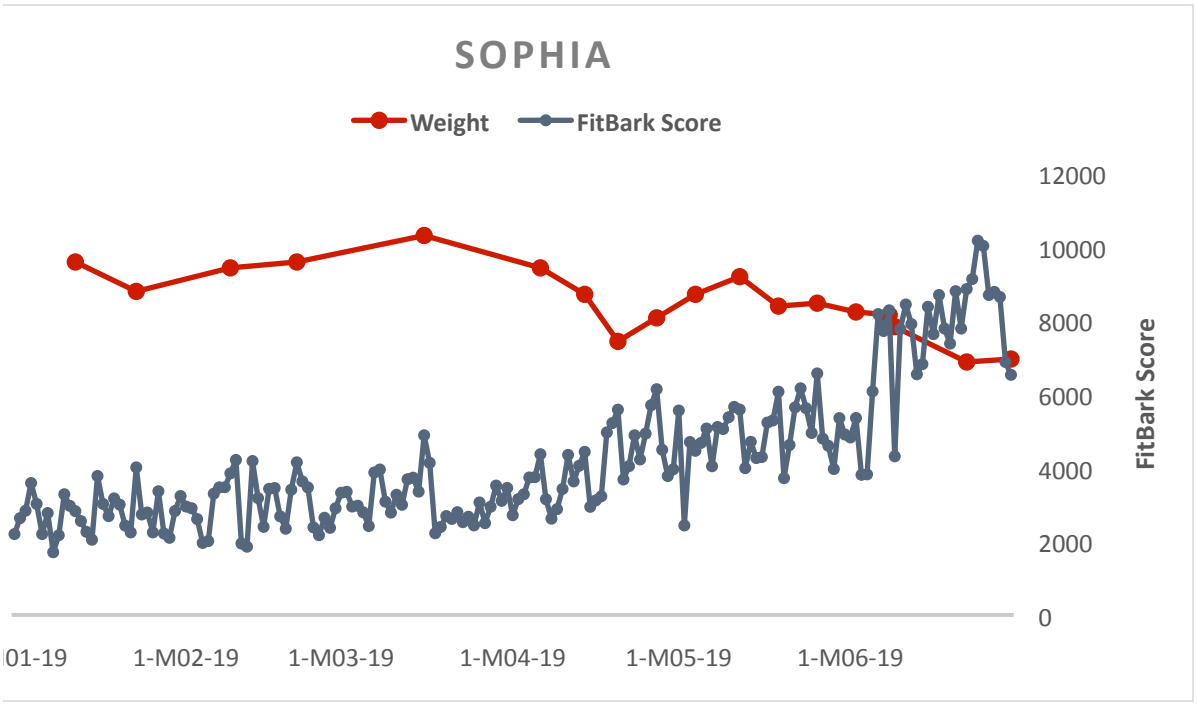
program

o weeks of collecting baseline data the exercise program was stared. The exercise program started slow and increased duration a levels as time went on over the course of 14 months Leslie Eide, DVM and Kristin Kirkbe Shaw, DVM from Sound Veterinary tation Center were consulted on a comprehensive Fitness Plan with appropriate exercises for weight loss and a program to get th lished and be the most efficient use of keeper time. The star of the program included walking both sheep on a guest loop that me mately ¼ mile distance. The sheep were walked 2-3 times per week. This activity level was maintained for one month until they ha ed to that threshold. The next phase increased the duration of the walks by completing 2 loops around the guest pathway, makir tance approximately ½ mile 2-3 times per week. Again, once they had acclimated to that threshold, the activity criteria was increa walks were faster with short sprints throughout the walks. As time went on, multiple cardiovascular exercises wherein the sheep eash in the shifting area at the Family Farm were added. The shifting area includes multiple natural inclines and they are utilized to increase difficulty for added benefits. Two agility rails for the sheep to jump while exercising in our back area were then adde



ult of this program, both sheep have lost weight and gained muscle mass. At the start of the program, Sophia weighed 71.2 kg an 57.0 kg. Lauren (the more enthusiastic exerciser) had a start weight of 67.5 kg and is currently 61.7 Although the weight loss amo tic, their overall body conditions look much improved.

it isn't surprising that increasing activity leads to weight loss, it should be noted that the amount of keeper time spent on these tr s has not changed much in the last year. With consistency in training, the sheep have built up stamina and motivation and are ing their fitness routines faster and with added difficulty, allowing keepers to get more "bang" for their training "buck". In the las the activity scores from both sheep have increased significantly despite keepers only spending 20 minutes per day on the exercis



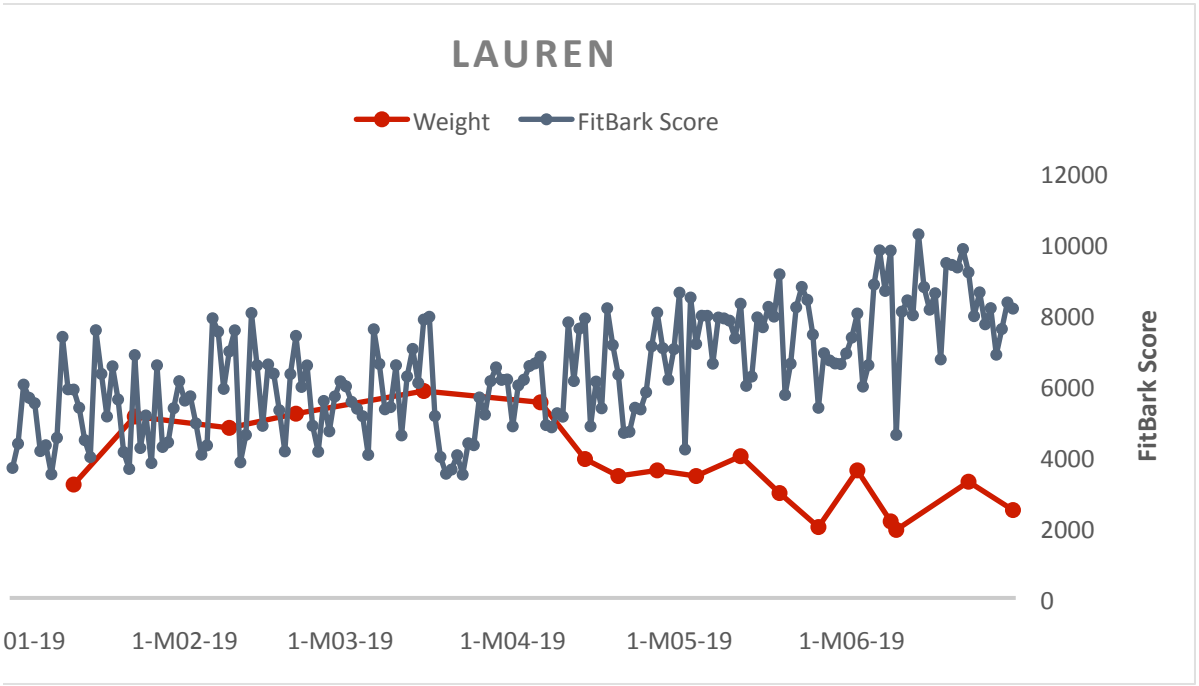


Figure 3: FitBark scores and weight for 0.2 sheep during first half of 2019. Though ke time spent on this directed j program has not changed, t activity levels of both sheep increased dramatically as th have gained stamina and motivation to exercise. In tu weights and body condition both animals have improve

ps include pinpointing the activities that result in the most "BarkPoints" (FitBark Score), calories burned, and/or active minutes. T to continue to develop a directed exercise and training program that maximizes the health and welfare benefits for the sheep as he most efficient use of keeper time.

