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AAZK 2016

CREATING A HARMONY WITH WILDLIFE

MEMPHIS

September 19th – 23rd

Papers

AMERICAN ASSOCIATION of ZOO KEEPERS

MEMPHIS AAZK

CONSERVATION. EDUCATION.

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2016 AAZK's BOWLING FOR RHINOS
"Making a Difference with AAZK's Bowling For Rhinos"

Presented by Patty Pearthree
National Bowling For Rhinos Program Manager

Introduction

The American Association of Zoo Keepers (AAZK) "Bowling For Rhinos" (BFR) fund-raiser has raised over **$6.2 million** since 1990 entirely through volunteer efforts. It is the hard work and dedication of these volunteers that make the difference in wildlife conservation efforts. 2015 was another record breaking year raising nearly $598,000 for conservation worldwide! In Kenya, we now protect over 1.5 million acres of white and black rhino habitat under Lewa's conservation charter. In Indonesia, we protect 1.4 million acres of crucial lowland rainforest habitat for the survival of the Javan and Sumatran rhinos and other species living in their ecosystems including Sumatran tigers, elephants, tapirs, Javan gibbons and sunbears. AAZK's BFR supports ALL 5 species of rhino plus hundreds of other endangered species from orchids to elephants that live in their habitat. Had it not been for organizations like AAZK many of these species would not be around today. AAZK has made a difference and will continue to do so.

Accomplishments through Our Conservation Partners

Our support of these conservation partners has allowed us to come together in conservation to help change the world. Black rhino were only one of a number of species that were likely to go extinct by the year 2000 had it not been for AAZK's BFR support. Black rhino have doubled to around 5,000 in number with BFR support. In 1990 we protected wildlife in Lewa's 10,000 acre Ngare Sergoi Rhino Sanctuary. We now protect 3 million acres of wildlife habitat. That is 25% larger than Yellowstone National Park! All this comes at a price. Operation costs to protect wildlife in these areas increases at 10-15% per year. Combined with the ever increasing poaching pressure, this means we need to increase our overall dollars raised. We have made a huge difference but our challenge is to keep growing bigger & better each year so all this can be saved for future generations. For additional information on rhino conservation, visit: www.rhinos.org and www.lewa.org

Together in Conservation

The best conservation programs involve long-term commitment. Since 1990, AAZK's Bowling For Rhinos has been one of the world's most successful conservation programs raising over $6.2 million for conservation worldwide! AAZK remains committed to its conservation partners: Lewa Wildlife Conservancy (LWC), International Rhino Foundation (IRF) and Action for Cheetahs in Kenya(ACK). 100% of BFR funding is being spent on conservation programs with 98% being designated specifically for conservation projects within rhino habitat. The remaining 2% of uncommitted funds is weighted heavily to favor rhino conservation programs and has now allowed us to support the conservation programs of the Indian rhino.

We started out supporting Lewa Wildlife Conservancy in Kenya- called Ngare Sergoi back in 1990 when it was 10,000 acres. AAZK paid for fencing, surveylance airplanes, transport trucks,etc. in the early years but have since moved to supporting the toughest to fund item- operating costs. Lewa's operating cost is now $3.3 million annually and Lewa is 72,000 acres. Lewa also now manages the 90,000 acre neighboring conservancy called Ol Pejeta. Rhinos disappeared from this area in the 1970's but Lewa reintroduced 15 black rhino in 1984. Lewa is now home to 12% of Kenyas Black rhino population (61) and 14% of the white rhino population(73) and several rhino have gone to other areas to repopulate. OL Pejeta is home to 108 black rhino, 29 Southern White Rhino and 3 of the last remaining Northern White Rhinos on the planet! 12 black rhino were moved to the neighboring Borona Conservancy. This was a longtime dream of Lewa staff that finally became reality in 2012. Lewa is now a globally recognized conservation initiative.

Lewa's **core** rhino conservation program has always been the main focus of BFR funding. AAZK contributes about 15 % of the core operating costs of this annually. These funds are vital to rhino conservation and the survival of the species. AAZK's long term and continuous funding makes it an invaluable contributor to the success of LWC in conservation worldwide!

In 2013, Lewa Wildlife Conservancy became a UNESCO World Heritage Site and is part of the area called **Mount Kenya World** Heritage **Site**. This unique recognition is reserved "for places of outstanding universal value to humanity that, as such, have been inscribed on the list to be protected for future generations to appreciate and enjoy". The World Heritage Committee considered Lewa and Ngare Ndare for their outstanding natural beauty, as well as their varied and impressive ecosystems and biodiversity. Lewa and Ngare Ndare are all connected to Mount Kenya through an elephant corridor. Lewa was instrumental in the creation of this crucial migration passage that serves as a route for landscape connectivity.

Expanding Support to Indonesia
In 1994, AAZK expanded its funding efforts when it began supporting Ujung Kulon National Park in Java Indonesia to save the Javan rhino. Ujung Kulon is home to the last 25-45 Javan rhinos on earth. AAZK expanded its funding efforts once again in 1997 to include Bukit Barisan Selatan National Park (BBS) in Sumatra, Indonesia where one of the largest populations of Sumatran rhinos live. Only about 100 Sumatran rhinos remain, and because of their rapid rate of decline, they are considered the most threatened of all rhino species. All of our funding for the Indonesian rhino Programs now goes through IRF.
Currently, the IRF funds allow the operation of rhino protection units in Ujung Kulon National Park (NP), Way Kambas NP & Bukit Barisan NP. Thanks to these Patrol units there have been no cases of Rhino or large mammal poaching in Way Kambas since 2006, Bukit Barisan since 2001 and Ujung Kulon in at least 15 years! With less than 100 Sumatran & perhaps as few as 25 Javan rhino remaining, these Patrol units are vital to the survival of both species.

Action For Cheetah in Kenya
In 2009, AAZK's BFR began supporting ACK under the direction of Mary Wykstra. This support will add to the protection of not only cheetah but also Rhino through education and conservation of habitat that is home to both cheetah and rhino and creates a larger buffer zone of protection. See www.actionforcheetahs.org

AAZK Conservation Resource Grant Helps Save All Five Species of Rhino
Each year, the AAZK Conservation Resources Grant is awarded to an ex-situ or in-situ rhino conservation effort. In 2010 and 2011, IRF was awarded the AAZK Conservation Resources Grant of 2% of the balance of BFR funds raised. Funds provided radio collars for Indian Rhinos that were being translocated as part of the Indian Rhino Vision 2020 Program. This program aims to attain a population of 3,000 wild rhino in seven of Assam's protected areas by 2020. So now **BFR funds support all five species of rhino!**

AAZK Working To Halt Demand for Rhino Horn
The 2013 and 2014 Conservation resource grant supported a new organization, RhiNOremedy that works to put an end to the demand for rhino horn, elephant tusks and other illegal wildlife trade products. See http://www.rhinoremedy.org/ for more information.

Zarraffas Coffee of Australia Pledges Sponsorship
Since 2013, Zarraffas Coffee of Australia (the "Starbucks of Australia") has pledged to donate $25,000 annually to BFR for Lewa specifically. In addition, proceeds from a conservation coffee of the month will also be contributed. Zarraffas will also be hosting their own BFR events. They are a very conservation and community oriented company that we are pleased to partner with to save wildlife worldwide. See

http://zarraffas.com/

Growing BFR Events Over 25 Years
In 1990, we raised $138,000 from 35 chapters. Today, we have over 80 chapters participating raising nearly $600,000 annually. Our accomplishments are grand but we must keep pushing forward to help save wildlife for future generations. Together in conservation we can accomplish our goal and raise $750,000 annually with 100% participation from all AAZK chapters!

2015 BFR Results
In 2015, BFR raised $597,814 with 88 chapters or institutions participating. This compares to 2014 with $581,325 raised by 80 chapters/institutions and 2013 with $481,449 raised by 76 chapters.

2016 BFR Results to date
As of the writing of this paper July 10th, chapters were just beginning to turn in funds. The **2016 winners have not been determined** since the deadline for trip winners to turn in funds is September 1st.

The 2015 Top ten Individual money raisers were:
#1- Kris Willis - Los Angeles with $55,000-**wins 2 week trip to Lewa**-All time record!
#2- Angie Snowie- Toronto w/ $22,507 -**wins 2 week trip to Lewa**
#3-Ann Knutson-San Diego - w/ $22,433 -**wins 2 week trip to Indonesia**
#4- Allycia Darst-Lincoln Park- w/ $17,262 **wins 2 week trip to Indonesia**
#5- Renaldo Curtis Woodson- Oklahoma City- $13,665
#6- Joe Hauser-Buffalo $10,000
#7- Hilary Colton- National Capital-$9,765
#8- Russel Pharr-Dallas-$9,225
#9- Lindsay Ireland-Detroit $9,000
#10- Amber Berndt- Indianapolis- $4,500

The 2015 top 3 money raising AAZK chapters were:
#1- Los Angeles-$55,000 (all time record!)
#2- Utah-$36,302
#3-Toronto-$22,507

Top 10 money raising chapters since Bowling For Rhinos started in 1990 (as of 12/1/15):
1) Portland-$307,342
2) Oklahoma City- $302,604
3) Los Angeles- $271,708
4) San Diego-$239,499
5) Dallas-$235,971
6) Utah- $233,715
7) Detroit-$211,662
8) Lincoln Park-$170,567
9) North Carolina- $158,546
10) Greater Philadelphia- $156,096

Anna Merz Rhino Champion Award (Formerly called Honorary BFR Trip Winner)
Each year, AAZK and Lewa reward an outstanding individual who has gone above and beyond in their extraordinary effort to organize BFR events. Often times, these behind the scene efforts go unnoticed. It takes a great deal of effort to hold successful BFR events year after year.
The 2016 Anna Merz Rhino Champion award winner is Kym Janke of the San Diego Zoo. Kym and

a companion will be hosted by Lewa in October 2017. Thank you Kym for your years of dedication to making BFR successful!

Trip winners have won trips with as little as $850 (1995) to as much as $55,000 in 2015. Trip winners have been from 22 DIFFERENT zoos!

2016 Chapter award: Detroit AAZK has bowled nearly every year since 1990 and has now raised over $211,000. They are being recognized as consistently having an individual in the top 10 list of highest money raisers. They also provided years of service on the BFR listserv (BFR yahoo groups email that was replaced with other forms of communication by the AAZK communications Committee) and provided a "How to hold a successful event" powerpoint.

See Appendix I (History of Funds Raised) on website: http://aazkbfr.org
See Table 1 for a comparison of events over the years.
See Table 2 for Distribution of funds

BFR Division of Funds
The first $160,000 raised each year will continue to go to LWC. Blue Rhino Gas $5,000 donation is split between Lewa and IRF. Once the $160,000 plateau has been achieved AAZK shall divide the remainder of BFR funds based upon percentage under the following distribution guidelines to the following entities until a $350,000.00 plateau is achieved:

International Rhino Foundation (IRF)	65%
Lewa Wildlife Conservancy(LWC)	25%
Action for Cheetahs Kenya (ACK)	8%
AAZK Inc Conservation Resources	2%

For BFR events that reach **$350,000-$500,000** in a calendar year, the financial distribution follows:
$160.000.00 LWC Dedicated Share
$ 50,000.00 IRF Dedicated Share
65% of Balance to IRF
25% of Balance to LWC
8% of Balance to ACK
2% of Balance to AAZK Conservation Projects

$500,000.00 and above

45%	LWC	$225,000.00
45%	IRF	$225,000.00
8%	ACK	$ 40,000.00
2%	AAZK	$ 10,000.00

As one can see, our goal is to reach the $500,000 annual level. All organizations benefit the more we can "grow" our events. We believe this is achievable but will take having everyone participate is some fashion every year. So come join us and let's grow together!

Bowling For Rhinos Tips for Success
-**Set a date early** so that it can be advertised in as many newsletters, fliers as possible. Info should be placed in **zoo newsletters** at least 4 times**, zoo volunteer newsletters**, zoo guild communications, **zoo maps or fliers**, etc.
-Check with your **Chamber of Commerce** prior to setting date to find out events that could conflict. Once you choose the date, inform your Chamber of commerce.
-Use **Social media** to advertise your event

-Talk to your **zoo volunteers at an organized luncheon** to let them know they can join the event or sponsor someone (have your forms ready).
-Put registration fliers in an area where volunteers may see them-in their "check –in" area
-Talk to your Zoo Guild or other organization that helps at the zoo
-Have fliers that you can hand out so they can fill out later
-collect door prizes. Seek the big airline prizes 4-6 months in advance (write thank yous)
-Restaurants are easy to get prizes from. **Go in person with letter of donation request in hand.**
-send out **invites to previous bowlers** (addresses listed on sponsor forms from prior year or gather email addresses)
-Invite Blue Rhino Gas/ Rhino Linings folks in your area to join your event (they might even sponsor)
-Let people know your event is **open to the public**
-Seek **donations** for pizzas and t-shirts
-See if your zoo will offer a **Day off work** for the team who raises the most $ (ex. Graphics team, Maint. Team, etc)
-Seek help from your zoo's **special events people**, **graphics,** etc. to get the word out.
-circulate the current **list of prizes** as they come in wherever possible
-INVITE CELEBRITIES to bowl at your event (especially TV/radio- free advertising when they talk up event!)
-Post info next to **rhino/elephant exhibits** about your upcoming event and how to join!
-If you are going for the trip prize, **let potential sponsors know they could help you win the trip!**
-Send out letters/emails to friends and family seeking donations.
-Check out **http://aazkbfr.org or http://aazk.org/committee/bowling-for-rhinos/**
Lewa Promo CDs & materials, "Patrols of Hope-The last Sumatran Rhino" CD, how to hold a successful event info and more can be found here. For additional Lewa promo materials, contact: Sabrina Antonio at Sabrina@lewa.org and for additional IRF promo materials, contact: Susie Ellis at: s.ellis@rhinos.org
- contact Patty Pearthree at: Patty.Pearthree@AAZK.org or ppear3@gmail.com or 919-678-0449

BFR Fund-raising Guidelines
• If possible, Events should be held between March 1- August 1st (optimal for PR is 1st week of May).
• If interested in participating, see http://aazk.org for information and go to the members only section to download sponsor forms + send your event coordinator contact info, date of event,etc,: ppear3@gmail.com
*If you have never held an event, see "how to hold an event" on the web site: http://aazkbfr.org.
• There is a **$25 administrative fee** to participate, which MUST be made out to "AAZK, Inc." and mailed to AAZK office prior to your event. Once your fee has been received, your event can be sanctioned & a **BFR EVENT kit** will be sent to you at the contact provided. Some of these forms MUST be returned to AAZK office to comply with IRS regulations. The fee covers indirect costs incurred by AAZK, Inc. due to BFR (phone, postage, faxes, and bank and online donation fees). Administrative fees are waived for the first year a chapter participates.
• **To win the trips, all money must be sent in to the AAZK office by September 1st!**
• **Please try to have all money sent within 30 days of your event.**
• If a chapter does not wish to send their checks certified mail, the following is the only way to insure that your check is not cashed by anyone other than AAZK, Inc.! **Please write "For Deposit Only" on the back signature area of all checks. This will ensure only AAZK can deposit it instead of just anyone who may intercept it!**
• Please make out one check payable **to "AAZK/BFR",** include a copy of your financial form & a copy of sponsor sheets from **all members raising at least $1,000** and mail to:

AAZK Office
8476 E. Speedway Blvd. Suite #204 Tucson, AZ 85710
(919) 678-0449 ppear3@gmail.com

*It is very important to remember that we advertise **100% of all donations go towards conservation**. All donations from donors must be submitted to AAZK Bowling For Rhinos for this to be true. This means that your organization must cover any expenses for this event. This can be done by charging a fee for bowlers, through silent auctions, door prize raffles, your local organizations funds, etc.

*Anyone can join the Bowl-a-thon so **don't limit yourselves to only zoo people. However, be sure it is clear that only National AAZK members are allowed to win the trips.** If you have a potential winner, ask them to join AAZK.

* **Blue Rhino Gas Company**

The Blue Rhino Gas Company became the **National sponsor of Bowling For Rhinos** beginning in 2004. The Blue Rhino gas company is extremely conservation oriented and uses the white rhino as their logo. They pledged to donate $20,000 per year to Bowling for Rhinos through 2008. Beginning in 2009, this was scaled back to $5,000 due to the rough economic times for gas companies. Blue Rhino is the leading cylinder gas recycler in the U.S. and keeps thousands of cylinders out of landfills each year. Some chapters have also received additional support from their local Blue Rhino Gas suppliers. See www.bluerhino.com for more information.

*Don't forget to use **Blue Rhino Gas** for any grilling needs- they help save rhinos too! Any publicity for them will help increase their future support of BFR.

Table 1 AAZK BFR Comparison of Funds Raised Year to Year

Year	Total Raised	# Events	Top Money Raisers	Amount	Chapter Affiliation	Top Chapter	Amount
1990	$138,795	35				Portland, OR	$14,659
1991	$122,801	40	Patty Pearthree	$4,877	Indianapolis	Lincoln Park	$12,697
			Brian McKenna	$3,791	Lincoln Park		
1992	$99,393	47	Cara Lance	$4,977	Indianapolis	Lincoln Park	$11,102
			Debbie Palay	$1,743	Lincoln Park		
1993	$112,015	44	Richard Buthe	$5,070	Philadelphia	Philadelphia	$13,168
			Kathy Knowin	$4,960	Lincoln Park		
1994	$106,452	53	Diana Villafuerta	$3,505	Lincoln Park	Portland, OR	$10,821
			Christine Bobko	$3,146	Denver		
1995	$120,657	45	Patty Pearthree *	$1,767	Indianapolis	Portland, OR	$11,398
			Katrina Osborn	$1,488	Miami Metro		
1996	$149,249	49	Bill Nelson	$5,670	Dallas	Dallas	$14,757
			Jay Weston	$3,498	Hogle		
1997	$128,604	43	Janet Wiard	$6,256	Oklahoma City	Dallas	$10,865
			Mary Wykstra-Ross	$5,240	Hogle		
1998	$124,920	43	Norah Farnham	$7,539	Lincoln Park	Lincoln Park	$12,653
			Kirk Nemecheck	$5,406	Rolling Hills		
1999	$135,625	38	Brenda Gunder	$10,618	Rolling Hills	Portland, OR	$13,311
			Dolora Batchelor	$6,245	Miami Metro		
2000	$143,083	37	Kirsten Christensen	$12,201	Oklahoma City	Oklahoma City	$12,201
			Tim Hays	$6,816	Rolling Hills		
2001	$192,789	42	Jay Pratte	$10,161	Dallas	Dallas	$17,877
			Debie Mangrum	$9,467	Oklahoma City		
2002	$158,456	40	Victoria Zahn	$16,607	Oklahoma City	Oklahoma City	$16,607
			Bethany Lutz	$9,200	Hogle/Utah		
2003	$188,643	44	Mary McFarland	$13,593	Oklahoma City	Puget Sound	$16,462

			Jason Peterson	$11,500	Hogle		
2004	$214,271	42	Todd Bridgewater	$17,680	Oklahoma City	Detroit	$19,494
			Michelle Pratt	$13,435	Detroit		
			Bethany Lutz	$12,000	Hogle		
			Mike Connolly	$6,000	Tulsa		
2005	$233,950	47	Chrislyn Newton	$18,074	Oklahoma City	Oklahoma City	$18,704
			Crystal Derusha	$14,000	Utah		
			Jessica Scallan	$9,000	Tulsa		
			Alex Vasquez	$8,706	Dallas		
2006	$250,577	53	Amy Stepens	$21,025	Oklahoma City	Oklahoma City	$21,025
			Kelly Wilson	$18,478	Detroit		
			Jane Larson	$14,200	Utah		
			Eric Flossic	$13,000	Tulsa		
2007	$316,397	53	Jaimee Flinchbaugh	$31,091	Oklahoma City	Oklahoma City	$31,091
			Ruth Ann Prey	$28,359	Detroit		
			Rana Bayrakci	$14,088	Puget Sound		
			Heather Strawn	$12,498	Cleveland		
2008	$273,279	55	Jennifer Davis	$35,388	Oklahoma City	Oklahoma City	$35,388
			Christine James	$14,554	Dallas		
			Jennifer Thomas	$12,150	Detroit		
			Rue Hewett	$11,000	Miami Metro		
			Kim Sevier	$11,000	Tulsa		
2009	$256,785	53	Nicole Miller	$30,101	Los Angeles	Los Angeles	$30,101
			Gina Garza	$13,327	Dallas		
2010	$256,420	61	Dani Cremona	$30,000	Los Angeles	Los Angeles	$30,000
			Melissa Kesler	$15,000	Oklahoma City		
2011	$280,015	65	Cori Monetti	$32,000	Los Angeles	Los Angeles	$32,000
			Holly Ray	$14,232	Oklahoma City		
2012	$337,191	76	Jennifer Gonsman	$35,500	Los Angeles	Los Angeles	$35,500
			Ashley Orr	$13,901	Dallas		
			Gil Myers	$10,817	National Capital		
			Logan Agan	$9,589	Oklahoma City		
2013	$481,449	76	Mike Bona	$35,800	Los Angeles	Los Angeles	$35,800
			Ann Knutson	$24,340	San Diego		
			Kenton Kerns	$15,716	National Capital		
			Crystal Butler	$15,701	Oklahoma City		
2014	$581,325	80	Samantha Cadman	$50,000	Los Angeles	Los Angeles	$50,010
			Carolyn Leonard	$47,284	Portland		
			Teresa Randall	$25,691	Oklahoma City		
			Robbie Clark	$19,000	San Diego		
2015	**$597,814**	**88**	**Kris Willis**	**$55,000**	**Los Angeles**	**Los Angeles**	**$55,000**
			Angie Snowie	$22,507	Toronto		
			Ann Knutson	$22,433	San Diego		
			Allycia Darst	$17,262	Lincoln Park		

** Bold indicates record amount raised

*Third place won trip this year as each winner can only win once.

Table 2: Bowling For Rhinos Distribution of Funds

Year	LWC	Indonesian Programs		ACK	AAZK Conserva-tion
		Through Adopt-A-Park	Through IRF		
1990	$138,795				
1991	$122,801				
1992	$99,393				
1993	$112,015				
1994	$106,452				
1995	$100,000				
1996	$100,000	$20,600			
1997	$100,000	$49,250			
1998	$100,000	$14,302	$14,302		
1999	$100,000	$12,460	$12,460		
2000	$100,000	$17,813	$17,813		
2001	$105,000	$21,541	$21,541		
2002	$100,000	$43,895	$43,895		
2003	$100,000	$29,228	$29,228		
2004	$110,000	$44,321	$54,321		
2005	$130,000	$47,453	$57,453		
2006	$130,000	$47,055	$57,055		
2007	$160,000	$55,387	$65,387		
2008	$160,000	$0	$156,397		
2009	$196,714	$0	$50,893	$7,343	$1,836
2010	$185,355	$0	$61,923	$7,314	$1,828
2011	$191,254	$0	$77,260	$9,201	$2,300
2012	$206,208	$0	$115,850	$13,705	$3,426
2013	$249,781	$0	$207,745	$19,138	$4,784
2014	$275,151	$0	$248,138	$44,364	$10,880
2015	$277,346	$0	$263,535	$45,554	$11,379
2016		$0			
Total	**$3,756,265**	**$403,305**	**$1,555,196**	**$146,619**	**$36,433**

PROGRAMMATIC AND FINANCIAL REPORT
LEWA WILDLIFE CONSERVANCY RHINO CONSERVATION PROGRAM
JULY2015-JUNE 2016

The Lewa Wildlife Conservancy remains extremely grateful for the continued support from the American Association of Zoo Keepers (AAZK) through the very successful Bowling for Rhino (BFR) program. AAZK contributed a total of **$246,986**towards Lewa's rhino protection and security operations. By supporting Lewa, home to 12% and 14% of Kenya's black and white rhino respectively, AAZK is directly linked and involved in *insitu conservation* efforts ensuring the survival of these endangered species.

This report outlines how AAZK's generous funds have been utilized between July2015 to June 2016.This support enabled rhino conservation and security operations including operations of the Lewa armed anti-poaching units, canine unit, aerial surveillance, ranger salaries, vehicle running costs and the radio communication center.

Rhino Conservation Programme

Lewa remains one of the few lucky sanctuaries to have zero poaching of rhino from 2014 to date, having previously lost 18 rhinos within a span of three years. An immense amount of dedication and effort has gone into deterring continuous attempts on Lewa's rhino population. The combination of a dedicated security and wildlife unit, coupled with effective patrols and the ongoing support of the communities living on Lewa's boundaries enhance its ability to effectively conserve and protect rhino and other wildlife species against ongoing threats.

The poaching menace continues to escalate amidst an increase in demand for rhino horn and elephant Ivory.This dramatic increase is as a result of a variety of factors, most notably the growing purchasing power of both the Middle Eastern and Asian populations, and the sophistication of organized poaching syndicates, selling illegal wildlife products on the black market in range countries.

There are great steps being taken in a joint effort tocurb poaching in the country, between the government and other stakeholders resulting in a notable decrease in rhino and elephant poaching across different parts of the country. Lewa's impressive anti-poaching team's track record is well known throughout the conservation world. This can be attributed to the attention, detail and constant adaptation of activities to meet the ever growing and newly emerging threats from poachers. Lewa

strives to address all conceivable forms of threat to its rhino population through daily monitoring of each rhino, vigilant observation of all entry points and conservancy boundaries, constant maintenance of the fence line, regular aerial surveillance, intelligence gathering and related community development support required in addition to continuous training of its entire security team and canine unit in preparedness for any eventuality.

The rhino population translocated to Sera Conservancy has stabilized., In 2014, Lewa translocated 11 of its own rhino in addition to others from other KWS parks, bringing the overall total to 21 black rhino. Since then Sera Conservancy has had three rhino births and Borana Conservancy has had four new individuals born on newly formed conservancy's, in areas that have not bred or sustained rhino within their habitat for over 25 years. The re-introduction of rhino into new sanctuaries, gives both the NRT and Lewa family renewed hope in the global fight to prevent the extinction of endangered species and community development in areas with wildlife. Efforts towards the growth of populations of critically endangered black rhino in Kenya, remain dependent on the availability of suitable and secure habitats to resettle and or re-introduce rhino. These efforts have helped the Conservancy maintain its ecological carrying capacity at a manageable level allowing rhino to breed and roam freely with less conflict over territory, a condition critical to the effective management of this species.

National Police Reservists (NPR) Armed Anti-Poaching Teams

37 members of Lewa's 150-person security team are recognized as National Police Reservists (NPR), trained and employed by Lewa, but licensed and armedby the Kenyan government to respond to any incidents of instability or violence throughout the region. Lewa operates a daily deployment system covering different locations on a rotational basis for effective patrols and coverage of the Conservancy and surrounding communities. The anti-poaching units are positioned throughout the Conservancy at all times and particularly at night, with a rapid response unit based at headquarters 24 hours a day, 7 days a week and 365 days a year- ready to deploy at any given moment.

Aside from their constant monitoring and regular responses to incidents on and off the Conservancy, Lewa's NPR teams are always augmenting and improving upon their operations and training. Training regimens encompassing new skills training and capacity development have been set in place,with each member of the NPR teams being trained. The training includes basic first aid training with one person from each of these teams attending an advanced field-first aid course in order to be prepared to deal with any case of serious injuries. Each NPR team is equipped with medical kits including bandages, tourniquets to control heavy bleeding and other necessary supplies. With the global increase in the demand for rhino horn and ivory and poaching attempts on the ground to feed that demand, more and more poachers have access to state of the art equipment including silencers for guns, night vision goggles as well as informers who leak information on animal locations and security detail. This is driven by the large sums of money on offer in exchange for information in order for these gangs to successfully carry out the illegal killing of endangered wildlife species. As a result of the ever changing dynamic of

attempts on rhino Lewa, Borana and NRT NPR anti-poaching units have also set in place structures to further augment responses to emerging threats. The teams patrol efforts are further supported with modern equipment including but not limited to night vision goggles, thermal imaging equipment, and a trained canine unit which enhances their ability to work at night in response to any poaching incidents or attempts and other security threats. Lewa's NPR team has continued to enhance its collaboration with the Kenya Police, Kenya Wildlife Service and other government agencies including judicial bodies especially in the counties of Isiolo, Meru and other neighboring counties in addressing security matters.

The total cost to effectively run the Lewa NPR armed team including salaries, rations, medical, uniforms and allowances was **USD$227,762 .**The table below indicates all operations and responses in conjunction with some joint responses with the NRT 91/2 teams to incidents between July 2015- June 2016.

Incident	Total reported during the Period
Armed NPR deployments / follow-ups to serious security incidents	39
Tracker dog deployments	28
Aerial follow-ups and reconnaissance	21
Rhino Poaching incidents reported within Lewa	0
Road banditry reports	24
Stock theft reports	76
Elephant carcasses / tusk recovery	26 (15 recoveries)
Robbery reports	2
Arrests	20
Firearms / weapons recovered	8

Canine Unit

Over the years, Lewa's canine unit has and continues to be recognized as one of the best in the country due to their success rate in tracking and support towards the armed units whenever they are called upon to support in incident follow-ups. The Kenyan Government calls upon this impressive team regularly to assist in a wide range of situations that require quick responses and scent tracking. Currently Lewa has five dogs attached to its canine unit including two male blood-hounds ,two Belgian Milionis and one Dutch herder (NRT Canine)managed and handled by a team of seven dog handlers

and one Canine unit section head-all of whom are well trained and continue to follow a daily training regimen to keep them fit, alert and motivated.

Over the grant period, the canine unit has been used in28 security follow-ups and has provided invaluable assistance to these situations.

The total cost to operate the canines and their handlers over this reporting period was **USD$22,262**

Aerial Surveillance & Support

Lewa's aerial surveillance continues to play a key role in all operations, supporting not just Lewa's security operations, but also partner organizations. The LWC Super Cub acts as back up to security related follow-ups to Lewa and other conservation partners nearby such as Ol Pejeta, Ol Jogi and other Northern Rangeland Trust member conservancies. Patrols further up North of Lewa are greatly assisted by SUE-Lewa's helicopter, whose success can be seen by a 40% reduction on elephant poaching incidents in northern Kenya, and success in increase in the number of elephant's in the area.

The introduction of the MD 350 helicopter-SUE has enhanced operations on Lewa by reducing response time to security and or poaching incidents to a bare minimal, easing wildlife capture and intervention activities as well as supporting game counts.

The super-cub has been particularly useful in responding to the upsurge in poaching threats, local stock-theft incidences and road banditry. The super-cub is a light aircraft that proves as an invaluable resource in locating missing rhino and in completing the annual wildlife count.

The ability to carry out aerial surveillance is one of Lewa's most important tools in protecting the rhino populations and combating insecurity. Without this tool, it would be impossible to provide the current high-level of wildlife protection and security response that Lewa is relied upon for.

Over the reporting period, the total cost of operating the LWC Super Cub aircraft and MD 30 Helicopter in support of the security deployment and surveillance was **USD$ 43,868 (**cost calculated on an hourly basis)**.**

Field Monitors Salaries

Lewa's rhino monitoring team is made up of **27** field monitors who follow a daily monitoring regimen in specific regions or "blocks" of the Conservancy. In response to the escalating poaching threats the Conservancy has restructured its 18 block patrol system into a nine block system, in order to increase the presence of the general security on the ground, in addition to enhanced round the clock security and surveillance of Lewa's rhino populations and other wildlife. The field monitors radio back to Lewa's operations room to report on the location of each rhino, as well as any unusual signs of human behavior or

entry into the Conservancy. The monitoring system has been adjusted to maximize efficiency and increase the daily protection of each animal, by the implementation of an advanced digital communication system.The team is also further responsible for the reporting of all wildlife activity to help Lewa better understand and manage migrations, territorial turf competitions, browse and grassland conditions and other relevant elements of the environment.

The security team has also set in place an intelligence unit attached to the NPR unit, but working closely with the monitoring team on the ground that are able to facilitate the collection of any information that may assist in preventing any poaching activities through collaboration with neighboring communities.

Lewa's field rangers are well trained and equipped to track rhino. Using binoculars, they can identify each of the animals in their block based on age, ear-notching pattern, sex and `behavior. Lewa's wildlife and security teams aim to locate every individual rhino each day with the main objective of reporting 100% rhino sightings to the operations room at Lewa Headquarters. Any lengthy disappearances of any individual rhino, act as a sign of a variety of issues ranging from illness, injury, calving and or poaching. The field staff treat the non-sightings as high-alert situations and doubletheir efforts to ensure each rhino is spotted and safe. In most instances rhino's change territory due to the emergence of younger males who displace much older males. This is mostly attributed to the scarcity of grass land (whites) and forage (blacks) due to increased number of rhino and prolonged dry periods with no rainfall on Lewa and more generally in northern Kenya. The drought conditions push ranging wildlife (Elephant, Giraffe, Eland, Oryx) into Lewa and result in additional pressure on vegetation.

The orphaned rhino handlers are also categorized under the general security, and form an integral part of the team raising and caring for Lewa's, hand raised male black rhino *Nicky* and *Kitui*. The team continues to monitor the two remaining baby rhino closely, staying with them day and night. Having lost two s orphaned rhino within a short time of each other as a result of a bacterial infection, it has become increasingly important to ensure the health and welfare of the two remaining. These keepers (surrogate rhino mothers), have a unique relationship with both the calves in their care- understanding their character, behavior and needs -teaching them one on one how to survive as they best understand. The experience and training they provide to all orphaned animals who have been in their care is invaluable and can be witnessed in yet another of Lewa's more famous baby rhino calves 'Elvis' a ten year old , hand raised black rhino, who was successfully re-integrated into the wild.

The total cost to operate 27 rhino surveillance rangers patrolling the "blocks", 21 gate guards, 11 night watchmen, two armory guards, five dog handlers and an additional two in the first quarter of 2016, six radio operators, two wildlife capture men, and three orphaned animal handlers for this reporting period was **USD$ 295,059**

Security Vehicles

The LWC security team has three vehicles, one for regular rhino monitoring and twofor the armed NPR units. As a result of the increased poaching threat, the security vehicles are driven round the clock, to

monitor every member of LWC's rhino population and other wildlife as well as in response to reported situations of instability in the community settlement areas. This level of mileage and overall wear and tear from constant usage on difficult terrain has taken a toll on these vehicles. While the Lewa workshop has done an excellent job of keeping these vehicles running safely and consistently, the old vehicle for regular rhino monitoring will eventually need to be replaced. This has contributed to a higher cost of maintaining and running the vehicles within this reporting period.

AAZK's funding was used to support part of the running costs of all three vehicles,total cost support from AAZK coming to **USD37, 803.**

Radio Operation Room Communication Costs

Lewa's radio room is the linchpin of the Conservancy's security operations, providing a central point of communications for the entire region including NRT conservancies. Lewa's impressive communications unit manages all security communications,all aerial communications for any internal and external flights in and out of Lewa, as well as maintaining records of each rhino's specific movements through tracking with the help of the field monitors located in different areas within the Conservancy, sighting and reporting the rhinos' movements. The team is also integral in maintaining and supporting Lewa's relationship with the communities by acting as the point of contact and providing a platform for the address of community calls for assistance, the gathering of Intelligence from community members who call in and warn team of imminent threats on Lewa's wildlife and other situations of insecurity.

Through its radio communication, LWC has been able to relay messages accurately and effectively coordinate effective interventions for many security occurrences within Lewa, its neighboring areas as well as NRT conservancy areas. These efforts are enhanced through collaboration and linkage with relevant security agencies like the KWS, Kenya Police and other government agencies. The radio communications on Lewa are augmented with the support of a modern state of the art, digital communication system and highly trained personnel who man operations 24 hours a day, seven days a week and 365 days a year.

Within this reporting period, AAZK funding contributed towards the costs of radio repairs, purchase of spare batteries, staff salaries and radio licensing- contributing towards the overall costs of the radio communications and intelligence network operations on LWC cost **USD $29,992.**

Submitted to American Association of Zoo Keepers Bowling for Rhinos Program

INCOME RECEIVED BY LEWA, KENYA	AMOUNT
Funds received from AAZK BFR on 22nd December 2015	**-$227,186**
Funds received from AAZK BFR on 3rd August 2015	**$17,600**

Funds received from AAZK BFR on 4th November 2015	**$2,200**
TOTALS	**$246,986**
Expenditure	**Amount**
AAZK contribution to salaries for KPR Anti-Poaching Team	**$51,502.00**
AAZK contribution to Dog Section operational expenses	**$7,373.00**
AAZK contribution to operating expenses for aerial Back-Up	**$ 15,336.00**
AAZK contribution to LWC Rangers salaries	**$108,066.00**
AAZK contribution to Motor Vehicle running expenses	**$11,650.00**
AAZK contribution to radio communication expenses	**$9,550.00**
AAZK contribution to boundary fence maintenance	**$16,645.00**
AAZK contribution to Lewa oversight, administration, travel	**$26,863.00**
TOTAL	**$246,986**
Balance	**NIL**

Note: AAZK contributed 35.9% of the total Rhino protection expenses incurred during the period

The total Expenditure incurred by LWC on Rhino protection during the period is as follows:

Description of cost line	**Amount (US$)**
KPR Anti-Poaching Team	**227,762**
Dog Section	**22,262**
Aerial Back-Up-Super Cab and Helicopter	**43,868**
Ranger Salary	**295,059**
Motor Vehicle Running Cost	**37,803**
Radio Communication	**29,992**
Boundary fence	**31,513**
TOTAL EXPENDITURE	**$688,257**

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

CeCe Sieffert, International Rhino Foundation, Deputy Director
Alexandra Hausler, International Rhino Foundation, Development Director,

Sumatran and Javan rhinos are likely the world's most critically endangered land mammals. AAZK's signature Bowling for Rhinos program has helped to conserve these two Indonesian species since 1996. Shy, secretive rainforest dwellers, Javan rhinos now number about 60 animals in one site, and Sumatran rhinos number no more than 100 in four sites in Indonesia. The Sumatran rhino was declared extinct in the wild in Malaysia in 2016. Sumatran rhinos have had a precipitous decline of more than 70% population loss over the last 20 years – but not in the areas in which AAZK supports their conservation. New plans for both species include bold actions designed to reverse their decline and maximize the potential for population growth. This paper provides an update on these plans, as well as our progress on breeding the Sumatran rhino in captivity. AAZK support for the Indonesian Rhino Protection Units, the backbone of the two species' protection, has never been more critical. AAZK's hard work to raise funds through Bowling for Rhinos ensures that AAZK plays a critical role in their long-term survival and recovery.

Action for Cheetahs in Kenya: Framework for a National Cheetah Survey

Mary Wykstra
Action for Cheetahs Director / Principle Investigator

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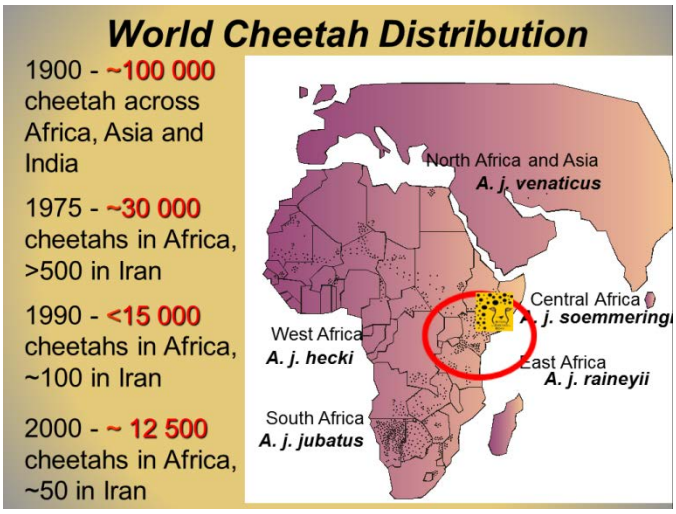
Abstract:

Action for Cheetahs in Kenya (ACK) is the only range wide cheetah conservation organization in Kenya. AAZK Bowling for Rhinos supported ACK's efforts in the Samburu region since 2010 enabling us to develop a field base in northern Samburu and to initiate work in the northeastern area of Wajir South. ACK conducted the first Kenya national cheetah survey in collaboration with the Kenya Wildlife Service, Cheetah Conservation Fund and the East African Wildlife Society between 2004 and 2007. Results of the survey formed the baseline for national and regional strategic planning in collaboration with IUCN and other cheetah experts from across Africa. Remote sensing technology will be used to employ occupancy modeling to show how land use change is affecting cheetah habitat and genetic corridors. Education materials developed from ACK's work in the community will be dispersed, including a video created for the survey, curriculum based school workbooks for wildlife clubs, and conflict mitigation materials.

INTRODUCTION

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

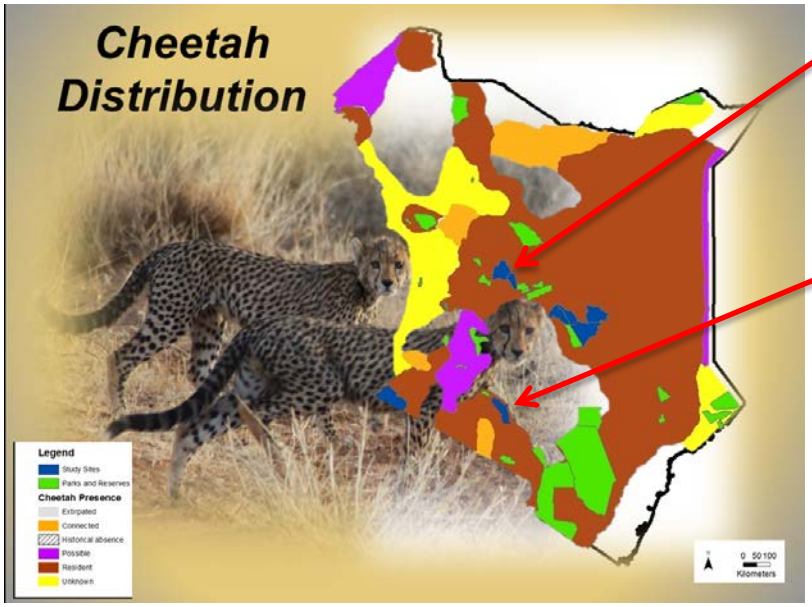
Throughout the cheetah's home range it is vulnerable to the threats that lead to wildlife population decline. While Namibia has the strongest population estimated at around 3000 – Kenya is the central population to the whole of eastern Africa. We estimate the Kenya population to be 1200-1400 based on studies completed in 2007. The trans-boundary issues with neighboring Tanzania, Uganda, Ethiopia, South Sudan and Somalia create a contiguous population facing similar threats.