cted Benefits

on to the benefits of tracking their activity, the FitBark information offered data from times when staff was not there for direct tions. For example, when Lauren came up lame on her left rear leg one morning, the FitBark data recorded that her activity was u the night. It could be inferred that an event had taken place overnight that altered her normal activity pattern. According to the restless through the night, which correlated with the observed lameness the following morning. The FitBark also allows for data a nimals response and activity during evening events or unusual noises (ie. fireworks). The sleep number was a lower percentage ar

One Step at a Time: The Story of a Young Orangutan and His Adopted Mother

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Megan Buecher, Primate Keeper-Orangutan

Indianapolis Zoo

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Introduction

In 2014 the Indianapolis Zoo opened a new state-of-the art orangutan exhibit. This innovate 16,000 square foot facility, known as the Simon Skjodt International Orangutan Center (Center), allows its arboreal ape residents to roam a 75-foot tall interior viewing space, access two outdoor yards and satellite buildings, and freely traverse an outdoor network of towers, cables, and platforms collectively referred to as the Hutan Trail (Figure 1). This modern building according to the Indianapolis Zoo was designed to stimulate the apes' physical, social, and intellectual abilities, and is home to one of the largest groups of orangutans in any American zoo. (Indianapolis Zoo Website 2018).

Figure 1. The Simon Skjodt International Orangutan Center

The Center, which is home to the Indianapolis Zoo's 11 orangutans, is a complex exhibit with a lot of different areas, giving guests a close-up view of the orangutans from a variety of vantage points. The exhibit was designed to promote choice; the apes have a choice on where they want to spend the day and with what other individuals they wish to spend it with. The main exhibit area, the Atrium, is a large, three-story all weather space that the apes can access from a variety of points. From the Atrium, the apes can directly access their off-exhibit holding area (Holding) as well as the West Yard from the room's first story. The third story has an access point that allows the orangutans to cross a glass tunnel, over the public space, to go into an off-exhibit area known as the Tail. The Tail is a three-story hallway that connects the Atrium upstairs to the Tim M. Solso Learning Studio (Studio) on the Center's second floor, and downstairs into Holding. The Studio is a unique space where the apes can go and work on computers with researchers focusing on language and cognition. The off-exhibit holding area includes 7 rooms, one of which is the hospital room, which houses the built-in scale and X-ray plate slot, and has attachments for a blood sleeve as well as other devices that allow keepers and veterinary staff to work with the orangutans safely and cooperatively. Holding is an oval shape and has several entries and exit points that allow the apes to move into the Atrium, Tail, or into the North Yard. In addition to the main building, there are two oases or satellite buildings, the West and East Oases. The West Oasis is connected to the main building via the West Yard. The East Oasis is only connected via the Hutan Trail, a tower and cable system, which intersects the North Yard and West Yard (Figures 2-4).