The cheetah is a charismatic species, often used as an icon for speed and elegance. But the future of the cheetah is threatened by land fragmentation, loss of critical habitat and conflict with people. As with most predators, the conflict over resources and space results in decline of the species. Field data has been collected in the Samburu District since 2010. Research is goal oriented through understanding the problems encountered by people living with wildlife; developing research methods and sharing our findings with local communities, Kenya Wildlife Service, agriculture and livestock partners, and other experts. The primary focus of academic research is in gaining understanding of cheetah health and

adaptations to the changing land use. The community focus is to mitigate conflict and raise awareness of non-lethal predator control options.

2015 – 2016 RESEARCH AND EDUCATION



The Meibae Conservancy and Samburu National Reserve are located in northern Kenya. In 2015, ACK opened our second field base at the conservancy HQ. Our first field base in the Salama area of the Makueni District was opened in 2009. In 2012, we extended our southern research base into the Athi-Kapiti region of the Machakos and Kajiado Districts. Research in these areas provide pilot studies that enable us to develop methods for range wide conservation actions.

Photos: Above - two primary ACK field sites.

In 2015, Juliana Masseloux (Bachelor candidate, Colorado State University) worked with Noreen Mutoro to pilot occupancy modeling. Noreen also worked with local masters students Cynthia Nyunga and Brian Solomon (University of Nairobi) on genetic isolation from cheetah fecal samples. Cynthia and Noreen were hosted by the Cheetah Conservation Fund to practice genetic isolation prior to initiation of the samples. Fecal detection dogs will find the scat which will help us to understand the relationships between cheetah populations across the country.

Photos: Samburu staff learn track ID, Juliana works with staff members to collect data for occupancy survey, Madi the detection dog explores the bush.

In June, 2016 we hired our first Education and Outreach Officer. Fiona Tande will coordinate community meetings, stakeholder workshops, sporting events and community development projects. With the assistance of Delaney Laughlin and artist Josphat Kiminwa we have completed the Teacher workbook for standard 4-8. The book design was in collaboration with regional teachers to be a curriculum based learning supplement with the cheetah as the main aspect of the materials.

In the Samburu study site we have focused on testing deterrent methods to reduce losses to night time predators. Deterrent testing in 2015 proved that the Lion Elephant Deterrent Light Systems (LEDS) are the most effective. These lights require technical skills for assembly, maintenance and transfer when the boma is moved. We opted to test the FoxLight system means of improved efficacy. During the upcoming national survey we will share information about improved methods to prevent depredation.

The focus of our programs in 2017 – 2018 will be the completion of the second national cheetah survey. We will work in collaboration with the Kenya Wildlife Service and several local and international partners in all aspects of the survey.

Photos: School education is an important aspect of the national cheetah survey, Dr Laurie Marker meets with Kenya students who will be analyizing the fecal genetics, Setting up cameras to assist in monitoring predator deterrent systems.

FINANCIAL REPORT

The primary source of income for ACK activities in the Samburu study site is from Bowling for Rhinos. Funding through zoo grants and AAZK chapters support the long-term conservation efforts and other regions of ACK focus. Students and volunteers are self-funded or utilize funds through joint grants with ACK. Below is the income and expense for 2015 - 2016 for the Samburu project. The full operational budget for ACK in 2015 was $124,000.

INCOME 2015-2016

Received BFR 2015:	$44,363.00
Received BFR 2016:	$45,517.29
Total Available:	$89,850.29

Expenses 2016 (January – December)

Meibae Conservancy Fee	$ 250.00
Field Officer Stipend and training	$ 7428.00
Transport (Fuel, Insurance, Public service)	$ 3880.00
Accommodation (Camping fees, lodging, food)	$ 3,525.00
Camp Construction and Maintenance	$13,650.00
Office Equipment and Supplies	$ 3,700.00
Motorcycle Purchase, Insurance	$ 3,563.00
Community Programmes	$ 3,283.00
Genetic and Occupancy modeling	$ 5,000.00
Expenses 2015	**$44,778.00**

Expenses 2016 (January – June)

Meibae Conservancy Fee	$ 250.00
Field Officer Stipend and training	$ 3,876.00
Transport (Fuel, Insurance, Public service)	$ 552.00
Accommodation (Camping fees, lodging, food)	$ 3,850.00
Camp Construction	$ 1, 245.00
Office Equipment and Supplies	$ 2,000.00
Motorcycle Fuel & maintenance	$ 549.00
Community Programmes	$ 3,275.00
Genetic and Occupancy modeling	$ 5,000.00

Expenses to Date 2016 $20,696.00

PROJECT GOALS AND ACTIVITIES 2016

The following goals will be achieved for two study areas by ACK staff.
Goal 1: Identify factors affecting cheetah livestock predation and mitigate conflict.
a. Prey Distribution and Abundance: Data from the Samburu area will be analysed for annual reporting and used as the baseline for continuing studies
b. Human Settlement Pattern: Complete publications using data from 2005-2013 and start pilot occupancy project for National Survey.
c. *Evaluate Livestock Depredation:* Conflict mitigation efforts include herder training, boma reinforcement, predator deterrent lights and livestock health improvements.
Goal 2) To understand cheetah health and habitat selection
a. *Monitor cheetah presence and movements through observation:* Monitoring methods include direct observations, camera trapping, spoor counting and verification of public sighting reports. Cheetah Scouts collect cheetah-sighting reports and verify predator spoor. Data is entered into an Excel database and mapped using ArcGIS for analysis and comparison annual and seasonal cheetah movements. Camera trap transects verify cheetah corridor use and provide positive ID for individual cheetahs in both the Salama and Samburu study areas.
b. *Determine habitat use of cheetahs in relation to vegetation and prey*: Boma monitoring, Vegetation surveys and highway monitoring will be included in regular cheetah field officer patrols
Goal 3: Influence public and administrative changes to positively affect cheetah conservation and management protocols.
a. Conduct community programs to disseminate findings, promote conservation awareness, and improve livestock management techniques (public meetings called baraza): Use natural resource planning to establish strategies for resource conservation and improved livelihoods.

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

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

Reintroduction of orphaned white rhino (*Ceratotherium simum simum*) calves

Matthew Lamoreaux, Wildlife Specialist
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Abstract
In early 2016 White Oak Conservation Holdings LLC was presented with two orphaned Southern white rhino (*Ceratotherium simum simum*) calves that required hand rearing. These calves had minimal human interaction prior to their hand rearing which added additional challenges from a husbandry standpoint. These challenges included getting the calves on the bottles, desensitization training for routine venipuncture, vaccinations, and transport within the facility. The hand rearing protocol used was based off of an established protocol for raising white rhinos.[1] The large size and associated herd management provided a unique situation when reintroducing these calves back to the crash. Several introduction scenarios were attempted until the most suitable situation was achieved. These introductions included placing one calf with an existing cow and calf pair, introducing a calf to two juvenile females, followed by reintroduction to the original herd. After many efforts, the two young calves are now housed with a juvenile surrogate and doing well together. Based on current herd dynamics, this trio is scheduled for introduction to a new herd in August 2016.

Introduction
White Oak Conservation Holdings LLC is a 13,500-acre conservation facility in northeast Florida. Currently an AZA affiliate member and active Conservation Center for Species Survival (C2S2) member, White Oak runs as a semi-private organization to the public. Currently White Oak houses 37 rhinos, 27 of those being white rhinos. We are pachyderm heavy to say the least. With our increasing number of rhinos, comes the potential for bumps along the way.

Our minimal staffing in comparison with many other facilities requires a wide range of knowledge from the keepers. From dietary changes and nursery care to landscaping and routine animal care, the animal management staff has a vast range of responsibility. On top of all our other responsibilities, our team is now accountable for ensuring over 120 gallons of rhino formula is made per week. The past six months have provided for unforeseen challenges, yet resulted in an extremely rewarding experience for our team.

In early 2016, three female white rhinos were lost due to a clostridium outbreak and left the staff with two young white rhino calves to hand raise. The main goal of hand rearing these individuals being to (re) introduce them to one of the crash at White Oak.

The Passing of Rhino Dams
On January 09, 2016 “Kelly”, a 10-year-old female white rhino was discovered dead in a corral during a routine afternoon animal check. At the time, her male calf was 43 days old. On March 21, 2016 “Annie”, a 9-year-old female white rhino was found early in the morning, her calf being 51 days old at the time. Nine days later a 3-year-old juvenile female was also lost. Currently, clostridium is suspected to be the cause for the white rhino deaths. Full necropsies were conducted on site by the veterinary and wildlife staff. The similarities between the two dam situations are alarming, yet significance beyond the timing has yet to be found. It is important to note that all three of the rhinos lost were held in the same 13-acre pasture and all on the same diet. In response to the believed cause of death, all rhinos at White Oak have been given clostridium vaccines and the titer results are pending at this time.

Calves Transported to Nursery

The two calves were transported to the nursery in rather different situations. These differences arose due to the variation in deaths of the dams. The first female, Kelly, was discovered in a corral. The somewhat confined space allowed animal staff to hand grab 2 month old "Jack" and push him into a crate, which he was then transported to the Animal Science Building (ASB) in. This hands on, no-sedation technique resulted in an angry and upset little rhino.

"Ophelia" had a different move to ASB. Since her dam was found in an open 6-acre pasture, the obvious choice was to dart the calf in order to guide her into a crate. Once darted, minimal running occurred and animal staff was able to push her into a crate with little to no resistance. She was reversed once in a treatment stall in ASB, and was relatively sedate.

Both calves had someone sit with them for the first day, since Jack was brought to ASB in the early evening, he was left alone for the first night.

On The Bottle

The time it took to get both rhinos on bottles was pretty similar, regardless of what contraption was used, both rhinos started on the bottle after approximately 48 to 72 hours. So in this case it wasn't an ingenious apparatus but more both calves getting to a point where they were at a hunger level that allowed for them to be willing to feed from something other than their dam. While we wanted them to trust us in order to get them on the bottle the idea wasn't to "hand raise" them in the classic sense, but more just them to understand we bring them food much like the rest of our animals recognize. The end goal remained to introduce them to a rhino herd, so we wanted them imprinted as minimal as possible. Jack was in the hospital for 41 days and although we wanted to get Ophelia out of the hospital as quickly as possible her time line was delayed due to the fact both the veterinary and wildlife staff wanted to her to receive her initial clostridium vaccine along with her 30-day booster. Ophelia was introduced to Mae and Jack outside 35 days after the passing of her dam.

Reintroduction

Both Jack and Ophelia were given a dose of butorphanol in order to induce a standing sedation for a relaxed move back out into the corrals where they would eventually rejoin their original crash.

The first idea we had for this reintroduction was to pair "Jack" up with a dam/calf pair. Although this seemed like a great idea at first, it turned out to be a little more challenging but for a reason we did not foresee.

We brought Jack out and joined him up with Lucy, a dam who had "adopted" an orphaned calf in the past only this time she already had her own calf with her that was 6 months old (BamBam). Due to the fact that BamBam was more than two months older than Jack we didn't think he would be kicked off his dam by the younger rhino calf Jack. However, that is exactly what happened. Jack was getting his bottles from us and when we weren't around he was also nursing from Lucy. This was discovered by one of the team members who drove by while both Jack and BamBam were nursing at the same time. As we let this play out Jack ended up completely kicking BamBam off of his dam. We realized this situation was not going to work and Jack had only been with Lucy and BamBam for less than two days. Jack was separated from Lucy and her calf BamBam.

Once we pulled Jack from Lucy and BamBam we put him with two adolescent three year olds. Mae, was born at White Oak and is very tactile, along with Peanut who was imported from South Africa in 2014. Both young female rhinos took very well to Jack. The trio were kept in corrals together for 13 days. Jack continued to be bottle fed 6 times a day while living with the two girls. Since the goal was to get him back in a herd environment for socialization, time locked in the corrals was minimized as much as possible. The trio was released into two connected pastures totaling 13 acres, with the remaining 1.6 of the crash. This required feeding Jack at whatever location he happened to be at. Luckily, he figured out within a couple days to come up to the fence lines for bottles. Not only did Jack figure this out, but also the rest of the herd. This resulted in lots of alfalfa treats being fed to keep the other rhinos away from Jack as he took his bottles. Unfortunately, 29 days after being released with the herd, another rhino was discovered dead in the morning. Peanut was believed to have succumbed to a clostridium overload. To say this third rhino death

hit the team hard would be an understatement, however this was not something to dwell on, as we still had two orphaned rhinos to hand rear. Following Peanut's death, all rhinos from the herd were placed under a quarantine situation.

Plans had been to move Ophelia outside as soon as possible; to minimize the amount of time she was isolated in ASB for. However, the death of Peanut stalled this process as we addressed the severity of the clostridium. Days after Peanuts death, all white rhinos were vaccinated with Clostridium A and C/D vaccines. Ophelia was given her initial clostridium vaccines 11 days before being put back outside. Before transporting Ophelia outside, another adolescent rhino was introduced to Mae and Jack in an attempt to take some of the burden of the calves off of Mae. Introducing Libby to Jack and Mae was unsuccessful. Although just across the road from the crash, the stress of being separated was too much for Libby and she was moved back with the rest of the crash within 24 hours. Mae would have to bear the weight of dealing with two rhinos calves under 4 months old on her own. For the move, Ophelia was sedated just as Jack had been to move her out to the corrals. Ophelia was introduced to the two, and they surprisingly paid minimal attention at first. Ophelia was a little nervous being back outside, but also adjusted quickly.

Feeding two calves at the same time was initially done by two animal keeper staff, or a staff member and intern. Whilst Mae occasionally gets pushy, she continues to do extremely well with the two calves at feedings, not requiring any alfalfa or other form of distraction. Once this routine was down, we dropped the extra person and went to one individual staff member per feeding. This provided for some challenges, i.e. how to juggle two bottles and two hungry rhino calves that drink at different rates and different amounts. We have altered some of the suggested formula ratios[1] to accommodate the two rhinos living together. Jack has remained on the suggested formula solution for the younger calf, Ophelia. After consulting with our veterinary staff, it was decided that maintaining Jack on a formula mixture for a slightly younger calf would not have any detrimental effects on his growth rate. Rice cereal was also added to formula for each feeding to provide additional substance without having to significantly increase liquid volume intake. As the calves have grown we have also introduced grain mash (ADF16 soaked in formula) feedings at the first and last feedings of the day. This has allowed for a smooth transition closer to what will become their routine diet of ADF16 cubes and hay.

Conclusion

With every "hand raised" animal a facility faces different struggles. Due to the nature of our resources, staff manning and our greater goal of returning the rhinos to a herd environment, traditional and intensive hand rearing these two calves was not an option. Instead we took the approach of instilling in the calves that we were there for food but the rest of the crash would raise and guide them to "rhinohood". Considering the circumstances the best possible option was found and to this point has been a successful journey. It has absolutely been a learning experience for the team, and something we are grateful to the help of our veterinary staff, amazing interns and the rest of the staff at White Oak. It truly takes a village to raise two white rhino calves!

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Use of fission-fusion to decrease aggression in a family group of western lowland gorillas

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Abstract

Captive western lowland gorillas *(Gorilla gorilla gorilla)* are commonly managed as harems, a social structure characterized by one silverback male overseeing a group of females and sired offspring. This reflects the species' typical social structure, contrasting with the model of fission-fusion typical of bonobos (*Pan paniscus*), for example, in which group members leisurely disperse and rejoin the larger commune. In 2014, Asha, a female gorilla at the Cincinnati Zoo and Botanical Garden, gave birth to her first offspring. Consistent and protective support of her offspring from the silverback allowed Asha to gain dominance. Asha became fixated on a one-year-old in the group, often grabbing and displaying aggression towards her. This behavior, in combination with a lack of discipline from the silverback, resulted in numerous aggressive incidents between Asha and other females, increasing stress within the group. Although considered state of the art in 1978 and still manageable today, the linear-style holding of the current gorilla facility (scheduled for a comprehensive renovation in 2016) catalyzed group disturbances. This unique dynamic along with a potential pregnancy within the group prompted the need for an innovative behavior management structure. To maintain the well-being of all group members, keepers adopted a fission-fusion system. Spending short times in sub-groups, the complete group was still maintained as a family led by the silverback male. Overall, there was an immediate decrease in the amount of aggressive behavior and frequency of incidents initiated by Asha while the cohesiveness of the family group was preserved.

Introduction

The management of captive western lowland gorillas (*Gorilla gorilla gorilla*) differs based on the institution and on recommendations made by the Gorilla Species Survival Plan (SSP). Factors such as individuals' personalities, natal emigrations, breeding recommendations, population size, etc. are all considered when overseeing the best interests of the captive population in order to facilitate a species-appropriate social setting and species-appropriate behavior. Captive management of gorillas strives to model the species' typical social grouping known as a harem, consisting of a single male, multiple females and their offspring (Armstrong et al., 1997). This differs from the typical social grouping of

another great ape, the bonobo (*Pan paniscus*), which uses fission-fusion. This style of management varies the configuration of society by changing the group size and composition (Ballman et al., 1997).

The Cincinnati Zoo and Botanical Garden manages two social groups of western lowland gorillas, one existing as a species-typical single male harem: four adult females, one juvenile, one infant, and the potential pregnancy of one of the females. The second group is comprised of a young silverback male with two adult females. The two groups are managed in a holding constructed in 1978 that was considered state of the art at the time. This holding contains a straight line hallway with cages on each side, a transfer chute connecting each side of the hallway, and one cage that accesses to a large "day room" below the main hallway holding (Figure 1). Due to the linear-style holding, many dead-ends exist, inhibiting gorillas from easily dispersing from one another and allowing more dominant individuals to block submissive individuals from getting to their desired or forced destination.

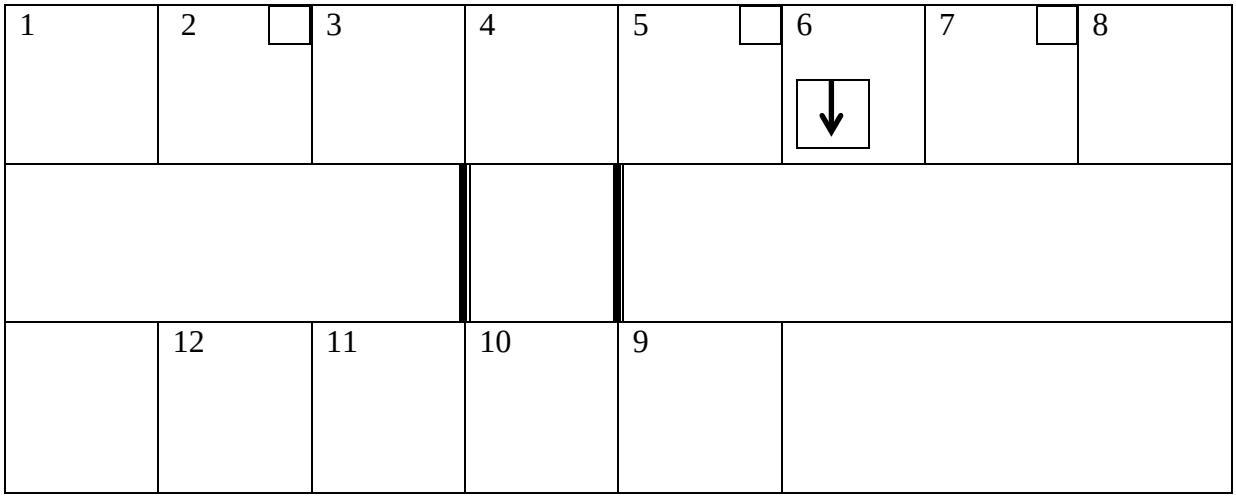

Figure 1. Bird's eye diagram of straight-line gorilla hallway showing in bold lines where transfer chute is located and the small box in "holding 6" leading down to the day room. The small boxes in holding 2, 5, and 7 are access points to the outdoor exhibit.

In August 2014, after the zoo's eight-year birth hiatus (based on a SSP recommendation), 11-year-old Asha gave birth within the larger of the two groups to a female offspring. Silverback Jomo became concentrated on the newborn, named Mondika, defending her and Asha if any conflicts surfaced. Asha recognized this pattern in addition to her increase in social status, using it to her advantage to obtain favored food sources and/or enrichment by displacing submissive individuals. Usually her act of displacing was carried out through aggressive behaviors, amplified by the support of Jomo. This dominant behavior expanded into a fixation on one-year-old Gladys, often stalking Gladys, her surrogate mother M'linzi, and frequently attempting to "baby-snatch" her. In addition to snatching, Asha would often initiate play with Gladys and would then slowly morph the activity into pinning her down and biting her. Attempts from Gladys' surrogate mother M'Linzi or geriatric female gorilla Samantha to protect Gladys would result in escalated aggression between the females and Asha. These aggressive incidents started occurring regularly, especially with the anticipation of food, and would result in Jomo disciplining M'Linzi and/or Samantha. Keepers began constant observation over the group to make note of when and where incidents occurred and attempt to prevent them.

Maintaining the group as a single male harem was priority due to the importance of the youngsters learning species-appropriate behaviors from adults and from each other. Fortunately, less aggressive incidents took place on exhibit versus inside holding, but with the weather changing seasons and a newborn in the group, the cut-off temperature of 65 degrees Fahrenheit prevented the group from going outside. It quickly became necessary to produce an innovative solution to manage the group in a linear-style holding for the winter in order to decrease aggression towards Gladys and other females by not allowing Asha to predict what her day would consist of nor to anticipate food. To accomplish this, we began implementing a social structure similar to that of the bonobo, using fission-fusion to manage the group. Using fission-fusion would potentially allow for a decrease in stress and aggression while maintaining social cohesiveness and development.

Methods

To help with communication between keepers, a weekly calendar was created that mapped out the group's living quarters for each day. This also dictated if the group would be managed as a full harem versus sub-groups. The sub-groups were divided with adult female Asha, infant female Mondika, and adult female Anju in one group and geriatric female Samantha, adult female M'linzi, and juvenile female Gladys in another. Furthermore, the calendar outlined which sub-group the silverback, Jomo, would be in for that particular day. Rotating Jomo between the sub-groups was vital to maintain and support relationships with the females. Though the schedule varied, they were together as a full group 3-4 times per week. Throughout each day, the time of feedings was also varied. Together, these efforts reduced Asha's anticipation of food.

Results

Overall, the group adjusted well to the fission-fusion. Stress level within the group decreased, and an increase in activity was observed. Additionally, there was an increase in play behavior from Samantha and other members of the group. While separated into sub-groups, there was less ear holding and nervous behaviors displayed by M'linzi. Additionally, M'linzi interacted and socialized more with Samantha during this time. When the group was together, there was an overall decrease in aggression with aggressive incidents occurring no more than once per day. Interestingly, when Asha would initiate play with Gladys and occasionally take it "too far," Gladys would vocalize negatively towards Asha and pursue her in a disciplining manner. Use of fission-fusion also allowed the keepers to reduce their constant vigilance over the group.

Discussion

Implementing the social structure typically found in bonobo society – fission-fusion – into a gorilla family group successfully decreased aggression and stress levels. Alternating silverback Jomo between two female sub-groups and allowing him to frequently rejoin the entire group as a whole several times throughout the week preserved the overall cohesiveness of the group. Additionally, Gladys was able to show curiosity and interest in infant Mondika and was able to engage in social behaviors with her. The frequent group changes and variation in feeding times reduced Asha's focus on the submissive adult females in the group as well as on Gladys. With the overall decrease in aggression, keepers were able to facilitate more valuable enrichment items to the family group with minimal aggression occurring.

The gorilla facility at The Cincinnati Zoo is scheduled for a comprehensive renovation and reconstruction over the next few years. This will hopefully eliminate dead-ends, decreasing overall tension and nervous behaviors. While the use of fission-fusion to manage a single male gorilla harem is rare, this management style proved to be effective when dealing with strong personalities, an antiquated holding, limited space, and the need for proper juvenile social development.

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Medical Management of an Infant Mandrill (*Mandrillus sphinx)*

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The Houston Zoo is home to a family of 1.3 mandrills (*Mandrillus sphinx*). We received the first female, Cleo on 16, April, 2013 from San Francisco Zoo. Our male and other female both arrived on 6, June, 2013; Ushindi came from Franklin Park Zoo and Louise came from Bronx Zoo. Cleo was already down at our mandrill building while Ushindi and Louise were in quarantine together. Ushindi and Louise were introduced on 21, June, 2013. 1.1 then moved down to the mandrill nighthouse and were introduced to 0.1 on 18, July, 2013. From that point on we had a stable group of 1.3 mandrills. At the time of introductions Ushindi was 11 years old, Louise was 14 years old, and Cleo was 24 years old.

On 29, November, 2014 a mandrill was born at the Houston Zoo to Louise and Ushindi. The female infant was named Annabelle, and is the first mandrill born at the Houston Zoo. This was sire's first offspring and dam's third offspring. The dam's two previous infants did not survive, and therefore we had concerns about her raising this infant. Plans were put in place if staff needed to intervene and assist with raising the infant. Louise was given domperidone two weeks prior to giving birth to encourage maternal behavior and lactation. Fortunately, no intervention was necessary as Louise became an attentive mother for this infant. Nursing was seen very early on and infant was clinging to dam well from the beginning. 0.2 were introduced to 1.1 within two weeks after being born. 1.3 mandrills were living on exhibit together without any major issues. The first five months of Annabelle's life were normal.

Five months later on 26, April, 2015 Annabelle sustained a wound on her right rear/hip area. She was bitten by the sire while out on exhibit. From what keepers saw it is not believed that sire was targeting the infant; instead he was upset with dam and since the infant was on dam's stomach she was inadvertently injured. 0.2 were sedated and taken to the veterinary clinic so that Annabelle's wounds could be cleaned and sutured. She was reunited with dam but both stayed at the clinic until all test results were obtained and to facilitate treatments. Infant received daily antibiotic injections to help keep the wound from becoming infected. After a few days 0.2 were then returned to the mandrill nighthouse but remained separated from 1.1 so the wound could heal. Less than two weeks later on 7, May, 2015 infant sustained a broken right humerus which required us to separate her from dam for surgery and post-op recovery. The fracture was repaired with a bone plate implant. It is unclear how her arm was broken as the incident was not witnessed.

For the next three months infant was hand-reared by keeper staff (Appendix 1). Keepers and veterinarians developed a gruel mixture for Annabelle which was initially mixed with human infant formula. She had a pretty good appetite from the beginning.

The first few days Annabelle was not supposed to put a significant amount of weight on her arm to allow it to begin healing, and there was still significant damage to her right leg. Keepers modified towels into a sling for her to be put in so that she could begin putting more weight on her injured arm and leg without putting all of her body weight on it. She spent time in the sling throughout the day for the first week. Once she was able to move better on her own she began physical therapy with a veterinary acupuncture and physical therapy specialist. In between these sessions she was given therapeutic massages from veterinary and keeper staff.

Care was provided around the clock until Annabelle began sleeping through the night consistently. Keepers encouraged her to move and exercise around the room during the day. She had a jungle gym set up for her to climb on, up, and over. It was filled with enrichment, browse, different substrates, and stuffed animals to act as surrogates to cling to when she was upset. Photos of mandrills were hung up around the room at her eye level so that she could always see other mandrills. She was still receiving physical therapy for her leg to help stretch it out and encourage her to walk on her foot correctly. Keepers then modified the gruel mixture (Appendix 2) for her and had a more consistent feeding schedule since she was eating more. As she got older, more solid fruits, vegetables, lettuce, and browse were added into her diet as well.

Primate and veterinary staff met to create a reintroduction plan (Appendix 3) for infant and dam. To prepare her for returning to the nighthouse and exhibit, Annabelle began spending time outside to desensitize her to the noise and to be in similar surroundings. At first she was very nervous of any noises; whether it was birds or helicopters. The Houston Zoo is next to a conglomerate of multiple hospitals with constant sirens, helicopters, and other traffic noises that she had to be acclimated too again. After going outside the first few days she became comfortable with her surroundings but she did not want to be too far from her caregiver.

The next step was to bring her back to the exhibit and then the nighthouse. Keepers began crate training Annabelle since she would have to be in a crate to be transported. Once she was comfortable in the crate she was put on the back of the primate cart and taken on very short trips to get her used to the movement. The time increments were slowly extended until she was ready to go back to the nighthouse. She started by going into the exhibit without the adults for about an hour before the zoo opened to the public. At this time the adults were not allowed to see her as staff worried the dam would become agitated. The crate was covered with a towel and she was walked through the nighthouse as fast as possible past the adults.

Once Annabelle was comfortable with the exhibit the time spent in the nighthouse was slowly increased until she was spending the entire day in the building and only sleeping at the clinic. This was two months from the time she was separated from her dam.

To move from one bedroom to another in the mandrill nighthouse you have to climb up over a “step”. Keepers wanted to make sure that Annabelle could make the climb on her own if for some reason dam did not carry her once she was reintroduced. It didn’t take long before keepers were able to train her to shift from one bedroom to another. Keepers had also begun removing themselves from continuous direct contact with her so that she would start to disassociate us being her “mother”. Once she was in the nighthouse for the entire day, keepers sat outside of the bedrooms and monitored her from a distance and also began feeding her through the mesh.

On 21, July, 2015 Annabelle was reintroduced to her dam 2.5 months after being separated and almost 3 months from her initial leg injury. The introduction went very smoothly and dam accepted her back immediately. Keepers were unable to do any supplemental feedings with infant for the first 24 hours. However, she was seen nursing the first day back with dam. On day 2 keepers were able to feed Annabelle gruel mix.

Two weeks later Annabelle and her dam were introduced to the other adult female, and this introduction was again uneventful. On 11, August, 2015 the male was introduced back with infant and dam on exhibit. Finally, on 25, August, 2015 1.3 were all together on exhibit without incident, 3.5 months after infant had been removed for medical care.

During the time Annabelle was being hand reared, keepers began to notice some abnormal behaviors. She would twitch throughout the day. During these episodes she would bite down on whatever was near her and keep her teeth clenched until the twitching subsided. Keepers also noticed that her eyes were twitching from side to side more often in a repetitive movement. The vets determined that she was presenting with nystagmus. Nystagmus is a vision condition where the eyes make repetitive, uncontrolled movements. These behaviors continued once she was back with her group. It was also noticed that she did not seem to be as coordinated as staff thought an infant her age should be, and that she may not be progressing normally for an infant mandrill. She still did not use her right foot normally and tended to walk on the side of her foot rather than the bottom. (This may be corrected with surgery once she is older and has grown more.) The coordination issues became more concerning as she got older.

In mid-September, Annabelle was anesthetized and an MRI was performed to help determine the cause of the neurologic symptoms. The MRI revealed that she had an obstructive cerebellar cyst with secondary hydrocephalus, similar to Dandy-Walker syndrome. The cyst was in her cerebellum, which is the part of the brain that coordinates movement. Due to the location of the cyst, it did not allow the normal cerebral spinal fluid (CSF) filled spaces in her brain or ventricles to drain. The lack of CSF drainage caused the ventricles to become enlarged with fluid, and displaced most of her cerebrum, and did not allow for normal brain growth. The space between the brain and the skull also filled with fluid. This led her medical case to become much more critical than it was first believed to be.

Several weeks after the MRI on 9, December, 2015, the infant had surgery to fenestrate or punch holes in the cerebellar cyst and install a shunt to reduce the severity of her hydrocephalus and allow a normal CSF flow. The decision to do this surgery was made with input from all staff involved in her care on both veterinary and husbandry teams with her long-term welfare considered. The hope was that this surgery would improve her hydrocephalus and reduce her clinical signs of nystagmus and incoordination.

Following surgery, Annabelle received constant care with keeper staff, who provided for her medical and husbandry needs. The aftercare protocol was modified from the initial hand-rearing protocol.

Relative to the first episode of post-op care, keepers and veterinary staff were much more hands off. Keepers also had to be much more careful about her falling and hitting her head on anything hard. Annabelle was much older at this point and much more active and curious about her surroundings. She was more confident with her abilities and would climb anything keepers allowed her to climb. She was prescribed several long term medications post-op to help with seizure control.

The reintroduction plan was very similar to the first reintroduction. She began going to the exhibit first and then staying inside the nighthouse for the day. Annabelle had become much more coordinated in walking and with her eye-hand coordination. She was able to pick food and other items up off the ground and get it to her mouth. She was able to catch food that was dropping out of her mouth and push it back inside. Overall, she had vastly improved after having the surgery performed. She did still receive massage therapy and had the veterinary acupuncture and physical therapy specialist visit to help with her leg range of motion during the time she was in-hand.

Once the veterinary team deemed her ready, she was reintroduced to dam on 6, January, 2016. The two went outside the very next day. Louise took her again immediately without issue and

began caring for her as if she had never left. Annabelle began nursing again, though it was unclear if Louise was producing milk. They were introduced back with 1.1 on 20, January, 2016. The family of 1.3 mandrills are still currently together and managed very flexibly (Appendix 4 and 5). An MRI is planned for 1 year post surgery to monitor her brain development.

References

Dr. Christine Molter, Houston Zoo Veterinarian

Appendix 1: Annabelle Hand-Rearing and Recovery Protocols

Feeding

- Mixing up formula:

  Mix 1 scoop powder with 60 ml (2 ounces) of distilled water in a bottle with a lid. Shake well until there are no lumps. Makes about 65 ml of formula. *Mark with date and time and discard unused amount after 24 hours.*

- Making biscuit mush:

  Place 1 biscuit in an ice cube tray square and add 15ml formula. Wait 15 min for biscuit to soak through (turning it helps). Carefully but thoroughly mix in **1 teaspoon** yogurt and **½ tablespoon** biscuit dust. *Mark with date and time and discard unused amount after 24 hours.*

- *Mark yogurt with date opened and discard unused yogurt after 4 days*

- When feeding, use 1 cube of the pre-made mush and warm for 5 seconds in the microwave. Test food before feeding. The food should be roughly room temperature.
- Break each warmed cube into an amount she can easily chew and give her as much as she wants. She should be fed on demand or at least every four hours during the day. Caregivers should check the time of her previous meal when starting a shift. Encourage her to reach for the food and feed herself if possible.
- Discard any uneaten mush after it's been warmed. Do not reuse later.
- Prepare another serving when you use the last one and put in fridge.
- Also offer daily: Approved browse, (Veggies will be added at a later time)
- **Offer water frequently** either with the baby bottle (she like to nurse still) or with the rabbit bottle. **Every hour if awake.**
- **Record amount of mush eaten (by the cube) at each feeding. Be as precise as possible. (1/4, 1/3, 1/2, etc.)**
- **Record approximate amount of water consumed.**

Health and Hygiene

- Weigh Annabelle once a day, around 6 AM and before her first meal.
- Wear a mask and gloves every time you handle her for cleaning, feeding or weighing.
- If the blankets she's on are wet, swap them out before you put her back.
- Place a "puppy pad" under her rear when she is sleeping.
- Please keep up on laundry so we don't run out. Ask if you don't know where the machines are, and if the dryer is full of clinic laundry, please fold and put away neatly. Use bleach – can be found under sink in main clinic room.

- Remove your shoes at the door of her room.
- Sweep and disinfect the floor at night after she has fallen asleep.

Mobility:
- She should be allowed/encouraged to crawl/walk around. Discontinue sling.
- Offer her the chance to play in or around the white tub with water in it. If she wants to get into it, so much the better. (If we could get her to exercise in a tub of water, it would be good PT.)
- You can take her outside to play on the grass by the pecan tree if you like.
- Her right arm should not be overused for climbing, hanging or swinging.
- Gently stretch and bend the right leg and encourage her to use it and bear weight on both legs. Straighten the toes on her right foot.

Other Notes:
- Each daytime shift should write tracks entry for the day. Morning shift (7AM-12PM) should record weight & include information from overnight care (8PM-7AM) in their noon entry. The last shift should also tally the day's food consumption by the cube and record it in tracks. Be sure the weight in TRACKS is entered on the "measurements" tab as well as the animal journal.
- The room temp should be comfortable for an infant mandrill that is missing half her hair. Do not lower the thermostat in the room.
- She chewed through the teething rings, so give her the latex tube or the white tub to chew on, or a dry biscuit.

Appendix 2: Feeding protocol revised

Annabelle Post-Surgical Feeding Protocol

Diet:
9-12 cubes of gruel (see recipe below)
112-128g Growth and Reproduction biscuits – feed this ad lib throughout day.
30g produce
¼ head of lettuce

7am**:** weigh Annabelle daily

8am-9am:
3-4 cubes of gruel

12-1pm:
3-4 cubes of gruel
Veggies and lettuce

4-5pm:
Feed 3-4 cubes of gruel
Fruit

Gruel mix for 16 cubes:
2 1/2 T bananas

4 tsp peanut butter
2 ½ T smashed blueberries (measure out before smashing)
1/3 cup of oats
2 cups G&R powder
1 cup water

Mix all together, divide into ice cube tray and store in mini fridge.
Late shift will make gruel for the next day.

Appendix 3: First Re-introduction plan meeting notes- 14, July, 2015

Preparations for re-introduction to Louise/Cleo:

1. Wean Annabelle off caregiver;
   This has been successful; bedtime is now 8pm.

2. Get her acclimated to night house cages/exhibit

   (a) This is going very well

   (b) Need her to get used to being on the scale

   (c) Need her to get used to wood shaving, wood wool and coastal hay

   (d) Allow Annabelle access to cages G and H, so it isn't new on the day of intro; may need someone outside to make sure Ushindi/Louise are otherwise occupied.

3. Food delivery

   (a) Continue to use tongs to feed Annabelle

   (b) Use squirt bottle to get water to her; we'll get more water bowls since she's not adept at using the lixits yet.

   (c) Continue to train Louise to allow tongs to be present without touching; do not reinforce her when she breaks station or looks at them.

4. Renovations to cages for Annabelle if Louise doesn't pick her up
   (a) Ron has made sturdy ramps up to the tunnel; he'll work on ramps to guillotine doors at a later date.
   (b) Possibly hang hammocks under tunnel.

5. Other preparations for Introduction
   (a) Set up cameras in E and F (overnight cages for Louise and Annabelle)
   (b) Set up curtain in case we need it?
   (c) Set up creep doors, get lock and chains ready
   (d) Order extra food items to distract Louise
   (e) Get Louise and Cleo used to being inside without Ushindi; put him out for 1 hr a couple of mornings.

(f) Pre-treat for roaches, since all cages will be heavily bedded for introduction

Introduction Plan

1) Make sure all cages are heavily bedded with wood shavings, wood wool and possibly coastal on top.
2) Make sure hose is rolled out, the fire extinguisher and air horn are nearby, as well as distraction food treats.
3) Put Ushindi outside; move Cleo to D and K, Louise in E and F. Bring in Annabelle in vari-kennel and put in I and J (across from Louise); possibly depending on if they are not calling to each other, show Louise that Annabelle is in the vari-kennel and make sure Annabelle notices there is a mandrill nearby.
4) Depending on how Annabelle progresses with the ramps (i.e. she doesn't fall off them); we may not be giving access to the tunnel cages during the initial introduction.
5) Give Louise access to Annabelle first, depending on what happens will determine when we open the doors for Cleo (i.e. Louise is nervous and doesn't shift, she ignores Annabelle, or she picks up Annabelle and is bonding)
6) Later in the day, Ushindi should be given access to cage H and exhibit; we need to gauge his reactions and if Louise/Cleo's behavior changes toward Annabelle and adjust as needed. If he gets riled up, we may need to use the curtain.

Acceptable behaviors

1) Normal maternal disciplining
2) Ignoring
3) Carrying her around part of the time or if the position is awkward or upside down
4) Partially dragging her (but not to the point of injury or more than 1 minute)
5) Stress crying that is not constant (less than 30 minutes)

When to intervene

1) Any bite wounds, separate and reassess…scratches and abrasions are okay.
2) If she gets stuck in the tunnel and needs rescue
3) Pain screaming
4) Being dragged around for more than 1 minute
5) If Louise is holding her and not allowing her to eat or drink
6) If Annabelle isn't coming over for food or water

The Next Steps

It is difficult to predict the next steps without knowing how the initial introduction will go; there are too many scenarios to discuss them all, decisions will be made by managers in real time
As of right now, Louise and Cleo will be held inside everyday with Annabelle until Annabelle can shift outside on her own (i.e. climb the ramps) or we may just move her in a vari-kennel to the exhibit before shifting out the females.
However; it is possible that if Louise holds Annabelle, shifts with her, sleeps with her and allows her to eat and drink, we may push up the time table of when we let them outside. At this time, we do not have a date of when we would consider introducing Ushindi.

Appendix 4: Mandrill Group Management Protocol

When to put them together:

Ideally from 9am-3pm they would all be on exhibit; however we can do any combination depending on weather, if raining in the morning, then give one animal access and then put them all together after it stops raining. After 3pm, it can be any combination except Ushindi/Louise/Annabelle – try to rotate.

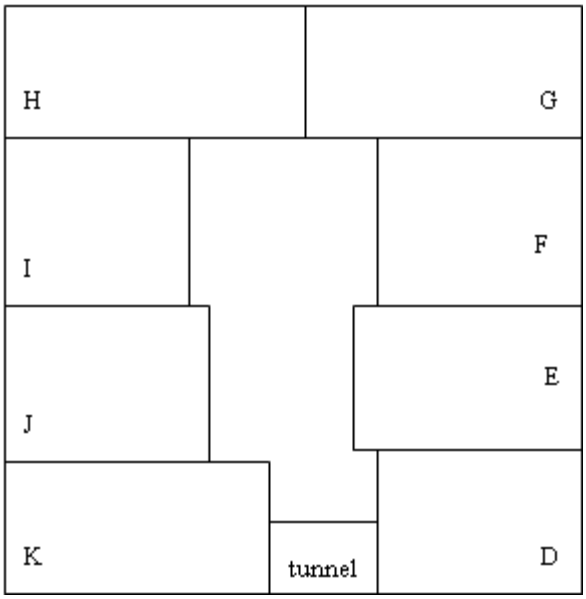
When letting mandrills on exhibit follow the following protocol:

1. Louise/Annabelle first – do a feeding if necessary
2. One keeper will watch and make sure that both Louise and Annabelle are away from the guillotine door area and that Annabelle is not between the door and Louise if they are not right next to each other.
3. Let Ushindi out first and wait at least 5 minutes and make sure Louise and Ushindi greet each other (she'll present and he'll smile).
4. Wait until both are apart from each other and away from guillotine door and then let out Cleo
5. Watch for 5-10 minutes and make sure they are at peace before leaving.

Monitoring the mandrills:

1. Check every so often (20-30 minutes) to make sure frustration levels are at a minimum.
2. If you feel that tensions are high, Bring in Ushindi or Louise/Annabelle and call a supervisor. Depending on the situation, we will give them a short time out and then possibly put them together again. The following are examples of high tension situations:
   a. Cleo is threatening Louise with Ushindi nearby for more than a few minutes
   b. Louise is yelling at Ushindi and not calming down after a few minutes
   c. Ushindi is bothered by the public and threatening crowds
   d. Annabelle seems slower, more needy or excessively whiny
   e. Louise and Annabelle chased up a prop
3. Continue with the noon Annabelle feeding and bring in Ushindi.

Appendix 5: Mandrill nighthouse schematic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Coolio, the Elephant Seal in the ‘Burgh

By
Amanda Westerlund, Marine Mammal Keeper
Pittsburgh Zoo & PPG Aquarium
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Introduction

Weighing only a quarter of a normal yearly seal and partially blinded by birds, Coolio the Northern elephant seal (*Mirounga angustirostris*) had a long road to recovery ahead of him. At the time of his rescue in November 2013 by the Northcoast Marine Mammal Center in Crescent City, California, Coolio was completely unresponsive. Over the course of the next months volunteers were able to aid him in gaining weight and help his wounds heal, but the trauma to his eyes deemed him unreleasable by the U.S. Fish and Wildlife Service. The call then came to the Pittsburgh Zoo & PPG Aquarium and it was agreed that Coolio would be on his way to call Pittsburgh home. He is currently the only male Northern elephant seal permanently under human care.

Natural History and Zoological History

Named for the large proboscis that adult male Northern elephant seals sport, these phocids or true seals can weigh up to 2000 kg (4,500 lbs.) for mature males and 600 kg (1,500 lbs.). They are only dwarfed by the Southern elephant seals that can grow to twice that size. Northern elephant seals reside off the coast of California, with males traveling up to the coast of Alaska and females traveling as far north as the coast of Canada. Elephant seals are solitary for most of the year with the exception of molting and breeding seasons, where 3 month spans in April-June and November-January, thousands of elephant seals congregate on the beaches.

Figure 1-
Mating Northern Elephant Seals
©Mary Ann McDonald

Figure 2 –
Elephant seal pup
©Richard Hermann

Single pups are born in November and nursed for only a month with high fat milk. After they are weaned, the pups are left to fend and learn for themselves over the next year in the rookery. After the year of learning they join the adults in leaving the rookery for the open ocean, where they hunt during dives of depths to 1150 m (5085 ft) and a length of 2 hours. In the 1800s, Northern elephant seals were hunted almost to extinction after whale blubber became scarce. Only about 100 remained. The Mexican government made it illegal to hunt them and their numbers have been climbing back to a stable population of over 120,000 individuals.

The history in zoos and aquariums for his species is difficult to research. Most individuals were Southern elephant seals that were kept from the early 1900s through the 1970s. These seals were captured from the wild and most did not live passed the age of 10. There has only been 1 recorded birth and the pup did not live to be older than 1 year. Many of the facilities that cared for elephant seals were found in Europe in the 1970s. Accessing these records, if they still exist, is next to impossible. Only a few rescue elephant seals have been taken in by U.S. facilities, but all have passed away due to complications of their injuries.

The individuals that were kept were extremely popular with visitors leading to many historical photographs that are easier to find. But these images do not provide much of the husbandry information that our facility needed to have an idea of Coolio's husbandry needs. Field research on Northern elephant seals is also rather limited due to their solitary nature in the open ocean, diving extremely deep depths for most of their time. Because of these challenges, we as a team

are making the husbandry manual on Northern elephant seals and we are all learning about the species through Coolio.

Figure 3 – Male Southern elephant seal and keeper at the Copenhagen Zoo in the 1930s.

Coolio's Rescue

Coolio was found by beachgoers on Pebble Beach in Crescent City, California. The Northcoast Marine Mammal Center, which is completely volunteer run, responded to the call of an injured seal. They found him completely unresponsive, extremely malnourished, and suffering from severe trauma to his eyes and head due to gulls and ravens. He was taken to the facility and given IV fluids and after a few days of tube feeding, Coolio began to respond. He weighed only 63 kg (140 lbs.) when he should have been over 4 times that weight as a yearly pup. Because his was an older pup than the normal resident rescues at Northcoast, Coolio was given his own pen and pool.

Figure 4 –
Coolio at the time of rescue
©Northcoast Marine Mammal Center

Specialists were brought in to check his eyes and it was found that his left eye had completely collapsed and would never be a viable eye again. This right eye also had trauma and had scaring covering the entire lens, leaving him blind. Because of these injures that he could never recovery from, Coolio was deemed a non-releasable seal by the U.S. Fish and Wildlife Service. Contacts then went out to see if any facility was interested in permanently housing this male seal that has the potential to grow into a massive marine mammal.

The Move to Pittsburgh

At the Pittsburgh Zoo & PPG Aquarium's Water's Edge section, we house polar bears and sea otters. We also housed sand tiger sharks in a habitat that was originally built with walrus in mind, including all life support systems that are required for a large marine mammal with a large bio load. At the time of Coolio's rescue we also had a 34,000 L (9,000 gallon) pool in our back holding area that was not being utilized. After our assistant curator visited Coolio in California, the decision was made to bring him to Pittsburgh and house him in the vacant holding pool until he acclimated.

April 23, 2014, after 2 days of travel via truck and plane in a special seal crate, Coolio arrived in Pittsburgh. He was extremely nervous when he first entered the pool, but there were many things that had changed from his normal routine. Our diets were different, there are life support

sounds from filtration, our pool in indoors, he was now in saltwater, and new keepers. He did not adjust to the changes well and went off food for 6 days.

Figure 5 –
Coolio after weight gain and learning to fish for himself.
©Northcoast Marine Mammal Center

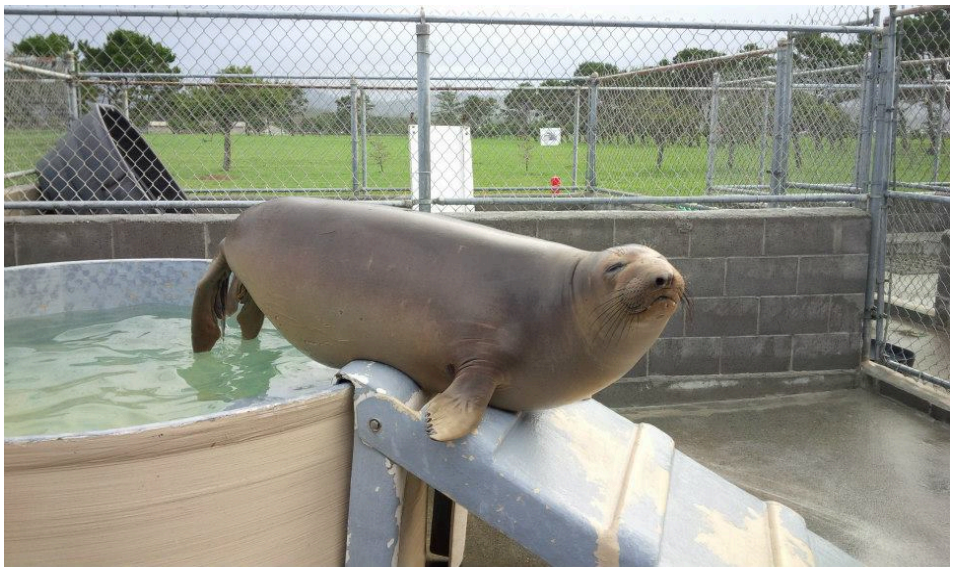

Figure 6 –
Coolio at the time of transport
©Northcoast Marine Mammal Center

To combat his loss of appetite, his pool was dropped and returned to freshwater in slow increments each day over the course of the following week. This allowed us to hand feed him and begin to create trust between trainer and seal. Once Coolio was consistently coming to sessions in his pool, this salinity was increased slowly by 5 ppt. This increase took place over the next month until his pool was at 32 ppt. By the end of May 2014, Coolio was more confident in coming to sessions.

During the quarantine period, an eye specialist was also brought in to see how much vision Coolio did have and if there were any options for improved vision. As previously thought, his left

eye is completely collapsed and there is no surgical option to repair it. But, Coolio's right eye was already showing improvement since his arrival. The scaring on the lens was not as visible and it was noticed during feeding sessions that Coolio was able to track the trainer's movement around the pool. The improvement was thought to be partially caused by the saltwater, rather than the freshwater he was previously housed in during this rehabilitation.

Figure 7 –
Coolio and Megan Paluh during the transport
©Northcoast Marine Mammal Center

Let the Training Begin!

Figure 8 –
Coolio learning to target with a target pole
©Paul Selvaggio

Once Coolio was consistently stationing at the two pool stations for sessions, the decision was made to begin formal training with him. Our Water's Edge team uses operant conditioning and positive reinforcement for our training program and Coolio responded wonderfully! The first behaviors were targeting on a pole target and follows from station to station in the pool. These behaviors took a while to complete, as with any green/new animal to training, but also due to his nervous behavior with new situations and stimulus. After the basics were completed, more

advanced behaviors such as flipper presents, especially on his blind left side, were attempted. As Coolio's confidence in training grew, his overall nervous behavior began to diminish.

Figure 9 –
Shifting to the outdoor holding pool
©Amanda Westerlund

The Enrichment Challenge

As an animal from the wild, who is vision impaired, and who does not respond positivity to new stimulus, providing Coolio with varied enrichment on a daily schedule was a challenge. When enrichment was first attempted, simply placing an environmental enrichment device (EED) in the pool while he watched, Coolio's response was to go off feeds for the remainder of the day. He would actively avoid the device and avoid trainers. Even when paired with part of his diet, enrichment was completely negative to him.

Figure 10 –
Coolio interacting with faux kelp
©Amanda Westerlund

Over the course of two months this pattern continued, but we believed that consistence was key to him gaining confidence around the enrichment. It worked! After 2 months Coolio finally

interacted with enrichment in a positive way. Today we still have to follow this method of slowly introducing new enrichment to him so he can gain confidence with interactions.

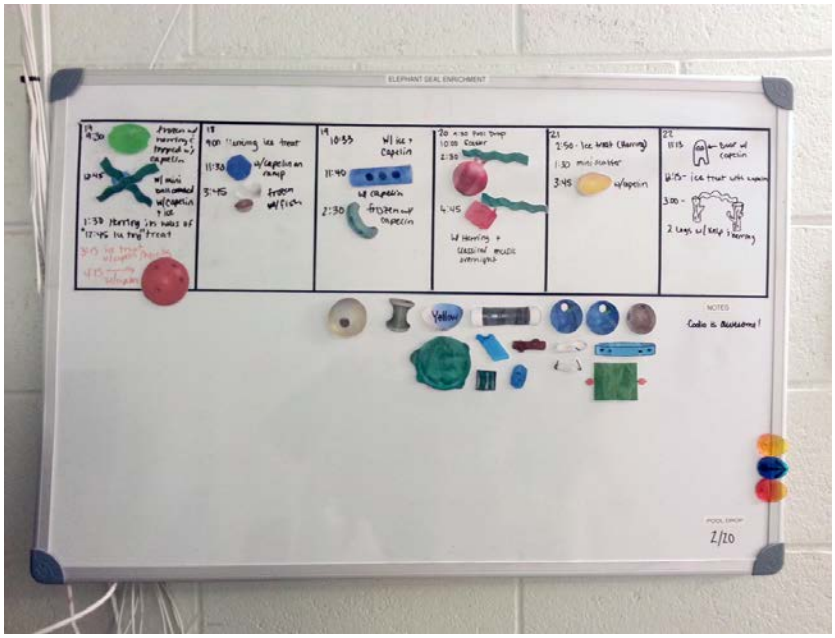

Figure 11 –
Record keeping for daily enrichment schedules
©Amanda Westerlund

Figure 12 –
Non-food enrichment device
©Amanda Westerlund

Coolio Today

Over the past 2 years since his arrival, Coolio has grown in more ways than one! He has great confidence in training and interacting with most enrichment. He has gained over 136 kg (300 lbs.) and his nose is beginning to mature into the large proboscis of an adult bull seal. We are able to shift him in between his indoor and outdoor holding pools, as well as his deck areas. He

is responding well to tours with the public, but he can still be nervous around new sounds or situations.

Figure 13–
Underwater enrichment with Coolio
©Amanda Westerlund

Figure 14 –
Shifting outdoors in snow
©Amanda Westerlund

Currently, we are making plans to introduce him to the public in the spring of 2017. While we have a lot of training to complete to keep his confidence high when introduced to the large 757082 L (200,000 gallon) pool with tunnel, we know with consistency for him and within our team we can prepare him to meet the world.

References

- Friends of the Elephant Seal - http://www.elephantseal.org/
- Northcoast Marine Mammal Center - http://www.northcoastmmc.org/

Goose's Tale: The Story of how a One-Legged Lemur Gained a Foothold on Life

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Abstract

The Lemur Conservation Foundation (LCF) in Myakka City, FL currently holds six species of lemur, including two critically endangered species, totaling over 50 individuals. The 120 acre property includes two multi-acre semi-free-ranging habitats where multiple lemur groups reside year round. In June 2015, LCF faced a new challenge when an infant ring-tailed lemur (*Lemur catta*) suffered an injury presumably from an aerial predator, resulting in spinal damage and paralysis of the infant's left leg. Initial prognosis was poor due to contributing factors such as severity and location of the injury. Staff immediately began caring for the infant while looking into treatment options. This paper will review the journey of both staff and lemur as they confronted further obstacles on the road back to health. It will discuss options for supplemental rearing, managing individuals with additional health requirements, and utilizing unique health treatment options, including acupuncture. Since there are few resources regarding many of the difficulties we faced, we hope to provide the zoological community with an informative reference on these topics.

Introduction

Endemic only to Madagascar, lemurs are living fossils of ancient primates—older than monkeys, apes, and humans. Although they are highly charismatic, lemurs are now "the most threatened mammal group on Earth." The lemur taxa categorized as "threatened" shot up from 74% to 94% between 2008 and 2012 (Schwitzer et al. 2014). The International Union for the Conservation of Nature (IUCN) estimates that, at current rates, 94 lemur species face extinction in the next 20 years. These findings not only urge us to increase our efforts in wild population conservation but also in maintaining viable managed populations. This is where the efforts of zoos and reserves play an important role in maintaining these populations.

The Lemur Conservation Foundation (LCF) is one such facility that works with the Prosimian Taxon Advisory Group (PTAG) and relevant Species Survival Plan Programs (SSPs) and houses breeding pairs of several species of lemurs, for a total of 50+ individuals. In addition to their genetic value, LCF's lemurs also offer scientists and students research opportunities with the goal of improving conservation and management practices.

LCF's 120 acre reserve is located in eastern Manatee County, FL surrounded on all sides by agriculture. At present the lemur area consists of two holding buildings, and two forested approximately 10-acre+ enclosures surrounded by 10-foot chain link fences topped by two feet of electronet. The remaining acres currently serve as a buffer zone for the reserve.

Managing these multi-acre animal enclosures comes with its own set of trials, including infant management. In June 2015, the LCF staff faced a new challenge when an infant ring-tailed lemur (*Lemur catta*) suffered an injury presumably from an aerial predator. This incident began a six month journey on behalf of the staff and lemur as they confronted further obstacles on the road back to health. (See Appendix).

Chapter 1: The Injury

On April 4, 2015, ring-tailed matriarch Ansell gave birth to her third set of twins- two males later named Goose and Darwin. The family of eight lived in the forest, spending much of their time at their forest shelter, known as a 'dome.' Goose and Darwin were both very healthy infants, quickly thriving under the care of dam Ansell and four older siblings. On June 16 at ten weeks old, the age that young ring-tailed lemurs become more independent, Goose suffered an injury presumably from an aerial predator.

LCF utilizes several wildlife cameras set up around their forests to monitor lemur behavior and possible incursions from wild animals such as raccoons. Although the incident was right out of camera view, video shows Ansell with one infant on the ground vocalizing with audible hawk calls in the background. At the very end of the clip, a staff member arriving with the morning diet is also audible. Upon staff arrival, Goose was on the ground alone and the group was agitated. The injured infant was able to pull himself onto the dam as she walked by, but his back left leg was hanging down her back instead of clinging. Staff also noted fresh blood at the point where the leg meets the body, and possible puncture marks.

Goose was immediately taken for veterinary care. LCF's veterinarian, Dr. David Holifield's, examination revealed several injuries: a puncture ventral left flank with a small to moderate hemorrhage, a second puncture to the lateral aspect of the left, mid-lumbar spine, and several 'scratches' between and caudal to the punctures. Dr. Holifield noted that the left hindlimb seemed to be paralyzed. There was no deep pain, nor withdrawal. Radiographs and an ultrasound revealed a disruption of the architecture of the L4 vertebrae with moderate to extensive soft tissue disruption in the affected area. Due to the location and the severity of the injury on such a young animal, Goose's prognosis was poor. Dr. Holifield felt that if he showed no progress on regaining use of the limb within four days a decision would need to be made regarding euthanasia based on his current and future quality of life.

Chapter 2: Get Goose to Eat

Goose was taken home from his vet visit and staff immediately began round-the-clock care while starting treatment for his injuries. During a typical infant intervention, the staff at LCF does their best to keep dam and infant in close proximity at all times. Due to the severity of Goose's condition this was not possible and it was decided he would be temporarily separated in an indoor building until his next veterinary exam. This time period began the first hurdle for Goose and his caretakers, quickly known as 'Get Goose to Eat'.

Williams (2002) recommends two types of formulas for supplementing lemurs:

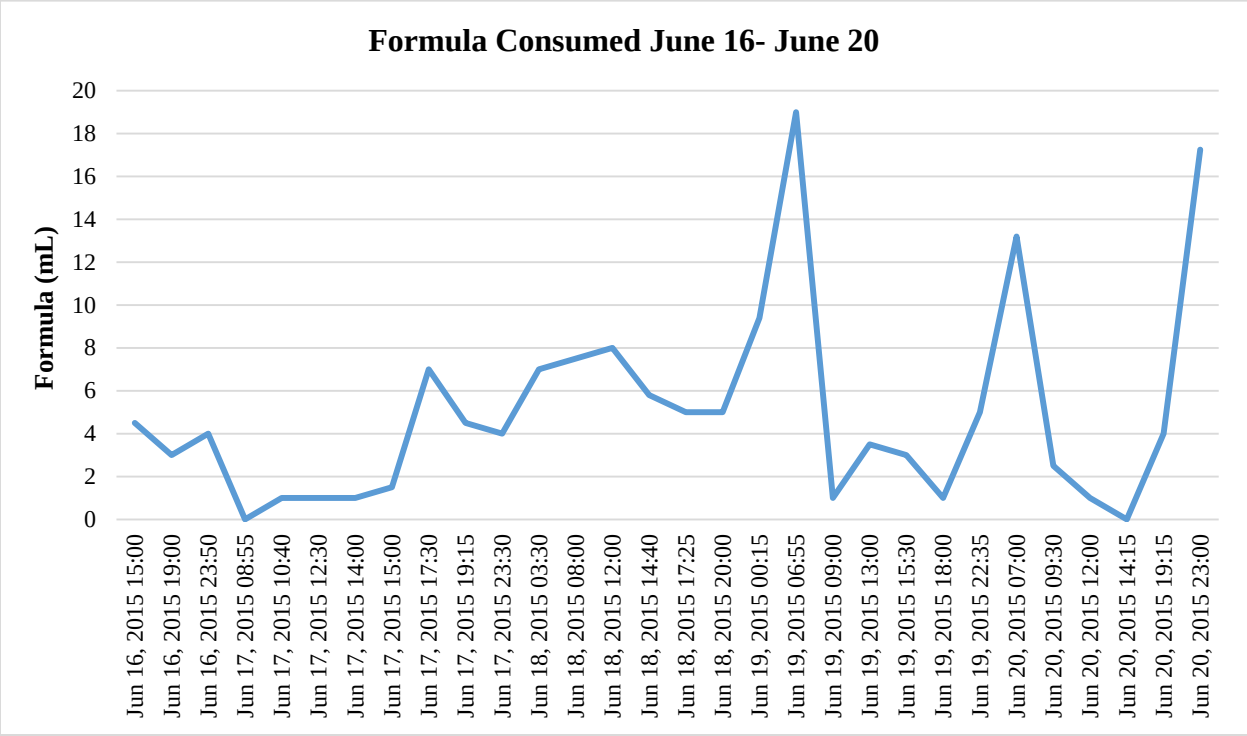
Table 1: Supplementary Formula Options

Formula 1 (LCF's Choice)	30ml Similac human infant formula prepared according to directions, 30ml nonfat milk, 3ml 50% dextrose
Formula 2 (Alternative)	Zoologic® Milk Matrix 20/14 by PetAg – 10g powder to 100ml water

Having consumed his mother's milk for over two months, Goose was disinclined to eat this new formula. In addition to formula, Goose was also at the age to start eating solid foods. Staff had seen him tasting a variety of foods prior to the incident, but he was again disinclined to eat most solids his caretakers provided. This reluctance to eat anything meant that instead of feedings every 6 hours, as recommended

between 2-3 months of age, Goose was being fed every one to two hours in the hope that he would eat consistently enough to maintain his weight, if not gain weight. Graph 1 illustrates the amount of formula consumed per feeding during the first four days of supplemental rearing.

Graph 1: Formula consumed (mL) per feeding

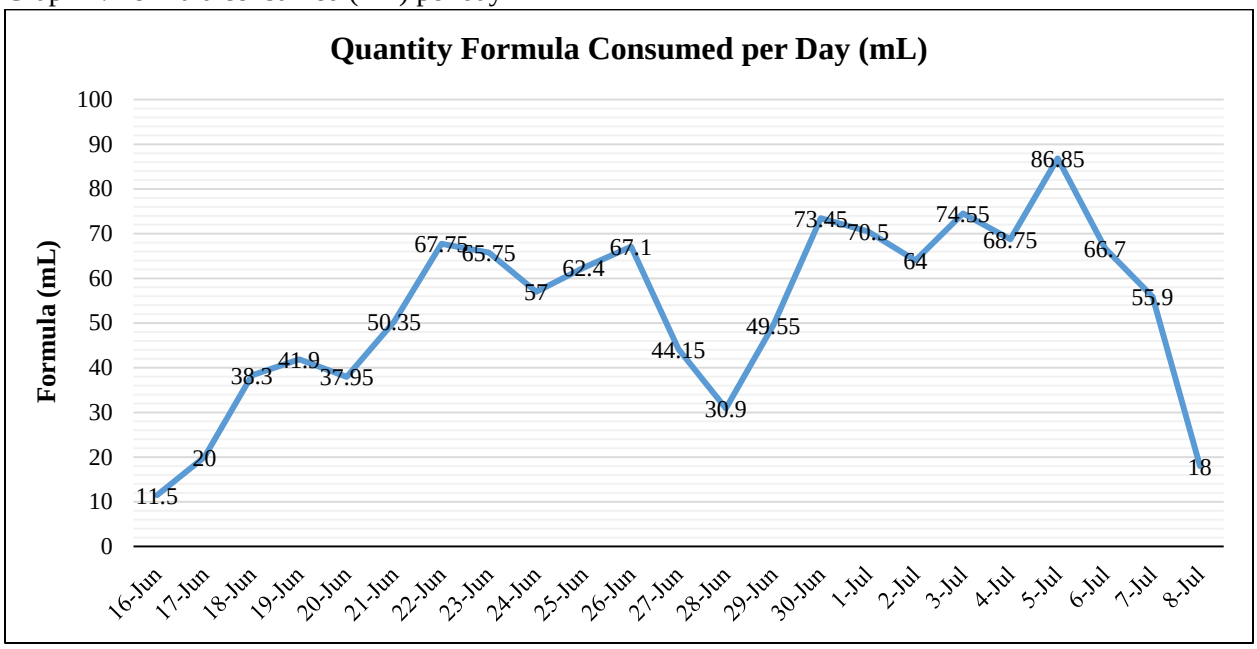


In ring-tailed lemurs the amount of formula consumed daily as a percentage of body weight will vary but 25% is a good target amount. This formula consumption rate continues even after the introduction of solid foods. On June 17 Goose weighed 325g, meaning he should consume an average of 81mL of formula per day. On June 17 he consumed a total of 20mL of formula, as illustrated in Table 2. This under consumption of food continued through the entire period of supplemental rearing. The amount of formula consumed daily began to increase to more appropriate levels on June 21, as seen in Graph 2 but never reached recommended consumption levels.

Table 2: Recommended formula consumption vs. actual formula consumption

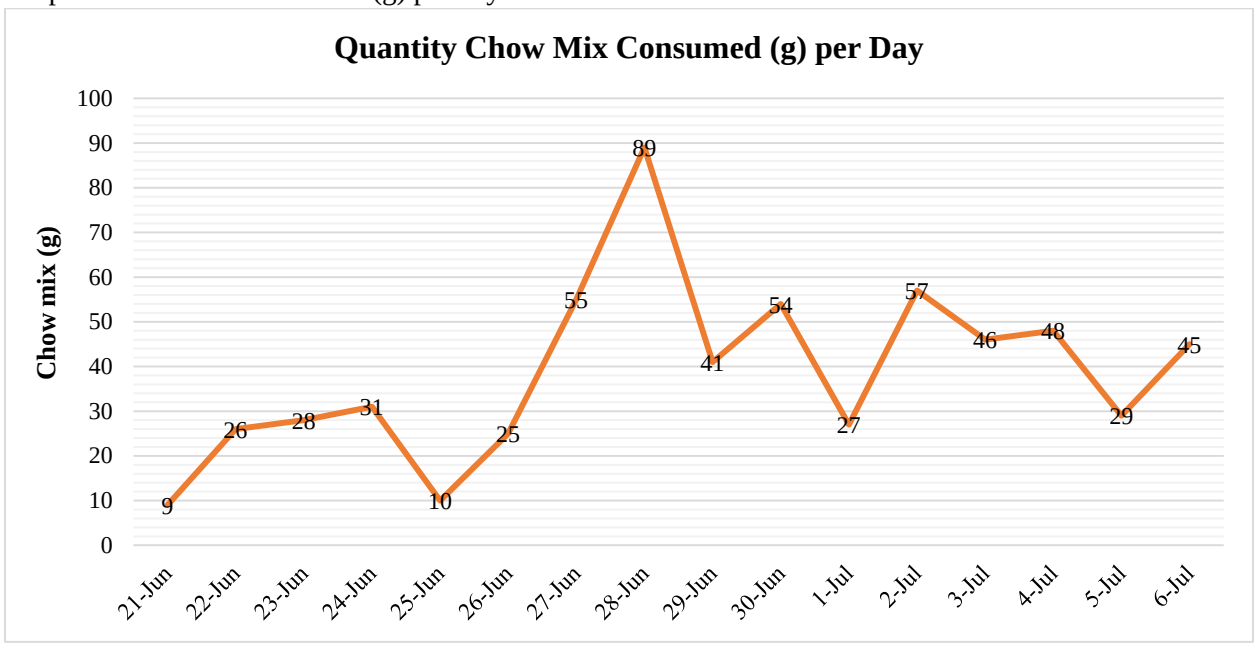
Date	Weight	Recommended formula consumption	Actual formula consumption
June 17, 2015	325g	81.25mL	20.00mL
June 21, 2015	322g	80.50mL	50.35mL
June 25, 2015	329g	82.25mL	62.40mL
June 29, 2015	357g	89.25mL	49.55mL
July 3, 2015	377g	94.25mL	74.55mL
July 7, 2015	398g	99.50mL	55.90mL

Graph 2: Formula consumed (mL) per day



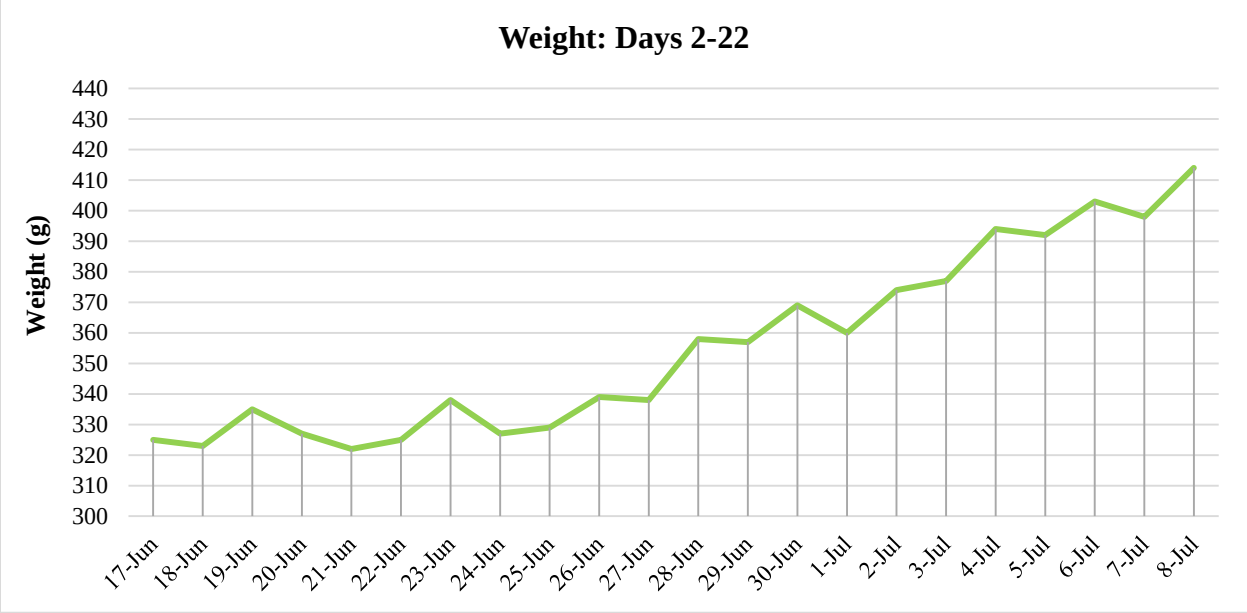
June 21 also began the introduction of consistently offered and recorded solid foods. Up to this point staff offered Goose his favorite solid foods only after an attempted formula feeding. These foods included a variety of fruits and vegetables (sweet potato, blueberries, carrots, kale, and melon). Since Goose would not consume chow, staff made a chow mixture consisting of soaked primate maintenance biscuit and very small pieces of fruit and vegetables. The mix was weighed when given and at every feeding to determine amount consumed. Graph 3 illustrates the amount of chow mix that Goose consumed per day while being supplementally reared.

Graph 3: Chow mix consumed (g) per day



From two weeks of age to 4 months of age ring-tailed lemur infants should average a weight gain of 4-7g per day. Graph 4 illustrates how Goose's weight fluctuated day to day but did not show significant increase until 8 days after the injury. However, during this time it is important to note that a portion of Goose's body weight resided in his injured left leg, which began showing signs of atrophy.

Graph 4: Weight (g) per day



Chapter 3: Treatment

During the time that staff was supplementally rearing Goose, they also began treatment for his wounds. Medications included dexamethasone (22 days) and clindamycin (15 days). After four days of care, treatment, and working on his leg flexibility, the staff brought Goose for another veterinary examination on June 20. It was determined that his overall health was improving despite a continued lack of feeling in his leg and toes and no withdrawal reflex. The decision was made to not euthanize but instead to embark on a new path- acupuncture. Dr. Pamela McGinnis, a specialist in mixed animal acupuncture complementing western medicine, began treatments the same day.

According to Dr. McGinnis the general idea behind acupuncture is to stimulate the meridians, or channels, in the body to move energy. Where there is pain there is stagnation and the goal is to remove that stagnation, both of energy and blood, by moving energy through the meridians and by moving blood physically locally from the area before the lesion to after it.

Under this philosophy, Goose was diagnosed with qi/blood stagnation at the spine and qi deficiency of the left hind limb. All treatment was aimed to clear this stagnation and regain function of the left hind limb. The area of focus was the kidney meridian, thought to rule and control neurologic, bone, kidney, reproduction, and bladder deficits. This meridian starts in the feet and runs to the chest, to approximately the pectoral region. Three types of acupuncture techniques were used during treatment; including dry needles, electro, and aqua. Dry needle is simply inserting the needle into specific points. Electro-acupuncture is the use of a low voltage current to stimulate the dry needles. Aqua acupuncture is the insertion of liquid (ex: Vitamin B12) into the point for longer stimulation. Several key acupuncture points utilized in Goose's treatment are listed in Table 3.

Table 3: Key acupuncture positions

Point	**Reason**
Bladder 62 (BL62)	Important point to open the back, helpful with spinal issues
Bladder 40 (BL40)	The master point for the back
Gall bladder 44 (GB44)	Tendon, ligament point for spine
BH	Local point, along path where spinal cord ends, connect to point ahead of wound to move energy through
Circle the dragon	Around the affected area (talon wound on spine)- homeopathic agent for pain, swelling, inflammation

Goose received acupuncture treatment on six occasions, including the first day where he simply received vitamin B12 injections into the affected foot. Rapid progress was observed in the form of holding the limb up instead of dragging it as well as toe curling and other spontaneous movement to the toes. Between acupuncture appointments, staff were also charged with working on Goose's leg flexibility. This included manually manipulating the leg and foot, flexing and extending all joints from the hip to the toes. Goose was also encouraged to move around his room and was taken on several trips outdoors to play and climb in a controlled section of vegetation supervised by multiple staff members.

In addition to his acupuncture appointments, staff also brought Goose to receive cold laser therapy treatment following two acupuncture appointments. The function of the laser is to produce photons from red and infrared laser radiation. These photons will induce temporary vasodilation that increases blood flow in the treatment area. As blood carries the nutrients required for healing, this additional blood flow will increase cell restoration and decrease overall healing time of the treated area. In Goose's case, the laser was used in the lumbar/spine area of the original injury, and was also used over the pelvis and left hind limb.

Chapter 4: Reintroduction

While staff were caring for Goose and were pleased with his improvements, there remained the challenge of reintroducing him to his family. The chance to do so came suddenly in the form of his twin brother Darwin being injured on July 6, also presumably by an aerial predator. Though receiving visibly similar injuries as Goose, Darwin's wounds were mostly superficial and did not require more treatment than a simple antibiotic. The staff moved quickly to reintroduce both infants together. On July 8 both Goose and Darwin were brought back to the group and reintroduced to their mother Ansell alone. Darwin immediately jumped onto Ansell's back. Goose huddled with Ansell but had difficulty competing with his large sibling for 'clinging space' on the dam. The introduction with the rest of the group went smoothly.

Goose attempted to nurse several times during the intro but appeared to have difficulty latching onto the nipple. After two hours of not being able to nurse, staff attempted to feed him formula but the dam was wary and reluctant to allow staff to approach her and her infants. Staff made the decision to increase his solid diet to the full adult ration and to spread out feedings and carefully monitor to ensure he was eating sufficiently.

Within 48 hours Goose became very clingy to Ansell and spent more time clinging to the dam compared to Darwin. A downside to Goose's reintroduction was that staff were no longer able to easily capture him to take him for acupuncture. After Goose rejoined his family, staff were able to bring him to one appointment before deciding that the potential benefit of the treatment did not justify the stress of repeated separation, especially considering Goose's strong attachment to dam.

Because of the second attack on Darwin and since it was necessary to carefully monitor Goose, the family group was confined to their forest shelter with planned forest time supervised by staff and interns for the next several months, until the infants were deemed big enough to not be susceptible to aerial predator attacks. Over the next several months Goose adjusted well to the atrophied leg. He developed a locomotion method which involved carrying the limb flexed, using it as a counter balance and a crutch. Although Goose maintained toe grasping and the ability to hold up the leg, no further improvements were seen after the final acupuncture treatment. Despite his handicap, Goose was able to maintain a normal activity level, running, jumping, and climbing fairly normally with the rest of his family.

Chapter 5: Amputation

October 2015 saw many significant changes in Goose's condition. On October 3, staff noticed the beginnings of a callus developing on the left knee. Within 20 days this small patch of missing hair turned into a wound with multiple layers of tissue showing, including a small circle of white in the middle. After a visit to the veterinarian, the white spot was determined to be the tendon sheath and treatment of a flexible aerosol bandage began. Unfortunately this treatment was unsuccessful as it was easily rubbed off on surfaces and was seen licked off by the lemurs as well. Five days after the appearance of the tendon sheath it was worn further, revealing an open wound. Goose and a companion, older brother Moose, were moved from their forest home to a more controlled environment in an indoor building room.

After another veterinarian visit on October 28, treatment changed to cleaning with chlorhexidine scrub, applying a liquid bandage, then applying a non-adherent pad followed by a Coflex bandage or vet wrap. There were two potential goals with this method. Goal one was if Goose left the bandage alone then we would initiate the use of Biodress (or a similar product) to promote wound healing. Goal two was if Goose did not leave the bandaging, we would continue to apply the liquid bandage until a callus formed. Goose was quick to show that he was not going to leave his bandaging alone, leading to staff intervention daily to capture, restrain, and clean and dress the wound. Despite the best efforts of the staff, eight days later on November 5, severe infection set into the wound.

Staff decided to restrict Goose to a large kennel and send Moose back to his group to ensure easy capture and treatment. The crate was outfitted with a plush pillow pet and blanket for maximum comfort. Clindamycin was prescribed as an antibiotic and basic wound care continued daily while staff awaited a surgical specialist to amputate the limb. For seven days a large amount of purulent matter was removed from the wound daily prior to being flushed with chlorhexidine or hydrogen peroxide. As a result of the infection, Goose also began to lose his appetite. Staff once again created a food log for him and recorded all food consumed daily while starting him on dexamethasone to increase his appetite. There was a marked increase in food consumption after starting the dexamethasone treatment.

On November 17 Goose was taken to Coastal Veterinary Surgical Specialists, Inc. for his amputation. Dr. John Kirsch performed the operation, completing a mid-femur amputation of the left leg, trimming the muscle and skin appropriately to create a tissue pad. Goose remained in his crate for two days following the surgery to ensure he was resting comfortably. Goose showed an immediate improvement in his overall

disposition, perking up, moving around, and vocalizing more just one day after amputation. Staff observed anxiously when two days after the surgery Goose was released from his kennel into the larger indoor room where he would have the space to move around and adapt to his new condition. Goose quickly showed the staff that they had nothing to worry about by moving well on all surfaces including branching, tables, crates and the ground. Movements even appeared better than before the amputation.

One week after surgery LCF's veterinarian Dr. Holifield was impressed with Goose's progress, saying the amputation site looked extremely well and there was no edema, erythema, or drainage. Dr. Holifield noted that Goose was compensating very well post amputation and was much more active, significantly brighter, and more alert. Following his exam, Dr. Holifield also gave the all clear to giving Goose outdoor access. The next day staff opened the outside shift door and allowed him to go out for the day. Goose played and explored outside for over two hours, investigating his neighbors and having no trouble moving along branching or through vegetation. Staff continued to give him access outdoors until December 2, when he completed his antibiotics and had his stitches removed. Following the removal of his stitches, Goose was equipped with a radio collar and brought back to his family for a reintroduction. The family once again readily accepted Goose back into the group.

Chapter 6: Epilogue

After about a week of acclimation, the family group, including Goose, was released from their forest shelter and allowed to free-range once again. Observations by staff and visiting researchers confirmed very little difference in behavior, locomotion, and distance travelled between Goose and his twin brother Darwin. In fact, data collected by Eastern Kentucky University students the week following Goose's release into the forest, showed that Goose was able to keep up with his social group, reach the highest level of the canopy, and was playing and exploring at similar rates to his twin sibling.

Over a year after his initial injury, Goose continues to thrive in his free-ranging habitat, seemingly unhampered by his missing limb. While still smaller statured than his twin, staff have noticed Goose becoming more barrel-chested, possibly developing from using his arms more to compensate for his missing leg.

This year staff also implemented a new husbandry routine for this ring-tailed lemur group, using an overhead tunnel system to shift them from the forest to the main building for overnight shelter. The hope is that by bringing the family in overnight they will not be out in a possibly hawk susceptible area in the early hours of the morning, when all of last year's attacks occurred.

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Appendix: 2015 Timeline

June 16: Original Injury

June 20 – July 13: Acupuncture treatments

July 6: Darwin injured; Darwin and Goose housed together

July 8: Goose & Darwin re-introduced to family group in forest shelter

July 21: Group given supervised access to forest

August 9: Another potential hawk attack; group locked in forest shelter

October 3: Callus on knee starts to develop

October 18: Group given access to forest

October 28: Goose & Moose moved to inside shelter to monitor and treat knee wound

November 17-19: Amputation and recovery in crate

November 19: Released from crate into inside room

November 25: Given access to outdoor enclosure

December 2: Reintroduced to group in forest shelter

December 10: Group given forest access

A Syringe Full of Banana Helps the Medicine Go Down: Syringe Training of Captive Giraffe

By
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Presented by
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Introduction:
At Lion Country Safari (LCS) in Loxahatchee, FL, a parasite known as *Haemonchus contortus*, which feeds on the host's blood while residing in the abomasum of ruminants, is prevalent in the pastures where the giraffes are housed. Severe infestations could lead to anemia, "bottle jaw" and even death in the infected animal if left untreated (Leite-Browning, 2006). A combination of the sub-tropical climate being favorable for *H. contortus* development, a learned, unnatural grazing behavior and resistance to standard de-worming medications previously made this resilient parasite difficult to manage. However, through the use of both proactive and reactive measures, changes in the management and treatment of the giraffe herd have minimized the severity of infestations and the health risks associated with it. Moxidectin is the only de-wormer found to be effective in killing *H. contortus* parasites at LCS. (Kandrac, 2011). Oral moxidectin, currently prescribed in the form of Quest gel, has been shown to have a good success rate in the treatment of this parasite and is the preferred treatment over its topical and injectable counterparts by our veterinarian. This medication however has three negative attributes that initially prevented it from being easily administered: it has an unpleasant taste, strong odor and is prescribed in large volumes. Some giraffe were hesitant to consume even a pea-size amount hidden in their diet. Those which did not refuse required a large amount of food to disguise the scent and flavor of a treatment that already requires a large quantity of medication. Caregivers were left with few options and no safe way to deliver medication if the giraffe refused to consume it. LCS does not have a giraffe restraint device to aid in forced oral medication delivery and has a philosophy of favoring positive reinforcement techniques to encourage voluntary participation in veterinary care and procedures. While this behavior was predominantly trained to ensure oral moxidectin medication could be delivered in the event of a parasitic infestation, the behavior is not limited to any specific oral medication, and other medications have been successfully administered.