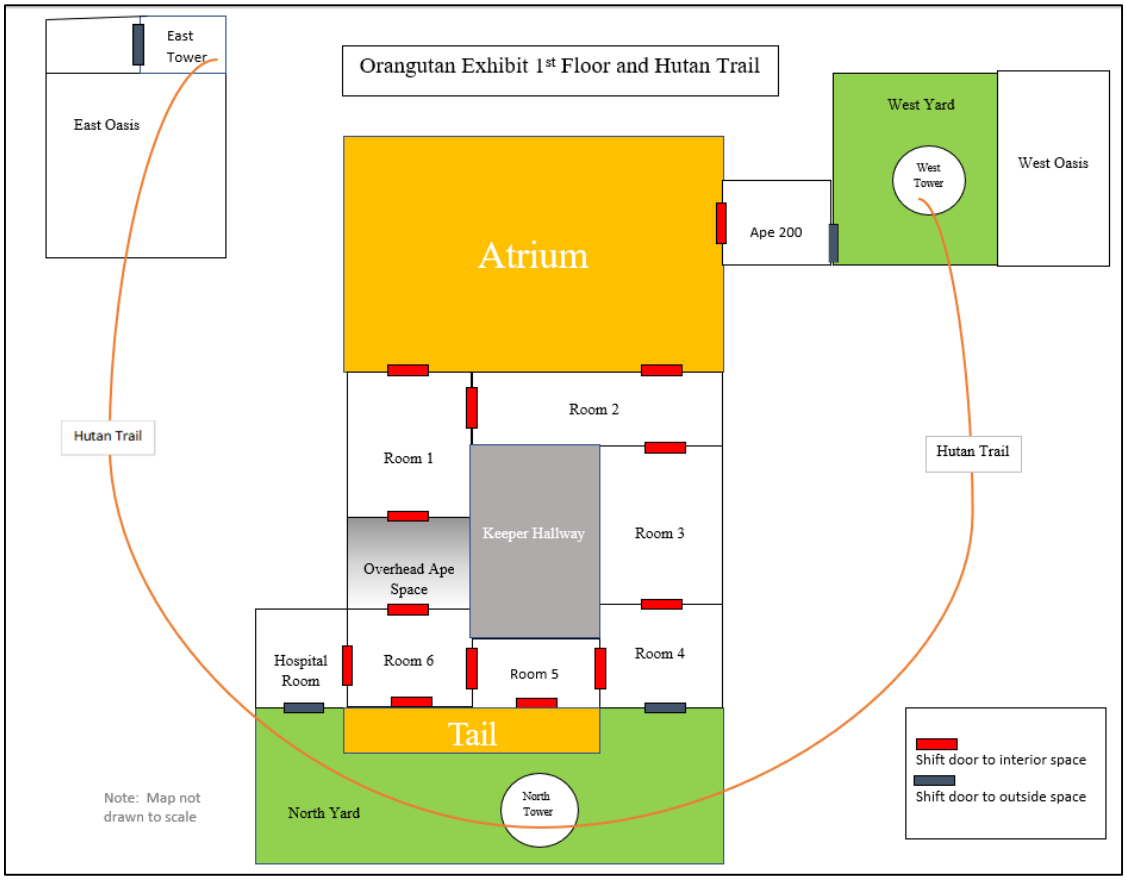

Figure 2. The Orangutan Exhibit 1st Floor and Hutan Trail Map

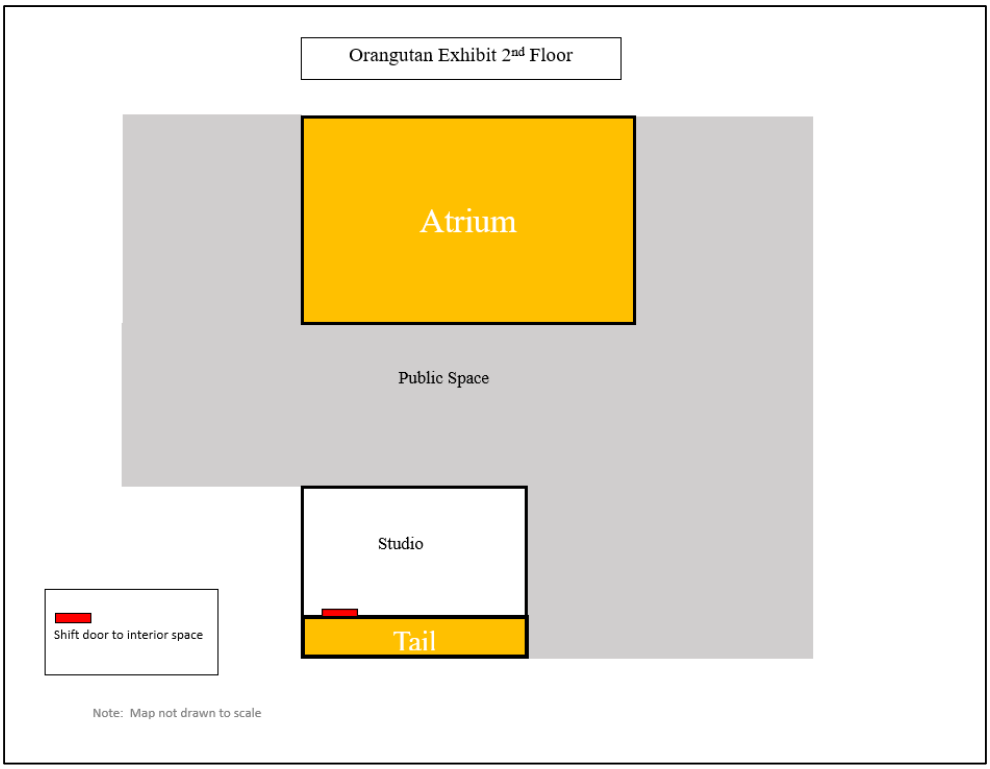

Figure 3. The Orangutan Exhibit 2nd Floor Map

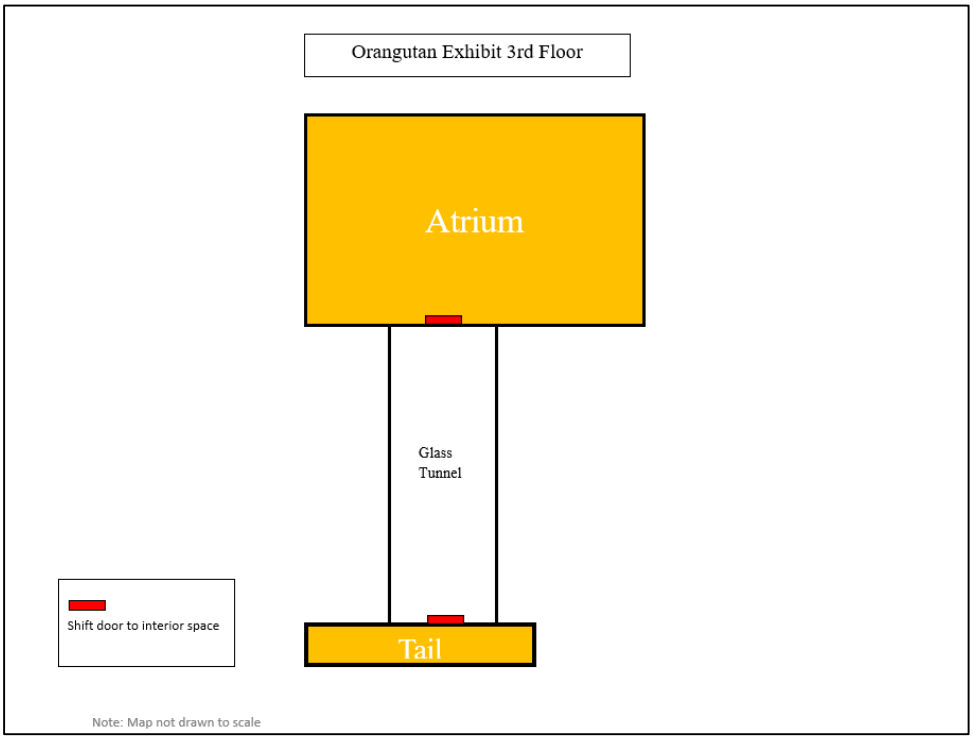

Figure 4. The Orangutan Exhibit 3rd Floor Map

Kim and Max

In August of 2016 the Indianapolis Zoo received two Bornean orangutans (*Pongo pygmaeus*); a mother, Kim, and her infant son, Max, from The Jackson Zoo in Jackson, Miss. Max was not hitting all of the mental and physical developmental milestones expected for an orangutan his age. As Max continued to struggle, the Orangutan Species Survival Plan (SSP) committee was consulted. The SSP program was developed to help ensure the survival of selected species in zoos and aquariums. Among other things, these programs help maintain healthy and genetically diverse animal populations within the zoo community. They determined it was in the best interest of both Kim, who was severely overweight and having some respiratory issues, and Max to be moved to the Indianapolis Zoo.

While in quarantine keepers worked to build their relationship with Kim and Max. Kim seemed to know something was wrong with Max and was good about presenting him along the mesh to keepers, which allowed staff to give him the supplemental feeds he needed. Zoo veterinarians teamed up with doctors from Riley Hospital for Children at Indiana University Health in Indianapolis, Ind. to figure out why Max was not thriving. After several tests and ultrasounds, they determined that Max did not have any detectable thyroid tissue and that his health issues were caused by hypothyroidism. This affected his metabolism and how his body was able to regulate temperature, heartbeat and his energy level overall. Medication was started immediately. After receiving his new medication and supplement feeds, Max started to slowly show signs of improvement. Kim was also slowly making improvements. She was on a new diet and began to move around a lot more. The combination of these two changes helped Kim lose weight. As Kim and Max were improving, they were moved to the Center and introductions to the other 10 resident orangutans began.

These introductions began in February with the Zoo's oldest, largest, and most dominant male, Azy (hybrid *Pongo*). Azy is the gentle peacemaker of the group. Overall, introductions between the three were uneventful. Kim tried to avoid Azy by always moving away from him, while Max clung to her. When Azy had the opportunity, he grabbed Kim and copulated with her. After that, he went on his way and did not bother her anymore. Introductions with most of the other apes were also relatively uneventful. A lot of the females were curious about Max but mainly left him and Kim alone. Kim was a very protective and serious mother. She rarely played with Max and would not let him climb the mesh on his own very often. Any time another ape would come over to Max while he was playing on the mesh, she would grab him off and move away. Knobi (hybrid *Pongo*) is the Zoo's oldest and most dominant female. She is bossy, headstrong, confident, playful, and motherly. She, in particular, was very interested in Max right away. She had never had a baby of her own but she had adopted Rocky (hybrid *Pongo*), another orangutan, when he was 2 years old and she always enjoys playing with Mila (*Pongo abelii*), an infant orangutan, at the Zoo. Knobi would follow Kim around and try to touch Max whenever the opportunity presented itself. However, Kim did not like Knobi following her and her baby around. When Knobi would get too close Kim would vocalize and move away from her. Eventually, Knobi's persistence paid off. By April, she was able to get close enough to Max to play with him. Even though, Kim protested by vocalizing, Knobi was able to slowly continue

physical interactions with Max. Building their relationship, she quickly became his favorite "aunt" and playmate.

As introductions with the Zoo's other great ape residents continued, Kim and Max were incorporated into the daily routine and group Atrium time. When all the apes were together Kim would occasionally let the other adult females play and interact with Max but only for short periods of time and she would often vocalize during interactions. Kim would never let Azy play with Max and would move away from him if he got too close.

Life in the Center continued with Max getting stronger every day. He started to eat more produce, try new foods, and started learning new things like brushing teeth and basic husbandry behaviors. Although Kim was losing weight and getting stronger herself, her respiratory issues worsened. Kim's breathing was very raspy and she would get winded easily. It was decided that she would be immobilized to do a full physical and bronchoscopy to address the increasing respiratory problems.

Kim's Death

In previous immobilizations with Kim, Max was placed with Knobi until Kim had fully recovered. Knobi and Max had a good relationship and he had done well with her in the past. During Kim's immobilization in May 2018, it was discovered that she showed signs of significant pathology within her lower respiratory tract. She had severe bronchiectasis caused by chronic inflammation and/or infection. They also found that her trachea and primary bronchi contained a very think exudate and the airways were significantly narrowed. Kim was directly started on a twice daily nebulizing treatment.