Training:
To begin oral syringe training, first establish a station. This is where all initial training will occur and the location from which the animal will eventually be medicated. Reinforce the giraffe for standing on the station. Next, desensitize the giraffe to the sight of the syringe by holding the syringe in one hand while reinforcing with the other. We use a 60mL catheter tip syringe which allows for the large volume and thick consistency of the medication. To help the giraffe get used to the feeling of a large syringe in their mouth, and further the desensitization process, feed cut up pieces of reinforcement off the tip of the syringe. Once the giraffe is eagerly taking food off the syringe and doesn't negatively react to the syringe tip being in their mouth, progress to holding reinforcement in one hand and the syringe in the other directly in front of the animal's lips. In approximations, hold the reinforcement in a fixed position, and move the syringe closer and closer to the animal's mouth until it is touching their lips, then deeper into the mouth until the syringe is inserted into the back cheek area. The syringe should be positioned straight back, not on an angle, which might cause the contents to be squirted out the opposite side of the mouth. Next introduce mashed contents into the syringe which are known to have a pleasing flavor. Using the same syringe-reinforcement positioning begin squirting small amounts into their mouth/cheek letting them initially taste the contents. Once the animal does not react to the squirt, continue to increase the

amount delivered into the mouth from ¼ to ½, ¾ to a whole syringe in successive sessions. Before advancing to each level you should successfully be able to deliver the syringe's contents into the giraffe's mouth in one squirt at a normal to fast speed without any reaction. Throughout the training process possible negative reactions that we have encountered are turning or pulling the head away, backing up, not letting the syringe be inserted into the mouth, spitting out the syringe contents, walking away or having an unwillingness to participate. If any of these reactions occurred we slowed the training speed and spent more time on each step until there was no longer a reaction. Once able to completely deliver the entire syringe contents in one fast squirt with no reaction we started to increase the length of time in between the squirt and the reinforcement to encourage the giraffe to swallow the syringe contents until eventually reinforcing after the swallow. This helped to ensure the giraffe's first reaction is to swallow when medicating. Also, the contents are randomly delivered between the first, second and third time the syringe is inserted into their mouth to prevent anticipation of the squirt. From this point training was considered complete and if stable the contents of the syringe could be replaced with oral medication once required and prescribed by the veterinarian. The whole process on average took about 2 weeks to a month to completely train per giraffe before medication could be successfully delivered. The behavior was also cross-trained between all giraffe caregivers and was shaped to allow the contents of the syringe to be both cold and room temperature to allow for variation in possible medications.

Maintaining & Medicating:

Giraffe are trained using a 60mL syringe filled with 50mL of mashed banana. Banana is the easiest to puree, squirt without clogging issues, and closely mimics the sound the actual medication makes. Future alternatives we aim to try are mashed sweet potato, apple sauce and canned pumpkin. However syringe contents are just as important as reinforcement so time and testing is needed to ensure training doesn't cause regression. Also, giraffe were initially reinforced with 3-4 whole or halved bananas, but have since also been reinforced with sweet potato wedges, romaine lettuce hearts, and/or halved apple wedges in order to decrease banana consumption. Depending on the frequency in which the giraffe is medicated maintenance training varies between weekly or monthly and typically only takes 5 minutes per giraffe. However that training is rotated between all cross trained keepers. For example a giraffe that is trained weekly with four cross-trained caregivers will only require one session per month per caregiver. This increases the likelihood the caregiver will have time to participate in the training sessions and give flexibility in that the giraffe is not dependent on any one person being present to medicate. When medicating everything is replicated exactly as trained but instead of being filled with mashed produce, the syringe is prepared with only enough produce to fill the tip of the syringe to prevent medication from leaking out and to mask any smell, and then filled with the medication. By having the negative taste associated with the syringe and not the reinforcement, it is then easy to bring back the behavior because no trust was lost in the most important part of the training process, the motivator. After medicating, training sessions are done daily until the behavior is stable and consistent (usually about a week) using an abbreviated version of the above steps, and then returned to the normal maintenance schedule.

Learned Tips:

Throughout the training-medicating process we have learned that the station should preferably be next to an elevated platform which allows the giraffe's head and neck to remain outstretched rather than downward. This will prevent the eventual medication from "falling" back out when the giraffe's head is lowered. Secondly, we have found that our giraffe are calmer, less suspicious and have a greater willingness to participate if the station is also in an area of the exhibit where the animal is not restrained or confined (i.e. chute). We also have tried several variations in our syringe contents including air, water, juice, and mashed produce. Air alone did not allow us to desensitize the giraffe to the feeling of something squirted into their mouth and the important step of swallowing. Water and juice accomplished these goals but sometimes proved more difficult and slowed the training process for some giraffe that disliked liquid dripping out of the syringe prior to the squirt. Also water and juice did not produce the same force necessary to push the plunger and squirt the contents that the medication required. Using

mashed produce helped the animal care givers mimic the needed feeling or force for medication delivery and furthered our giraffe desensitization by producing a similar sound the medications make when squirting through the syringe. Finally, we experienced a difficult time in progression with one adult female giraffe on a single step: feeding cut pieces of produce off the syringe. While she would willingly come over and participate in training and eagerly eat whole bananas, once the banana was broken or cut she would no longer eat it and would walk away. It was assumed that after years of having medication hidden in her produce, once a banana was altered (in this case cut) she appeared to expect it to be tainted. By skipping this step and progressing to the next using whole produce she was successfully trained without any other setbacks.

Conclusion:

Establishing a positive relationship between animal and care giver creates opportunities to overcome previously difficult situations. Through training and positive reinforcement we were able to take administering medication from a negative and potentially dangerous endeavor to an acceptable, safe and successful procedure. These training steps have been used to successfully train, medicate and maintain a herd of 11.9 giraffe (*Giraffa camelopardalis*) ranging in age from 7 months to 17 years at the time of training. The same steps were also used to train a 1.0 dromedary camel (*Camelus dromedarius*) to accept voluntary oral medication demonstrating that it is possible to train a variety of animals using this same method. Once a relationship of trust is created with an animal many training goals can be accomplished with a plan and patience, even making a syringe full of medication go down.

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Sticking my Neck out for Giraffe, a keeper's journey to Africa to help conserve giraffe

Melaina Wallace, Animal Keeper
Disney's Animal Kingdom

After having worked with the Giraffe Conservation Foundation (GCF) from the States on World Giraffe Day projects as well as Longnecks for Longnecks fundraising events and having met Dr Julian Fennessy at Disney's Animal Kingdom (DAK), I was able to make the journey to Windhoek, Namibia to work with GCF first hand. My trip was a total of 2 weeks spent assisting GCF on all aspects of an NGO. I was able to spend some of the time working in the field establishing hiking areas for their new Environmental Education (EE) programme and surveying an area for a potential giraffe education centre. I also spent time working in the GCF office where the work is always on going. Running an NGO is a non-stop job and one that performs many aspects that many people might not think about.

The first week of my trip, August 1-8, 2015, I spent many hours working with Rachel du Raan, GCF Environmental Education Coordinator. We began by reviewing the EE curriculum the schools in Windhoek are required to work into their syllabus. The Namib Desert Environmental Education Trust (NaDEET) has developed numerous environmental education programs that supplement the standard Namibian curriculum and strengthen aspects of environmental education. GCF is establishing an EE program based on the NaDEET work. The GCF EE program, Khomas Environmental Education Programme (KEEP), will focus its attention on primary (grade 2-3) and secondary (grade 8-9) school children in the Khomas Region of Namibia. While all schools in the region will be welcome and encouraged to join KEEP, a focus will be placed on under-developed schools.

A large part of KEEP will be to get kids in the bush. We feel there is no better way to connect children with the environment and nature, than to bring them into it. Doing this requires finding a safe place for the children to hike that will also provide a diverse environment. During my trip, three locations were chosen to hike and evaluate the best possibility.

Rachel and I hiked Daan Viljoen National Park located just a short drive outside the city. Daan Viljoen offers already established hiking trails, bathroom facilities, and a nice flat area of grass shaded by large trees where the children can have a lesson, play a game and enjoy a provided lunch. The hike is ~3km and can be fairly easily navigated by children. A day prior to our visit, I hiked the trail with Julian and his family. His children, grades 1 & 3, were both able to hike the trail without issue. The trail uses a natural riverbed and has various habitats and ecosystem that can be used as tools in the field. The park is host to a lot of wildlife as well. While hiking we saw giraffe, zebra, oryx, eland, springbok, hartebeest, wildebeest, warthog, ostrich, and many other birds. The park is also close to a recycling plant and waterworks plant that could be used as side trips, time permitting.

The second area we hiked, River Crossing, is also close to Windhoek. There is however no designated trail already established. A trail could be cleared but this would take time and manpower. There are also currently no bathroom facilities for school groups; a lodge is on the property however in case of emergencies. There are no safe open areas for the children to play games. The hike was ~2km but gets

tough as it is not cleared and becomes steep in some areas. More breaks would be required along the way to allow the children to rest. The area provided limited habitat and ecosystem tools to use in the field and therefore the EE coordinator or teachers would have to carry and provide more tools. There is wildlife in the area, however it is a very large property and viewing of the wildlife is more of a challenge. This area is being considered for a possible giraffe education centre. If this project were to go through and the centre were built, then it would be an obvious choice for school groups. The area is far from the recycling and waterworks plants.

Our third location, Avis Dam, is located close to Windhoek. It is a popular place for locals to hike, bike and walk their dogs. The area provides plenty of open areas for a lesson, game and a provided lunch. There are no bathroom facilities. The established trail is 4.2km and is an easy hike for children. There are a number of habitat and ecosystem tools already available however wildlife is very limited in this area. The area is far from the recycling and waterworks plants.

After evaluating all three locations, we agreed that Daan Viljoen would be the best choice at this time. It not only gives a sense of adventure and excitement, but it obviously has more wildlife opportunities, more habitat and ecosystem tools, a safe and open space for the children and existing bathroom facilities. There is also National Park staff on location to assist encase of an emergency.

With a location chosen, Rachel and I hiked Daan Viljoen once more. We took along our lesson plans and google maps to assist in the planning of the day's hike. We marked the flat area of grass with shade trees as the location to be used for the beginning lesson plan and the area to hand out backpacks and water. The bathroom facilities are in this area as well which is ideal for the beginning and end of the hike. Along the hike we established areas to talk about key points of the learning plan. Some of these key points will also involve an activity, such as a debate game, therefore we chose areas that provide shade for the children. These areas would also provide a short break for the children where they can sit for water. We determined that Rachel will need to hike the area with the park warden at a future date to determine if it will need to be modified during the rainy season as the hike does follows the riverbed. A modification should be easy to manage as there is plenty of land on either side of the riverbed. At the end of the hike the children will either be bused back or will walk alongside the paved road to the open area location where the hike began. This location will once again be used for their lunch break, the final portion of the lesson plan and the final game within the lesson.

Having the lesson plan established before hiking proved to be ideal as we were then able to incorporate it into our hike. The EE program is currently applying for grants in order to establish the funds needed to get it up and running. Rachel and I met with the Ministry of Education and Tourism and gained their support in the program. The current plan is to do a test run with a class or two in October 2015 and begin the full program in January 2016.

The second week of my trip consisted of office time to work on all other aspects of an NGO. Dr Julian and Stephanie Fennessy have their hands full working on all of these aspects on a daily and sometimes nightly basis. The work never ends as

there are always proposals to write, grants to apply for, projects that need further work, conferences to plan, marketing, etc.

Julian was recently in the field as a part of a giraffe research project in Uganda's Kidepo Valley. In order to help establish giraffe populations within that area, ID photos were taken. Through these photos I have identified at least 9 adult females, 9 adult males, 3 subadult females and 2 subadult male giraffe. The ID photos have been placed in individual folders and will be printed and given to guides in the area.

My next project was to edit a plan for the GCF Giraffe Conservation Centre concept. The project is in the planning stages and will need the approval of the BOD. In order to best edit and add comments to the plan, Julian, Stephanie and I hiked the proposed area and discussed options and best plans for the centre. My skills as a zoo keeper were able to be used in this situation as well. I could offer advise on husbandry and training of giraffe that could potentially be a part of the centre. The centre would be an invaluable place for local Namibians, school groups and international travelers to learn about giraffe conservation. Again, what better way to connect people to a cause then to give them the hands on experience around it.

I have also had the opportunity to work on brochures to encourage citizens in science in the areas of Lake Mburo and Kidepo Valley. By using Giraffe Spotter, a website established and run by GCF, locals, guides, tourists, etc. can download photos of giraffe in these two locations and the coordinates of the location the giraffe were spotted. This information will be assessed by GCF in order to help determine giraffe numbers in these areas.

The Giraffe Indaba III will be held in South Africa in late August. GCF is very busy planning the Indaba and I was able to assist by making materials and reviewing the programme. I wrote a press release concerning the Indaba as well. This is a huge project taken on by GCF and held every 2 years. While it is a lot of work for the GCF staff, it has huge benefits for giraffe researchers and therefore the giraffe species.

Prior to the Indaba the Giraffe and Okapi Specialist Group (GOSG) will meet. To assist with GOSG, I compiled information and photos and uploaded them into the IUCN SSC Giraffe and Okapi Specialist Group website. This is a site that provides general information, conservation and threats, past/current projects, future projects and FAQ on giraffe and okapi.

In my last couple of days, I worked on writing grant proposals for the GCF EE program. The program's success will be dependent upon grant funding, so this is a very important aspect of the work that needs to be done.

Many of the aspects of an NGO were quite foreign to me. It has definitely been a great learning experience for me and hopefully I was able to provide much needed assistance for GCF. Julian and Stephanie definitely have their hands full, but are dedicated to this wonderful organization. They have a passion for giraffe conservation that is evident in the work they do. Being a giraffe researcher sounds like an exciting and glamorous job, and it is, but there is so much more to it then research in the field. The behind the scenes work that has to be done to run an

NGO is never ending, time consuming and can be very tedious work and yet they do it all and save giraffe along the way.

Thank you to GCF's Julian, Stephanie and Rachel for allowing me to join you in this great organization. It has provided me with new skills to take home and allowed me to see another giraffe subspecies. A huge thank you as well to Disney's Animal Kingdom for providing me with a week of professional leave and the American Association of Zookeepers for providing me with a travel grant. This has been an experience of a lifetime and my work with GCF will continue on in the States as I too have a passion for giraffe conservation.


Daan Viljoen

When a tiger roars in a forest and no one is around to hear it, does it make a sound?

Zookeepers learning to eavesdrop on tigers may answer this question while helping save the species

By

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Deep within the forest of Sumatra live a multitude of animals which rely primarily on vocal communication due to the dense vegetation blocking most visual confirmation. The Sumatran tiger (*Panthera tigris sumatrae*) is arguably one of the loudest animals in this environment, producing a call which can transmit several kilometers and reach up to 114 decibels (approx. 25 times louder than a gas-powered lawn mower.) Combined the various animal vocalizations could be likened to a symphony, each species being equated to a different instrument and adding a unique sound to the forest. This symphony, however, has had its instruments plucked one by one. Species have been disappearing at an alarming rate and as soon as 2020, the tiger could be one of them.

Since the early 1990s, tiger populations of all subspecies have plummeted by over 50% throughout their shrunken ranges currently only occupying 7% of their historic range (Seidensticker et al. 2001). Primarily responsible for this rapid decline is the growing illegal wildlife trade in various body parts from this species sold as health tonics and economic charms (Dinerstein et al. 2007). Habitat degradation and the increasing rate of prey depletion are also to blame. Functioning as a keystone species, all tiger subspecies indirectly manage forest ecosystems through prey control (Mills et al. 1993). The rapid disappearance of this keystone species is creating a measurable impact on the ecosystems they support and leaving researchers struggling to find a solution before it is too late.

Presently, most censusing involves humans actively tracking tigers on foot, looking for pug marks (commonly known as pawprints) (Sharma et al. 2003). These outdated tracking methods may cause more harm than good due to habitat invasion, disturbance and low efficiency (Karanth et al. 2003). Automatic cameras triggered by animal movement (a.k.a camera-traps) can provide more accurate information about tiger density, but here too there are inherent problems (e.g. tigers frequently cross a trap's path without a sufficient photo taken). Improved census techniques are essential and important for habitat protection and anti-poaching enforcement.

On the other hand, tigers seem to have no problem at all knowing exactly who and how many other tigers are in or near their territory (Leyhausen 1969). Scent-marking of territories as well as visual marking through use of claws determine boundaries and carry information relevant to the territory holder. Since both of these behaviors allow communication at relatively close-range, how do they communicate over farther distances? The answer lies in their diverse vocalizations. Tigers use vocalizations common to other felids, including growling, hissing, and snarling (Vratislav 1981). Outside of these common sounds, tigers produce a range of distinctive calls due to the unique anatomical adaptations of their species (Kelmuk et al. 2011). The distinctive calls are prusten, moans, true roars, and coughing roars (Ulmer 1966). A coughing roar mainly occurs during a close-range attack or fight. On the other hand, prusten, moaning, and true roaring occur exclusively in friendly circumstances such as greeting other individuals or searching for a mate (Peters and Leyhausen 1999).

What if instead of reinventing the wheel, researchers were to “hack” the tigers’ methods of communication in order to better understand and track their populations? The Prusten Project came into existence to answer this basic question by determining if individual tigers do have unique vocalizations perhaps correlated with sex, age, or other individual-related attributes which could lead to new methods of remote acoustic monitoring. But, how exactly do you record tigers when you have no idea where to find them?

This is where the use of zoos entered the equation. “Zookeepers are constantly looking for ways to contribute to conservation,” stated Tiffany Mill, Cat Keeper at the Erie Zoo. “We don’t just want to come to work and look at animals we love, knowing that one day there will be none left in the wild.” It was from this thought and many others like it that a database of captive tiger vocalizations begin to form within AZA zoological institutions. Facilities collaborated amongst each other by mailing Songmeter SM2s, a brand of recorder produced by Wildlife Acoustics, to each other to continue the chain of recording. Carl Moher, Animal Keeper II at the Dallas Zoo, pointed out visitors were “very inquisitive as to why the keepers were carrying a small green box during tiger shifting.” Many zoos took this as an opportunity to educate guests on the plight of the tiger by incorporating the research into their talks. The Downtown Aquarium of Denver displayed training signs, illustrating which tiger was being recorded that day and why. Erie Zoo’s Director, Scott Mitchell, took it one step further and invited local media in to learn about their zoo’s participation. Sumatran, Amur (*P. tigris altaica*) Malayan (*P. tigris jacksoni*), and Bengal tigers were each recorded for 72 straight hours before having their vocalizations processed by volunteers using a sound analysis program known as Raven Pro (http://www.birds.cornell.edu/brp/raven/ravenoverview.html).

The first portion of the study, focused on Bengal tigers (*P. tigris tigris*), showed the sex of members of this subspecies could be identified with over 90% accuracy by comparing the aforementioned characteristics. Distinct individuals could also be identified with 60% accuracy. This apparent complexity of tiger vocalizations could potentially enable a vocal “fingerprint” to be assigned to individuals, which, in turn would allow for vocal monitoring as well as censusing when using microphone arrays placed strategically over tigers’ home ranges. Although the study is still a work in progress with the other subspecies of tigers, the results have been promising thus far. “It has shown we need to think outside of the box and utilize what is directly presented to us such as vocalizations and sounds,” explained Carl Moher. “Every day, the tigers I work with produce a multitude of acoustics and I always wonder what each tone, frequency, and volume translates to.”

Acoustic monitoring such as this also has the possibility to contribute to conservation in many other ways. Lora Baumhard, Mammal Supervisor at the Dallas Zoo, points out it could “potentially help catch poachers, in addition to learning more about other species.” Once set up in a forest, the recorders are able to capture a multitude of sounds which collectively make up something known as a soundscape. The soundscape includes birds, amphibians, mammals, and of course poaching activity or illegal logging. An all-inclusive piece of equipment such as this could also revolutionize field research by allowing biologists to crowdsource their data, collaborating in ways never thought possible.

As The Prusten Project continues to work on protecting tigers in the field, the zookeepers who have made this research possible are also continuing to give a voice to the animals they care for. “Being able to share information with guests and other staff about how the animals they come to see and learn about help their wild counterparts means that I'm better able to do my job of helping bring awareness to the general public,” said Kristyn Hayden-Ortega, Animal Keeper at Topeka Zoological Park. Tiffany Mill also points out “it really hits home when the visitors can see the animals in front of them, and hear how one day they might not be able to.” The project has also provided professional development for the keepers themselves. “It afforded me an opportunity to bring an organization working with real-world conservation techniques into our zoo and allowed our resident tigers to contribute to a database of auditory recordings,” Jenna Schmidt, Carnivore Keeper at the Tulsa Zoo explained. “It has opened lines of communication to other keepers involved in the project, which has led to some great professional contacts and learning opportunities.”

Although the future may seem grim for many endangered species, zookeepers have shown hope for the tiger can arise from even the smallest of collaborations even if those collaborations occur countries away from the tiger's native range. "By using our resources that are available to us, we are able to potentially help save the species we all care and love," remarked Tiffany Mill. "With the right drive, anything can happen."

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Sending out a Tapir SOS: Connecting guests with conservation

By:
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Abstract
The Houston Zoo promotes a keeper driven initiative known as a Spotlight on Species (SOS) in which the staff is able to use creative approaches to achieve animal conservation and guest education. The Tapir SOS began from a passion for the often unknown and frequently misidentified animal in our collection. The main purpose of this Tapir SOS is to raise awareness of their existence and highlight the positive impact they have on their ecosystem. Funds are also raised during the events that are donated to the Tapir Specialist Group to assist with *in situ* conservation efforts around the world. The Tapir SOS is a two day event held over a weekend close to the celebration of World Tapir Day on the 27th of April. The whole event is a collaborative effort between many different departments including; keeper staff, education, conservation, marketing, volunteers, graphics, and many more. During the Tapir SOS, guests are presented with hands-on games and activities, merchandise, keeper chats and educational graphics. Hundreds of guests of all ages are engaged each day and roughly $2,000 was raised and donated during the last two years. The Tapir SOS has been a great way to connect our visitors with this unique species and the people working to save them in the wild.

SOS Overview
A Spotlight on Species (SOS) is a keeper driven initiative designed to educate guests and raise awareness about the plight of that species in the wild. The Houston Zoo has had many successful SOS events throughout the years. These events began as an internship project several years ago. It has now become a part of our culture and has been expanded to include the involvement of several departments within the zoo. Throughout the year the zoo has numerous SOS events to celebrate various species from lions to frogs.

Each SOS has its own feel and style due to the fact that they are organized by many different staff members with a wide range of interests and talents. Utilizing the unique abilities, training, and real life experiences of the staff is essential to a successful SOS event. The individual staff members each bring their own frame of reference and passion, which can help enhance the SOS guest experience. Learning from people that truly care about and have a love for the subject matter is certainly a plus. Many keepers not only have first-hand knowledge from working with the animals in their care, but perhaps even from seeing them in the wild or assisting with field research. Some staff members might be talented artists and crafters. Performers and gifted speakers are in the mix as well. The point is, the zoo's staff is a resource rich with talent and ability, ready to make a difference.

Some SOS events may focus only on education, with many hands-on activities, games, or puzzles. Getting guests to interact with and make a connection with the spotlight species. Staff

will be on hand to help guide the guests through the various stations with informational graphics and the knowledge to answer any question. Other SOS events will also add a fundraising element which will go towards supporting *in situ* conservation efforts. This can be accomplished with a simple donation box or there may even be a variety of items up for sale. However, all SOS events all have the same overall goal. This is to connect each guest with that unique species and foster an appreciation for them through education.

An SOS at the Houston Zoo has several steps to complete before the actual date of the event. These steps include, but are not limited to, an application, volunteer requests, graphic designs, public relations requests, education materials, conservation approval, etc. The process must begin at least eight weeks prior to the requested SOS date. These eight weeks are needed so other departments may have plenty of time to assist in the SOS. An SOS requires the help of many departments, but it all comes back to the keepers running it. Many emails and meetings are made with these departments to ensure a successful SOS.

The first Tapir SOS was done as an intern's project in 2011. This intern collaborated with a keeper to create a fun and educational event for guests. The 2011 Tapir SOS raised $215.00. This SOS was a single day SOS that was made as part of the intern's project that was done at the end of her semester. The Tapir SOS was not done again until 2015 by keepers from the Hoofstock Department.

Keepers are a key component of any SOS. Each individual is able to bring new ideas to the table and has specific assets that they may contribute. An SOS tends to focus on education and research, but it is essential for ideas for games and sometimes sales items to be taken into consideration. The Hoofstock Department has nine dedicated keepers that participate in three SOS events throughout the year. The leaders of the Tapir SOS were Mary Fields and John Scaramucci. Mary Fields has been a keeper in the Houston Zoo Hoofstock Department for over two years, since March of 2014. Before that, she had three years of volunteering and three separate internships with hoofed animals, including Baird's tapirs, and other species. Mary had the idea to create the current Tapir SOS in the summer of 2014; and worked on all of the paperwork, planning, and the creation of the sales items and the photo-op. John Scaramucci has been a keeper at the Houston Zoo for over 2 years and a full-time keeper for over 5 years. The relationship between zoos and conservation is one of his main interests, especially for tapirs. He was able to volunteer with the Lowland Tapir Conservation Initiative in Brazil in July of 2015. He spent 3 weeks with Patricia Medici and her team trying to capture and study lowland tapirs in the wild. This first-hand experience with *in situ* conservation is something that has been invaluable to the messaging and interactions with SOS guests. Obtaining the knowledge of how radio telemetry, camera traps, box traps, and GPS tracking is used in the field is one thing, but being able to share personal experiences with visitors adds another dimension.

Tapir SOS Goals

The Tapir SOS began from a passion for the often unknown and frequently misidentified animal in our collection. Hippo, anteater, pig, bear, and elephant are some of the most frequent

mistaken identities attributed to the tapir. The main purpose of this Tapir SOS is to raise awareness of their existence to the general public and highlight the positive impact they have on their ecosystem. It is hard to have people care about an animal that they didn't even know existed. Tapirs are certainly a keystone species and serve an important role as seed dispersers, which helps maintain a high level of biodiversity in the regions in which they are found. 100% of the funds raised during the event are donated to the Tapir Specialist Group to assist with conservation efforts around the world. The Tapir Specialist Group Conservation Fund aims to support the implementation of the recommendations of the IUCN/SSC Tapir Status Survey and Conservation Action Plan. The fund supports activities such as creating educational and marketing materials for *in-situ* and *ex-situ* education initiatives, giving small grants to tapir researchers to sustain their projects, and supporting vital meetings such as the International Tapir Symposiums where tapir researchers can come together in person to share information, strategize and plan for tapir conservation around the world (tapirs.org.2016).

Our Tapir SOS is a two day event held over a weekend close to the celebration of World Tapir Day on the 27th of April every year. These days tend to have a higher attendance and we were hoping to have as much of an impact as possible. The whole event is a collaborative effort between many different departments including; keeper staff, education, conservation, marketing, volunteers, graphics, photography, and many more. All of these departments came together to create an opportunity to connect our visitors with this unique species, and the people working to save them in the wild.

Tapir SOS Event Breakdown 2015/2016

The first outreach to the general public for the Tapir SOS each year was a blog. This blog included the date, activities, items being sold, and other general information about the SOS. The blog had to be approved through the PR Department. Generally, a photograph and some fun and educational facts were given in each blog to catch the public's attention. The 2016 SOS blog included information about Moli, the zoo's new breeding female, as a way to attract attention. These blogs are published on the zoo's web page and social media sites the week of the event.

The Tapir SOS includes seven stations for guests to interact with. These stations include several educational games, biofacts, a photo-op, and a sales table. The primary goal of an SOS is educating the general public about the species being promoted and how to conserve that species. Both staff and volunteers come together to make this two day event happen.
The Volunteer department has many dedicated volunteers that help with education, animal sections and SOS events. The Tapir SOS had two shifts of six volunteers for a total of twelve volunteers per day. The volunteers were given a handout with tapir information to prepare for the SOS. Volunteers could help with all seven stations, as long as one keeper is in charge of the cash box for the sales table.

Educational games provide a way to reach out to the younger guests at the zoo. Three games were used for the 2015 and 2016 Tapir SOS. The Graphics department created a tapir range map that guests had to match a tapir species to. This game helped guests figure out where

tapirs were from and how tapir habitat includes many different species other than tapirs. The Education department created two activities for the SOS. The first activity was a board game to help guests understand extinction and what humans are doing to the environment. The second activity from Education was an arts and crafts activity where tapir tunnels through the forests were created. This activity allowed children to “create tunnels” and “plant trees” like tapirs provide in the wild. The final activity was a way for our guests to enrich the tapirs. Keepers made several papier mache, or “tapir mache”, balls before the SOS dates. Guests were allowed to place their fingerprints on the tapir mache with non-toxic stamp pads. The tapir mache was tossed out at the second keeper chat of the day, which the guests were informed of.

The Houston Zoo has a great collection of biofacts available for educational purposes. Tapir, rhinoceros and equid biofacts were pulled from the collection for the SOS. The following biofacts were used, tapir skull, horse skull, rhinoceros skull, horse hoof, and zebra skin. Tapir tracking collars, tapir hoof prints, and camera traps were also used at this table. This table was manned by volunteers who had several cheat sheets available to them. The camera traps and tracking collars were added to this table as a way to display conservation and research done in the wild.

A large keeper made photo-op was set up at the end of the SOS, near the camera traps on the biofacts table. Keepers painted a large eight by eight foot photo-op for guests to pose in front of. The photo-op was called a camera trap to allow guests to be a part of an important way to research tapirs. “#SAVETAPIRS” was painted on the board as a way for guests to spread the word with others through social media.

Although educating guests about tapirs was the primary goal, an effort was made to raise funds for tapir conservation as well. Several items were sold at a sales table, including several handmade items. The items sold ranged from two to fifteen USD. The Houston Zoo's Conservation department makes bracelets with different species’ names on them. For this event, Conservation made green and white bracelets that said, “TAPIR” on them; these bracelets were two dollars each. The Houston Zoo’s Photography department provided professional prints of tapirs to create photo magnets for the sales table. These photo magnets were sold for three dollars each. Tapir painted magnets were made by our two tapirs and keepers. Keepers spread non-toxic paint and produce onto canvases for the tapirs to smear around with their noses. These canvases were then cut into individual segments for magnets to be attached to. The tapir’s name who painted it, Houston Zoo Inc, and the species name was written on the back so each guest knows what individual painted it. These painted magnets were one of the most popular items sold during these events and we're sold for five dollars. The final item was sold from five to fifteen dollars, depending on the size, and is commonly known as shrinky dinks.

Pendants, or shrinky dinks, were made by keepers out of recycled plastics. Tapirs and species that share the same habitat as tapirs were hand drawn on these pendent, then made into key chains, bracelets, and necklaces based on what the guest asked for. Throughout the year, Hoofstock keepers collected plastic number six for the Tapir SOS. Keepers created the pendants by drawing on the recycled plastic, cutting the pictures out and using a hole puncher

to create a hole for a string to go through. The plastic was then placed on a baking sheet and put in an oven at about 375 degrees until the plastic shrunk. At the SOS, guests chose if they would like the pendent made into a bracelet, key chain, or necklace; small pendants were five dollars, medium were ten, and large were fifteen. Species from the tapirs' habitat were depicted on the pendants as a way to demonstrate that tapirs are not the only species benefiting from this SOS. Guests were educated at the sales table about what species they benefit by purchasing or donating to the SOS.

Two chats with enrichment were done during each SOS day. Each chat was approximately fifteen to thirty minutes long and focused on conservation. Pictures and videos on a tablet were displayed to help guests understand the message. An ice pop made by the Houston Zoo's Animal Nutrition department was given to the tapirs during the first chat each day. The tapir mache was given during the second chat each day.

Guests had two options provided for donating to the SOS without purchasing anything. Throughout the month, a coin funnel was placed on zoo grounds by the Greater Houston Chapter AAZK that guests could donate to. A donation box was located at the SOS for guests to donate on the day of the SOS. A grand total of $1,784.99 was raised; $1,011.00 was raised for the 2015 Tapir SOS and $773.99 was raised in 2016. All proceeds were donated to the Tapir Specialist Group.

Looking Ahead

With hundreds of guests reached and over one thousand dollars was raised in just the past two years, the Tapir SOS is making a huge impact on tapir conservation. Houston natives are learning about wildlife and how they can be more involved in the natural world. The keepers and volunteers at the Houston Zoo will continue to hold an annual Tapir SOS for years to come. Future plans may include adding video recording with Tapir Specialist Group researchers, like Patricia Medici. We would like to involve more departments by having South American, Central American, and Malaysian all represented at the Tapir SOS. More publication through blogs, the news and social media may be used to get more guests to come specifically for the SOS. Finally, we may vary the games and activities for any returning guests from previous years. The Houston Zoo's Tapir SOS is still in its youth and has a lot of room to grow in order to connect even more of the public to tapir conservation.

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The role zoo's play in salamander conservation

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Smithsonian National Zoo

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Introduction

We live in the most biologically diverse region of the world for salamander diversity. The IUCN lists half of the world's salamanders as threatened or endangered, yet very few people know that roughly 1/4 of all salamander species occur within the United States and half of those occur within the Appalachian region, making it an extraordinary salamander biodiversity hot-spot and a priority region for salamander conservation.

In 2008, an Appalachian salamander conservation workshop co-hosted by the Smithsonian's National Zoo and the IUCN's Conservation Breeding Specialist Group was held at the Smithsonian's Conservation Biology Institute (SCBI) in Front Royal, VA. A multi-disciplinary team representing State and Federal agencies, Zoo's, Universities and Non-profit organizations examined the threats facing salamanders, prioritized them and identified conservation actions, which could be used to mitigate those threats. I would like to highlight two of these pro-active conservation actions, which include: 1) Managing species in captive breeding conditions and conduct experiments to help understand and mitigate the specific threats of climate change and emerging disease; 2) Educating the general public and local stakeholders on the ecological significance of salamanders and preserving a biodiversity epicenter in which we live.

Global amphibian populations are imperiled. A systematic global assessment of the conservation status of all 7,545 (Appendix 1) known amphibian species found that 42% of all non-data deficient species were in danger of extinction (Stuart et al. 2004). Salamanders are not spared from these declines and the IUCN lists 47% of the world's 686 salamander species threatened or endangered (Stuart et al. 2004). Surprisingly few people know that 25% of the world's salamander species are found in the United States (Appendix 2) and an estimated 14% of those are found strictly within Appalachia (Appendix 2), making it an extraordinary salamander biodiversity hotspot (Chippindale et al. 2004; Kozak et al. 2005; Young et al. 2004).

Salamander biologists have cause for concern with recent field observations showing steady declines due to the various threats facing salamanders all at once. One example from the Appalachian region is a series of long-term studies conducted by Dr. Richard Highton, which suggested that populations of 38 species of *Plethodon* salamanders have declined by 50% in the 1990's and the causes remain mostly unknown (Highton 2005). Salamanders are a unique feature of America's biodiversity heritage and out of the roughly 176 species occurring in the USA, the U.S. Fish and Wildlife Service (FWS) lists 13 of these as threatened or endangered (FWS 2008), while the IUCN lists 41 American species as endangered, threatened or vulnerable (IUCN et al. 2006). Given the uncertain status of many Appalachian salamanders, it is clear that a systematic examination of the potential threats to salamanders is in need and some pro-active conservation steps proposed.

The Smithsonian's Conservation Biology Institute (SCBI) and National Zoo co-hosted an Appalachian Salamander Conservation workshop with the IUCN's Conservation Breeding Specialist Group in May of 2008 to try to address some of the important issues. A multi-disciplinary team of 35 experts representing federal and state agencies, Zoos, universities as well as non-profit organizations was asked to identify potential threats to salamanders in the Appalachian region, prioritize them and identify conservation actions, which could be taken to protect this unique feature of America's biodiversity. The group prioritized climate change, pollution, residential development, energy production and mining, invasive species and disease as the top threats facing salamanders in the region. While everyone agreed these threats might severely affect salamanders, they acknowledged that very little was actually known about

how salamanders might respond to projected changes in weather conditions, the effects of endocrine disrupting chemicals or disease such as chytridiomycosis. This uncertainty makes these issues a priority for research. Based off this list of prioritized threats, some pro-active conservation actions were identified for the region, they include: 1) Mapping species distributions to identify high conservation value land for salamander conservation; 2) Improving management of invasive species and diseases; 3) Managing species in captive breeding and conducting experiments to restore habitat and populations of salamanders; 4) Educating local residents to highlight how important and unique salamanders are and identifying ways in which they can change their own behavior to help salamanders; 5) Improving legislation to encourage responsible use of agrochemicals and endocrine disrupting chemicals, restricting residential development in high conservation value land, mitigating climate change and reducing the extent and impact of mountain-top removal mining practices; 6) Engaging with other organizations such as Partners for Amphibian and Reptile Conservation (PARC) as well as potential funding partners and researchers to build capacity and interest in salamander conservation.

At the Smithsonian's National Zoo specifically the Reptile Discovery Center (RDC), we felt that trying to address conservation actions three, four and six were within our capacity. The Association of Zoos and Aquariums (AZA) Amphibian Taxon Advisory Group lists 12 Appalachian salamander species as priorities for ex-situ conservation (Crump and Grow 2007). The first step in addressing action #3 was to create space. One of the RDC's largest storage areas was converted from a behind the scenes graveyard of glass aquariums and light fixtures into a 40 ft. x 20 ft. temperature controlled exhibit/ holding area for Appalachian salamanders and salamander research. Since 2012, the staff at the reptile discovery center have hosted and collaborated with Post doctorate Smithsonian Fellows, National Park Service, United States Geological Survey, State of Virginias department of wildlife, and various Universities on Appalachian salamanders in what we call our "Salamander lab". The lab is on display to the public and has informational graphics illustrating the threats facing salamanders today. The major collaborative projects to date have been; the cryptic impacts of temperature variability on amphibian immune function in Eastern hellbenders, assessing climate change effects on competitive interactions of the federally endangered Shenandoah salamander, (*Plethodon Shenandoah*) and various other observational and behavioral studies.

The Smithsonian's National Zoo receives over 2 million visitors per year. The RDC is one of the most visited areas within the Zoo so there is an opportunity to educate visitors and local stakeholders

addressing action # 4. To begin that process a series of multiple-choice surveys conducted during the height of the Zoo's busiest visitation season. The questions included; Which of the following are true about salamanders, in what types of habitats do salamanders live, in what part of the world would you find the most variety of salamanders, which of the following do salamanders eat, why are salamanders important, what do you think might be threatening salamander populations, how do you feel about salamanders, which of these animals is most closely related to salamanders (Appendix 4)? The results were not surprising, although 17% of visitors said they "loved salamanders", 65% said they found salamanders interesting. Most visitors knew what a salamander was but did not know what habitats they live in or in what regions of the world they were found or any real specific information about salamanders. This data was used to establish an interactive ID panel and exhibit messaging with a focus on addressing the "gaps" in we saw through the surveys. The messaging focused around a new state of the art mixed species Appalachian salamander exhibit. Through donations, grants and a very active volunteer led fundraising campaign, the reptile discovery center opened, "Jewels of Appalachia" in December 2015. The exhibit is 8 ft. x 5 ft. x 2ft. and constructed as a giant rock seepage wall. There are currently 16 salamanders living together representing four species; Green salamander (*Aneides aeneus*), Two- lined salamander (*Eurycea bislineata*), Long-tailed salamander (*Eurycea longicauda*), and Cave salamander (*Eurycea lucifiga*). There are two or three other species, which are candidates for exhibit in the future. Throughout the busiest times of year, RDC's docent interpreters are strategically placed near the exhibit with flashlights helping visitors find the salamanders while also educating them on the importance of salamanders to our ecosystem. The exhibit and educational graphics are only one aspect of the captive collection. In off exhibit holding, the staff are raising up juvenile salamanders as well as setting up breeding tanks to explore breeding of plethodontid salamanders and learn about salamander behavior and husbandry. To date, most of this information is unknown and is crucial to understanding and learning what we can under captive conditions where we can observe salamanders up close.

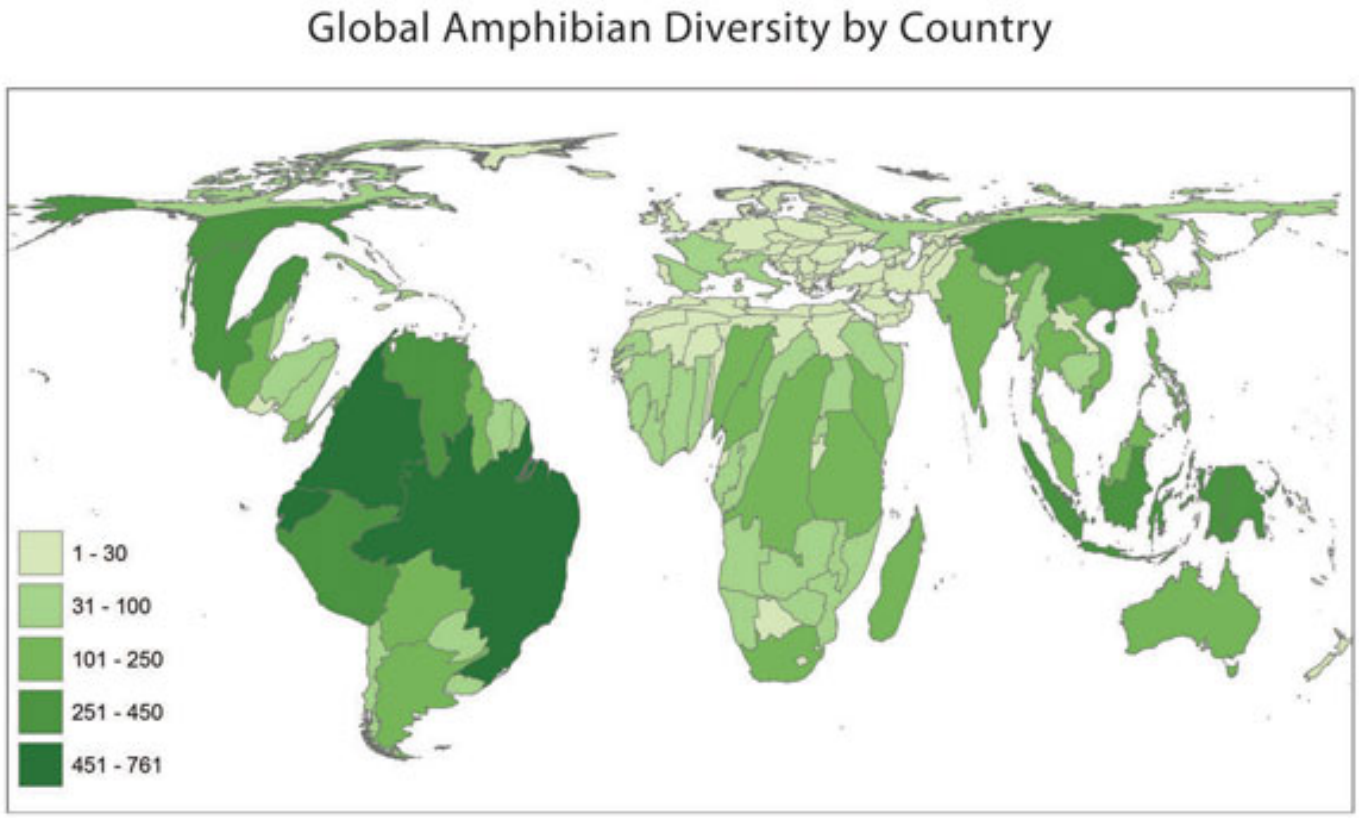
Around the country and in particular around the Appalachian region, Zoos are participating in salamander conservation. Knoxville Zoo has been assisting the Tennessee state wildlife agency since 2008 in field surveys for the Common Mudpuppy (*Necturus maculosus)*. This year the group reported a probable new species that is confined to one particular river drainage. The Jacksonville Zoo in coordination with the Memphis Zoo and the Coastal Plains Institute have collaborated on a conservation strategy for the striped newt (*Notophthalmus perstriatus)*. Due to its perceived extirpation from Florida, this group has worked to release captive-bred offspring into designated recipient wetlands in Apalachicola National Forest to reestablish historical populations. Since 2013, 1,188 newts have been released. Finally, the Amphibian

Conservation Program at the Atlanta Botanical Garden (ABG) has taken on A very ambitious project. The team at ABG collaborated with the USFWS and the USGS to develop a salamander recovery initiative for flatwoods salamander (*Ambystoma cingulatum)*. This plan consisted of *ex situ* captive breeding and experimental release. In 2016, the team at Atlanta Botanical Garden successfully reproduced and have raised up larval flatwoods salamanders for the first time to the release stage.

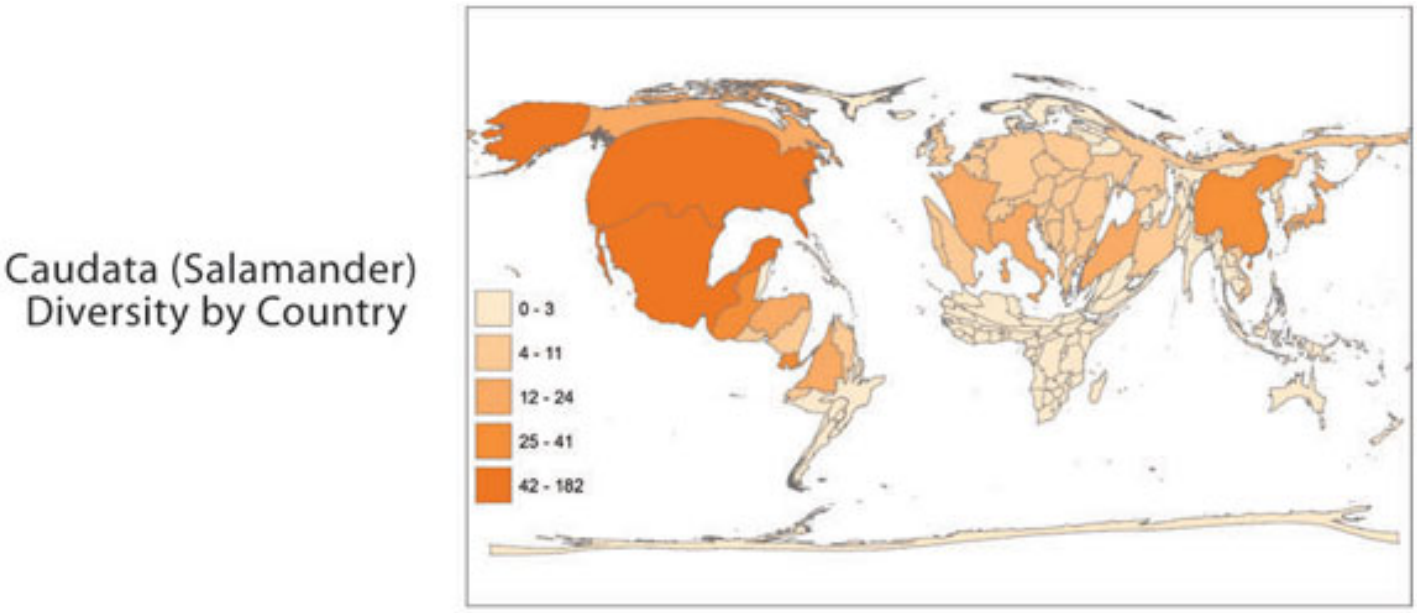
Zoological institutions can play a pivotal role in salamander conservation through many different avenues. Many zoological staff have extensive biological backgrounds in field biology and husbandry. Zoos are regularly working with state and local wildlife agencies on conservation initiatives and have capacity for projects *in situ* and *ex situ*. I believe Zoos to be an untapped resource for collaborative projects especially as it pertains to sensitive amphibians in need of conservation action.

Appendix 1:

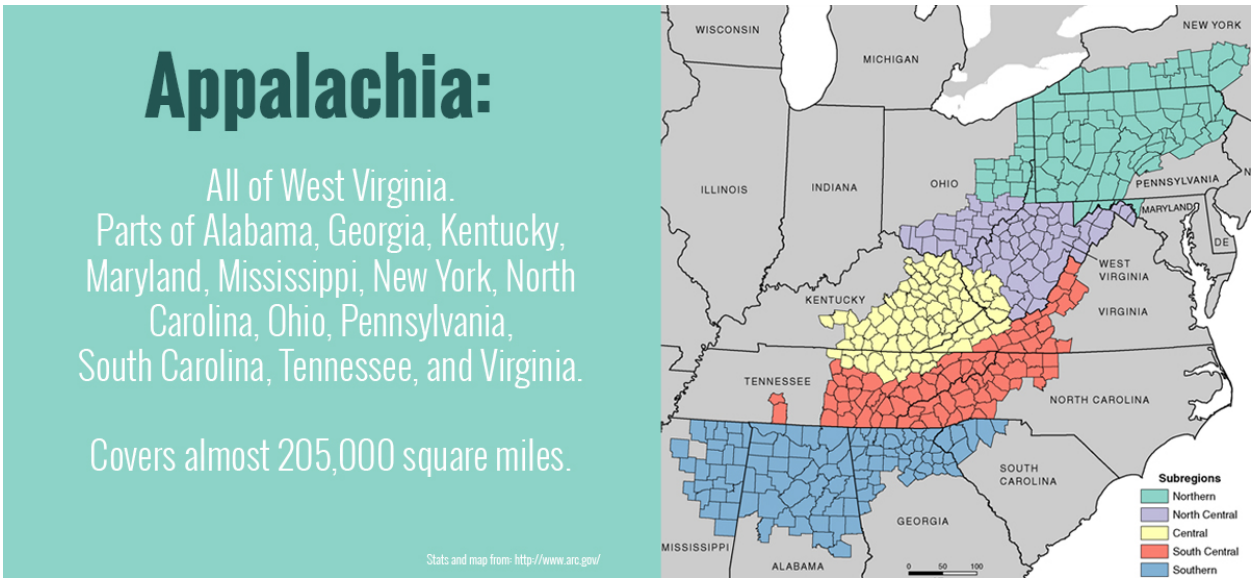
This density equalizing cartogram of the continents displays largely and boldly the most diversely concentrated regions of amphibian diversity (Wake 2016).



Appendix 2: This density cartogram shows the heavily biodiverse countries largely and boldly, specifically for salamanders (Wake 2016).



Appendix 3: This map highlights the specific areas, which make up Appalachia



Appendix 4: This is the complete eight-question survey about the national Zoo's visitor knowledge about salamanders with the corresponding results.

Which of the following is true about salamanders?

They need air to breathe	75.8%
They spend their entire lives in the water	4.5%
They are venomous	4.5%
They have four legs	69.7%
They have scales	16.7%
None of the above	3.0%
I don't know	12.1%

In what types of habitats do salamanders live?

Rocky coasts	30.3%
Grasslands	27.3%
Swamps and marshes	63.6%
Temperate forests	39.4%
Tropical forests	56.1%
Deserts	16.7%
All of the above	12.1%
None of the above	0.0%
I don't know	16.7%

In what part of the world would you find the most variety of salamanders? (pick one)

Asia	21.2%
South America	42.4%
Africa	3.0%
Europe	1.5%
North America	18.2%
Australia	6.1%
I don't know	18.1%

Which of the following do salamanders eat?

Small rodents	21.2%
Worms	40.9%
Algae	28.8%

Insects	77.3%
Mushrooms	19.7%
Decaying animal matter	39.4%
Decaying plant matter	22.7%
All of the above	15.2%
None of the above	1.5%
I don't know	13.6%

Why are salamanders important?

They pollinate aquatic plants	13.6%
They are indicators of environmental health	53.0%
They are important for medical research	19.7%
They control insect populations	53%
Like other species, they play an important role in their environments	63.6%
I don't know	12.1%

In the United States, salamander populations are dropping. What do you think might be threatening the salamanders?

Their habitats are being destroyed	75.8%
People take them from the wild to keep as pets	40.9%
They are preyed upon by cats	28.8%
There's less rainfall than there once was	36.4%
The climate is becoming too warm for them	27.3%
I don't know	6.1%

How do you feel about salamanders?

They're slimy and gross	6.1%
I don't care either way	9.1%
They're interesting	63.6%
I LOVE salamanders!	16.7%
I don't know	4.5%

Which of these animals is most closely related to a salamander?

Frog	57.6%
Eel	3.0%
Worm	3.0%
Lizard	33.3%

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Conservation from Scratch: Where to start?

A Case Study (Paper)

By

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Abstract

Columbian Park Zoo was founded in 1908 and has seen many renovations and paradigm shifts throughout the years. The most recent focus has centered on conservation. In the fall of 2014, several Zoo staff members began discussing the need and importance of a conservation committee at the Zoo, and the important role that it could play to better help animals in the wild. The committee was formed by animal care and education staff who all shared an equal passion and dedication for conservation. This group laid the groundwork for the conservation programs that are now at the Zoo.

Smaller facilities such as Columbian Park Zoo may oftentimes find it difficult to develop a strong conservation program because of limiting factors such as staff resources, time, and budgets. This case study will outline how a six-acre, municipally-owned zoo tackled some of those challenges and created a group that continues to keep Columbian Park Zoo at the forefront of local and global conservation initiatives.

The newly-formed committee worked diligently over several months developing, designing, and refining the mission of the group and the "hot topic" conservation issues. This work has yielded corresponding special event days, fundraising for external projects, community outreach programs, staff field experiences, and incorporation of conservation education throughout current educational programming and interpretation. The committee developed new community partnerships, provided valuable staff experiences and training, and sponsored many successful special event days, leading to an increase in conservation awareness and action in the Greater Lafayette Community.

Introduction

Zoos and aquariums have become increasingly more focused on wildlife conservation and have elevated the field to become leaders in many global initiatives. Many of the institutions spearheading these initiatives have household names such as the St. Louis Zoo and Disney's Animal Kingdom. In this new game of giants, where do the little guys fit in? This following case study outlines how a small, municipally-owned zoological facility worked to meet that challenge and grapple with many of the limiting factors such as minimal staff, funding, and physical resources.

The Columbian Park Zoo, located in Lafayette, Indiana, was founded in 1908 and has undergone many paradigm shifts and cultural norm transitions. The Zoo is a municipally-owned and operated, six-acre, non-AZA accredited facility that has housed everything from large carnivores and an elephant all the way down to the smallest of amphibians. The most recent undertaking for the Zoo has been embarking on a

new master plan project which will culminate in accreditation by the Association of Zoo and Aquariums. The project saw the Zoo close in 2004, and everything on grounds, aside from one historical building, was demolished. The next three years was focused on laying the ground work for the new zoo. In 2007, the Zoo opened its doors again to the anxious public with a few of the new exhibit areas. Over the course of the next several years, the Zoo saw continued expansion with addition of more exhibit areas, interpretive space, and an education center.

In the early years of the new Zoo, attention was focused on designing new exhibits, improving the animal programs with enrichment and behavioral conditioning, and increasing the capacity of the education department. The Columbian Park Zoo employs four full-time animal care staff and two full-time education staff. The Zoo is also staffed with three part-time year-round animal care staff and one part-time year-round education staff. During the open season, the Zoo also employs approximately 15 combined animal care and education staff that work tirelessly to staff immersion style exhibits and offer many educational and interpretation programs throughout the season.

In addition to seasonal employee help, the Zoo survives on a daily basis with a variety of volunteer help including interns and regular volunteers. These unpaid staff account for approximately 14,000 labor hours annually. The very limited staff was kept busy focusing on these tasks and supervising support staff which unfortunately, didn't leave many resources to address other issues such as conservation programs. As the Zoo improved on many levels, it became apparent that more focus needed to be placed on new conservation initiatives and working on becoming a leader of the next generation of conservation.

Purpose

The purpose of creating a conservation committee at the Columbian Park Zoo was to better integrate conservation into organizational operations and culture at the Zoo and improve community awareness, attitudes, and behaviors related to local and international conservation issues. This committee needed to navigate limited funding, staff time, and the local attitudes towards conservation. Each of these hurdles was approached from various angles in order to design and deploy all conservation programs at the Zoo and within the local community. This case study briefly details the committee's endeavors to keep conservation at the forefront of daily operations and long-term planning.

In the Beginning

It all started with a discussion and an opportunity. Several staff members began discussing the importance of conservation and brainstorming ways on how to establish a conservation program. How would such a small zoo with very limited resources such as funding, staff, expertise, and space tackle a seemingly large project as designing a conservation committee to address the needs of the institution and ensure that the Zoo is still accomplishing its mission? These discussions came at a time when a unique opportunity was presented to the Zoo to participate in an on-going recovery program within Indiana.

A committee was formed consisting of representatives from animal care, education, and marketing. Each individual represented different departments with various backgrounds and skills. It became an important aspect to have committee members with skills in fundraising, interpretation, education, animal care, marketing and social media, just to name a few. This newly-formed committee would be responsible for laying the groundwork for the entire conservation program at the Zoo.

The committee quickly agreed upon using a concept termed a “hot topic.” These “hot topics” were focused, relevant, single conservation issues and would serve a better role in determining how resources were divided. These topics would also provide the Columbian Park Zoo a better onboarding platform for staff and volunteers that had varying, often low, levels of conservation awareness and current ecological issues. The “hot topics” provided a lens for the committee when developing frameworks and future campaigns.

Once it was established that resources would be applied to two main conservation campaigns per year, it was agreed upon to highlight one international and one domestic conservation “hot topic”. Each “hot topic” would be voted upon by committee members before being presented to Zoo administration for approval. These “hot topics” would then shape the outreach and education efforts as well as the fundraising efforts of the Zoo.

It was shortly after the development of the “hot topic” idea that a unique partnership presented itself, making it a natural first hot topic. The Columbian Park Zoo would be the temporary home of three, state-endangered Eastern hellbenders that would eventually be released back to the wild in hopes of bolstering their wild populations in Southern Indiana. This project was hosted at the Zoo in cooperation with a local university, Purdue University. It was decided that a conservation campaign was going to be developed around these three animals to include a dedicated school outreach program and a special event day.

The committee would also assess current practices on an ongoing basis to identify best practices and potential areas for improvement with the overall purpose of reducing the Zoo’s ecological footprint. Areas that were identified as important areas were recycling and composting, waste reduction, water conservation, energy conservation, environmental impact of chemicals, and sustainable and local sourcing of products.

Many discussions took place during the initial planning stages to determine and develop a framework within which the committee would work. This was the most time consuming step but the most critical. This would allow future projects to be efficiently designed while still meeting the committee’s goals.

The Blue Sky and Storytelling

Now that a committee was formed, a framework in place, and first set of topics agreed upon, where does the process go next? Since humans are hardwired to remember information told to them in a story format regarding concepts and ideas that relate to them in some way, it was onto storytelling time. The next step employed a technique called Blue Sky brainstorming. During these sessions the committee would gather and toss out any ideas associated with the topic being discussed. No idea was bad or not worth doing. This allowed everyone to have a part in the session and spurred many interesting discussions that morphed into fantastic ideas.

Once all ideas were mentioned, they were reflected upon. Then a separate meeting was held to begin to determine what story was to be told for each conservation campaign. These stories were crafted in such a way that each “hot topic” was related back to something that local community members care about in a simple big idea statement. In the case of the hellbender topic, it was lawn care. Creating a healthy yard can lead to healthy hellbenders in the wild. That campaign was targeted at decreased yard chemical use and increased permeable space to decrease water runoff.

Once each topic's story was crafted for the year, it aided the committee in developing programs and experiences that fit within that framework. It guided all educational and interpretation programs as well as field experiences for staff, keeping everyone focused and on the same page.

Program Development

Once topics and plans were in place, it was time to start designing all the brand new programs. The committee looked to design robust program campaigns for each "hot topic" involving on-grounds interpretation and education, integration into existing education programs when appropriate, community outreach, fundraising, media awareness, and staff field opportunities when available. Months of planning and work went into each "hot topic" and many of the first stages were exploratory. Since many of the programs were brand new, there were tiers of approvals that were needed to proceed further. Once this trail-blazing was complete, the committee would be able to be more efficient in future years.

Conservation Days would be special events hosted at the Zoo, related to various topics. Some topics included hellbenders and watershed quality, palm oil, and World Ocean's Day to name a few. Community partners were invited to a few key days and delivered family friendly activities that focused on the purpose of the event.

Fund Development

The new programs would need financial support and the committee was tasked with securing that additional funding. Fund development was known from the outset as being of importance. The Columbian Park Zoo is a free admission zoo and is operated on a small budget. There were limited funds available from the annual budget to aid in developing and deploying any additional animal or education programs. One committee member had experience in grant writing and some minor experience in fund development.

Special interest grants and local sponsors were approached to secure funding for a variety of new projects. Several very generous community sponsors aided the committee in realizing some of its goals. An additional conservation funding source was identified in the Zoo's gift shop. The committee approached the administration with the goal of raising money in the gift shop from small donations associated with daily sales transactions. A program called "Conservation Round-Up" was adopted and patrons were asked to round up their sales purchases to the next whole dollar. This was later amended to ask for one dollar donations at the end of each transaction. This method of fundraising proved to be very successful. The amount of money raised via gift shop donations was to be given to outside organizations for field conservation. This furthered the committee's reach for conservation and supported additional projects outside of the Zoo.

Conclusion

The Columbian Park Zoo saw the formation of its conservation committee in a unique way and it has shaped how the Zoo views conservation and how it participates. Since a small zoo has limited resources, it must begin to think outside the box in how it participates in conservation. The Columbian Park Zoo has focused on partnering with other organizations such as local universities and nonprofits that already have existing programs and has been able to increase education and interpretation of those projects at the Zoo.

As with any undertaking of this kind, many limitations were addressed and continue to be addressed as the committee blazes new ground and continues to develop new “hot topics” and programs. Some challenges were overcome while others are still being addressed. In the future, the committee plans to continue addressing different “hot topics” and aid the Zoo in becoming a recognized leader of conservation with the local community and region.

TURNING PASSION INTO REALITY:
Conservation of Amur tigers one tree at a time

By:
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Statement of the Problem:

Amur Tigers (*Panthera tigris altaica)* are an endangered subspecies of tiger found in the Russian Far East. There are many factors influencing the population including habitat destruction, illegal wildlife trade, and lack of sufficient prey.

The biggest threat to the Amur Tigers in the Russian Khabarovsk Province is disposable chopsticks! The region is continually logged, sometimes with government approval, and the lumber exported to China and elsewhere for manufacture into disposable chopsticks and well as other uses. These three species of native trees, Manchurian Oak, Manchurian Walnut, and Korean Pine are logged without replanting thus decimating the forests which the tigers depend on because their prey, usually wild boar, deer, and other mammals depend on the leaves and fruits of the trees to survive. If the prey cannot find food they either die or move away. The same consequences impact tigers, they die, or they move and/or get into conflict with humans and domestic animal in order to survive. This region is prime tiger habitat: it is sparsely populated and prey are readily available as long as the forest survives.

Background:
While at the Durminskoye Reserve, Khabarovsk Krai, Russia, we worked with our tour director Martin Royle, who is a conservationist from England, and Alexander Batalov, the Russian tiger conservationist who manages this reserve. I've included a brief biography of Alexander because he is not well-known in the Western Hemisphere but is recognized for his conservation work including an award from Vladimir Putin and as an invited speaker at the 2010 Global Tiger Initiative Conference in St. Petersburg.

> Alexander Batalov is the creator of the Durminskoye Reserve and also it's Director. He is not only educated in Wildlife Conservation (he graduated from the Wildlife Faculty of the Irkutsk State Academy of Agriculture in Irkutsk, Siberia), but has over 35 years in experience with wildlife management in the Khabarovsk Province, (downloaded from www.russiatigertracking.com)
>
> Born in Russia, Alexander Batalov has dedicated his life to the conservation of the Amur or Siberian tiger. Responsible for establishing the Durminskoye reserve spreading over 20,000 hectares, located 100 kilometers from the city of Khabarovsk in the basin of the river Durmin, he works tirelessly as director, researcher and protective warden over some of the last remaining habitat of the world's largest big cat.
>
> Alexander has published around 40 scientific studies on the wildlife ecology and rational usage of game resources including methodical instructions on monitoring and tracking the populations of local wildlife. He participates in the annual tiger count. He has trained over 600 students in forestry practices and wildlife conservation. He is an expert on methods for monitoring and tracking wildlife population. As the Director of the Durminskoye forest and game reserve, where he applies his experience in rational usage of the wildlife resources and preservation. Thanks to the advent of camera traps, Alexander and his team have constant photo and video observation of the wild animals

and tigers residing in the reserve. (We spent several days following him through ice and snow tracking paw prints and setting up camera traps.)

Alexander dedicates a lot of his time and efforts to the "popularization" and awareness building of local wildlife preservation through publishing photo books and educating local school children. As a result, Russia's first edition of locally produced photo books specifically about the Amur tiger and Himalayan bear have been published in both Russian and English. Alexander Batalov's photos and articles about the Ussuri taiga flora and fauna were also published in different books, booklets, textbooks, directories and books for children which also help to promote the ideas of wildlife preservation. He is also writes a column "We and Wildlife" at the regional newspaper Priamurskiye Vedomosty.

Most recently, the reserve and its team were featured on international media, including Gordon Buchanan's documentary “Amba the Russian Tiger” (as seen on Animal Planet) and has also been featured on several Japanese TV documentaries.

In December 2015, sitting inside over dinner and vodka on a cold winter’s night, Martin, Alexander, my husband Rob, and I started to identify method and resources to assist Alexander’s work in Durminskoye, work he has mostly done with no outside support since much of the international money goes to tiger conservation projects in the Primorsky Province. We identified three initial strategies that would assist Alexander and his team in Durminskoye to conserve Amur tigers: replanting the forest after it has been logged; conservation education, and eco-tourism to increase the value of tiger conservation and forest preservation for the local people. We named this “Trees for Tigers.”

To introduce you to Martin Royle, this is a brief summary of his background: Since graduation from The Victoria University of Manchester with a degree in Zoology, Martin has been fortunate enough to spend most of his adult life travelling the world and working in a plethora of wildlife projects, before setting up and establishing Royle Safaris (a wildlife eco-tourism company that specializes in rare and elusive species with a focus on conservation and human/predator conflicts).

With a life-long passion for the natural world and thirst to learn and experience as much as possible Martin has set Royle Safaris up with the overall aim of highlighting some of the most endangered animals and ecosystems in the world to help raise awareness of these animals and ecosystems; not just for the people who enjoy our tours but the local people we help by employing and educating as a long term commitment to help the sustainable development of eco-tourism around the world. Through Royle Safaris has become involved in tiger conservation, research and establishing tiger eco-tourism in many of their range countries, including the Russian Far East. (See http://www.royle-safaris.co.uk/ for more information.)

Kim has had a passion for Amur tigers since she began volunteering at the Oregon Zoo more than 13 years ago. Kim has always loved domestic and exotic cats, but her fate was sealed when she met Mikhail and Nicole, Amur tiger siblings at the Oregon Zoo. She also has a Ph.D. from the University of California, Santa Barbara in Educational Psychology and currently works as an organizational consultant and career counselor.

Rob is Kim’s very tolerant and loving husband who was willing to travel to the Russian Far East in the winter even though he doesn’t like cold weather. He is also an organizational consultant, an Episcopal priest, and a psychologist. He started the Appreciative Way, an organizational consulting practice, as an s-corporation over a decade ago.

We were also assisted in our endeavors by, Viktor, a brilliant translator with us since Alexander has limited English skills and none of us are fluent in Russian.

Method: Getting from A to B: Creating a Nonprofit

We then returned to Oregon and Martin returned to England while Alexander remained in Khabarovsk Province. We knew we needed an organization to implement these strategies and truly help tigers. We discovered that it in much easier to establish a non-profit organization in Oregon than it is in England or Russia. We decided on a non-profit since this would allow Trees for Tigers to receive donations.

Both Rob and Kim have worked with non-profit boards in the U.S. but they did not have any experience in creating a non-profit organization. So began the exciting adventure through bureaucracy at State and Federal levels of government. Surprisingly it was easier than we imagined! We accomplished non-profit status including the IRS tax-exemption within a few months.

As a Board we thought that sharing our learning experiences as novices would be helpful for many people attending this conference who are passionate about conservation and may feel daunted at the prospect of establishing a non-profit organization.

Initially, we considered allying ourselves with an already established non-profit working in the Russian Far East. What we found is that there are not many non-profits focused on the Khabarovsk Province, particularly in this region. Of course we knew this already since we had agreed to focus our efforts in the region, but we had also hoped to have a non-profit sponsor our organization until we could get established, especially with tax-exempt status. We did not have success in our attempts to get a sponsorship but it is definitely something to consider when implementing your organization.

In order to obtain non-profit status, you do not have to establish it in the state where you reside or where the organization is formed. Some states have more cost advantages than others. Many have differing regulations around fundraising, local taxes, state taxes, and other issues. If you have no clear reasons to select a particular state, then go for a state that offers fewer complications. "For example, Delaware, Wisconsin, Arizona, Nevada have way less regulations on nonprofits, then (sic) say New York or California. California and New York have a number of regulations specifically for nonprofits and you'll want someone local to wade through them, if you decide to register there." (*Downloaded from www.quora.com on 14 July 2016.)*

The Federal Government provides resources including this Step-by-Step Guide, "Incorporating a Nonprofit."

> "This process is very similar to creating a regular corporation except that you have to take the extra steps of applying for tax-exempt status with the IRS and their state tax division. These are the steps you should take to incorporate your nonprofit:

- Choose a business name - Make sure to check the state-by-state information on the various laws that apply to naming a nonprofit in your state.
- Appoint a Board of Directors - Draft your bylaws with guidance from your Board of Directors. These are the operating rules for your nonprofit.
- Decide on a legal structure - Choose whether your organization will be a trust, corporation, or association.

- File your incorporation paperwork - You must next file formal paperwork, or articles of incorporation, and pay a small filing fee to your state. Look up your state office through the National Association of State Charity Officials (NASCO).
- Apply for nonprofit federal and state tax exemptions - A nonprofit organization may be eligible for exemption from federal income tax. The IRS provides guidance and instructions on applying for tax-exempt status.

(Learn more about federal tax exemption requirements in IRS Publication 557 - Tax-Exempt Status for Your Organization (PDF, Download Adobe Reader) or by calling the IRS Tax Exempt and Government Entities Hotline at 1-877-829-5500. https://www.usa.gov/start-nonprofit)"

We decided to file in Oregon without checking other options but this has been a fairly easy process for us. We also had local resources including the Nonprofit Association of Oregon (NAO) and their The Oregon Nonprofit Corporation Handbook. We were able to complete almost all Oregon and IRS forms online

There are also businesses that provide a fee-based service for completing and filing documents with governmental agencies. Of course, when you are starting up, you may not have the funds available to pay for a fee-based service.

There are fees associated with filing for non-profit and tax-exempt status. For example, to use the IRS short EZ form cost is $400 in order to apply for tax-exempt status. States also have fees to set up the organization. In Oregon it was only $50 to set up the nonprofit corporation and obtain a Registry number which is required to apply for IRS non-exempt tax status. We also had to file with the Oregon Department of Justice.

Board of Directors:

For most of the State and Federal forms you need to identify certain positions in your Board of Directors. Usually this includes the President, Secretary, and Treasurer. Two essentials when selecting a Board, that they have the knowledge and the skills to move the organization forward and passion for the project. According to The Nonprofit Kit for Dummies, (p.84) cites the following "three traits as critical:

- Believing in your mission
- Being a strong advocate on behalf of your programs.
- Serving the organization as a careful and honest board member."

We knew we needed a working board, since we cannot afford staff, so wealth was not a criterion in identifying Board officers and members. Kim became the President since we needed a U.S. citizen. Alexander became our Vice-President-Russia and Martin became our Vice-President UK/Europe. We were fortunate to have an individual who wanted to help and with Nancy's background, including an M.B.A. and working for the Oregon Zoo' Education Division she became our Treasurer. Our Board Secretary, Celess, is the Lead Keeper for Amur Tiger and Leopard and has plans to go to Durminskoye Reserve. We have two additional members, Rob and Carolyn who are not officers both with exceptional skills and share our passion for Trees for Tigers.

Bylaws:

At your first Board meeting it is essential to review and approve the Bylaws. These can be drafted by using an online resource like *Legal Zoom* or you can find other resources and even consider Bylaws from other organizations in your state. It is important that your Bylaws are appropriate for the State you are registered so generic bylaws are only a beginning. Most of the online resources allow you to select the

state in which your organization is registered and will incorporate the appropriate language into the draft of the Bylaws. You can also use an attorney who specializes in nonprofit law.

We identified several resources and pulled together a final draft for the Board to review. We decided against the cost of hiring an attorney to review them because we were confident in our resources, especially the Nonprofit Association of Oregon. After approving the Bylaws, we could then file the final form with the Oregon Department of Justice.

By the time of the AAZK Conference, we will have conducted seven Board meetings. We have chosen to meet monthly with the five Board members who live near Portland, Oregon. This brings us to some of the challenges which we will discuss in the next section. After setting up the organization, we are focused on the opportunities to raise money for projects at Durminskoye.

Sharing our Vision:

In order to achieve our goals, we needed to articulate a compelling vision of what we intend to achieve and tangible steps that others can see themselves engaging in. For Example, we can evoke a person's interest in tigers, concern for their survivability and present a tangible way they can be interested in helping to create a safe and sustainable habitat for both people and tigers by planting trees for tigers.

To engage the enthusiasm of others, we created a Facebook page and a website. Through these Internet resources, in addition to more traditional marketing and networking efforts, we are sharing our vision for a sustainable and safe habitat for Amur tigers. Our Facebook page is Trees for Tigers and our website is www.treesfortigers.org. Join with us on social media to receive updates and chart our progress. We also have some great wild tiger videos.

Challenges:

International work: Our greatest challenge has been to work in another country, especially with the cool relations between Russia and the United States. The other challenge of international work is not sharing a common language. Lastly, one of our key concerns is that the local people do not feel like this is a group of foreigners telling them what to do.

Communication: Due to language barriers we needed a translator to assist us with Russian language. We have been fortunate to have the free assistance of a Russian translator living in Khabarovsk City. Additionally, we have been unable to set up a Skype connection with Alexander and Olga, our translator, to communicate in any method other than email. Durminskoye does not have the money yet for the technology that this would require. In fact, Alexander is only able to receive email when he is at his apartment in Khabarovsk City. (We conduct much of our work by email which is one important item to be sure to include in the Bylaws.)

We are fortunate that Martin travels to Durminskoye twice each year with tour groups so he is able to spend time face-to-face with Alexander, a translator, and staff. This year he will deliver new cameras for the camera traps which were purchased with a donation from the Portland Chapter of AAZK.

As a Board, we Skype with Martin so that he is included in our meetings and we hope to include Alexander in the future. We have had a few beginning Board meetings that were more organizational development without including Martin due to the time differences. Input from Martin is essential, not only as Vice-president, but also since he has been to Durminskoye several times and has ongoing contact with Olga and Alexander arranging tour groups. Trying to arrange this with schedules means that the Board meetings are at 4:00 pm for the Oregon board members but midnight for Martin in the U.K.

Transferring money to Russian banks: When we started we did not realize how difficult it would be to get the money to Alexander in Russia. Russia has a law similar to the Foreign Agent Corrupt Practices Act in the United States. In Russia there is a specific law governing "Non-commercial Organizations Performing the Function of Foreign Agents." This law as well as the ability for the government organization that provides bank oversight to close a bank without any notice complicates work in Far Eastern Russia.

Bureaucracy: Dealing with the U.S. bureaucracy to set up a nonprofit organization has been easier than we expected. We expected that it would take 12-18 months to obtain the 501(c)(3) approval from the IRS. Surprisingly, we were notified of our approval within one month and the tax-exemption was backdated to include the day we were established under Oregon Law.

The Russian bureaucracy is more difficult, especially because we cannot read Russian. Fortunately, Alexander already has an accountant for his business and she has been a great help. There are also different taxation requirements on foreign monies which can be as much as 50%of the donation. At this time, Alexander has identified a local tiger nonprofit organization to sponsor our nonprofit work in Russia.

Organization: We have included in this paper the basics to set up a nonprofit organization, but once it's established then what? We have a lengthy proposal for the goals and projects for the next three years. This composes our strategic plan and also our core values and what we hope to achieve. This is essential work for any organization: what is our purpose and how will we accomplish it? Prior to establishing our organization we had drafted our proposed plan with Alexander, Martin, Rob, and Kim. We shared our Key Strategies of: Establishing Reforestation Teams, Education about Amur Tiger and Forestry conservation and Eco-tourism with our potential board members. As a Board we have adopted these strategies and our work now is to establish specific goals and key tasks to be done in the U.S., Russia, and the U.K. Establishing the organization has been our focus these last few months and now our efforts are the practical tasks of turning this passion into specific actions.

Fund Raising: In order to accomplish our strategies, goals, and action plans, we need money. We have been fortunate to have many people excited about this project and are willing to assist with donations. We have been focused on getting the bank account established and setting up the process to receive credit card donations after receiving tax-exempt status. We were fortunate to find a local bank that specializes in nonprofit banking services. We established our bank account in July and have the ability to receive donations by credit card. Our plan is to have a small fund-raising event in October. Since this will be our first effort, we are inviting approximately 25-50 guests to dinner and/or vodka tasting to celebrate Amur Tiger and Leopard Day. Our celebration will be a little later than the Russian celebration on the last Sunday in September, but this will be the focus of our celebration.

Conclusions:

Our purpose in sharing our Trees for Tigers efforts was to encourage you to turn your passion, your conservation dream, into reality. We have shared with you our efforts as well as challenges. At the end of this paper we have listed resources to assist you in your journey. We are also available to share our experience in more depth as long as you realize that we are not professionals in the field. We want you to know that it can be done with little or no paid professional involvement if your passion can carry you past the challenges. Remember how Anna Mertz started with in Kenya to save black rhinos and look at how her efforts brought into being Lewa Wildlife Conservancy assisted by the individual fundraising efforts of Zookeepers through AAZK.

Resources:

Nonprofit Association of Oregon: https://www.nonprofitoregon.org/
Internal Revenue Service: https://www.irs.gov/charities-non-profits/application-for-recognition-of-exemption
Other Federal Government Resources: https://www.usa.gov/start-nonprofit;
Small Business Association: https://www.sba.gov/blogs/how-start-non-profit

General nonprofit online resources:
Legal Zoom: https://www.legalzoom.com/business/business-formation/nonprofit-overview.html
www.Charitynetusa.com
www.grantspace.org
National Council of Nonprofits: https://www.councilofnonprofits.org/
Society for Nonprofits: https://www.snpo.org/resources/startup.php
Nonprofit Hub: www.nonprofithub.org
Idealist: www.idealist.org

Working with a Sponsoring Organization: www.unitedcharitable.org/; https://www.councilofnonprofits.org/; and TCI-FS (2014) "fiscal Sponsorship: A 306 Degree Perspective" a white paper available for download from the Trust for Conservation Innovation (TCI)

Books:

Cumfer, C. and Sohl, K. (2012) The Oregon Nonprofit Corporation Handbook, 5th Edition. Portland, OR: The Nonprofit Association of Oregon Publisher.

Hutton, S. and Phillips, (2014) The Nonprofit Kit for Dummies, 4th Edition. Hoboken, NJ: Wiley and Sons, Inc.

Pakroo, P. (2011) Starting and Building a Nonprofit: A Practical Guide, 4th Edition. Berkeley, CA: Nolo and www.nolo.com

Don’t Squeeze the Jaguar: Voluntary Dart Training in Jaguar (*Panthera onca*)

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It is widely agreed upon in the zoo field that animals which are sedated under less stressful conditions generally have fewer risks associated with sedation. Smoother induction leads to more stable patients and can mean smoother recovery. Under this premise, the primary jaguar keeper and veterinary technician sought a voluntary training behavior that would create a positive and less stressful situation for sedation of one of the zoo’s 2.0 jaguars (*Panthera onca*). Both jaguars had had issues with sedation in past physical exams, such as hyperthermia and slow recovery, thus training a behavior that could be used as a method of sedation was warranted by both keeper and veterinary staff. The training began with both jaguars, but as the physical exam date approached, one individual, “Jean”, was making more progress than the other, so the training team decided to focus the training on “Jean”. The other individual, “Phil”, is currently being trained for this behavior.

Challenges:

As with many trained behaviors, the training team faced several challenges in working on this behavior. The facilities itself presented one of the largest obstacles, as there are no chutes or squeeze sections in the jaguar holding areas. The dens also shift straight out to the exhibit, so there are no exterior chutes or sections of fencing that could be utilized. One den had a large section of mesh between it and the adjacent den, which was large enough to be used to train a present side behavior. This area became the training station.

Initially, the training began with the intention of training a standard voluntary injection behavior, using a present side behavior as the basis. Problems arose when it appeared that neither jaguar was comfortable turning away from the keeper. The keeper tried shaping the present side behavior by targeting the jaguars laterally, alongside the training station mesh. Both jaguars responded by walking in a side-stepping manner, but remained facing the keeper. The keeper also tried isolating just the head movement by targeting to the side in very small increments to attempt to train the jaguars to turn away, but this was also unsuccessful. It was clear the jaguars would need some sort of makeshift “squeeze” to assist in presenting their sides to the keeper.

The keeper tried several arrangements of logs, cinderblocks, and landscaping timbers to create the “squeeze” area, but none could hold up to the destructive nature of jaguars. Around this time, the keeper attended the Felid TAG meeting where a presentation was given showing a large, heavy duty rubber trough for jaguar training and enrichment. The keeper realized this could work to create “squeeze” in order to continue the training. A large, rubber trough was

incorporated into the training area set up, and the keeper began to work on shaping the present side behavior.

The final challenge the training team faced was getting the jaguars close enough to the mesh to either hand inject with a syringe or use a pole injector. As with the keeper, the veterinary technician was also inspired by a colleague at a national conference. At the Association of Zoo Veterinary Technicians Annual Conference, a vet spoke about using a dart gun at close range rather than injecting with a syringe. For the safety of the animal, the dart pistol is charged to a low pressure and releases the dart at a lower velocity than in normal darting situations. Using a dart allows for a better chance at getting more medication in the animal, as a dart stays lodged in the animal's skin and/or muscle, while animals often jump away from the sensation of being injected by a needle and syringe. Thus a decision was made to attempt a voluntary close range dart behavior instead of a voluntary injection behavior.

Methods:

This behavior was trained using operant conditioning over a period of about a year and a half, though progress really began to be made after the incorporation of the rubber trough, about six months into training the behavior. It should also be noted that the jaguars' physicals are only scheduled once a year, which in itself extended the training timeline. A clicker was used as a bridge. The main reinforcer used was hot dogs, due to their cost effectiveness and ease in spearing onto a feeding stick. However, the jaguar that completed the behavior has an exceptionally high food motivation, and the keeper found that any food reward was effective as a reinforcer for this individual. Since this behavior really began to take shape after the main challenges were overcome, the methods used to shape the voluntary dart behavior are detailed beginning after the training station was created with the large, rubber trough.

In the early stages of training the dart behavior, the heavy duty trough was set up about three feet away from and parallel to the mesh, creating a "squeeze" that was large enough for the jaguar not to feel confined. The ends were left open to give the jaguar the choice to leave the station at any time. Training began by using previously established target and lay behaviors. The jaguar was targeted into the area between the trough and the mesh and rewarded. Once comfortable with coming in between the mesh and the trough, lay was added to the chain to help keep the jaguar in position long enough to be darted. The jaguar was targeted into the station and then immediately asked to lay, and then rewarded. A large Saurus Egg enrichment ball was moved to one end of the training station to control which side the jaguar could enter from, so that the keeper was reinforcing the same side being presented in each training session.