November 1, 2018 Kim was again immobilized for her re-check bronchoscopy and computed tomography (CT) scan to evaluate her response to the 6-month medical nebulization therapy. During the procedure, Kim was stable and doing well. After she recovered from the anesthesia, she had multiple episodes of acute respiratory distress and passed away 5 days post-immobilization. Necrocroprosy showed that severe acute pulmonary edema was the cause of death and that the changes observed in Kim's lungs resembled the acute respiratory distress syndrome described in humans.

After Kim had passed away, the team had to pull together quickly to make a decision on another female ape to put Max with. Orangutans have the longest infant development period of all the great apes. In the wild, and in human care, young orangutans typically spend 7-9 years with their mothers. Because of their relationship and history, the team unanimously decided Knobi was the best choice to be an adopted mother for Max. Probably the most difficult and heart wrenching task for keepers was pulling a distressed Max off of Kim. It was done quickly and he was placed

in a room adjacent to Knobi. Keepers told Knobi, “You have to take care of Max now,” and shifted her into the room he was in. Once they were together, Max settled down.

Knobi and Max

Luckily, Max was at an age that although he still nursed, he was eating solid foods and had his own established diet. Max was already familiar with the Center and knew the rest of the orangutans. Keepers had to make sure Knobi knew that Max was her baby now and it was her responsibility to care for him. To do this, keepers started Knobi and Max’s new routine slowly and worked step-by-step to establish their new routines.

The first couple days after Kim’s death were hard for Max. He would often cry and would get upset. Initially, Knobi did not seek him out when he cried or made distress sounds nor did she share her nest with him at night, like his mother used to do. At first, every time Lucy (hybrid *Pongo*), an orangutan who looked similar to Kim, would be shifted from another area into Holding Max would get upset. He also could not go near the Hospital room, where he and Kim had slept almost every night, without looking for her and crying. Keeper staff wanted to rush to his side but Max had to learn to seek out Knobi for comfort and she needed to learn to respond to him.

At the start, keepers would only shift Knobi and Max one room over to clean and then shift them back. Knobi never carried Max like Kim did so Max had to learn to just follow her or hold on to her hair when she left the room. Keepers would tell Knobi, “wait for Max,” whenever they shifted the two, and after the third day, Knobi was observed stopping and waiting for him before she shifted over to the next room. Max also learned, if he was the first to shift, he needed to stop and make sure Knobi was following. Knobi started letting Max take food from her and sleep closer to her at night. During the day, they would play together or with enrichment and Max began to cry less.

Once the pair was shifting together regularly in Holding, keepers decided to start re-introductions to the rest of the apes. Azy was the first introduced. Knobi and Azy have always had a close relationship and have always gotten along well. When they were all placed together Knobi went over to Azy to copulate. It seemed Max remembered what his mom had taught him, so he kept his distance as best he could while still being close to Knobi. Max was cautiously watching Azy and Knobi and grabbed her arm hair, seeking comfort, waiting for them to finish. Azy did not seem to care about Max being there. Max slowly followed Knobi around while she was hanging out with Azy and continued to watch them together, standing or sitting right next to them. After a bit, Max went about the room by himself, while Knobi and Azy were playing with enrichment. Any time Azy would make a loud noise with enrichment or a display, Max would run to Knobi.

Because introductions in Holding with Azy continued with no issues, keepers put the trio in the Atrium. Even with the bigger space, Max followed Knobi and shifted back into Holding easily. The next few days the three apes continued to go into the Atrium during the day adding the other female apes into the mix. It appeared the other apes were curious as to why Max was with Knobi and not Kim, but re-introductions happened without incident. The next step for Knobi and Max was shifting them up the Tail into the Studio where they could work on computers. This shifting made keepers nervous because once in the Tail, they could no longer could see the apes until they emerged upstairs at the Studio. The first time keepers gave the pair access to the Tail, Max stood at the threshold and waited for Knobi to join. They proceeded upstairs together and into the Studio with no issues. Soon, Knobi and Max were shifting around the entire building together without any problems.

As Knobi and Max spent more time in the Atrium with the group, Max began gaining more confidence and independence. Knobi did not coddle him or restrict him from interacting with the other adult apes. Where Kim took a very protective parenting technique, Knobi was the opposite. As Knobi has continued her mother role she has become better at comforting Max. She knows when his cries and squeaks are serious or just whiny. Max, Knobi and Azy also spend the most time together out of all the apes. The more time they spend together, the most self-assured Max becomes with Azy. Now when shifting the three of them together, Max will willingly come straight into a room with Azy and not wait for Knobi before entering. Azy also plays with Max frequently. They wrestle and play with enrichment together. Azy has been observed letting Max take some of his food, although it is usually something he was not going to eat anyway. The three have become a group, often shifting and sleeping together in the same area.

The Next Steps

The next steps for Knobi and Max are separation training and navigating the Hutan Trail. Due to Max's thyroid issues, he has to have bloodwork done once a year. At present, keepers are working on voluntarily blood draws with him but have not yet successfully accomplished this goal. Until then, Max is immobilized so veterinary staff can obtain a blood sample. To do this, Knobi and Max need to be in separate rooms. With training and trust in their keeper staff, Max and Knobi are comfortable being separated from each other. In June 2019, Max was successfully separated from Knobi, immobilized and re-introduced to her without any issues.

Navigating the Hutan Trail is currently the last big hurdle that Knobi and Max need to overcome. Several apes at the Zoo use the Hutan Trail regularly. Knobi is one ape who often traveled across the cables and towers to explore different parts of the orangutan exhibit. Kim, although she did go to the tops of the towers in the outdoor yards, never traversed the cable system. Because Max has never clung to Knobi and she has never picked him up, keepers are waiting to give them access to the Hutan Trail. At 80 feet off the ground, the cable system extends over the public pathways. Being an arboreal species, orangutans are built for life high above the ground. Still, safety is the highest priority, so keepers are gradually working toward seeing if Max will follow

Knobi on her travels around the Center or if he will stay on the tower and patiently wait for her return.

Today, Knobi and Max are doing well. Max continues to gain his independence and hit all his developmental milestones. Azy and Max continue to have a good relationship. Although keepers know it is only temporary, this relationship has been enriching to both apes. Azy gets enjoyment from playing and wrestling with Max and Max has an older male to learn from. Hopefully, as he matures, Max will learn from both Azy and Knobi on how to be a good, self-sufficient, confident, male orangutan.

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Can Non-Sibling Male Fishing Cats BroExist?

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Abstract

The fishing cat SSP population faces a very common problem; lack of space. Knowing that, perhaps innovative housing strategies could increase usable space for fishing cats. After successfully breeding fishing cats at Denver Zoo, we were left with a space problem. We were unable to place the male offspring, because no zoos had room for a male. Since females were in higher demand, we sent our female to pair with another breeding male, leaving us with a father (Ronaldo) and son (Miso-Chi), who rotated holding areas and the single exhibit. We wondered if introducing the two males would increase the space they had access to and possibly create a more dynamic exhibit. We also discussed how this innovative strategy could potentially consolidate animals in the population and lead to more spaces overall. We created an ethogram and observed both animals before and after the introductions. The introduction went smoothly, and initial mild aggression quickly diminished into curiosity. The male cats have now been housed together during the day for months. They exhibit more behavioral diversity, they are more visible to our guests, and they have more space than they did when they lived separately. If other zoos are in the same position Denver Zoo was in, it might be worth thinking outside the box and trying unique groupings of fishing cats. This could benefit both individuals and the population by providing more housing options.

Introduction

Fishing Cats (*Prionailurus viverrinus*), small felids found in Southeast Asia, are listed as vulnerable overall by the IUCN red list, but are already considered endangered in some localities. While much is still to be learned about this species, researchers confirm their population numbers are declining due to habitat loss, wetland pollution, and trapping for consumption or retaliation. Considered solitary, fishing cats seem to follow the typical felid occupancy pattern, in which several females' home ranges are overlapped by one male (Small Cat Advocacy and Research). However; recent studies show evidence of more territory overlap with other cat species than previously recognized.