As the jaguar became more comfortable with the training station and lying in the area, the trough was moved closer to the mesh, in increments of about six inches, until the trough was about one and a half feet away from the mesh. This distance seemed to be the limit of the jaguar's comfort with confinement.

At this point in the training the vet tech was brought in to training sessions as the second trainer. Two trainer sessions began with the keeper targeting the jaguar into the station and asking to lay as normal, while the vet tech slowly approached the mesh. Next, the keeper targeted the jaguar into station, asked for lay, and the vet tech kneeled in front of the jaguar's back hip. When the jaguar was comfortable with this, the jaguar was targeted into station, asked to lay, and the vet tech poked the back hip several times with a metal skewer (before the decision to

change from pole injection to voluntary dart was made), while the jaguar was continually reinforced as long as he stayed lying in position.

When the training team opted to change the behavior from injection to voluntary dart, the behavior was still approached in a similar manner. The vet tech began with bringing in only the CO2 chamber for the dart pistol, to test the jaguar's comfort level with the equipment. The jaguar was targeted into station as normal, and the vet tech slowly approached the station with the dart pistol chamber, while the jaguar was continually reinforced to keep him lying in position.

When the jaguar seemed comfortable with the dart pistol chamber, the vet tech brought in the dart pistol barrel and chamber, fully assembled. The jaguar had an immediate negative response to this, as if he recognized the dart pistol from previous sedations. The keeper utilized redirection to refocus the jaguar and encourage cooperation in the training session, while the vet tech disassembled the pistol's barrel and chamber. With the pistol in two separate pieces, the jaguar was willing to cooperate with the training session and targeted into station and lied down. The keeper continually reinforced the jaguar while the vet tech approached with the pistol in separate pieces.

The final step was to bring the jaguar into station, ask him to lay, and continually reinforce as the vet tech approached with the pistol in two pieces, assembled it as she got to the mesh, and was able to line up a shot at the jaguar's hip and release the trigger multiple times without charging the pistol. The jaguar would sometimes turn to look at the vet tech or the gun, but never chose to leave the training session.

On the day of the annual physical exam, the training went just as the training team hoped. The dart with the sedative was preloaded into the barrel of the dart pistol. The jaguar calmly came into the training station, laid down, and stayed in position as the vet tech approached, assembled the pistol and charged it to about 1.5 bar of CO2, took aim, and expelled the dart. Unfortunately, the dart ejected from the needle on impact, so a full injection of sedative did not occur. The training team suspected that the dart had been previously used, which can lead to issues with the dart and needle staying intact. However, the jaguar needed more medication than expected to be fully sedated for the exam. All in all, three darts had to be used to fully sedate the jaguar, so a second dart at least would have been needed to sedate the jaguar, even if the initial dart had stayed intact and given a full dose of sedative.

Conclusions and Recommendations

The training team feels that the voluntary dart behavior was successful in that it was trained to completion and allowed for the initial dart to be given under low stress for the jaguar. The keeper would also like to note that in the first training session following the physical exam, which occurred about two days later, the jaguar came into station and fully participated in the voluntary dart behavior without any regression. Currently, the zoo's other jaguar is being trained for voluntary dart, with an expected annual physical in late fall.

From this experience, the training team offers the following recommendations:

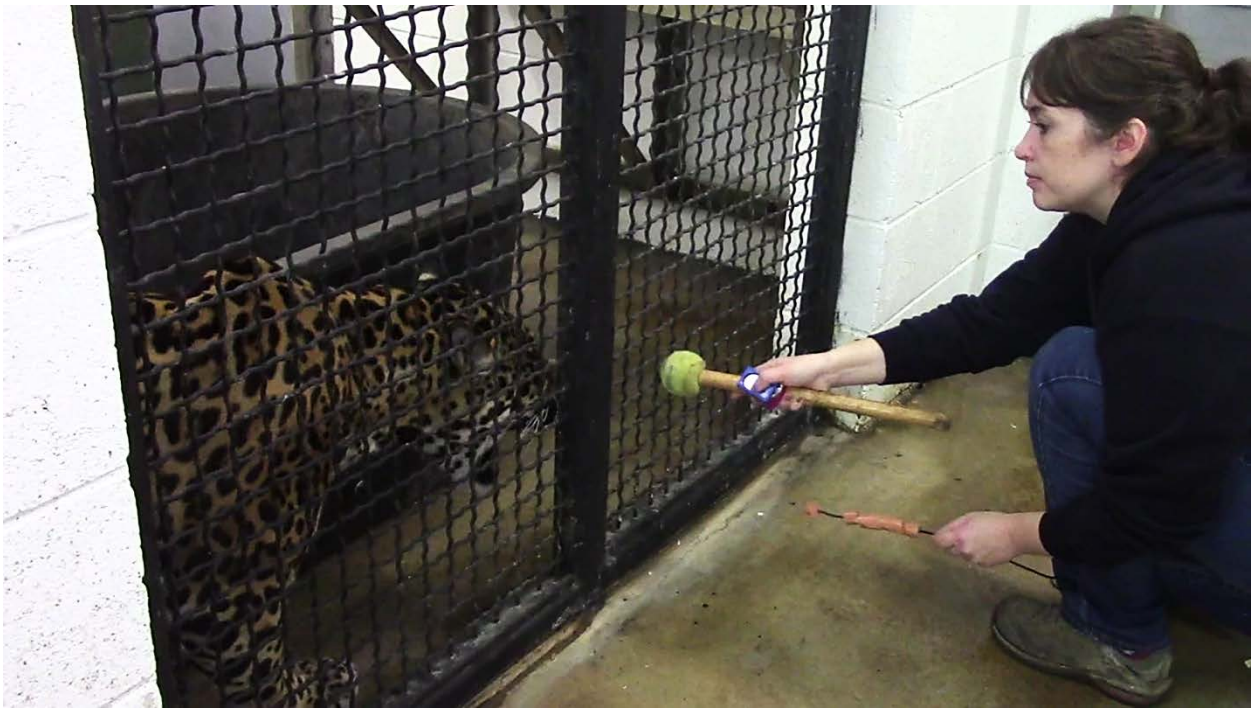
1. Keepers should strive to maintain a great working relationship with vet staff. Vet staff can be instrumental in not only suggesting new health related behaviors to train, but can also be an integral part of the training itself. This cooperation will be beneficial to both parties and to the welfare of your animals.

2. Participate in workshops and conferences and learn from what colleagues are doing at their respective institutions.
3. If you feel your ability to train is hindered by your facilities, try some creative solutions. Think outside the mesh!
4. Always use a new dart, especially if you may only have one chance to sedate the animal.

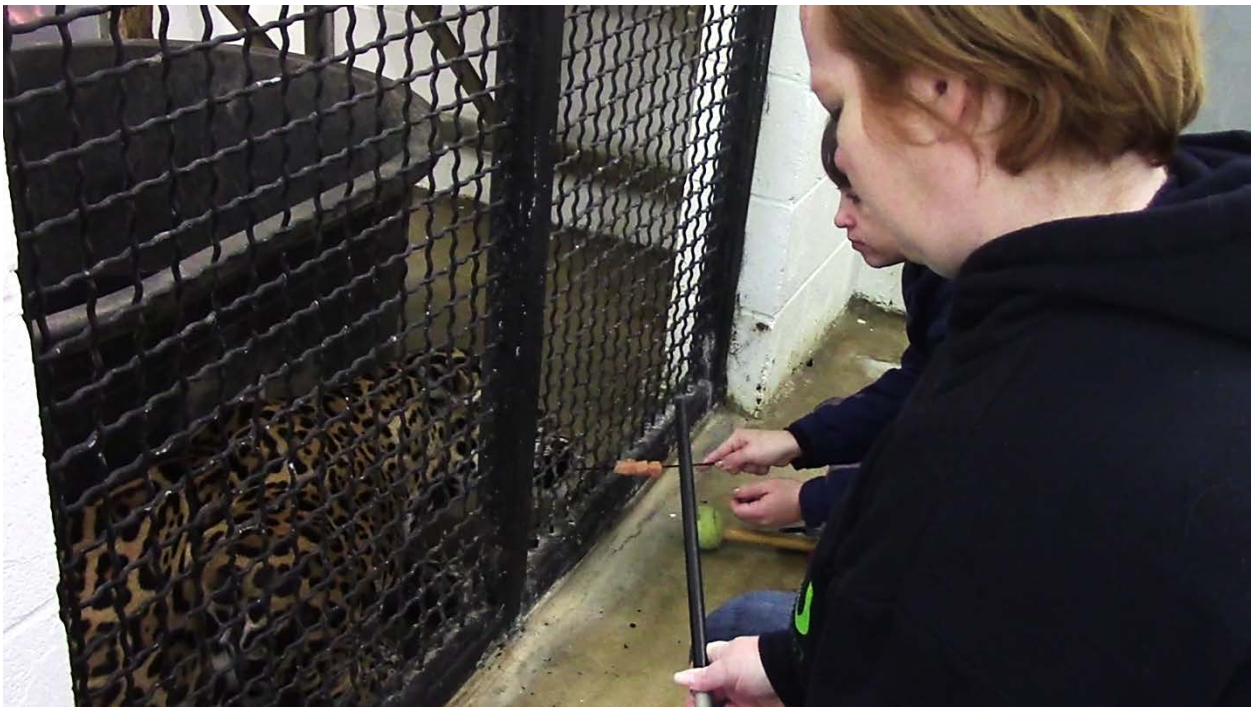
Acknowledgments

We would like to thank our General Curator, Stacy Laberdee, our Veterinarian, Dr. Anthony Ashley, and Training Coordinator, Tawnya Williams, for their support and encouragement in pursuing this training. We would also like to thank our colleagues from Felid TAG and AZVT for their helpful tips and inspiration.

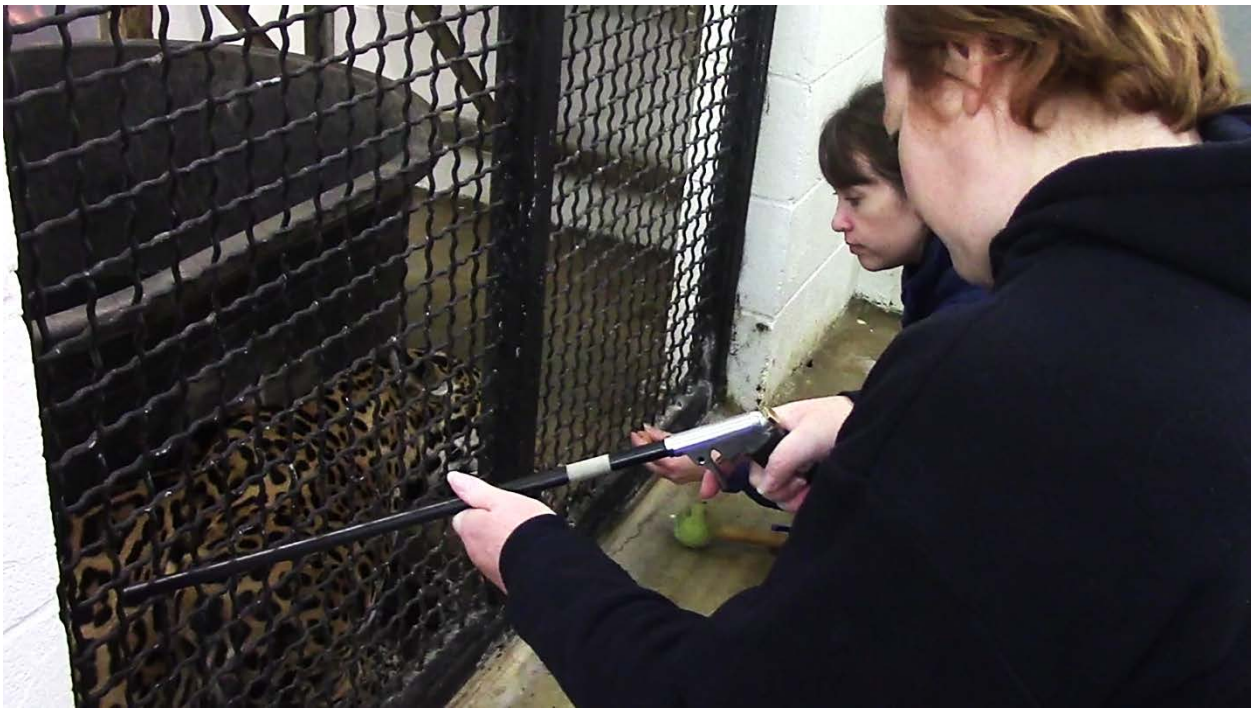
Training station set up (Photo by Rachel Thayer)



Targeting the jaguar into station. (Photo by Rachel Thayer)



The vet tech approaches and assembles the dart pistol. (Photo by Rachel Thayer)



The vet tech aims the assembled dart pistol while the keeper reinforces the jaguar. (Photo by Rachel Thayer)

Speke's Gazelle Crate Training for Voluntary Examinations

By
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Abstract
Speke's gazelles, *Gazella spekei*, are a small antelope species endemic to the Horn of Africa. Like many small hoofed species, Speke's gazelles tend to be skittish and wary of people. The Houston Zoo had a collection of 1.4 Speke's gazelles being trained a variety of behaviors. The goals of these behaviors are to create a stress-free environment where the animal chooses to interact with the trainer. One of the female gazelles was hand raised, but the other 1.3 in the collection were parent reared. Through patience, these gazelles have been trained to go into a modified crate for blood draw, injections, and vet visuals. Once all medical procedures were completed, staff was able to safely relocate them to a new exhibit. Several of the gazelles allow tactile and are being trained for voluntary blood draw, injections, and hoof work. The goal of these training techniques was to prevent potential injury and negative association by catching up the gazelles by hand and to create less stress on the animal. Through patience, positive reinforcement, and creative thinking, Houston zoo keepers are able to work with these gazelles in a less stressful environment.

Introduction
Speke's gazelles, *Gazella spekei*, are an endangered species of gazelle endemic to the Horn of Africa. These gazelles are commonly identified by their small size and unusual folds of skin on their nose. These folds allow Speke's gazelles to inflate their nose and create an alarm call. Speke's gazelles are about 15 to 25 kilograms and are 50 to 60 centimeters at the shoulder.

The Houston Zoo currently is home to 0.4 Speke's gazelles. The zoo has housed 3.5 Speke's gazelles since 25 May 2013. Daffodil is five years old, birth date of 29 January 2011, and the most dominant of the herd. She was born and hand-raised at the Saint Louis Zoo. The remaining gazelles were all parent reared. Hollyhock is a five year old, birth date of 3 May 2011, female born at the Saint Louis Zoo and the second most people friendly of the herd. Prim is a four year old female, birth date of 22 July 2012, and was atolls born at Saint Louis. Rose is a one year old female that was born on 15 April 2015 at the Houston Zoo to Prim. 1.0 was also present during crate training, Dale, a two year old, birth date 29 July 2013, from Saint Louis. Dale had a jaw infection when he got out of quarantine and had to be caught up quite often, causing him to be flighty around humans. He ended up passing away from complications from a jaw infection in summer of 2016. All of the gazelles were housed at the West Hoofrun and needed to be relocated to the African Forest Rhino Barn and Exhibit due to the relocating of several species within the Hoofstock Department.

Materials and Methods
Training of the Speke's gazelles began with 0.2 Daffodil and Prim in October of 2014; with Mary Fields being the primary trainer and John Scaramucci as the secondary. Despite Daffodil being

hand-raised, both gazelles were wary of humans. In general, this species is a skittish species. Training began with a desensitization of the gazelles by first sitting in holding the holding areas with them. The keeper would often sit, typically by the daily diet, for ten to fifteen minutes with the gazelles before ending the session. While sitting, the keeper tossed a reward to the gazelles. Apples, lettuce, kale, alfalfa and Mazuri petting zoo pellets were used as rewards. After about a month, Daffodil began consistently approaching the trainer for a reward. A target was introduced to begin target training in December of 2014. Hollyhock is the second most people friendly of the gazelles. Scale training began with Hollyhock in August of 2015 and keeper was able to hand-feed Hollyhock by October of 2015. Hollyhock began consistently targeting in December of 2015. Hollyhock and Daffodil will target for a reward and Prim and Rose will for browse. All will stand on a scale for weighing. Tactile training was initially started on the left side of Daffodil's neck. Daffodil currently allows for tactile all over her body and allows keeper to pick up her front hooves; Hollyhock allows tactile along her neck. Random keepers, then vet staff was used to begin blood draw allows injection training for Daffodil in July of 2015. A blunt needle is used on the left side of the neck and rump for this process; vet staff poke from the left and keeper rewards from the right, creating a "chute" with their bodies. Crate was introduced in February of 2016.

The crate (Figure 1) used for this training was built by John Register, the Houston Zoo's Hoofstock Supervisor, and Daryl Hoffman, the Houston Zoo's Large Mammal Curator. The crate has four windows with doors, three on the side of the crate and one on one of the doors. The window on the door has one by one inch mesh on it. A push wall is able to be attached via several holes in one side of the crate. Two removable sliding doors can be placed on the entrances of the crate. The outside dimensions are as follows, height of 86.36 centimeters, width of 35.56 centimeters, and length of 86.36 centimeters. The inside dimensions area is as follows, height of 80.1 centimeters, width of 34.29 centimeters, and length of 76.2 centimeters. The door mesh window is 45.72 by 22.86 centimeters. The two upper windows are 30.48 by 22.86 centimeters and the foot door is 55.88 by 15.24 centimeters. Four metal handles were placed at the corners for easier mobility and two handles were shaped in the doors. The crate weighed a total of 28.9 kilograms.

Figure 1: Side and front views of the crate, during an examination.

The crate was designed for several different uses, including training and transportation. The primary use was to allow vet procedures without catching up the Speke's gazelles by hand. Hand catch ups of animals have the benefit of speed, but have a few risks involved. An animal or keeper may be unintentionally injured during these catch ups. Stresses on the animal and negative association with people are also risks of catching up animals.

The original goal for this crate was for the gazelles to have an examination and be transported from our West Hoofrun to our Rhino Barn. Initially, a larger gerenuk crate was placed between stalls WB-11 and 12 on 26 February 2016. All gazelles would easily go into this crate with or without doors attached to it. Daffodil and Hollyhock would come into the gerenuk crate when asked and rewarded at a mesh door. The gerenuk crate was deemed too large as gazelles were able to turn around in it. A new, smaller Speke's gazelle crate was built and this crate was placed between stalls WB-11 and 12 on 3 March 2016. 1.4 gazelles were initially wary of the crate, but began visual and olfactory inspection within minutes of the addition. Food was placed in both stalls, grain in 12 and hay in 11 to encourage movement between both stalls. All were going through the crate within the first day. On the same day as the new addition, the door with the mesh window was added to the side furthest in stall 12. Food was initially placed in the crate, and then a keeper was able to call Daffodil and Hollyhock into the crate to eat at the mesh. This went on for several days. On 13 March 2016, keeper began separating Daffodil into stall 12 and leaving 1.3 in 11. Daffodil would eat in 12, which appeared to coax the remaining gazelles to enter the crate while one door was attached. Throughout this time, keeper made noise with the crank of the door between 11 and 12. Prim was the first to allow the door to be fully shut while in the crate, with the remaining females to follow. Dale typically did not put his whole body in the crate, so keeper was not able to shut the door during training.

Results

Although it was rescheduled a few times due to weather, 2 May 2016 was the moving and examination day for the gazelles. Prim went into the crate almost automatically. The doors were shut and Prim was locked in the crate. The crate was then moved for weighing and the exam (Figure 2). While in a dark crate, Speke's gazelles automatically lie down, Prim remained in this position throughout the exam. Blood was collected, injections were given and an ultrasound was performed. Once the exam was done, Prim was transferred to a Vari Kennel and transported to the Rhino Barn. The crate was placed back between the stalls and keeper attempted to get the remaining gazelles. Unfortunately, the remaining would not put their whole bodies in the crate for the keeper to shut it. The remainders were caught by hand for examination, then transport.


Figure 2: Two separate Speke's gazelle examinations. Ultrasound on left, blood-draw on right.

Discussion

There are several possible reasons to why the remaining gazelles did not enter the crate. During the exam, there were many more people in the barn than during a normal training session. Typically only one to three people were around during a training session. The action of moving the crate also had never been done during training. This is a step that could have been added to the training. Blood and ultrasound gel was spilled in the crate during the exam; this may have deterred the gazelles as several did begin to go in, then back out suddenly. If transportation was not a goal, examinations via crate might be more successful spaced out, without all gazelles on one day or at least not within the same time frame in one day. Several of these could be prevented or desensitized, but examining and transporting the gazelles on separate days was not feasible for this instance.

Crate training has continued since the move. All current gazelles will enter and allow being locked in the crate. Dale was caught up several times after the move due to jaw issues. He would not go into a crate voluntarily, so keepers hand caught him and placed Dale in the crate. We found that the method of placing a caught-up gazelle in a crate was less stressful on the animal than holding them for exams and sedations. Prim voluntarily was locked in the crate on 11 July 2016 for an ultrasound and palpation. The remaining gazelles have all been locked in since the move, but have not had exams. Crate training will be continued with Houston's Speke's gazelles and started soon with several other species.

Polar Bear Front Paw Blood Draw

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Como Zoo

Saint Paul, MN

Introduction

Operant conditioning training has advanced the care of captive animals worldwide. Many institutions have expanded the animal species trained, as well as increased the types of behaviors they train. Como Zoo's training program started in 2000 and includes two male polar bears, *Ursus maritimus*, Buzz and Neil. Buzz and Neil are twin polar bears born to Louisville Zoo in December of 1995. Buzz and Neil came to Como Zoo via San Diego Zoo in 2001 with a handful of established behaviors. Since their arrival, they have been incorporated into Como Zoo's training program and receive one to two training sessions daily. During these sessions their primary reinforcer is lard. We use both clickers and whistles as a terminal bridge.

In 2010, Como Zoo opened its new exhibit Polar Bear Odyssey, with more training spaces included in the design. Increased mesh and access to more areas to train allowed the training program to progress. The new design did not include any ports or access points to obtain access to the bears' paws or other body parts. With the bears getting older, our staff began looking towards training more advanced behaviors including obtaining a voluntary blood sample. For these behaviors the training mesh would need some modifications.

Materials

In 2011, the Oregon Zoo was the first to obtain voluntary polar bear blood samples without anesthesia. (Oregon Zoo) These samples were obtained on the rear paw of the animals with a special crate that allowed access. This set up was not a feasible option in our exhibit due do safety, budget, and the advanced exhibit modifications necessary. We continued to have discussions with our staff to find a feasible way to get blood from our polar bears. After considering many options, it was decided to build a small blood port that would allow access to the top of the front paws. This approach was less costly and quicker for exhibit modifications. The first step was to determine the right size to allow comfortable access for adult male polar bears, Buzz and Neil. So an approximation of measurements was used to create a mock port.

Fig. 1 Fig. 2

This mock sleeve (Fig. 1and 2) was slipped on the bear while he was immobilized for his annual physical. It was determined that the height of the sleeve needed to be increased. After this trial, the final port was created. The final measurements are 16.5 centimeters high by 28 centimeters wide for the opening of the bears' paw. The front angles down to 7 centimeters high. (Fig. 3 and 4)

Fig. 3 Fig. 4

The second step was to see how feasible obtaining a blood sample from the bears' front paws would be. Upon reviewing literature, we found there was not a lot of information on front paw blood draws in polar bears. During their routine immobilizations, we shaved the bears' front paw and tried for blood with the same needle set up we would be using for our voluntary stick. It only took a few tries and we were able

to get a good sample from the front paw. (Fig. 5) After this success we were very optimistic that we would be able to obtain a sample using the blood ports through training.

Fig. 5

In April of 2014 the blood port was installed. Overall, it was a simple design where two holes in the mesh were cut 21. 5 centimeters apart and the two blood ports simply slid into channels made on the mesh and bolted into place. (Fig. 6) With all our exhibit design, we try to create as many options as possible and the ports are no exception. The ports could be removed and replaced with a smaller port for a female or young bears or covered and bolted with a flat plate.

Fig. 6

Method

Training for the blood draw behavior began prior to its installation. Both bears already had a 'step' behavior trained. The criteria for this behavior is to place their paw perpendicular to the mesh a few inches from the ground to mimic the keepers' foot. We felt this behavior could be easily modified to asking the bears to 'step' into the blood port once it was in place. The blood port would be installed on the ground with the idea that the bears could be laying down while simply sliding their front paws into the port. In preparation, we trained the 'step' in a laying down position for months before the port was put in place.

Neil started his training with the ports in place on 4, April, 2014. The presented timeline and discussion will be centered on Neil's training and progress. Buzz held a similar timeline and will be noted at the end of the paper. Each section describes a major event in the training of the blood draw; however it is important to note that during the whole progress small approximations were taken daily**.**

Working the 'step' behavior in the down positon for the prior months was extremely helpful, because in just one session Neil was placing his paw into the port. (Fig. 7 and 8)

Fig. 7

Fig. 8

The next step was to desensitize Neil to having his paw touched while in the port, because of his previous years of training Neil was ready for taction in the blood port by 30, April 30, 2014.

The first major component for the blood draw training was to get Neil comfortable with clipping his hair with an electric razor while in the blood port. We felt this was an important step that would allow us better access to his paw and a better visual without his hair in the way. The clippers proved to be very interesting to Neil's sense of smell. Since we used clippers that had been used in other areas of the zoo,

he was very focused on sniffing them. Getting past the wonderful aromas was the most difficult part of the clipper training. Once he was desensitized to the smell, we turned the clippers on. The small buzzing noise was a new step to overcome. During his session, another trainer would stand behind Neil's trainer and just have the clippers running so he could get comfortable with the sound. Once he was comfortable with the sound we progressed to touching the clippers to his paw in the port. He had little reaction to the clippers simply touching him even in the on position, but when a bit of pressure was applied to clip his hair he pulled his paw out a few times during this training process. However, by 13, June, 2014 we were able to shave a small patch of hair. It is important to note that after his hair was shaved the flies were able to bite his skin causing his paw to bleed. We have since been working the blood draw behavior without shaving. The importance of shaving for a visual does not seem to be as important as we previously thought.

The next step was training the application of alcohol to the blood collection site on top of his paw. We first started with water on gauze and applying to the paw, this was no problem. Then we switched to alcohol. This was the biggest hurdle of the blood draw training. The smell of alcohol was very upsetting to both bears. When we first trained Neil while a second person applied alcohol to gauze he immediately chuffed and backed up. He did basic behaviors but was noticeably distracted. We assumed because the environment, as well as their hair, smells like alcohol after their immobilizations, they associate the smell with that. Both bears were very distracted with the smell of alcohol, so we had to back up. We left alcohol soaked gauze out in their holding for several weeks so they could smell it continuously. We did training sessions with the smell of alcohol in the air for about a month. This helped considerably. By 4, July, 2014 Neil was allowing the alcohol to be applied to his paw.

The next step was applying pressure to approximate a needle stick. For this we straightened a paper clip and attached this to a syringe for a visual approximation as well. On 8, July, 2014 Neil's paw was wiped with alcohol and then poked with the paper clip. During the pretend stick, Neil was continuously reinforced with lard. We felt that starting with continuous reinforcement during the blood draws was best since the bears would need to hold this position for multiple steps of alcohol, touching, sticking, and finally drawing the blood. Neil showed no reaction, so on 11, July, 2014 we stuck him with a 28 gauge needle. Again, Neil showed no reaction, no movement. On 25, July, 2014 we increased to a 25 gauge needle, again Neil had no reaction. During this time we alternated between just finger pressure, paper clip pressure, and 25 gauge needle sticks before moving up to a 23 gauge.

On 10, September, 2014 Neil was stuck with a 23 gauge needle. This was the first time and remains one of the only times he has pulled his paw out of the port during a stick. It is important to note he never got

up from his laying down position; he simply pulled his paw out of the port. He did not seem particularly stressed or anxious, so we re-stuck with the 23 gauge and he was perfect. After this we alternated between finger pressure, paper clip, 25 gauge, and 23 gauge needle sticks.

On 7, September, 2014 a notable interruption in the training progress occurred. Two polar bear cubs from the Toledo Zoo, Suka and Sakari, came to stay at Como Zoo while their new home at Henry Vilas Zoo in Madison, Wisconsin was being finished. During their first 30 days they were housed in an isolation yard and holding that our bears did not have visual access to. Once Suka and Sakari were through their 30 days isolation period, they were moved to the yard across from our bears and given holding access across the hallway from our bears. This added a whole new level of distraction to the training progress. It also limited the access to the area that contained the blood port, since we rotated areas with the cubs. We have two exhibit yards that connect through an area we call the knuckle. This knuckle area is where the blood port is installed. (Fig. 9)

Fig. 9

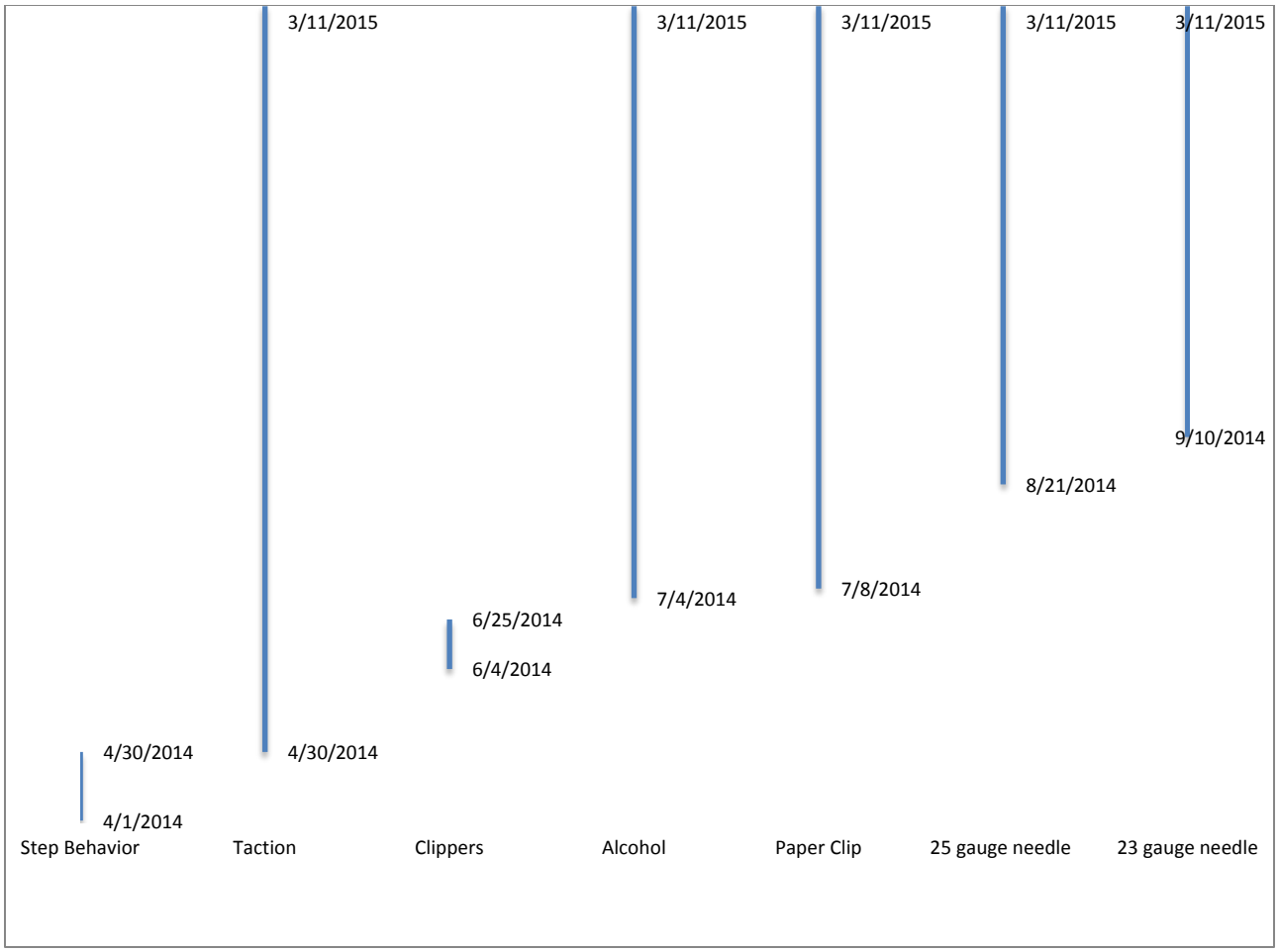
The knuckle also has small windows where Buzz and Neil could see Suka and Sakari. Keeping focus in this training area was much more difficult. At times the polar bear cubs would be sniffing and even pounding on the doors while we were trying to train our bears. With this new social dynamic the training approximations moved a bit slower from October -December.

It is also important to note that while working this behavior I had multiple staff be the second person in the session doing all parts of the approximations expect sticking with a needle. For the actual needle sticks we used only the senior keeper. This made the sticks and location of sticks more consistent, but also made scheduling a bit more difficult. Therefore holidays, vacations, and animal events in other parts of the zoo also slowed down the process in the fall and early part of 2015. Even with these slowdowns, we were able to obtain a voluntary blood sample from Neil on 11, March, 2015. During the sticking and blood draw, Neil was reinforced with lard and other special treats fairly consistently. We have since lengthened the amount of time between reinforcements. Since then we have obtained small flashes several times and another big success on 8, October, 2015. (Fig. 10 and 11)

Fig. 10

Fig. 11

The graph represents the important steps in the training plan with the corresponding start date leading up to the first successful blood draw. We continue to break down the behavior into these important steps to maintain the completed behavior. Some training sessions might just be taction in the port while others may be alcohol and paper clip.



Buzz started his training and the same time as Neil but took a bit longer getting comfortable with all the steps, but we were successful with obtaining a blood sample with Buzz on 10, September, 2015, and have since gotten two smaller samples as well.

These ports allowed us an access point to their front paws and this proved to be helpful in another situation as well. In December of 2014 Buzz started limping badly on his L front paw. After a few days, the limping was getting worse, with him barely putting any weight on his paw. We discussed the possibility of doing voluntary x-rays on his paw by fully removing the blood port and having him place his paw out onto a x-ray plate. (Fig. 12 and 13) It was a fairly simple behavior to train since the mesh was already modified for the blood port. By removing the port we were able to slide Buzz's front paw onto an x-ray plate which was under a plastic protective layer and obtain voluntary x-rays. We are now training this behavior with Neil and have even started to train a down behavior parallel to the mesh with the hopes of getting their rear paw in the opening. This simple modification has allowed us to obtain our goal of voluntary blood samples and opened our minds to even more possibilities.

Fig. 12

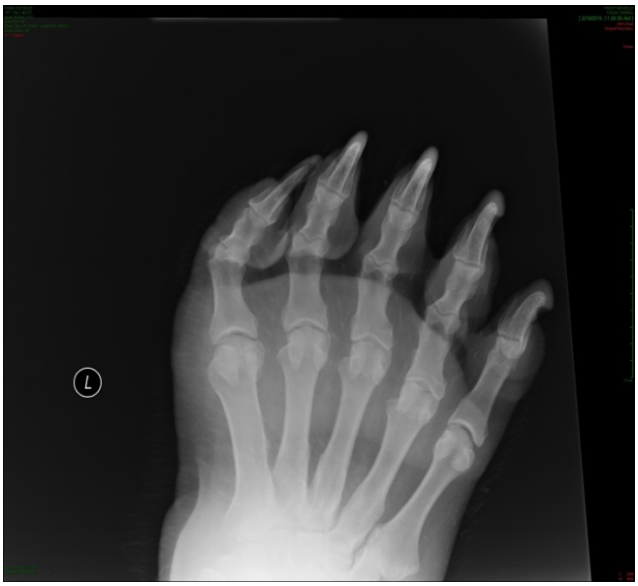


Fig. 13

Conclusion

Through training and the simple and inexpensive addition of two blood ports, we were able to obtain voluntary front paw blood draws from Neil in March of 2015 and Buzz in September 2015. We were able to increase the original function of theses ports and obtain voluntary x-rays as well. We hope by sharing our approach that other institutions may also succeed with these behaviors, even with limited resources. This accessible approach will increase the ability to collect diagnostic samples through training and advance the medical care of polar bears in human care. We ultimately would like to see our captive population contribute samples through training to the research community and acquire a better understanding of wild polar bears.

Training a Snowy Owl to reduce stress during bumble foot treatment.

By

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Abstract

Pododermatitis, more commonly referred to as bumble foot, is one the most common ailments with birds of prey under human care. Bumble foot is an infected lesion affecting the ball of the foot or toes (Forbes, 2016). Medical treatment of bumble lesions can include numerous topical treatments, bandage changes, and several courses of oral or injectable antibiotics. These treatments can be very stressful for birds of prey because they typically require the bird to be manually restrained once or twice a day. In December 2015 a 1.0 Snowy owl (*Bubo Scandiacus)* at the National Aviary presented with a severe bumble foot infection in both left and right foot pads. This paper will discuss different phases of his medical care, preventive Aspergillosis treatments, and progress made, as well as current status. How trainers were able to work with veterinary staff to modify existing glove behaviors to allow for voluntary treatment with ointments, DMSO, and sterile wound washes will be discussed. It will also highlight that as treatments were modified, glove training was changed to allow for voluntary restraint for twice daily injectable antibiotics. Snowy Owls can get overly stressed and overheated when being restrained for medical treatments and are highly susceptible to Aspergillosis when stressed. By using training as a tool, the National Aviary staff was able to make our 1.0 Snowy owl's medical treatments a less stressful experience which is helping the healing process.

Introduction

Bumble foot is a condition recognized as an inflammation, and typically is an infected lesion of the plantar part of the foot, affecting either the ball of the foot or one or more toes. (Forbes, 2016). It can be caused by an injury to the foot by a talon, thorn, or abrasive object. It can be caused by unsuitable perching or by long periods of inactivity in which a bird is placing excessive weight on their feet (Forbes 2016). Bumble foot can occur in all species of birds but is more prevalent in birds of prey and penguins under human care. Heavier bodied species, such as snowy owls, are more susceptible to bumble foot when compared with other species (Miller, Fowler 2015). Medical treatment of bumble lesions can include numerous topical treatments, bandage changes, and several courses of oral or injectable antibiotics. These treatments can be very stressful for birds because they typically require the bird to be manually restrained once or twice a day. Positive reinforcement training can be used as a tool for reducing stress during medical procedures and has been used in past bumble foot cases at the National Aviary including a 1.0 Bald Eagle (Haliaeetus leucocephalus) and 0.2 Silver Gull (Chroicocephalus novaehollandiae). When a 1.0 Snowy owl (Bubo Scandiacus) named "Fleury" presented with bumble foot there was concern over how a species susceptible to stress related diseases would handle treatment.

This paper will discuss different phases of his medical care and how trainers were able to work with veterinary staff to modify existing glove behaviors to allow for voluntary treatments including injectable antibiotics.

Materials and Methods

The National Aviary's Snowy owl named "Fleury" has been avian ambassador for almost 5 years appearing in free-flight shows, classes, and even few national television appearances. "Fleury" is trained to voluntary step up onto a raptor glove, hop into a travel crate, and complete point A to point B flights. In late December 2015 trainers had noticed that "Fleury" was not bearing full weight on his right foot. Upon physical examination he presented with a bumble foot infection in both left and right foot pads. Because of "Fleury's" heavily feathered feet, trainers were unable to see the lesions unless they would have been lifting his feet and looking directly at the bottoms.

Figure 1: Shows the initial bumble lesions of right and left feet during first stages of treatment.

Veterinary staff prescribed an aggressive series of medical treatments for "Fleury" which involved twice daily oral antibiotics and twice daily topical DMSO treatment. DSMO is dimethyl sulfoxide, it is a topical anti-inflammatory agent that penetrates through the skin barrier to treat joint inflammation or infection. The veterinary staff at the National Aviary mixes DMSO with antibiotics and other anti-inflammatories so that DMSO acts as a vehicle to deliver these agents through the skin as well. Since education trainers had success with applying bumble foot treatments to previously trained birds, staff felt confident that they could administer these initial treatments while he was sitting on the glove, being reinforced with pieces of mouse. It took very little time to train "Fleury" to allow another trainer to lift his foot up while he was sitting on the glove (See Figure 2) by pairing it with his reinforcement from the trainer who was holding him on glove. The ointments and swabs were introduced almost immediately (See Figure3) and there was very little apprehension to these items on "Fleury's" part.

Figure 2: Shows trainer lifting “Fleury’s” foot while he is sitting on the glove.

Figure 3: Shows trainer applying topical ointment on the bottom of “Fleury’s” foot while he is sitting on the glove.

Veterinary staff would assess “Fleury’s” progress twice a week alongside the education trainers. Vets were able to visually examine his feet during his training sessions. After two weeks of treatment, veterinary staff were very impressed with “Fleury’s” response to treatment. On January 13th, part of the right foot lesion (See Figure 4) started to slough from the foot on its own. Vet staff prescribed sterile foot

washes of Nolvasan dilution and additional topical triple antibiotic ointments to prevent infection and keep healthy tissues moist. Sterile washes and three topical ointments made "Fleury's" treatment more time intensive to set up (See Figure 5) and took longer for education trainers to administer. Twice a day treatments involved pulling up sterile Nolvasan wash into designated right and left foot syringes and thoroughly washing the area in and around the lesions. After the wash there was topical application of DMSO on the tops and bottom areas of the feet. Then there were two separate creams to apply – Silver Sulfadiazine (SSD) and Triple antibiotic cream. Since there was previous success with treatments on the glove, education trainers thought it would be best to continue with treatments this way. As you can see in Figure 6 a trainer is able to lift "Fleury's" foot to apply sterile Nolvasan dilution wash. Veterinary staff was also able to commit to helping education trainers twice a week, giving "Fleury" his treatments while on the glove as well as examine his feet at the same time. "Fleury's" initial glove training proved to be beneficial with his more extensive treatments.

Figure 4: First piece of "Fleury's" bumble lesion on right foot to break away from foot.

Figure 5: Set up for "Fleury's" sterile washing and 3 topical treatments.

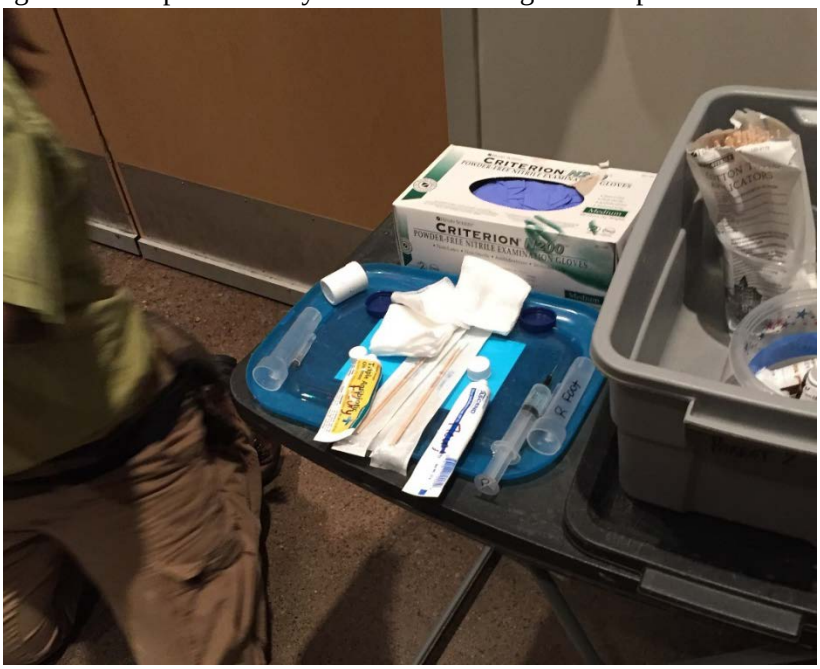


Figure 6: Trainer applying sterile Nolvasan dilution wash to bottom of “Fleury’s” foot.

Snowy Owls under human care are also prone to a disease called Aspergillosis. Aspergillosis is an infection that can cause disease if the host is immunocompromised, stressed, or when the bird is exposed to an overwhelming number of spores. (Abundis-Santamaria, 2003). Stress seems to be the major factor in the development of the disease and can be caused by several factors including heat, capture, or changes in management (Abundis-Santamaria, 2003). In order to prevent the development of Aspergillosis in “Fleury” vet staff prescribed an increased preventive medicine treatments including a rotating schedule of oral Terbinafine and Amphotericin B nebulizations. Fleury had been receiving pulse therapy of Terbinafine, seven days on, seven days off from December to June. In July he went to daily Terbinafine treatment for a fifty-six-day course. This purpose was twofold – Aspergillosis prevention and to treat fungal infection in his feet. The Amphotericin nebs were scheduled twenty-one days on, seven days off since December. Fortunately, “Fleury” had already been accustomed to a protocol of preventative anti-fungal nebulizations every three months, so treatments continued to be easily administered while “Fleury” was in his crate which only lasted ten minutes each day.

After a month of sterile washes and topical treatments on January 27th veterinary staff decided it was necessary to physically restrain “Fleury” (See Figure 7) for an extensive examination and potential debridement of the lesions which would remove dead tissue from the feet and encourage healthy tissue growth. Vet staff worked carefully to only remove dead tissue without removing anything that could cause excessive bleeding (See Figure 8). They were able to remove an extensive amount of necrotic (dead) tissue from both feet (See Figure 9), however the left foot’s lesion was less extensive and was almost removed entirely as seen in Figure 10. It was determined as this stage that his prior medical

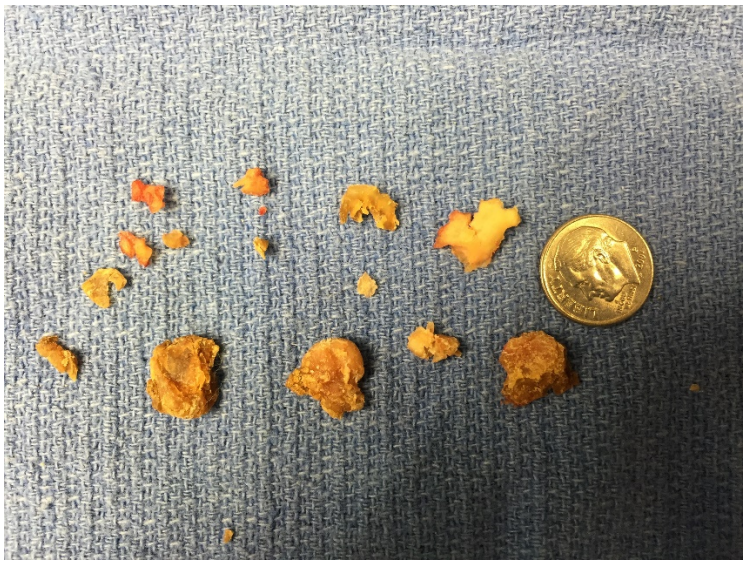
treatments had prevented the need for surgical treatments, which was a considered a success due to the risks involved in surgery.

Figure 7: Veterinary staff restraining “Fleury” for first debridement of lesions

Figure 8: Veterinary staff removing dead tissue from “Fleury’s feet

Figure 9: “Fleury’s left foot after debridement

Figure 10: Dead tissue pulled from both of “Fleury’s” feet



After debridement was complete, vet staff bandaged both of “Fleury’s” feet to prevent any further infection and to allow the wounds to heal. It was decided that it was in “Fleury’s” best interest to have the hospital manually restrain “Fleury” for bandage changes three times a week. Bandage changes would be very extensive and restraint would minimize the amount of bacteria infecting the open wounds. To minimize stress during catch up he could be caught out of his kennel crate. On bandage change days trainers would voluntarily step up “Fleury” and ask him to hop into his kennel crate which was a behavior he was very comfortable performing.

Vet staff advised the education trainers that due to his open wounds on his feet, “Fleury” may need to start a course of injectable antibiotics. Injectable antibiotics would allow vet staff to administer stronger

antibiotics and those antibiotics would be based off of the bacterial cultures of “Fleury’s” feet. This would involve a vet tech to inject antibiotics into “Fleury’s” pectoral muscle mass. In order to do this safely “Fleury” would have to be restrained during injection as to prevent injury. Trainers decided they could try to train a voluntary restraint while “Fleury” was sitting on the glove. Training only took a few days and started with trainers just placing their hands on the side of “Fleury’s” wings while he was being fed on the glove which you can see in Figure 11. Then the same trainer could also reach around and restrain his head if necessary. The trainer holding “Fleury” on the glove would have control of his feet with them placed firmly on the glove and his raptor equipment secured properly. Eventually a course of injectable antibiotics were started on February 4th and “Fleury” would sit on the glove, allow trainer’s to restrain him, eat his reinforcement, and receive his twice daily injectable antibiotics. Training the voluntary restraint allowed staff to minimize the number of times “Fleury” would have to be caught up and restrained which is a stressful process. To ensure that “Fleury’s” injections were not harmful, vet staff would routinely check his keel for bruising on bandage change days.

“Figure 11: A second trainer holds in “Fleury’s wings while he is sitting on a glove, as vet tech simulates antibiotics injection.

Fleury’s” bandage changes continue to be changed three times a week, typically on Mondays, Wednesdays and Fridays. In March, as “Fleury’s” feet healed and healthy granulation tissue filled the dead space left behind by the debrided lesions, some of the tissue on his right foot was too proliferative and did not adhere to other healthy tissue. Figure 12 shows the proliferative tissue regrowth of “Fleury’s” right foot, while Figure 13 shows the left foot healing normally.

Figure 12: Proliferative tissue regrowth of “Fleury’s” right foot March 2016.

Figure 13: “Fleury’s” left foot as tissue healing around removed bumble lesion March 2016.

Veterinary staff applied a steroid cream to “Fleury’s” right foot on bandage change days which successfully reduced the over proliferative effect from the tissue growth. The healing process continued, and Figures 14 and 15 show what his right and left feet looked like in April. Figure 14 shows how the proliferative tissue subsided to leave a small flap of skin which help pad the wound for a period of time before eventually being removed by Veterinary staff.

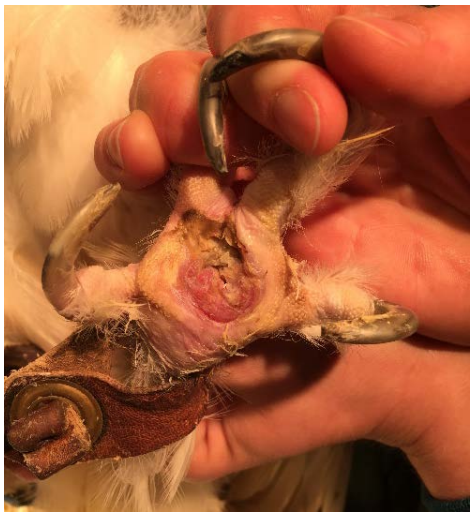
Figure 14: “Fleury’s” right foot in April with small flap of skin.

Figure 15: 5“Fleury’s” Left foot in April

Currently education and vet staff are hopeful for “Fleury’s” recovery as his feet continue to heal. Figure 16 and 17 show “Fleury’s right and left foot as of July. There is pink healthy tissue developing which is closing both of the holes left behind by the lesions. However due to the nature of bumble foot, “Fleury” could have re-occurring foot issues in the future, but hopefully any potential issues can be stopped quickly with regular foot examinations which can occur while “Fleury” is on the glove.

Figure 16: “Fleury’s right foot in July

Figure 17: “Fleury’s left foot in July



Discussion and Conclusion

Bumble foot can be a difficult infection facing birds prey under human care, especially in “Fleury’s” case as he has infection in both feet. Medical treatments for bumble foot would have been very stressful because they included numerous topical creams, injectable antibiotics, and regular bandage changes. However due to his history with glove behaviors as an education bird and with additional positive reinforcement training, “Fleury’s” trainers were able to minimize the number of times “Fleury” would have to be “caught-up” and restrained by veterinary staff. Ultimately education trainers would have preferred to administer bandages changes voluntarily but due to the extensive nature of “Fleury’s” bumble lesion wounds it would have been very difficult to administer the precise and sterile environment his bandages changes require. Medical treatments prior to extensive debridement in February also prevented the need for surgery, which can be risky. Preventative Aspergillosis treatments were administered easily due to his previous training history with these treatments. Since education trainers were able to minimize the number of times “Fleury” needed to be restrained by vet staff to three times a week, staff considers our efforts a success in reducing “Fleury’s” levels of stress during treatments.

Currently the education and vet staff are hopeful for “Fleury’s” recovery as his feet continue to heal. There is healthy tissue developing which is closing both of the holes left behind by the lesions. However due to the nature of bumble foot, “Fleury” could have re-occurring foot issues in the future, but hopefully any potential issues can be stopped quickly with regular foot examinations which can occur while “Fleury” is on the glove. To prevent bumble lesions within the education collection in the future, staff now plan on training and routinely checking the bottoms of raptor feet for signs of bumble foot. By using training as a tool, National Aviary staff was able to make our Snowy owl’s medical treatments a less stressful experience. Though he has a long road ahead of him, Veterinary staff has indicated that “Fleury” is healing faster than what was anticipated.

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Counter-Conditioning and Psychological Appetite: Building Trust with 1.1 American Kestrels *(Falco sparverius)*

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Abstract

In their 2013 article *The Power of Trust,* Steve Martin and Susan Friedman define trust as "a level of certainty that interaction will result in good outcomes." They assert, "When trust is established, animals are more motivated to control our reinforcers with their behavior, i.e., to learn."

In August of 2015, The Living Desert accepted 1.1 wild-born, non-releasable American Kestrels *(Falco sparverius)*. We found ourselves challenged by the seeming impossibility of building a foundation of trust with two animals that could not be approached without provoking frantic flights in the farthest side of their enclosure.

This paper will discuss our deceptively simple program of counter-conditioning, enacted by regularly dropping small rodent pieces onto a shelf in their enclosure. This not only created frequent brief interactions with positive outcomes, but also increased their psychological appetite by preventing satiation at each meal. Both birds, despite their previous tendency to leave portions of their diet uneaten, increased in weight and began consuming every bite. Before long, they flew to the front of their enclosure when trainers approached and accepted tidbits from our hands. Now, their repertoire includes stationing, weighing, and A-to-B flights to a trainer's glove. Soon, they will travel to schools around Southern California, teaching students about raptors and how to live in harmony with wildlife.

Our success with these American Kestrels has improved their quality of life by reducing fear behaviors and facilitating voluntary husbandry participation. This use of counter-conditioning may be relevant to the care of any animal that cannot be reinforced directly due to avoidance of humans.

Introduction

In August of 2015, the Wyoming Game and Fish Department accepted 1.1 American Kestrels *(Falco sparverius)*, approximately three weeks of age, which been found by a member of the public. The Wyoming Game and Fish Department determined that they had imprinted on humans and were thus non-releasable. The fact that they were imprinted led The Living Desert Zoo and Botanical Gardens to accept both birds with the goal of training them to become animal ambassadors in our Wildlife Programs Department. This department utilizes free contact to display a variety of small animals with the purpose of providing guests and students up-close animal encounters through our Wildlife Wonders amphitheater shows, Wildlife on Wheels outreach programs, and on-grounds volunteer animal handling.

Upon arrival, neither kestrel displayed any behavior indicative of a positive relationship with humans – not even the expected ones with imprinted birds such as approaching the front of the enclosure or consuming food in our presence. In fact, their behavior was quite the opposite of what we had expected – when any human passed by or approached their enclosures, the birds would fly back and forth at high speed, vocalizing loudly, as far away from the humans as they could get. During prolonged exposure to humans such as routine cleaning of their enclosures, these behaviors would sometimes escalate to the point that the birds would display behaviors such as panting (despite cool morning temperatures) or even excrete loose, watery stool. Despite our hope that the incidence of these behaviors would decrease over time as the kestrels adjusted to their new environment, they remained consistent.

While these behaviors did lead us to believe at the time that Cheyenne and Jackson (the kestrels) may not be well suited to the regular handling necessary for our animal ambassador program, we were still determined to build a positive, trust-based human-animal relationship – one which allowed, at the very least, reduced stress reactions during routine cleaning and voluntary participation in husbandry behaviors such as standing on a scale. However, the intensity of the kestrels' avoidance behaviors provided a hefty roadblock. We were at a loss – how could we even begin to establish a foundation of trust with birds who reacted with behaviors indicative of extreme stress at our very approach? The avoidance behaviors did not decrease with time, and attempts to habituate them to the presence of staff by traditional "manning" techniques such as restraining them by their jesses on the glove in a calm, quiet environment did not result in any measurable improvement.

Thankfully, we didn't have to figure it out alone. With advice from Megan Sanders, former Animal Behavior Programs Manager at the Cheyenne Mountain Zoo and current professor at Pike's Peak Community College, we began a simple program of counter-conditioning which radically altered the kestrels' relationship with humans – allowing not only the positive reinforcement training of a variety of husbandry behaviors, but also behaviors that will soon allow both birds to travel on- and off-grounds for animal encounters which will assist in teaching thousands of students about native wildlife.

Sanders' advice was so simple and straightforward that it's difficult to imagine how it could create such an incredible change in behavior over such a short period of time. She simply suggested that we drop small pieces of food into the kestrels' enclosures as often as we can while passing (personal communication, November 3, 2015).

Methods

As we began our program of counter-conditioning, each kestrel was receiving three insects (mealworms or crickets) and one large adult mouse (thawed from frozen) each day – approximately 30 grams of food.

We divided the mouse into multiple small pieces while preparing their diets each morning, with the goal of delivering as many small reinforcers throughout the day as possible. The kestrels were fed anywhere from one to six times per day, depending on staff availability.

A staff member would walk up to the enclosure, push a small piece of rodent through the mesh onto a shelf, and immediately walk away.

Results

When they arrived at The Living Desert, the kestrels' response to staff approaching their enclosure was an immediate flight to the furthest back corner, with back-and-forth flights and vocalizations escalating if staff remained nearby. They would only consume food when staff members were out of sight, and often left large portions of their diet uneaten.

Within the first week of our counter-conditioning program, behavioral changes had become apparent. Both birds had ceased the flight behavior, and would remain quietly on their current perch until the staff member left. They were now consuming 100% of food items offered.

By the second week, Cheyenne, the female kestrel, would fly to the front of the enclosure and grab the rodent piece in her beak as soon as the staff member removed her hand from the mesh. However, she would immediately fly with the piece of food to a more distant perch to consume it.

By week three, Jackson, the male kestrel, was displaying that same behavior. Cheyenne was now taking the piece of food only a few inches away from the front of the enclosure, and would eat it while staff members were standing directly in front of her. This quickly graduated into Cheyenne accepting food directly from the keeper's fingers through the mesh. Jackson wasn't far behind – he reached this milestone by week four.

Now that the kestrels would remain calm at our approach and accept food from our hands, we could begin differential reinforcement in order to shape specific behaviors. We were easily able to train flights to a scale and to a trainer's glove.

In addition to behavioral changes, the kestrel's weight fluctuations proved surprising. As visible in Figures 1 and 2, the kestrels' weights increased sharply in early November, which is when we began delivering their diet in small portions throughout the day. Despite no change in quantity or type of food items offered, Jackson's weight increased from 98g to 130g in a one-month period, a 28% increase. Cheyenne's weight increased from 120g to 130g, an 8% increase.

At a routine veterinary examination in January, both kestrels were pronounced overweight. As a result, we reduced their diet slowly over a period of several weeks. Now, their weight is managed based on body condition and motivation.

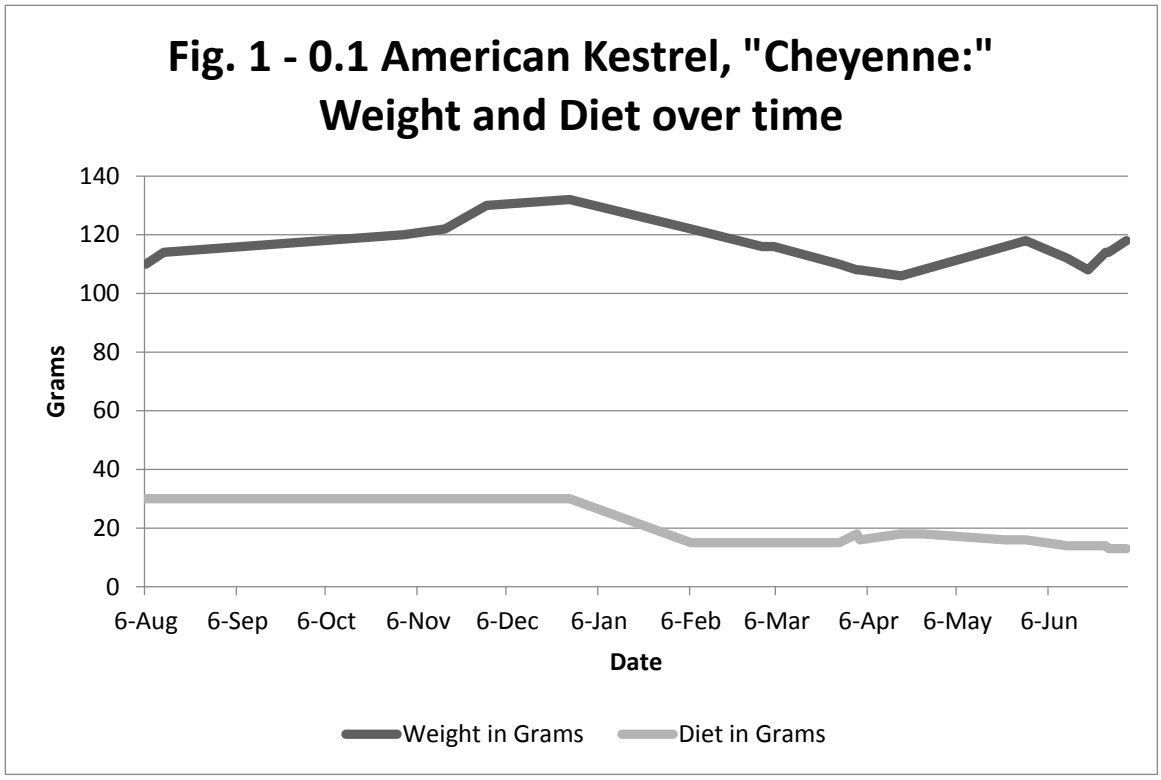
Fig. 1 - 0.1 American Kestrel, "Cheyenne:"
Weight and Diet over time
140
120
100
80
60
40
20
0
Grams
6-Aug
6-Sep
6-Oct
6-Nov
6-Dec
6-Jan
6-Feb
6-Mar
6-Apr
6-May
6-Jun
Date
Weight in Grams
Diet in Grams

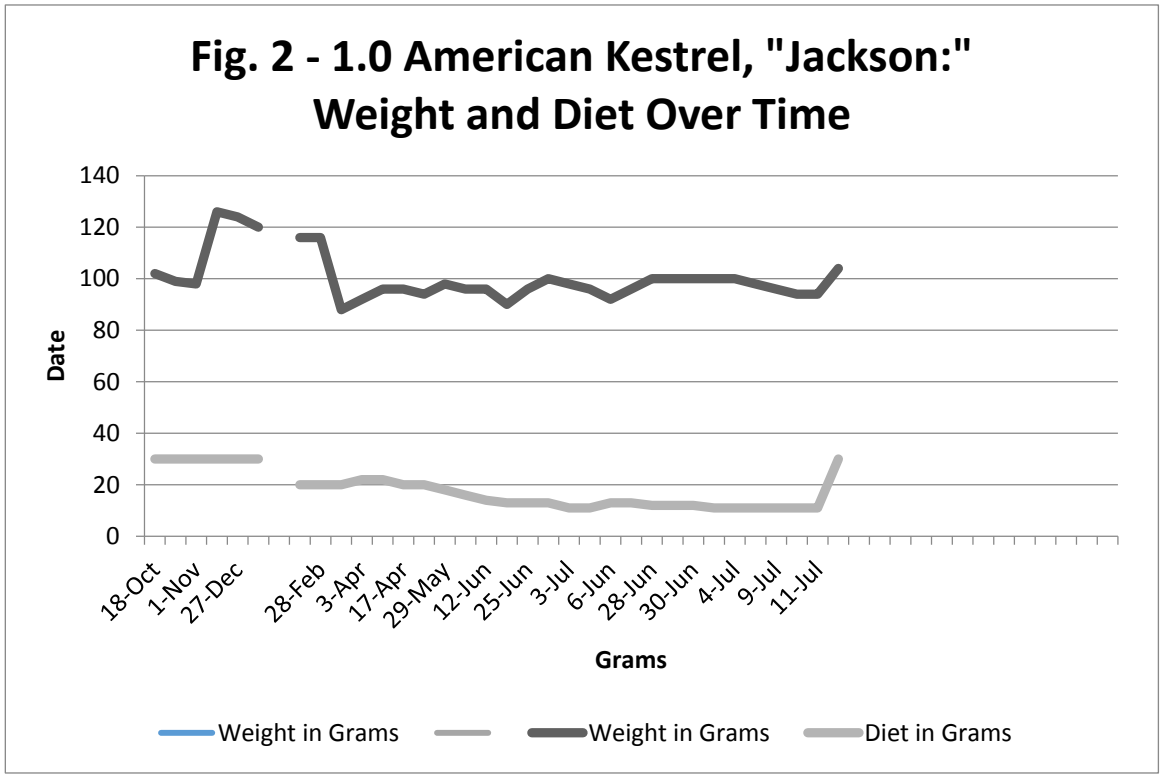
Fig. 2 - 1.0 American Kestrel, "Jackson:"
Weight and Diet Over Time
140
120
100
80
60
40
20
0
Date
18-Oct
1-Nov
27-Dec
28-Feb
3-Apr
17-Apr
29-May
12-Jun
25-Jun
3-Jul
6-Jun
28-Jun
30-Jun
4-Jul
9-Jul
11-Jul
Grams
Weight in Grams
Weight in Grams
Diet in Grams

Discussion

For Jackson and Cheyenne, counter-conditioning by pairing a previously aversive stimulus (presence of humans) with a reinforcer (in this case, mouse pieces) both increased their overall food motivation and allowed trainers to establish a relationship based on trust. This simple method of behavior modification may be useful to animal care staff in a wide variety of facilities. Establishing a positive relationship that allows trainers to shape behavior through training sessions can increase guest opportunities to learn and improve their perception of animal care in zoological facilities. In addition, based on current research, developing a positive human-animal relationship has welfare implications far beyond simple participation in husbandry behaviors.

While the use of the word "trust" to describe an animal's relationship with a human may initially seem a bit nebulous and anthropomorphic, Susan Friedman and Steve Martin do a fantastic job defining the term using observable behavior in their groundbreaking 2013 paper *The Power of Trust.* First débuted at an IAATE conference, the paper describes trust as "a level of certainty that interaction will result in good outcomes." Cheyenne and Jackson's behavioral changes display this principle clearly. Initially, their daily interactions with humans included the highly aversive cleaning of their enclosure and a single positive interaction in the form of delivering their diet. As we began the program of counter-conditioning, the birds were suddenly receiving up to six positive interactions in the form of food delivery every single day. This changed the entire paradigm – for the first time, their trust account was in the black – for the first time, an interaction with a human was more likely to be pleasant than aversive.

A second paper originating from an IAATE conference provides an explanation for the weight gain Cheyenne and Jackson developed as a result of our counter-conditioning training program. In her 2015 article *The Mouse Went Down the Hole – Revisited,* Cassie Malina explains that "the procedure of delivering a healthful diet in several small portions throughout the day often causes the bird to eat more food than it would when an abundant diet is provided one time per day." Referred to as "psychological hunger," "psychological appetite," or "the food paradox," this tendency toward increased food-seeking behaviors may be the result of a perceived food shortage. If food is only available in small amounts, it makes sense to the animal to store up as much as possible. This allows animals to be worked at higher weights, as they are more highly motivated to seek out food items, even when, as in this case, the quantity and type of food items have not been modified. The "psychological appetite" that the birds experienced probably increased the reinforcement value of the mouse pieces, which may have contributed to how quickly they developed positive associations with humans.

A positive human-animal relationship (HAR) has been found to produce measurable benefits for animals housed in zoological facilities. In fact, two separate studies published in *Applied Animal Behaviour Science* revealed impressive results – both using a model that measures the HAR of various animals and using that to successfully predict increased enclosure use in activity budgets and reduced fear behaviors toward humans (Claxton, 2011) (Melfi & Ward, 2013). Similarly, a 2009 study researching the effect of desensitization training on singly-housed rhesus macaques (*Macaca mulatta)* in a laboratory setting found similarly impressive results – researchers "found that a significant proportion of animals exposed to desensitization training showed a reduction in the rate at which they engaged in cringing toward humans..., cringing in general…, and in stress-related behaviors" compared both to animals simply allowed to habituate to the environment and animals which received positive reinforcement training for husbandry behaviors (Clay, Bloomsmith, Marr, & Maple). The use of strategic counter-conditioning to

establish a positive HAR with animals that currently display fear, aggression, or avoidance behaviors toward humans may allow a drastic improvement of the quality of life for many animals housed in human care.

In addition to improving animal welfare, a positive HAR can allow us to be even better at achieving our goals of educating and inspiring guests. A 2003 study published in *Environment and Behavior* found that "public animal training and public animal training with interpretation produce more positive zoo experiences, training perceptions, exhibit size and staff assessments, and longer visitor exhibit stay times when compared to passive exhibit viewing and interpretation-only sessions" (Anderson, Kelling, Pressley-Keough, Bloomsmith, & Maple). The benefits of public training sessions paired with interpretation may become available for more animals than ever before if positive human-animal relationships can be developed easily by counter-conditioning a previously aversive association with humans.

For Cheyenne and Jackson, building a positive human-animal relationship enabled complete elimination of several stress behaviors, voluntary participation in husbandry behaviors, and incredible up-close encounters with young people that will inspire generations of conservationists.

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Ringing the dinner bell: unique approaches for hooved mammals on a large multi-acre, multi-species habitat.

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Introduction

Since their inception, zoological facilities have continued to grow and evolve toward a dedicated conservation mission and animal welfare cause. Busch Gardens continues to be a leader in this ongoing evolution, and several changes continue throughout the park every year. In 1997, the Serengeti Plains at Busch Gardens were redesigned and holding pens were included along the Plains' perimeter to allow the ability for hoofstock to shift onto and off of the veldt. Animal husbandry has improved through this innovative setup. Training hoofstock to shift into night holding pens from two separate multi-species 30-acre displays allows for species-specific feedings and/or medications and allows pasture revitalization and maintenance to occur. Each species is brought into their individual holding pens each night by a species-specific discriminative stimulus (S^d) and reinforced upon completion of the behavior.

Planning

Choosing a tone was a challenge. Certain criteria needed to be considered. Intensity of the sound was the first consideration; it needed to be loud enough to carry over 30 acres. We also needed to consider each species' ability to discriminate among different sounds/tones. Through trial and error, it was discovered that a bike bell, cow bell, and truck horn (Figure 1) were the best options. A bike horn was also attempted, but due to lack of durability and low sound quality, it was eliminated.

Holding habitats were determined by the availability of pens, size of herd, and the behavioral characteristics of the species. The two 30-acre main displays vary greatly. The South Veldt has five holding pens in one location which house Eland antelope (*Taurotragus oryx)*, Grevy's zebra (*Equus grevyi)*, Addax antelope (*Addax nasomaculatus*), Impala (*Aepyceros melampus)*, Reticulated giraffe (*Giraffa camelopardalis reticulate*). This holding area includes two access points to/from the veldt. The North Veldt consists of six holding pens along the perimeter of the main display. This veldt houses Greater kudu (*Tragelaphus strepsiceros)*, Sable antelople (*Martes zibellina*), Ellipsen waterbuck (*Kobus ellipsiprymnus)*, Grant's gazelle (*Nanger granti)*, White-bearded wildebeest (*Connochaetes taurinus albojubatus)*, and Grant's zebra (*Equus quagga boehmi*). When choosing a night holding pen for a herd, their behavioral characteristics and herd dynamics had to be considered. Several of the holding pens are located next to a high traffic road. As a result, only specific species were deemed suitable for certain holding locations.

For introducing new species to the veldt, additional measures would need to be taken. In deciding to shape a behavior or capture a behavior, the location needs to be considered. Once given access to the main veldt display, we would not have a means to reinforce approximations to the end goal without addressing the issue of alternate-species interference. As a result, and as the new species would not yet be given access to the main veldt display for a minimum of two months, we could establish a tone in the holding pen. The chosen tone would be used when feeding in the evening (as evening time would be the maintenance-level shift time back into holding). This would pair the S^d with feeding time in the holding pen. Once there is a strong reaction to the tone (movement to the feed location without the food being there) the tone would be considered established. When letting a new species on 30 acres for the first time, the other species/herds are held in holding while the new species is allowed to explore the new habitat. The tone will again be utilized at opportune moments (when herd is in close proximity to holding area) to encourage shifting into the pen (with reinforcement upon completion). It is species dependent how long they will stay on habitat for the first few weeks.

When adding new individuals to an established tone-trained herd, the group is allowed only holding habitat for at least two weeks. The herd's tone is used when feeding in the evening. Once the new members of the herd are acclimated, they are all allowed to explore the main display together. Generally, the new individuals follow the herd back to the night holding pens—the experienced members of the herd do most of the training!

Implementing

Four of the South Veldt herds recall to the truck horn, as these species utilize one entrance point at the same time. The Eland antelope and Grevy's zebra enter through the same gate together. The two species are separated further down the lane by a member of the zoo team. The impalas approach the entrance upon clearance of the Eland and Grevy's zebra, using a creep system in an interior perimeter gate (Figure 2) to enter their pen. The Addax antelope are brought in through a tunnel chute system (Figure 3). This can be done before or after the other South Veldt species are brought into holding habitats as this utilizes a different access point. Due to the aggressive nature of the Addax antelope, they are the only ones shifted via protected contact. Once all of the smaller hoofstock have been shifted in, the Reticulated giraffes can be given access to the barn (Figure 4).

There are three different S^d's used for the North Veldt herds: the bike bell, cow bell, and truck horn (Figure 1). The Greater kudu are shifted into the kudu pen using a bike bell. The Sable antelope, Ellipsen waterbuck and Grant's gazelles are recalled to their respective pens using a cow bell. The truck horn is utilized for shifting in the White-bearded wildebeest and Grant's zebra into their individual holdings. As these holding habitats are on opposite sides of the veldt, these species needed to learn not only the sound of the S^d but the correct location/access point for holding. All of these holding habitats are behind bollards (Figure 5), as White rhinos (*Ceratotherium simum)* share the main habitat as well. This allows hoofstock to be brought in safely, without offering rhinos access to an area not structured/reinforced to their strength level.

Evaluation and Adjustments

In the spring of 2015, construction began on a new coaster, with site perimeter next to the Addax antelope holding habitat. Due to construction needs, the Addax antelope needed a new holding habitat. Changes were made to the Grant's zebra, Eland antelope, and Grevy's zebra holding habitats to allow for the creation of a new holding area for the Addax antelope (Figure 6). At the start, smaller hoofstock were shifted off of the South Veldt, allowing the addax to be fed in a new location. During this time, the giraffe stayed on the main habitat overnight, extending time for the addax to adjust to new behaviors. Once the Addax antelope were consistently eating in the shift area, the chute was opened, and they were shifted to their new holding habitat. They were kept in this area for 30 days while a new protected contact chute was completed. The Addax antelope then shifted to the main habitat using this new chute system. They then learned their new holding habitat in a similar fashion as any new species to the veldt would. Now, with only the S^d of a truck horn, this species is consistently going to the new holding location.

Behavioral characteristics were a factor in the original location of the Grant's gazelles holding habitat. The original holding pen was next to a high traffic road, with a bus stop next to it. The Grant's gazelles were held in their holding habitat for six months before going onto the North Veldt. During this time, they acclimated well to the holding habitat. However, once on the North Veldt they were hesitant to return. When they did choose to shift into the area at night, various injuries were observed the next morning. As we were not able to modify the variables of sound intensity or proximity, we immediately sought out a more conducive location to a rested, relaxed herd. A vacancy in holding pens allowed us to move the Grant's gazelles to a holding habitat with less traffic noise. The new holding habitat also had a similar creep system in the gate allowing a smoother transition. The Grant's gazelles are now consistently reacting to the S^d and new holding habitat in a positive manner.

The Sable antelope have responded very well to shifting. They initially had three pens. Due to herd management of another species, the sable needed to be relocated. Using their natural curiosity, we were able to capture the shifting behavior often, and they were successfully moved to a new holding area. The new holding habitat was situated next to a high traffic road; this did not cause any behavioral reaction in the Sable antelope. When the original holding habitat was vacated, the sable were quickly and successfully transitioned back to it.

Benefits

Training hoofstock to shift into holding habitats allows for multiple species to be separated for feedings, medications, breeding, and births. On the South Veldt, there are grazers and browsers that receive separate diets. Since they are brought into specific holding areas, different diets can be offered with effective results. This allows various species to share a main naturalistic habitat without unnecessary food aggression. If a herd needs to be medicated, it is possible. The South Veldt herds also have a chute system they can be shifted through daily. This allows for weighing, separations, injections, and/or loading into a trailer. Pasture maintenance can be difficult when the plains are at capacity. Having hoofstock off of the main veldt habitat allows the maintenance staff members to work freely. In addition, having animals in holding habitats allows for pasture revitalization on the main habitat, which is important to improve grass growth and aids in parasite control.

Conclusion

Since the holding habitats have been built, herds have been healthier, and the pastures have improved. Using the different S^d's has given the ability to quickly recall the herds as needed. Shifting the animals into holding areas allows us to obtain a closer look at each individual animal to evaluate for medical concerns. The addition of these areas has allowed the animal care staff improvements in animal monitoring, shifting, medicating, breeding, herd socialization, and general veldt care.

Figure 1. S^d bike bell, truck horn, and cow bell.

Photo by Morgan Lashley

Figure 2. Creep system.

Photo by Morgan Lashley

Figure 3. Addax tunnel chute system.

Photo by Morgan Lashley

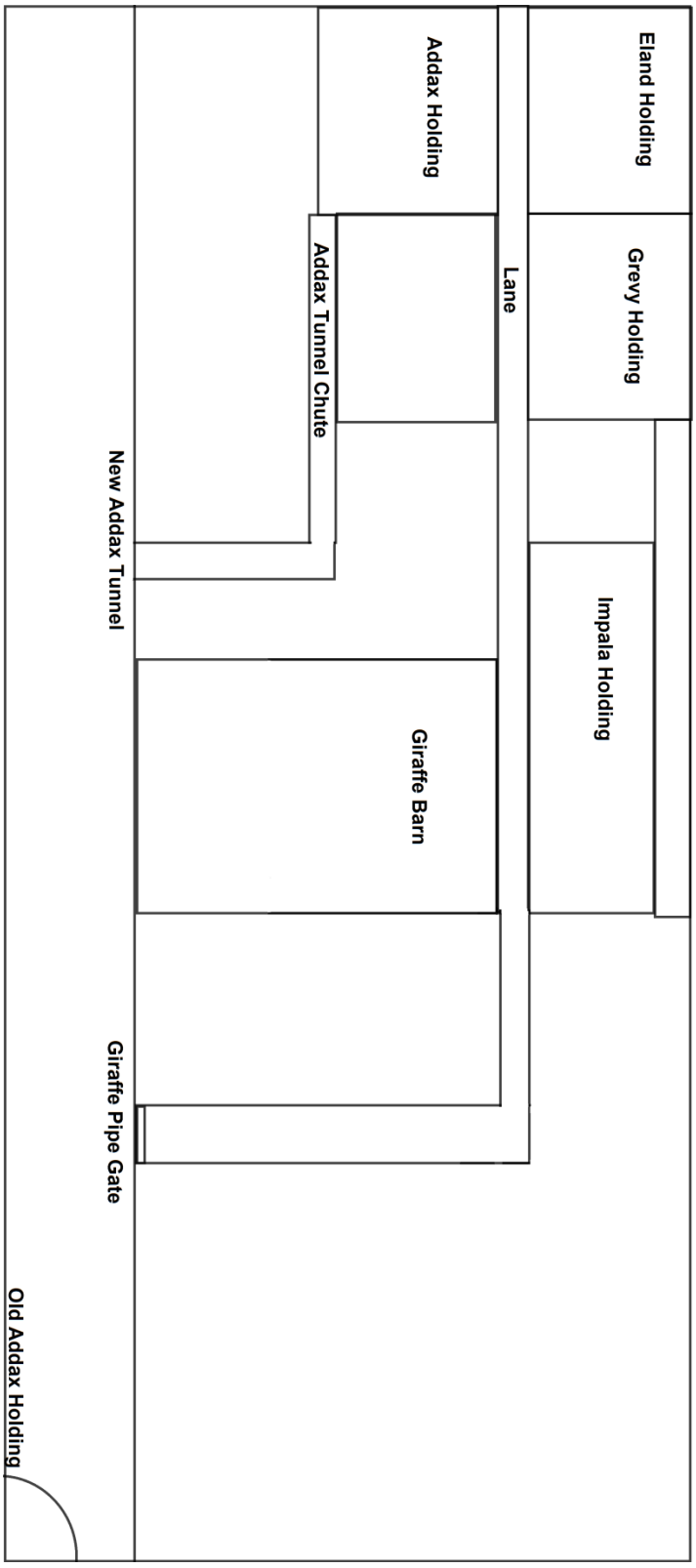
Figure 4. Giraffe pipe gate.

Photo by Morgan Lashley

Figure 5. Sable and Grant's gazelle bollards.

Photo by Morgan Lashley

Figure 6. Addax Transition *not to scale



Bridging Between Animals & Guests: How Training Can Connect & Inspire

At Cheyenne Mountain Zoo our keepers are fortunate to have a strong background in operant conditioning methods and positive training skills. Utilizing those has enabled them to build strong connections and relationships with their animals and they are able to help show guests the incredible natural behaviors that these animals possess, as well as highlight husbandry behaviors and enrichment demonstrations that are unique to each species. Utilizing space in the best way possible to improve our animal's welfare, coupled with engaging conservation messaging through shows and keeper talks brings our guests closer to the animals in our collection, and helps them feel connected to their wild counterparts. Through captivating natural behavior shows and defining moments with our guests, our animals are helping convey an important message to the public; that the world needs animals and preserving the earth is essential to our survival.

By discussing the different ways that our staff train and work with our collection I hope to bridge the gap not only between the public perception of zoos and our animals, but also from zoo to zoo and trainer to trainer, highlighting what we have accomplished and demonstrating what can be possible through operant conditioning and positive reinforcement.

Often times ungulates can fall into a stigma of being considered "brown deer" and they don't appear to have any special qualities to endear guests to them. We know that is incorrect, now how do we show our zoo guests that?! At Cheyenne Mountain Zoo the keepers have worked hard to build relationships with their animals and through extensive training programs, have empowered the animals to show our guests just how amazing they are. Giraffe will walk over and interact with guests on their level, hippos will open wide for cabbages, and mountain tapirs will come over to meet guests and allow for up close meet and greets. Utilizing special training doors, we are able to not only bring our moose, hippos, and zebra closer to our guests, but we are also able to work on voluntary hoof work, blood draws, and more with our animals.

Hoofstock are not the only animals that are making great ambassadors through training and empowerment. Many defining moments with guests occur with some of our flock species, including bringing one of our African Penguins out into the public area for guests to see, having a guest help train one of our homing pigeons, and even getting up close and personal with a Rio Grande Turkey! The keepers work tirelessly with their animals to build relationships that help create an animal that is comfortable around strangers and gentle enough to eat delicately out of the guests' hands. I never would have thought I'd fall in love with a turkey until I met Eugene, and having one come right up to me to take a peanut from my hand was a very special experience!

All of the animal at our zoo have something amazing they can offer, it's just a matter of finding the perfect fit for our animal and our opportunities. We believe that every animal has a "job" to do, and that job is to help the guests fall in love with them and empower the guest to want to help save the species. Our otter exhibit is designed with an upper "Sky Pool" that guests are able to come up to and they can tong feed the otters. After a tiger show, a guest may get called up and can help feed the tiger right at the fence. During the lion show, keepers ask guests to help train Abuto, our male, by holding his target stick on the public side of the window while Abuto demonstrates how tall he can stand to reach his target stick. On the target pole is a sign telling guests about boma's and how important they are to helping save wild lions.