Similarly, the Fishing Cat SSP population faces a very common problem; lack of space. Holding and exhibit areas are at a premium. It is unlikely that enough new holding spaces will be found to increase the population to a sustainable level, but as wild fishing cat numbers decrease, it is important for us to maintain a healthy population in zoos. Fishing cats in zoos are usually housed alone or in breeding pairs, but perhaps innovative housing strategies could increase usable space and benefit the entire population.

Denver Zoo's breeding pair of fishing cats, Namfon and Ronaldo, had their first successful offspring, Miso-Chi, in the beginning of 2017. Like the majority of the fishing kittens born in zoos recently, Miso-Chi is a male. He would be added to the waiting list for a breeding recommendation as all of the breeding females in the population were already paired, but Denver Zoo did not have space to continue breeding while also housing Miso-Chi. Since females were in higher demand, the decision was made to send Namfon to pair with another breeding male. This left Denver Zoo with a father (Ronaldo) and son (Miso-Chi), who rotated holding areas and a single exhibit.

Initial Idea and Brainstorming

Although Ronaldo was separated from Namfon before parturition, the two males did have visual and howdy access to each other in the back holding. For two years, no negative interactions were observed, despite often eating right next to each other. There was awareness and curiosity between the two, but no aggression or concerning behavior. Although there was a lack of affiliative interactions, keepers began to wonder if they would tolerate each other, and potentially be enriched by each other, if they were housed together.

As we began to brainstorm the possibility of introducing two non-sibling male fishing cats, we considered Ronaldo and Miso-Chi's individual backgrounds. Ronaldo had been housed with Namfon successfully as a breeding pair. Keepers observed them sleeping and vocalizing together at night, but generally maintaining their own space during the day. Occasional warning aggression, such as hissing or raising of the paw, was seen around feeding times, but they always responded appropriately to each other. Ronaldo was separated from Namfon before she gave birth, but Miso-Chi remained with Namfon until he was about a year and a half old. Namfon displayed proper maternal behaviors, but as Miso-Chi got older, she became less tolerant of his presence. Miso-Chi quickly learned to read Namfon's behavior and respected her space. Because Miso-Chi and Ronaldo both had successful histories and displayed proper social behaviors when with Namfon, we were hopeful this would translate if we housed the two males socially. We knew other institutions had successfully housed sibling males with varying success, but a father and son pairing as adults hadn't been attempted or done successfully in AZA institutions.

We evaluated the potential risks and rewards of this innovative introduction. Housing them together would benefit the population, the individuals, and the guest experience. If successful, this strategy would also have implications for the SSP population by allowing the option to consolidate animals and leading to more spaces overall. Housing two fishing cats together would increase useable space and allow opportunity to display an increased variety of behaviors. This could create a more dynamic exhibit and increase guest awareness and interest in the species as well. However, the introduction was risky as fishing cats have been known to seriously injure or kill each other. The team at Denver Zoo felt that the possible benefits and population-wide reward for this introduction was worth a try. We felt confident in our exhibit space and ability to separate the two cats if the introduction was not going well.

Behavioral Observations

With the hope of sharing the story of this introduction and its results with the zoological community, we designed a behavioral study to compare activity budgets, behavioral diversity, social interactions, and visibility before and after the introduction.

We predicted an increase in behavioral diversity once they were housed together as this would give them the opportunity to display social behaviors not observed with a solitary animal. We also wanted to evaluate any changes in visibility, which was heavily dependent on their shifting compliance and if they had access to the behind-the-scenes holding area. Lastly, we wanted to look at how their frequency of social interactions and their proximity to each other changed over time. We predicted an increase in affiliative behaviors and a decrease in agonistic behaviors over time and as they got more acclimated to being with each other. We also hoped to see an increase in time spent at a closer proximity.

Once establishing our goals for the study, we created an ethogram. We reached out to Birmingham Zoo, who had previously housed two brother fishing cats together, to get an idea of what behaviors they observed and what we might expect. Because we had to make predictions about what their interactions might be, we made our ethogram very detailed and specific, including multiple categories and defining many behaviors. (Denver Zoo Fishing Cat Ethogram, Addendum 1).

We initially designed a six-week study, with two weeks of baseline observations before the introduction and four weeks of observations after the introduction. After the initial six-week period, we planned to re-evaluate the study and assess frequency of observations moving forward based on our results. We used the ZooMonitor© program to record these observations.

Study Length	2 weeks baseline, 4 weeks after introduction, re-evaluate
Session Length and Intervals	15- minute session with 45- second intervals
Observation Frequency	4 days per week, 3 times per day
Time Frames *(one each per day)*	7:30am-10:30am, 10:30am – 1:30pm, 1:30pm – 5:00pm
Behavior Modifiers	Proximity *(all behaviors)* and Intensity *(social behaviors)*

Introduction Plan

While working on the ethogram and behavioral observation study, the keepers also created an introduction plan. The plan included details specific to our area such as keeper roles, behaviors expected and behaviors that would determine separation, and methods for separation if needed. We did our best to prepare for different scenarios, but with no experience of male fishing cat introductions, we knew a lot of decision making would come on the day of depending on what actually happened.

Based on our knowledge of the two cats, we predicted that Ronaldo would be aggressive towards Miso-Chi, but Miso-Chi should submit and that would cease the aggression appropriately. We would separate the cats and end the introduction if aggression continued despite submission or avoidance from one of the cats or if any serious injuries were inflicted. Because this introduction was led by the team and not by other factors such as breeding priorities, we did not have any pressure or expectation for how long it would last or how much progress was made towards housing them socially. (Denver Zoo Fishing Cat Introduction Plan, Addendum 2).

Initial Introduction

Overall, the first day of introductions were successful. Upon opening the door, the cats ran past each other with no reaction and settled in to their own spots in the back holding. After 45 minutes of no further interaction, the two cats got into their first tie-up. The cats were likely not active or investigating each other initially because of the abnormal presence of multiple keepers during initial introduction. The fishing cats are not used to more than two keepers in the holding at a time, and generally the keepers are only around for training and cleaning. The initial tie-up happened quickly, but they separated themselves once they heard the hose turn on.

After separating themselves, we left them together, and as we predicted, they found their own places to sleep and hide for the rest of the day. We saw further investigation from the two throughout the day, with hissing being the most aggressive behavior observed, and no resulting injuries from the introduction. We decided to separate the two overnight and reintroduce them the next day so we could further observe their interactions. The reintroductions the next day were uneventful, so we continued

with this plan of them being housed socially during the day and separate overnight. During the day, we left them access to their holding area as well as the exhibit to give them space as they adjusted to each other. We continued with this plan for two months.

Throughout this initial two-month period, keepers occasionally found signs of physical interactions, such as hair clumps in the holding, but the cats never showed any sign of injury or increased hesitancy around each other. Keepers were consistent with how they reintroduced the cats each morning and utilized an audio cue before the door was opened. Keepers also focused on building strong shifting behavior to the exhibit during this time, even though they would have access all day, to prepare for the next step of locking them on exhibit together.

We did try leaving the cats together overnight once early on during these initial two months. A keeper stayed late to observe their behavior as we anticipated an increase in activity. As predicted, when the lights turned off, their behavior changed, Miso-Chi began to follow Ronaldo persistently which resulted in a tie-up. We decided to separate them after the tie-up and regroup as a team. We needed to look at smaller steps working towards an overnight and find ways for us to better monitor their behavior overnight. Because this introduction was elective, there was no pressure to how often they needed to be housed together.

Additional Steps and Goals

After the initial two-months went well, the team decided to move to the next step of locking the cats on exhibit together during the day. We had been practicing the shifting plan, which included feeding them both on exhibit at separate locations at the same time, to prepare for this step. The fishing cats historically had never been strong shifters, so being able to reinforce them both with their morning diet on exhibit, was key to this step working.

The transition to this step went smoothly, with the cats shifting consistently despite the change in access. We were able to secure them on exhibit each day, and continue to separate at night, making them more visible to guests and allowing us to better observe their behavior throughout the day.

Once securing them on exhibit during the day proved successful, we began to work on making more usable space on exhibit for the two cats. Initially, we avoided using enrichment that created trapping locations, but as both cat and keeper comfort levels increased, we added more enrichment that created secure hiding and resting locations for the cats. Hollow logs, cat towers, and other bench-like items were the most successful. We also added more perching to take advantage of the vertical space in the exhibit.

We continued to work on ways to make the exhibit more positive for the two cats by increasing the options for enrichment we could give when housed together. For example, offering live tilapia together. We started with smaller tilapia as they were less valuable to the cats and progressed to larger fish. We always gave at least three fish to give each cat a better chance of getting one. Although there were some days where one cat caught all the fish and the other did not get any, they defended their fish appropriately and no food stealing or fights resulted from this enrichment. Overall it was really successful for the cats and made a great guest experience.

As we continued the socialization, we encountered situations where the cats needed to be kept separate for various reasons, such as for routine urine collection. The cats continued to shift well after these days off and the reintroductions continued to be uneventful. This allows us flexibility in our

housing options as we continue with this process. Now, if one of the fishing cats does not shift to the exhibit, that cat stays in the holding, while the cat that shifted is on exhibit. This increases our percentage of visibility even more because one cat is still on exhibit instead of housing them together and leaving them with access.

We will use this as a tool as we begin to explore overnights together with these two males. We can house the cats separately during the day, and introduce them later in the day as an approximation towards housing them overnight and for longer periods of time. If we find overnights together to be successful, we can use a fission/fusion type management to allow them time alone as well as together as we see fit.

Behavioral Observation Results

Our behavioral observations included the two weeks prior to the introduction, the first four weeks after the introduction when they had access to the exhibit and the holding, and eight weeks once they were locked on exhibit together. The results from the first four weeks after the introduction proved to be insignificant in addressing most of our questions because the cats were out of view the majority of the time (Miso 62% and Ronaldo 85%). This piece was important though in addressing how the introduction affected their visibility.

Visibility

	BEFORE INTRODUCTION	**AFTER INTRODUCTION**
Percentage of time with access	*33%*	*8%*
Percentage of time out of view	*Miso-Chi 26%, Ronaldo 27%*	*Miso-Chi 3%, Ronaldo 5%*

Before the introduction, the fishing cats successfully shifted and were locked on exhibit 67% of the time. Because of this, they had access to the holding 33% of the time and were out of view 27% of the time. This increased when we were actively leaving them with access, but we recognized this would be a necessary step to work towards securing them on exhibit together. Once we began trying to lock them on exhibit together, they only had access due to non-compliance 8% of the time, which significantly decreased their time spent out of view (Miso 3% and Ronaldo 5%). This increase in visibility has created a better guest experience, with many guests noting that they had never seen the fishing cats out before.

Behavioral Diversity

Number of behaviors exhibited	**BEFORE INTRODUCTION**	**AFTER INTRODUCTION**
Miso-Chi	*14*	*>24*
Ronaldo	*11*	*>24*
New behaviors:	*Social vocalize, displace, hiss, approach, allogroom, mount, & more*	

Before the introductions, Miso exhibited 14 different behaviors and Ronaldo exhibited 11 behaviors. After the introduction the two cats were exhibiting 24 different behaviors, not including the behaviors that were recorded as ‘other’ during observations. New behaviors included both agonistic and affiliative social behaviors including: social vocalize, displace, chase, hiss, avoid, and allogroom. Behaviors that were recorded as ‘other’ included mount, approach, investigating/smelling the other, and follow.

Activity Budgets

Behaviors listed in the ethogram were divided into different categories: Locomotor, Self-Maintenance, Other, Out of View, Affiliative Social, and Agonistic Social. As stated above, both cats' time spent out of view decreased significantly. Another significant change was Ronaldo's 'Locomotor' behavior category increased from 8% to 20%. His 'Self-Maintenance' behavior category also increased from 25% to 35% with keepers also anecdotally noticing an increase in Ronaldo's time spent grooming himself. Miso-Chi also exhibited an increase in the 'Locomotor' behavior category from 31% to 43%.

Interactions over time

We also looked at the frequency of agonistic and affiliative behaviors over time. As predicted, we saw a decrease in frequency of agonistic behaviors, of which swatting and hissing were the most common. Hissing and swatting have decreased from occurring frequently when the cats got near each other to only being exhibited when the cats are in specific situations such as protecting live fish they caught. Tie-ups were infrequent and short-lived and never caught during observations, but as we continue to explore next steps, including overnights together, we anticipate these to continue to occur.

As the cats were together longer, we began to see new affiliative behaviors being displayed. These behaviors progressed in level of interaction over time from social vocalizing to following, playing, mounting, hiding together, and eventually, allogrooming. These behaviors began to increase in frequency and intensity over time, but overall, they spend an insignificant amount of their time engaged in these social behaviors.

Other Notable Results

There were also some notable results in their activity budgets on an individual behavior level. Miso-Chi exhibits a pacing behavior, that could be more accurately described as patrolling, that remained the same before and after the introduction at between 12% and 13%. Keepers observe that this behavior is consistent in the mornings when Miso-Chi is on exhibit and saw a correlation to strollers and wagons in the guest lobby of the building. Seeing that this level of pacing or patrolling remained the same after introductions, allow us to better understand a possible cause of this behavior and address it, feeling confident it is not a result of stress due to Ronaldo's presence.

'Alert' and 'Vigilant' were two similar behaviors in the ethogram, with 'alert' meaning the cat was stationary, awake, and aware. 'Vigilant' was defined as a more heightened awareness being focused on something. Although 'alert' may have a negative connotation, it is a comfortable and awake position, and it is what we expected to see a large majority of the cat's activity budget to include. When comparing these behaviors before and after the introduction, both cats showed an increase in time spent 'alert' and a decrease in time spent 'vigilant.'

Results Summary

There were no behavior changes shown through the behavioral observation results that concerned us or made us feel the cats are uncomfortable being housed together. On the other hand, we did see some trends and changes in activity budgets that we hypothesize could be due to an increased comfort when housed socially on exhibit. Historically, the fishing cats have been poor shifters and sensitive to noise, changes in routine or environment, and public presence. We hypothesize that the cats may be less

hyper-aware and vigilant when together because they know where the other cat is or because they are more comfortable on exhibit when housed socially. We also see an increase in natural behaviors such as self-grooming, locomotion, and investigating environment, which could be a result of increased comfort. These could be a potential explanation to why their shifting compliance increased once they were housed together.

Future Steps

Overall, we feel like this introduction has been extremely successful and has shown benefits for the cats through enrichment, space, and behavioral diversity. It has also proven to enhance our guest experience and has increased our guests' interest in fishing cats in general. We still have many future steps we are working towards such as increasing time spent together overnight, exploring more food enrichment options such as scatter feeds or ribs together, creating more permanent exhibit structures that will further increase the cats' comfort on exhibit, and working on improving shifting compliance and resilience.

In addition to the benefits this introduction has had for our individual fishing cats, there are benefits for the fishing cat SSP population as well. If other institutions are interested in trying introductions of non-sibling male fishing cats, it could increase the space in zoos available for breeding pairs of fishing cats. In the future, it would be interesting to do a fecal cortisol study before and after introductions. It would also be valuable to see if introductions are successful when introducing males of different backgrounds and relatedness, for example two young unrelated males or two older males.

Addendum 1: Denver Zoo Fishing Cat Ethogram

Fishing Cat Introduction

2.0 Ronaldo and Miso-Chi

Fishing Cat Ethogram

LOCOMOTOR: modifiers: proximity (within 2 feet, within 5 feet, more than 5 feet)
Climbing – locomotion between levels: ascending or descending
Fishing – active locomotion towards catching a fish including jumping in and out of water and swimming
Investigating Environment – exploration or manipulation of exhibit furnishings and/or enrichment items (including smelling exhibit, enrichment, etc.)
Locomotion – directional movement through exhibit on one level
Pacing – a patterned walk repeated at least three times
Stalking/Hunting – focused attention; crouched, walking stealthily, or pursuing prey; body tense; includes towards fish, otters, or the public, but does not include towards other cat
Swimming – any non-stationary movement while in water when not engaged with fish
Wading – laying, sleeping, or sitting calmly in water

SELF MAINTENANCE: modifiers: proximity (within 2 feet, within 5 feet, more than 5 feet)
Defecating/Urinating – using latrine
Drinking – consuming water
Eating – consuming or licking food
Resting – laying, sleeping, or sitting calmly; may have eyes open, but not focused on a specific stimulus
Self-Grooming – cleans *itself* by licking, scratching, biting, or chewing the fur on its body

INTERACTIONS AGGRESSIVE: modifiers: intensity (low, medium, high); contact (brief contact, extended contact, no contact); proximity (within 2 feet, within 5 feet, more than 5 feet)
Avoid – intentional or attempt at separation when approached by other
***Bite** – using teeth/mouth to clamp down on a body part of other animal
Chase – following other cat at a slightly increased speed
Corner – blocks other cat into an inescapable space
Displace – one cat purposefully moves to where another one is; the second cat leaves their spot so the first can have it
***Hiss/Open Mouth Threat** – looking directly at other individual with mouth agap and bared teeth, may or may not include a hissing sound
***Lunge** – making a sudden forward thrust towards another animal
***Posture/Display/Threat** – standing upright; facing and staring at other cat; may include head tilt or piloerection
Stalking – focused attention; crouched, walking stealthily towards other cat; body tense
***Swat** – one cat raises paw and swipes toward other cat, contact may or may not be made
***Tie Up/Grapple** – an aggressive encounter where two cats are entangled in each other or engaged for extended period of time (fighting, biting, wrestling, etc.); can include combinations of other aggressive behaviors happening simultaneously or strung all together in one encounter
Other Aggressive – other aggressive behavior
Other Submissive – other submissive behavior
Yield – exposing the belly by laying on back

Fishing Cat Introduction

2.0 Ronaldo and Miso-Chi

INTERACTIONS AFFILIATIVE: modifiers: intensity (low, medium, high); contact (brief contact, extended contact, no contact); proximity (within 2 feet, within 5 feet, more than 5 feet)
Allogroom – one cat cleans other cat by licking, scratching, biting, or chewing the fur on its body
Play – cats engaged in affiliative interactive behaviors
Resting with Contact – laying, sleeping, or sitting calmly with contact to other cat; not focused on a specific stimulus
***Social Vocalizing** – emits any type of laryngeal call towards cat; excludes hissing
Other Affiliative – other affiliative interaction (we observed: follow, approach, smelling the other, mounting)

OTHER: modifiers: proximity (within 2 feet, within 5 feet, more than 5 feet)
Alert – stationary with eyes open and head up; aware of surroundings; not focused on one specific stimulus
Agitated – cat still and focused on stimulus with slight movements of tail
Hiding – attempting to conceal itself; usually crouching and not in a relaxed position; eyes wide, body tense
Keeper Interaction – engagement with caretakers; includes participating in training sessions
Public Interaction – chasing, stalking, or other agonistic behaviors directed at guests
Vigilant – focused on a stimulus; eyes open, head held high; ears erect
Vocalizing – emits any type of laryngeal call not directed at other cat
Out of View – not visible to observer
Other – any behavior not specified in this ethogram

ALL OCCURRENCE: modifiers: intensity (low, medium, high); contact (brief contact, extended contact, no contact); proximity (within 2 feet, within 5 feet, more than 5 feet)
Bite – using teeth/mouth to clamp down on a body part of other animal
Hiss/Open Mouth Threat – looking directly at other individual with mouth agap and bared teeth, may or may not include a hissing sound
Lunge – making a sudden forward thrust towards another animal
Posture/Display/Threat – standing upright; facing and staring at other cat; may include head tilt or piloerection
Swat – one cat raises paw and swipes toward other cat, contact may or may not be made
Tie Up/Grapple – an aggressive encounter where two cats are entangled in each other or engaged for extended period of time (fighting, biting, wrestling, etc.); can include combinations of other aggressive behaviors happening simultaneously or strung all together in one encounter
Social Vocalizing – emits any type of laryngeal call towards cat; excludes hissing

Addendum 2: Denver Zoo Fishing Cat Introduction Plan

Red text are more detailed edits after the first draft was written,
and blue text are notes added after the introduction for future reference.

Fishing Cat Introduction Plan

1.0 Ronaldo and 1.0 Miso-Chi

GOAL

The captive fishing cat population faces challenges because the population is largely male and does not have a lot of genetic diversity. This creates issues with space and limits options for bringing in international and genetically diverse fishing cats for breeding. Introducing males could aide in creating more space for new breeding pairs in the United States population. This could also increase social enrichment for the cats. Whether successful or not, experimenting with introductions will be beneficial information to have for all facilities that house fishing cats.

INDIVIDUAL HISTORIES

Ronaldo – Ronaldo was housed with his brother until shipped to Denver for a breeding recommendation. Ronaldo was then housed with female Namfon for breeding. They were housed in a variety of ways over the span of 2 years. They were howdied sometimes, they were together overnight only, and they were housed 24/7 for some time once shifting for both cats was solid. Ronaldo submitted to this female, and the only aggression seen was when they passed each other right after feedings. This consisted of minor hissing and swatting. They slept together in a den box every night, whether the female was in estrus or not. This pair bred successfully twice, but only the second litter (one male – Miso-Chi was successful).

Miso-Chi - Miso-Chi lived with mother Namfon for 8 months. Miso-Chi was submissive to his mother and showed hesitancy to shift around feeding time as this is when any aggression between the two occurred. Miso-Chi was never aggressive, but Namfon was swatty towards him around feeding times. The two were separated due to age and an increased intolerance of each other.

These two males have been howdied when in the back holding of the fishing cat exhibit since Miso's birth in January 2017. Although plexiglass was installed between stalls initially to prevent physical contact, no aggression between the two at the mesh was ever observed. Because no negative interaction has been observed, cats are allowed to be howdied between any of the stalls where there is only mesh and no plexi glass. Flashing at bottom of mesh stall barriers was lowered to eliminate areas where cats could reach paws underneath and between stalls. In fall of 2018, a solid door that separated the exhibit from back holding was changed to a mesh door. This increased the time the cats were howdied from only at night to almost 24/7. The cat on exhibit during the day, could see and interact with the cat in the back holding through this door. Miso-Chi and Ronaldo are often fed at this mesh door and have been seen both licking leftover food off of the mesh door at the same time. We also observe them frequently approaching this door (from the front and from the back) for visual access to the other side. We have seen Miso-Chi vocalize towards the back holding while on exhibit and at the door as well. Although they are never sharing space at the same time, Ronaldo and Miso-Chi are frequently rotated and swapped on exhibit and in the back holding allowing them to smell each other in their "territory." Behavioral responses to this include increased time investigating environment, spraying urine, and exhibiting the flehmen response. There have been no signs of negative behavior or reaction to rotating the cats or howdying them at various places in the back holding.

Fishing Cat Introduction Plan

1.0 Ronaldo and 1.0 Miso-Chi

INTRODUCTION PLAN

Date: Wednesday, 1/2/2019

Start Time: 10:00am

Location: Introductions will be held in the fishing cat exhibit and stalls B through E in the back holding. Lock cats out of stalls A and F because they create an opportunity for a cat to get trapped. All of the other stalls have at least two "escape" options either to another stall or to the exhibit. There are plenty of doors that can be used to separate the cats if aggression or negative behavior is seen.

Prior to the intro: Hoses will be pulled out and ready to be charged. There will be no food around and the floors are absent of any crumbs/fish guts. Notify any staff that wants to be present. Notify vet staff of intro taking place. All animal shift doors should be unclipped and ready to operate if needed. Floors should be dry to prevent slipping. Keepers will be stationed in back holding and in front of the exhibit. More information on keeper roles below. Village Hall building will be closed to the public. It will be reopened as soon as things are concluded or have been determined to be going well. The exhibit pool and stream should be drained the day before.

Feeding: Both Miso-Chi and Ronaldo will be fed their AM diet plus an additional herring prior to the introduction. Keepers will also hose or pick up any food scraps to remove additional opportunities for aggression. Ideally introduction would be at least 30 minutes after feeding to make sure the interaction and door movements are completely separate from a feeding session. Both cats will be fed their PM diet at around 2:30pm. Depending on how things went earlier in the day, keepers can decide to physically separate the cats or leave them together. The advantage of leaving them together is having to do another small introduction afterwards. If the cats aren't separated by a door, they should be fed at opposite ends of the holding and keepers should coordinate finishing the session at the same time.

Enrichment: Staff should set up a good deal of scent enrichment and possible barriers for the fishing cats to go around so they can hide or go around items to avoid direct approach. Avoid creating dead ends with enrichment and hiding locations. This includes removing all crates from the back holding. Various enrichment/furniture should be placed for vertical space options (i.e. cat tower, blue barrel, etc.). These will also allow for retreat options because crates will not be available.

Keeper Roles: 6 staff members needed to begin introduction, but more people can be used if they are present. Two team members in back holding to operate doors. Another two team members in back holding to observe, but role will be to enter fishing cat exhibit from keeper door if necessary. Two team members in lobby observing the exhibit from the front. One of the team members in the back and one of the team members in the front will be primary communicators to keep communication efficient between front and back as they are two different viewpoints. These two will make the decision if needed to separate animals. The following roles have been assigned:

- Door operators (2) – Kelsey, Erik
- Observers in holding/kitchen & separators if needed – Molly, An, Becca

Fishing Cat Introduction Plan

1.0 Ronaldo and 1.0 Miso-Chi

- Observers in public area – Matt, Jen, Katelyn, Laura
- Becca can help serve as the decision maker from the back and Matt will be from the front. Input from everyone is obviously welcome.
- Recorders: Molly, An, and someone from the front group

Because the fishing cats are not used to large numbers of staff members in the holding, and separation with just loud noises (sound of the hose) seemed to stop tie ups quickly, I would consider minimizing the number of staff present for future introductions. More staff present could be a stressor that causes a change in behavior. Documenting introductions with video footage and minimal staff may be more indicative of normal behavior between the cats.

Introduction: Fishing cats will both be locked in back holding for normal AM feeding. Miso-Chi will have stalls A – C and Ronaldo stalls D – F. Lock Miso-Chi out of stall A and lock Ronaldo out of stall F. The door operators will open all of the back stall doors first. We want to make sure that Miso and Ron are both aware they are now sharing the same space. Depending on how things go, the door operators will either open the exhibit doors or keep them closed. They will weigh the interactions between the cats and the need for more space. As soon as possible if things are going well, the cats will be given the exhibit in addition to the holding.

Duration: The length of the introduction should be based on behaviors seen. Ideally, the two fishing cats are kept together all day and overnight. Fishing cats are generally more active at the end of the day, so team may want to do observations around 2:30 through the end of the day. If possible, having a keeper stay overnight would be ideal to get a better understanding of their behavior and interactions overnight. Other zoos have had trouble with overnight separation and re-introducing the next day, noting that the introduction process starts all over. If there is aggression, see separation notes below for when to separate. If we do decide to separate, we will leave them separate overnight and regroup as a team to discuss next steps based on the behavior we saw.

After initial introductions, one keeper stayed behind to monitor for rest of the day. This is when their behavior picked up and they got into their first tie up, as there were fewer keepers in the holding which may have had an affect on their behavior. The initial introduction was uneventful, but as they were together longer and adjusted to a keeper watching them, more interactions between the cats occurred. We decided to separate the cats overnight due to the tie up observed and thankfully the reintroductions the following mornings were uneventful. We attempted an overnight a few weeks after putting them together during the day daily, and as soon as the lights turned off they got into a tie up. They were separated and we decided to give them a longer adjustment period before re-visiting overnights.

Behavior Expected: Ronaldo might aggress on Miso, but Miso should submit and Ronaldo should cease aggression appropriately. Could be vice versa as well, but we expect Ronaldo to attain dominance. After initial aggression, we hope to see them both find their own spots to sleep/hide for the day and tolerate each other's presence. Other zoos have noted that fights would generally only last a few minutes mainly consisting of a long stand-off with head tilts and low growls then escalating suddenly into a tie up. These fights may result in superficial wounds or chunks of hair being ripped out. After these tie ups, the cats would often separate themselves and leave each other alone. Fights always began with one cat stalking or chasing the other.

We did not observe any posturing, head tilting, or stand-offs before tie ups, noting that aggression mostly occurred when passing one another or one approaching the other quickly. After the initial aggression, as predicted, we did see them separate themselves and find their own places to hide and sleep. After the first few tie ups, hisses and swats were used instead of a full on fight to indicate wanting to be left alone or with more space. As time went on these hisses and swats decreased in severity and more respect for each other had developed.

Behaviors Determining Separation: Separation may need to occur if animals are too aggressive with one another. Some aggression may be normal and superficial wounds may occur. If one cat aggresses on the other and does not let up despite the other cat submitting or avoiding, we will separate the cats. If the cats aggress on each other, causing wounds to break skin, and neither seems to be letting up, submitting, or leaving, we will separate the cats. We expect to see some aggression, but ideally one cat will submit and the aggression will cease.

No wounds were visible after any of the tie ups between the cats. The only sign we saw of aggression when we did not observe it was hair in the stalls, but there were no noticeable locations of hair loss on the cats. The initial tie up brought a foul odor, but that was not detectable with any tie ups after that.

Separation Methods: Doors can be closed at any point once the decision to separate has been made. Depending on the location of the fight, the pressure of the door may be enough to separate the cats. First line of defense in an aggressive fight for separation will be banging, yelling, clapping, and air horns to get cats' attention and hopefully separate. If this does not work, hoses can be used if cats are fighting in the back holding. Other zoos have noted that hoses have worked 100% of the time for separations. If cats are aggressive on exhibit and noises, doors banging, hosing from back holding through exhibit doors, etc. are not enough to separate, designated keeper from the back (with a back-up keeper from front) may enter the exhibit with hose, nets, and bite gloves to separate the cats. These keepers should start with loud noises or hoses before physically separating the cats with tools. Keepers in the back will remain in position and will be ready to close cats in back holding ASAP.

Just turning on the hose was enough both times it was used to separate the cats. Other times they appeared to resolve on their own within minutes.

CONCERNS

- Neither male has been with another adult male fishing cat before.
- Both males are full-grown adults, but Miso-Chi is still young.
- Natural history is not fully known.
- Most commonly zoos house males individually, but it is not unheard of to house males together.