There are many different ways that we as keepers can inspire the guests that visit our zoos. Spending as much as we do with them, and as we better our training skills and our understanding of the animal's behavior, it makes sense to use the best tools at our disposal to help us achieve our mission. The animal's will always be a zoo's best "tool", and if we can draw the guests in and help them care more about the animal and connect on a personal level, they will feel more empowered and be more connected to our mission.

Large Lessons Learned from Tiny Turtle Training

By

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Abstract

The Brevard Zoo aquarists started training 0.3 diamondback terrapins for guests with the goals of providing mental stimulation for the animals and creating an educational experience. The terrapin training exceeded expectations in many ways and progressed more quickly than anticipated. The terrapins were incrementally trained to touch their nose to a specific color target from amongst three different colors; surprising to the trainers, they were able to select their color target when two colors were introduced on the first try. There was also an improvement in guest experience. After training sessions, the children are allowed to engage with the terrapins through feeding opportunities. This level of involvement turned the training sessions into defining moments for guests.

The terrapin talks previously consisted of a background in terrapin natural history and then ended with a conservation message. It evolved into an engaging conversation beginning with the training session and letting the dialogue progress from, "I didn't know you could train a turtle…," concluding with guest participation in feeding. Finally, guests were more interested in hearing about the zoo's terrapin conservation efforts after watching the terrapins train than they were listening to the talk alone. Often training is focused on the "smarter," larger, charismatic animals. However, there is a lot to be gained from training the less alluring animals, such as our tiny turtles.

Introduction

The Brevard Zoo is home to 0.3 Florida East Coast Diamondback Terrapins, *Malaclemys terrapin tequesta*, which are housed off exhibit near the Indian River Lagoon aquarium. While diamondback terrapins range from Massachusetts to Florida, this subspecies lives locally in the Indian River Lagoon. Unfortunately, these animals face danger from a variety of sources including overhunting, crab pots, raccoon predation, motorized vehicle traffic, and habitat destruction (Casteel, 1911; Seigel, 1980; Roosenburg, Cresko, Modesitte, & Robbins, 1997; Wood & Herlands, 1997; Fitzsimmons, Greene, Gibbons, Lovich, & Tucker, 2001).

Before the onset of training, it was established to bring the terrapins out for guest viewing three times a week (Tuesday, Thursday, and Saturday at roughly 1100 hours). During this time, aquarists put them in three separate clear 27-quart Sterilite containers filled with two to three inches of fresh, dechlorinated water for feeding. Feeding in separate tubs allows aquarists to keep food waste, and often feces, from fouling the water in their main tank. It is also an opportunity for them to get a drink of fresh water, as they are kept in brackish water at a salinity ranging from 15 – 25 ppt.

Feeding time was also used for spotlighting the terrapins in an interpretive talk. Initially, the talks consisted of having the animals brought out in plastic containers and placed on a bench next to the Touch Tank. During each talk, guests could observe the terrapins eating while a staff member orated the natural history of the terrapin. Each session would end in a conservation message promoting awareness of the zoo's diamondback terrapin citizen science program. The program encourages guests to report diamondback terrapin sightings in either an email to the zoo or by submitting an online form. The Brevard Zoo's conservation department will analyze this data, in partnership with other groups, to determine where the terrapins live, nest, and breed. The conservation department will then determine what locations are most important for concentrating conservation efforts.

Figure 1 - Brevard Zoo's 0.3 diamondback terrapins: Tortuga, Tiffany, and Gemma

Methods

The aquarists decided it was time for some terrapin enrichment and were excited about the idea of creating a target training plan. The first step was to research whether terrapins could see in color. Members of the group had observed sea turtles perform visual discrimination tasks at other facilities, but wanted to verify that terrapins had color vision before starting to use color targets. Armington's (1954) research on the spectral sensitivity of turtles studied cooters, genus *Pseudemys,* and found that turtles possess photopic (cone cells for vision in well-lit conditions which also allows color vision) and scotopic vision (rod cells for vision in low light).

The initial training plan included using a clicker as a bridge, but after considering the complications of potentially using a bridge for underwater, and that there would never be a training situation without the opportunity to use a primary reinforcer, it was decided to forgo the bridge.

The first approximation was to hand feed the terrapins using tweezers. A variety of food reinforces were used including capelin, smelt, squid, and shrimp, with shrimp being unanimously the favorite. It was uncertain whether the terrapins would react negatively or take food readily. It was quickly apparent the terrapins had no problem taking food from the tweezers. The trainers anthropomorphically attributed this to their curious nature.

The next step was to introduce the target. The target was made out of an 18 inch long, 0.75 inch diameter wooden dowel, with roughly a 2.25 inch painted section at the end. Each terrapin was assigned their own color; Tortuga – purple, Tiffany – green, and Gemma – blue. Early in the course of training, it was decided blue was not a good color choice as their fiberglass tank is blue. Although training does not take place in their main tank, if that ever changed, the color would be difficult to discern from the backdrop.

Again, because of their inquisitive natures, all three terrapins were quick to approach the target, which was immediately rewarded with a piece of food.

Target training began the end of September 2014 using a single target stick. Tortuga, who was most successful in her training sessions, was introduced to two colored targets after 8 months of single target training. She was able to pick her correct colored target on her very first try. The other two females moved to two targets after 10 months. Tiffany went to the correct target five out of five times, and Gemma went to the correct target 4 out of 5 times. After Gemma's incorrect response, she did target on the correct color. The expectation had been that discriminating between the two colors would have to be trained, so keepers were ecstatic that the terrapins grasped this right off the bat. As more target sticks were introduced, more space was needed to place the sticks with adequate space in between. Aquarists rotated each terrapin into a larger tub for their training session and remained in smaller feeding containers

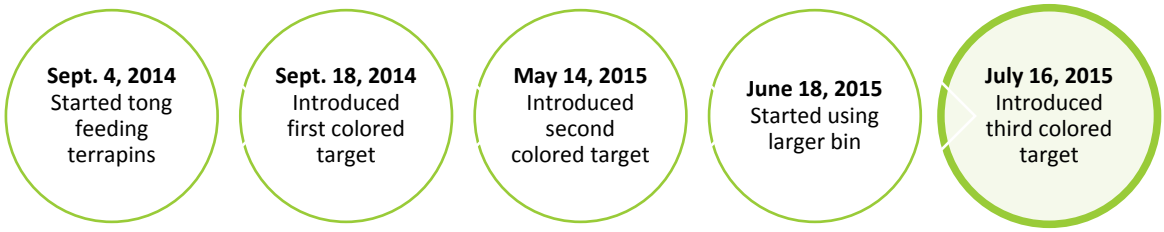
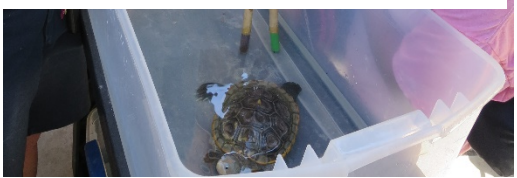


Figure 2 - Timeline of Tortuga's training approximations

before and after their training.

We experienced one setback with the single target training. The criteria for reinforcement was for the terrapin to only touch the target with their beak, not bite the target stick. Each time they bit the target the trainers did not reinforce and waited for the terrapin to touch the target. Occasionally, if they continued to bite, the target stick was removed from the water and replaced in a new spot. Subjectively, it appeared that the terrapins were getting frustrated for approaching the target and not being rewarded, and after several biting attempts with no food they would lose interest. The way we dealt with this failure to communicate our intended desired behavior was to take a step back. The trainers started reinforcing the terrapins for approaching the target before they had a chance to bite it. Through successive approximations, the terrapin was moved closer and closer to the target stick until they were close to or were touching the target.

Figure 3 - Guests participating in a terrapin training session by holding the target sticks



After touching the single target was brought under stimulus control, a second colored target stick was introduced. It was expected that targeting to their assigned color and not to the second color would require training, however, each terrapin immediately went to their original color.

Guest Interaction

Early in the training process, Steve Martin, an animal training expert and consultant, visited the zoo and gave a presentation on Connecting with Our Audience. He emphasized that every guest interaction is an opportunity or a "defining moment," and that these moments are created by

getting the guests to participate, not just passively listen. Since the training sessions were going very well, and the training was engaging guests in a new way, this was a perfect opportunity to make the talks more engaging. We started with allowing children to throw in food, Mazuri turtle diet, at the end of the training sessions, which the kids loved. The targeting behavior is now established enough that guests can hold the target sticks while keepers reinforce with food. Watching the shift in guest engagement has really illustrated what Martin (2012) emphasized: “Information does not equal education.”

Future Plans

The future plans for terrapin training include getting them to come to their target sticks in different environments so that it may be used for recall. This has been initiated by putting one terrapin at a time in our Touch Tank on slow days (which is home to hermit crabs, horseshoe crabs, conch, and fish) and having them target with just the original target stick. So far, each terrapin has done well with this, although they are occasionally distracted by the novel items in the tank, such as the coquina substrate.

Since the color discrimination training has been so successful, another possibility for the future is to follow a similar procedure, but with shapes of the same color. This could demonstrate how well they can target to a specific shape.

Some aspects of the project were not done consistently – addressing these issues may improve future training endeavors. There were three to four people training the terrapins on the different days, and there was not a huge effort to standardize the procedures. The sticks were not truly placed at random, but haphazardly by the trainer. Some trainers pulled the target sticks out of the water before reinforcing, while others left them in as they offered the piece of food. This approach is not wholly scientific and would make it difficult to publish research on terrapin’s color discrimination abilities. One potential future plan is to standardize our procedures, truly randomize the placement of the target sticks, and record data on how distance or other variables influence their ability to touch the correct target.

Conclusions

The Brevard Zoo aquarists set out with the goals of providing mental stimulation for the terrapins and to be able to recall them when they are eventually moved to a larger exhibit. We were successful using training as an enrichment activity, and the terrapins have not been moved, so the recall functionality has yet to be tested. Based on their participation in training sessions in the Touch Tank, it seems likely that the terrapins will swim over to the target as a method of recalling them. An unanticipated benefit of target training was providing a more engaging terrapin experience for guests. Visitors are more likely to listen to the zoo’s conservation message while they are watching training take place or while they are feeding the terrapins, than when the keepers were doing all of the care and talking. Guest interest is subjectively judged based on the aquarist’s opinion of how many questions they ask and how long they stay at the terrapin station. If more objective data was required, it would be possible to follow up further by distributing a brief survey to guests after either only listening to a talk, watching a training session, or participating in the training session. In conclusion, we have met our goals for the project, and based on this experience, would like to encourage other keepers and aquarists to consider offering training sessions with smaller, less charismatic animals. Guest experience has been greatly enhanced by transitioning guests from passive recipients of animal facts to active learners, using terrapin training sessions as a springboard for their inquisition.

Acknowledgements

I would like to thank my fellow aquarists Courtney Duff, Nicole Moyer, and Jeremy Bray for co-developing the terrapin training plan and conducting regular training sessions and interpretive talks for guests. I would also like to thank my managers Dave Quavillon, Kerry Sweeney, and Michelle Smurl for their advice and support while striving to improve training and guest interactions at the aquarium. I want to thank my home institution, the Brevard Zoo for all the opportunities they have afforded me. Finally, I want to thank the American Association of Zookeepers for the chance to share my experiences with others.

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Virginia Zoo brings animal care and training workshops to a critically important fauna region of the Philippines through a WAZA international training grant

By:

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Introduction

The Philippines have one of the most critically endangered fauna regions in the world and are in vital need of conservation assistance. Of the species inhabiting the area, 78% of them are found nowhere else in the world, ranking them first globally with the most critical and endangered endemic species. Unfortunately, many of their facilities lack knowledge in exhibit design, care, and training for captive species. Using a grant from the World Association of Zoos and Aquariums, the Virginia Zoo created a training program specifically targeted for leaders (managers, curators, veterinarians, and head zookeepers) of facilities in the regions of Negros, Panay and Cebu Islands. Using knowledge gained from these workshops, the goal was for participants to then turn around and train their entire staff. This will improve husbandry practices and pass knowledge onto more people than could be trained during this brief visit.

In February 2016, a team from the Virginia Zoo traveled to the Philippines to conduct these training workshops. Over five days, participants received information on basic veterinary care, nutritional information, enrichment, animal training, exhibit design, capture and restraint, grant assistance, and development of action plans for each facility. Practical sessions were conducted for the participants to apply skills learned during the lectures. These workshops not only taught invaluable captive management skills but also served to bring various wildlife facilities together so they may form partnerships and reach out for assistance (e.g., grants, knowledge), from their US and international counterparts.

Philippines Background

Ask someone to tell you where the Philippines are located and they may be able to give you a vague answer of somewhere near Asia. Now ask that person, how many islands encompass the Philippines? Guaranteed they don't even come close. The Philippines is comprised of 7,107 islands which approximately total 300,000 square kilometers. With all of these individual islands, the biodiversity is extremely high, as well as the number of unique species endemic to only the Philippines. Sadly, there are also threats from factors such as deforestation, rapid human growth, agricultural encroachment, lack of protected areas, and lack of enforcement of areas currently under restoration. The nation is unique in that it contains 5 very separate faunal regions: 1) Greater Luzon, 2) Mindoro, 3) West Visayas, 4) Greater Mindanao and 5) the Sulu Islands. Each are separated by deep water channels, creating five distinct areas of endemism. Palawan, part of the Philippines politically but not regarded as a faunal region as it is separated by Huxley's Line, is a possible sixth region with its own faunal diversity correlating more closely to the Sudanic Region of Asia than to the Philippine Archipelago (see Figure 1.)

Figure 1

Having an area so secluded from any other land mass, it's no surprise that 78% of major species groups found on the islands are found nowhere else in the world. Chart 1 shows where the Philippines ranks in all of these areas compared to the rest of the world.

Geopolitical units ranked by number of threatened bird species

	Number of species				Rank with only:	
	Total	CR	EN	VU	CR+EN	CR+EN endemic
1. Indonesia	104	4	16	84	5=	6=
2. Brazil	103	16	31	56	1	2
3. Philippines	86	16	29	41	2	1
4. China	86	5	8	73	11	
5. India	71	4	9	58	12=	20=
6. Colombia	62	9	22	31	3	3
7. Peru	60	6	12	42	7	10
8. Ecuador	50	5	11	34	9=	13=
9. U.S.A.	46	13	12	21	4	4
10. Vietnam	45	7	9	29	8	16=

Chart 1

Of the avian species found in the Philippines, a vast majority of the species are either threatened or endangered due to the threats previously discussed as shown in Chart 1. In fact, the Philippines ranks extremely high in the world for most endemic avian species either threatened or endangered.

Taxon	*Endemics*	*Rank (World)*
Plants	6,091	9
Mammals	102+	5
Birds	234+	3?
Reptiles	160+	8
Amphibians	74+	11
Freshwater fish	67+	11
Tiger beetles	113+	3

Chart 2

For example, the Philippines are home to the most critically endangered Hornbill species, the Sulu Hornbill (*Anthracoceros montani)* and the Rufous Headed Hornbill (*Aceros waldeni*). The Rufous Headed Hornbill was once found on three islands. Today it is only known to now exist on two islands, Panay and Negros. It is unknown how many currently live on the island of Negros, but less than 1,500 remain on the island of Panay. This is an increase from 60-80 breeding pairs in 2001. For the most critically endangered, the Sulu Hornbill, recent studies suggest there are less than 30 individuals left in the Philippines. And sadly, Hornbills are not the only species facing this decline. Every taxon has representatives on the endangered list. The world's most endangered crocodile, the Philippine freshwater Crocodile, faces similar challenges to the hornbills. The country is also home to the critically endangered Philippine Eagle, Tamaraw or dwarf water buffalo, Red-vented Cockatoo, and endangered Philippine spotted deer. Other notable species include the Island Flying Fox (a bat species), Clouded Rats, Visayan Warty Pigs, several Bleeding Heart Dove species, and the Visayan Leopard Cat.

The number one reason for the rapid decline in numbers for most of these species is habitat loss. In 1988, it was estimated that only 4% of Negros and 8% of Panay forests remained intact (see Image 1).

Image 1

With all of this biodiversity, why isn't there more of an effort to help save these species and assist in conservation efforts? Zoos in the Philippines have typically been private, for-profit attractions. The national Zoo is run by the City of Manila but otherwise the word 'zoo' generally refers to for-profit animal attractions. Detached from these facilities, there have long been wildlife centers attached to universities that have been operated for research/conservation purposes and are not commercially driven. These are usually universities with large Veterinary programs or which have a Wildlife Science focus. A few of these partnerships include Mari-it Conservation Park and Western Visayas State University in Panay, the Wildlife Center at the Center for Tropical Conservation Studies at Silliman University in Negros Oriental, and the Biodiversity Conservation Center in partnership with Negros Forests & Ecological Foundation Inc. (NFEFI) in Bacolod, Negros.

Meet the Partners

In April of 1990, the Philippines Biodiversity Conservation Programme, which later became known as the Philippines Biodiversity Conservation Foundation Inc. (PBCFI), was initiated to survey the field status of the Philippine Cloud Rat. Funded by a partnership with the Zoological Society of London, the organization quickly began to take on many of the challenges facing several other species in their country. Other institutions also began to assist in funding and conducting research in the area including, Zoological Society of San Diego and the Zoological Society for the Conservation of Species and Populations (ZGAP). PBCFI set its main focus on "The long-term conservation of the Philippines' native and endemic wildlife and natural habitats for the benefit of future generations of all peoples who may inhabit and share the natural resources of the country." Today, with the local government's help (the Department of Environment and Natural Resources, DENR), they are doing vitally important work to help the many critically endangered species endemic to their country. The Foundation now operates in five (5) major regions of the Philippines and has more than eight (8) species conservation programs. In addition to in-situ research, PBCFI also manages two (2) conservation breeding centers.

Recognizing a need for further conservation assistance in the Philippines, the Virginia Zoo's Assistant Director, Roger Sweeney, submitted an application in 2015 for a training grant from the World Association of Zoos and Aquariums (WAZA) to work directly with PBCFI and the Provincial Government of Negros Occidental. Having previously worked with and become acquainted with many of the PBCFI employees, Assistant Director Sweeney knew how important it was for American zoos to assist in this critical region. The training grant is awarded to applicants every two years for programs that help build the capacity of zoos and aquariums in developing country and improve their conservation and animal management programs.

Grant directive and mission

For the 2015 grant, the focus was on improving animal welfare practices in zoos and aquariums globally for things such as exhibit design, environmental enrichment, animal care, etc. Many of the priorities the grant required were right in line with what PBCFI and the Philippines institutions were seeking and what the Virginia Zoo could help provide. Those priorities were to:

- Build the capacity of a developing countries zoos and aquariums and their personnel to manage their collections and contribute to local, regional or global conservation
- Have a significant and quantifiable impact on the public or the local communities incorporated in the project

- Have a more applied research approach and emphasise basic principles of animal care and management or wildlife conservation rather than more technical research
- Are both scientifically and economically feasible in a designated period of time
- Are continuing rather than “one time” efforts; incorporate a strong educational and training component that can serve as a model for future programs.

Meet the Team

Once the grant was approved, work began on assembling materials to help educate, train, and assist the facilities that would be attending this workshop. Mr. Sweeney tapped the Virginia Zoo’s veterinarian, Dr. Amanda Guthrie, and Chelsea Hohlweg, a full-time roving keeper, to assist in this undertaking. With the Virginia Zoo since 2012, Dr. Guthrie also has field work experience with a wide variety of species and has travelled abroad to work with sloths in Costa Rica and Asian Elephants in Thailand. Mrs. Hohlweg been a full-time roving keeper with the Virginia Zoo since 2013 and has worked in the zoo community for over 9 years. As a keeper, Mrs. Hohlweg has worked with a wide variety of species including many of the threatened or endangered species found in the Philippines and would be encountered during this workshop.

Workshop info

In February of 2016, the team from the Virginia Zoo traveled to the Philippines for a one week series of intensive workshops.

Upon arriving in Bacolod, the capitol city of Negros Occidental in the Philippines, the team visited PBCFI’s main conservation breeding center, Negros Forests & Ecological Foundation Inc. - Biodiversity Conservation Centre (NFEFI-BCC), which also serves as a zoological park and training facility for keepers in the area. Attached are several photos from the facility where they specialize in caring for local species, many of which are severely threatened or endangered. Their goal is to reintroduce many of the animals back into their native habitats as forest reclamation efforts progress. Being located in the capitol city, visitor attendance is very high and therefore helps play an important role in generating conservation awareness among school children, indigenous people, and tourists. The facility currently houses:

Visayan Warty Pigs	28
Visayan Spotted Deer	several
Visayan Leopard Cats	6
Negros Bleeding Heard Doves	16 (including 3 breeding pairs)
Luzon Bleeding Heart Doves,	1 breeding pair
Rufous Necked Hornbills,	2 breeding pairs
Visayan Hornbills,	3 breeding pairs
Mindanao Rufous Hornbills,	2 females
Philippine Red-vented Cockatoos,	1 breeding pair

Philippine Eagle Owls	17 (including at least 1 breeding pair)
Luzon Hawk Owls	2
Philippine Ducks	1 breeding pair
Southern Philippine Sailfin Lizards	Several pairs
Metallic Wood Pigeon	1
Pink-bellied Imperial Pigeons	1 pair
Philippine Hawk Eagles	1 pair
White-bellied Woodpecker	1

The high numbers of warty pig, bleeding heart dove and eagle owls are all the result of successful breeding programs. With all of their success, the center now faces the challenge of housing adults and offspring, making the need for reintroduction programs all the more important as captive numbers begin to rise. Space constraint is definitely one of the main issues faced by this facility. It was extremely eye-opening to see what four keepers could manage with the space and resources available.

Day 1 began with meetings with provincial governor as well as provincial head veterinarian (see Image 2.) When working in the Philippines, it is important to make sure you have the proper permissions, permits, and authority from partner organizations. This also provided an opportunity for PBCFI to show the interest from their international partners. Following the formal meetings, meet and greet session were held with all of the participants. PBCFI and the Virginia Zoo instructors gave introductions and briefly explained the agenda and goals for the upcoming days. Participants also were able to introduce the facilities they represented and the challenges they currently face. Many of the participants were local government veterinarians looking for more knowledge on care and husbandry practices for exotic species. Others were keepers/ managers of local wildlife rehabilitation centers and conservation breeding facilities looking to gain more experience in basic husbandry and medical techniques. All of the participants were eager to make connections with one another for future partnerships and receive advice on requesting financial assistance.

Image 2

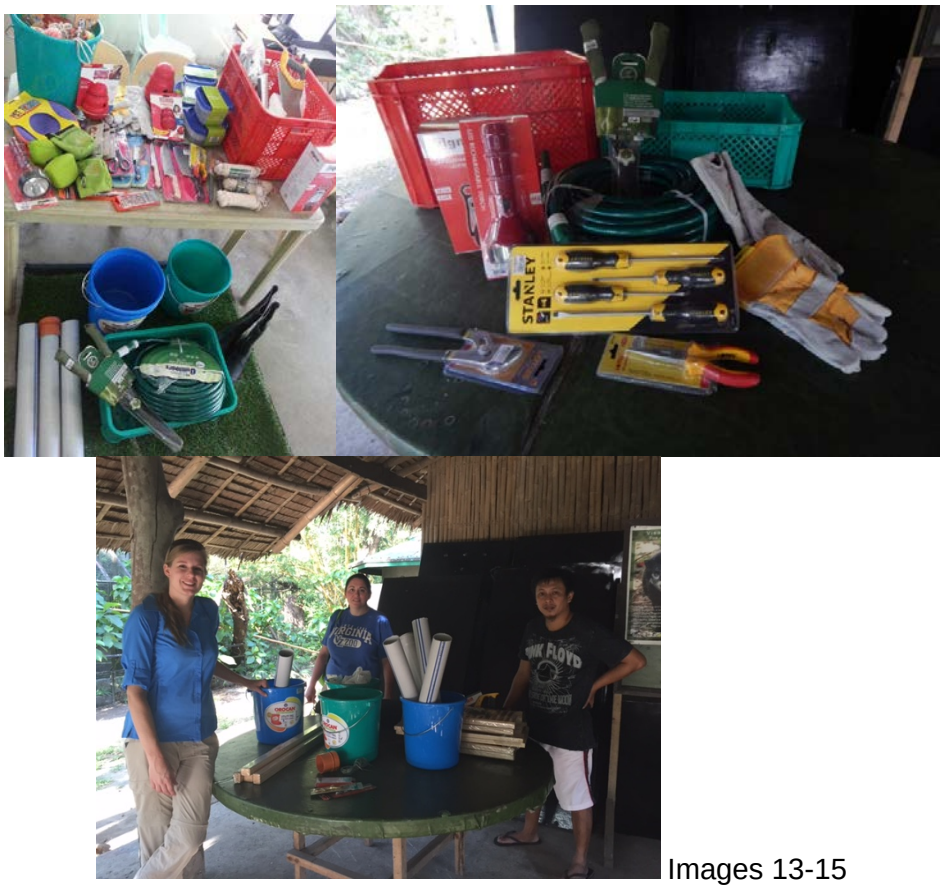
The bulk of coursework began on Day 2. Lectures covering preventive health care programs, enrichment, and nutrition/ food handling took up most of the morning. After lunch, participants were brought to NFEFI-BCC for a hands-on enrichment workshop. Using the lessons taught earlier in the day, we wanted to be sure they had comprehended the material. The group was divided into teams and each were given one species, found at the center, for which to create an enrichment item. The teams quickly went to work and were creating amazing enrichments using material the Virginia Zoo team had purchased the previous day and freshly harvested browse from the center. After the teams finished constructing their items and presented their ideas to the rest of the participants, the items were placed into exhibits for the animals at the center to enjoy. The groups then evaluated the effectiveness of their enrichment and reported their findings using techniques taught earlier in the day. It was wonderful to see everyone so excited about creating enrichment and realizing what a difference it could make in the lives of the animals in their care. (See images 3-7)


Images 3-7

Day 3's lectures consisted of animal handling and restraint, identification and markings, record keeping, and animal learning and training. After lunch, the group enjoyed playing the Training Game to see if the concept of Animal Training had been comprehended. The bridge and reinforcement concept took a bit of time to understand but once they were given candy as reinforcement and able to work together as a larger group, things began clicking. The group then went to the breeding facility and took a few hours to watch their kitchen staff prepare meals. Participants were able to evaluate the techniques used and discuss what changes they could incorporate in their own facilities. (See images 8-12)


Images 8-12

On Day 4, the morning began with discussions on exhibit design, zoonotic disease, wildlife risk management, and stress management/wildlife rescue. The latter topic was the most popular of the day due to the correlation with the types of facilities represented at the workshops. The participants explained that most of the animals they take in are rescued and that they were not always certain of the appropriate manner in which to handle the situations. After the lectures, they all felt much more confident having learned some of the best and safest practices to care for these animals when they enter their care. Many of the participants were also interested in learning what the ideal exhibit size should be for many of the species at their facilities. We listened to their stories and attempted to work through as many examples as possible. As this was also a holiday in their country, the workshop ended early to allow everyone time to celebrate. This extra time gave the team an opportunity to ask the keepers at NFEFI-BCC what some of their needs were and what additional resources we may be able to provide. Using money from the grant, the team headed to the local hardware store and mall to do a little shopping (every keepers dream!). (See images 13-15)



Images 13-15

The final day of lectures focused on bringing the facilities together and helping them plan the next steps for their centers. Lectures consisted of grants and partnership opportunities both nationally and internationally, facility safety and contingency planning, captive wildlife laws, regulations and licensing, and regional synergy and resource sharing opportunities. Groups were asked to create a needs assessment by describing issues that their facilities were facing and brainstorming ways they could go about solving the issues, ways they could work together to solve the issues, and what steps they plan to take moving forward to solve their issues (see Image 16.) Many believed making their governments more aware of their situations would be the most beneficial. Several government agencies came together to help promote these workshops and met with us during the course of the week. Hopefully, by seeing the involvement from their institutions, as well as those internationally, more emphasis will begin to be placed on conservation.


Image 16

Follow-up

In the coming months, the Virginia Zoo and PBCFI will work together to follow-up with the participating facilities to see how they are implementing the lessons taught and if they have made progress in their work. A goal of this workshop was to not only teach the groups present at the lectures these valuable skills, but to have them return to their facilities to train their fellow keepers and staff on the topics discussed. The hope is that facilities will feel more comfortable working with each other to solve issues that may arise in the future and have a better understanding of how to care for these valuable animals in the best ways possible.

How AAZK and Zoos can help

All AAZK chapters understand the importance of conservation and what it hopes to achieve: ‘preserving species for years to come and keeping a healthy environment in balance.’ AAZK and its Chapters have contributed millions of dollars over the years to different conservation efforts around the world which have helped countless species.

But more can be done. Donating money is a fantastic way to help contribute to the efforts of local organizations; however, as keepers, we possess valuable skills and knowledge that may be beneficial to local breeding centers and keepers in the field. Many of the species at the breeding centers are part of reintroduction programs or are used to educate visitors about the importance of saving their habitats. Having many resources at our fingertips, we are often very familiar with these situations and could lend a great deal of knowledge.

In addition to donating money, chapters and zoos can look into working with worldwide Keeper Organizations (such as the Zookeepers Association of the Philippines), keeper development projects (including funding for AAZK Online), providing funds for exchange programs, or supporting efforts to fund a temporary keeper position for an externship. Many times, the US Dollar can go much farther abroad than it can within the States. Local development projects and grants, just like this workshop, not only teach invaluable captive management skills but, going forward, the wildlife facilities have the resources to work together and form partnerships both nationally and internationally, and reach out for assistance to help save the precious species found in their beautiful countries.

Resources

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Enrichment Team, Activate!

Inspiring Guests, Enriching Animals and Challenging Keepers

By

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Sasha Francis, Biologist II Penguins and Pinnipeds

Moody Gardens

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Introduction

It is imperative that we in this field find ways to engage and inspire the public to act. In the age of sensationalism and social media, how can we make people care about the many pressing environmental and wildlife issues? How can we make these pressing issues real to those that we come in contact with for only a few minutes? Zoos are no longer simply menageries, they are conservation and education organizations (Rabb & Saunders, 2005). Zoos and aquariums around the world are creating innovative events to raise both money and awareness for species. Keeper presentations are implemented daily in efforts to educate and inspire guests to act. Most importantly, many zoos are implementing enhanced educational programs (camps, encounters, animal shows, etc.), events and campaigns to specifically target a conservation focus. This paper explores the impact that we can have on education and conservation awareness with the public and the attainable ways that we can inspire action.

Who We Are

The Enrichment Team (ET) at Moody Gardens was established in 2014 as part of the evolving enrichment program. The team has set a mission to not only enrich the lives of animals in human care, but also to proactively spark green initiatives through educational events. The enrichment program adopted the Disney's Animal Kingdom S.P.I.D.E.R. model and divided the responsibility into two groups, the Enrichment Committee (EC) and the ET. The ET takes charge of the S.P.I. which is **s**etting goals, **p**lanning and **i**mplementation. The ET is currently comprised of one coordinator and four biologists. The EC is in charge of the D.E.R. which is the **d**ocumentation, **e**valuation and **r**e-evaluation portion of the program. This union provides a unique opportunity and challenge for the staff. The first priority in our enrichment program is the safety and welfare of the animals and second to engage the public while providing that enrichment in hopes of motivating conservation awareness. The team began by planning small enrichment themed events that would actively educate and engage the visitors. By hosting these themed events, we also broadened our enrichment program while at the same time challenging keepers.

Enrichment Team, Activate! How We Get Started

The members of the Enrichment Team never have a shortage of conservation messages we want to share with guests. The biggest challenge is choosing which topic or theme we want to focus on for each event. The team will often plan the events to take place around holidays or approaching seasons to better connect with guests to our animals and the conservation message. The ET considers what the general public will be interested in and works to find an educational angle to incorporate related conservation messages. We prefer to choose topics that relate to species we have in our collection. This way, we are able to put a face or name to the conservation concern and are more likely to inspire guests to act. Once we decide on a theme, we all brainstorm relevant enrichment and conservation concerns for our respective species. Team members from different animal departments are usually responsible for enrichment selection, creation, and implementation for their area. Other responsibilities like conservation details, keeper chat topics and schedule, signage creation, and interdepartmental coordination are also discussed and then divided among team members. The ET coordinator will then create a realistic timeline and meeting schedule. Based on the complexity of the event and the timeline, we may also ask management's permission to schedule paid lunchtime meetings. We also make an effort to identify local environmental or student organizations that can assist with creating enrichment for the events to help reduce the time required by staff for preparation. An example of this is that recently we have acquired the talents of The Galveston College's Dual Credit Culinary Art students from Ball High school to create approved food enrichment for events.

How We Assemble

The ET brings forth a detailed schedule and timeline for each event to ensure the most success. Preparation for an event often begins with brainstorming from all team members. The ET will meet once a month and when an event is close, much more frequently. During this time the theme, conservation message, and enrichment focus is discussed and established. Once the ideas have been refined, a proposal is written up for management approval. After approval, several meetings with all involved will occur to streamline duties. This usually involves working alongside our marketing department to advertise the event to our members and general public. Over the past two years we have hosted various events but each year our goal is to host at least four events, two large scaled and two small scaled.

As a team we concentrate on sharing high-impact facts paired with real solutions. The ET will compile the information for signage and talking points during keeper presentations. Staff members outside of the enrichment team are given talking points and signage ahead of time to prepare for themed presentations. Signage is then printed by the Graphics Department at Moody Gardens or made by the team to help give the event a uniform look. It is important for us to be as green as possible so the signs can be reused for future purposes or recycled.

The main focus once those details are completed is making sure that we have safe, goal oriented enrichment for the species that will be highlighted in the event. Certain events focus on only a few species

while other events can encompass a wide variety of taxa. Once we decide on the species specific behaviors that we are hoping to elicit, we construct our enrichment plan. Again, we want to create enrichment that is both sustainable and interactive for animals to engage the guests. It takes approximately two to four weeks to plan, make, and arrange enrichment. If food is used, it is usually done a few days prior and frozen or assembled the day of. This does require extra effort from the ET as well as the biologists in the area. The staff is then instructed when to implement the enrichment. Most of the time, we allow the staff to be inventive and encourage additional creativity in the implementation.

Activation! The Day of One Earth, One Choice

The day of our event, ET members arrived early to place signage and decorations throughout the rainforest and aquarium, including signs with a schedule of keeper chats and demonstrations during the event. With so much important information to pass on, we developed a cohesive theme or "story" throughout the rainforest so guests wouldn't be overwhelmed. The first gallery guests encountered contained an introduction to our event and our mission, an explanation of our recycled signage, and a brief history of Earth Day. The next section conveyed the importance of the intact rainforest as a resource and the consequences of deforestation. Then came an overview of the IUCN and what different conservation statuses mean, followed by a key for these statuses and other important information guests would see on signage at each exhibit. Links for conservation organizations, as well as simple ways guests could help, were offered on signage as well. Important conservation issues were highlighted throughout the day via keeper chats. In the rainforest, these focused on the effects of mining operations on Asian wildlife, the decimation of amphibian populations by the chytrid fungus, the effects of air pollution on butterflies, and the exotic pet trade.

In the aquarium, the layout is not as immersive as the open walk through Rainforest Pyramid therefore interactive keeper chats and exhibit specific signage were key. These presentations focused on the plastic pollution in oceans, the effects of oil spills on penguins, reef conservation, and how pollution alters water quality. Prior to Earth Day, biologists had participated in a recent local beach clean-up. This allowed the opportunity to set up a station with findings that guests could investigate. One of the powerful items collected included two melted plastic bags that looked like seaweed and coral. This was a high-impact demonstration, especially for locals who frequent these same beaches.

To further encourage guests to stay at exhibits long enough to learn, and to provide novel stimulation for our animals, recycled-themed enrichment was used throughout the weekend. Approved recycled items that had been identified during planning were placed in exhibits for enrichment each morning and trash decals were placed along the water line on window panels to demonstrate how their environment looks when "trashed" with pollution. Signs were created to accompany the trashed exhibits, asking guest "which would you rather see, animals or trash?"

All biologist presentations and signage included what Moody Gardens as a facility and the staff do each day to assist these issues, as well as what guests could do to make a difference. Members of the staff outside of the enrichment team participated in presentations and helped to work the schedule around demonstrations each day. All signage and schedules were left up after Earth Day to keep the event going over the weekend to appeal to higher attendance. During the weekend, educational demonstrations and tutorials were offered in our visitor's center to show guests how to collect rainwater, how to compost and how to live a greener life. These educational demonstrations, combined with our presentations, informative signage and recycled enrichment, created a complete learning experience for our guests that raised awareness and offered easy ways for them to help make a difference.

A Work in Progress, The Reignforest of Terror!

This event was initially brainstormed to be an intimate and guided night time walk through our Rainforest Pyramid as a ticketed event. The focus was to highlight the "terrors" animals in the wild face and the "scary" truths that the general public is not aware of. We highlighted major issues that animal care professionals combat daily: pet trade, poaching, deforestation, fear and ignorance. In addition, the plan was to have assorted Halloween themed enrichment for all taxa that encouraged foraging and exploration. The ET planned to create a production in efforts to make the event impactful. An example of the production ideas:

> **Pygmy Slow Loris Exhibit** – a keeper dressed as a loris sits in a small cage and tells a scary story about being caught and sold in the pet trade. **Komodo Dragon Exhibit** – a villager laments the decline of Komodo dragons around his village. **Ocelot Exhibit** – an evil poacher searches for an ocelot fur for his collection. **Egyptian Bat Exhibit** – someone runs screaming out of the Egyptian bat cave because he/she thinks bats are repulsive. The tour guides calm him/her down and inform him/her of the redeeming qualities of bats. **Anaconda/Vampire Exhibits** – These misunderstood, often reviled animals are examined, exposing several misconceptions and celebrating their ecological benefits. The harmful effects of water pollution are also discussed. These animals will be highlighted throughout the tour.

However, time and minor setbacks changed the event to be more of an educational Halloween weekend with enrichment and interactive signage. This year we plan on following through with the original layout and offer it as an exclusive member's event with the possibility of raffling of a few tickets on social media.

Examples of Other Successful Events

- Pyramids of Love- A Valentine's Day event that concentrated on courtship in the animal kingdom.
- Music Enrichment Event- Live music performed by local guest artists and musically talented staff paired with presentations.

- Hunting and Gathering- An Easter event that focused of foraging.

Conclusion

The average guest today does not gather information simply by standing in front of an exhibit with signage (Jensen, 2014). Encouraging positive encounters that leave lasting impressions is a beneficial to conservation education (Clayton, Fraser & Saunders, 2008). It is our hope that the ET will continue to grow all of our events so that we can not only educate patrons but also to inspire action and change from them. In turn, these events also benefit the staff by challenging them to think outside of the box, literally and figuratively. Finally, this effort supports and enhances the welfare of the animals in our care. Over a decade ago Rabb et al. stated that it was evident that zoos needed to transition to more innovative ways to be effective with conservation messages to save species (2005). Zoos and aquariums connect people with the opportunity to connect with species, science and conservation (Jensen, 2014). Implementation of interactive and immersive events through zoos and aquariums could possibly be the key to staying ahead of the plight against species and the environment. We feel as a team that it is time to use all we know and continue to activate, thus inspiring change that benefits animals in our care and their wild counterparts.

Enrichment Team Coordinator, T'Noya Gonzales. Team Members- Sasha Francis, Sean Salinger, Bridgette San Marco, Lisa Cariello and Mirzza Salinas.

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Evaluation of the critically endangered Indochinese Box Turtle (*Cuora galbinifrons* complex) to improve captive population management

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Abstract: Turtles throughout Asia are unsustainably harvested to meet an overwhelming demand for traditional medicine, food markets and pet trade. Of particular concern is the Indochinese box turtle (*Cuora galbinifrons* complex), a polytypic, terrestrial species of Asia that is listed as critically endangered and in Appendix II (CITES, 2013). *Ex situ* conservation actions are being implemented for this species through participation in Association of Zoos and Aquariums Species Survival Program. Recent taxonomic changes have pertinent consequence to AZA studbooks in terms of *ex situ* captive breeding and recommendations are to keep the three distinct species separate for breeding purposes. Currently the North American studbook is relying on morphological distinctions through photographs of each specimen to distinguish species. This study aimed to use AZA studbook participants to collect genetic samples from each wild caught adult turtle in the studbook. Specifically, we intend to perform genetic analysis of the captive Cuora population to confirm accuracy of the morphologic identification currently used. Mitochondrial and nuclear genes will be sequenced and microsatellite loci used for inferring genetic differentiation and gene flow among the three taxa involved. These types of genetic studies are important when attempting to maintain a genetically diverse and pure population under these types of circumstances.

Introduction: Of the top 25 most endangered turtles in the world, 68% are from Asia with 6 species from China, 3 from Vietnam and 4 species from Indonesia (Rhodin et al., 2011). Turtles throughout Asia are unsustainably harvested to meet an overwhelming demand for traditional medicine, food markets and pet trade. All potential sources for wild-caught turtles in Asia are being exploited (Cheung and Dudgeon, 2006; van Dijk, 2000) to fullfill the demand for these markets resulting in a widespread crisis for turtle populations. Of particular concern is the Indochinese box turtle (*Cuora galbinifrons* complex), a polytypic, terrestrial species of Asia that is listed as critically endangered by the International Union for Conservation of Nature (IUCN, 2013) and in Appendix II by Convention on the International Trade of Endangered Species (CITES, 2013). Due to chronic overexploitation for the Asian wildlife trade, CITES recently recommended a transfer from Appendix II to Appendix I (CITES, 2013).

Native to Vietnam, Laos and Hainan Island, China (Bourret, 1939; Lehr et al., 1998; Fritz et al., 2002; Stuart and Parham, 2004), several species of Cuora overlap in their ranges and the hybridization of these species pose challenges for conservation biologists. Stuart and Parham (2004) analyzed the mitochondrial DNA of five historically recognized subspecies of *Coura.galbinifrons* and found that three major mitochondrial DNA clades correspond to the three subspecies, the flower-back box turtle(FBT),*C. galbinifrons*, the Indochinese box turtle(IBT), *Cuora bourreti* and the Southern Vietnamese flower-back box tutle(SFBT), *Cuora picturata*. These findings in conjunction with previously described morphological distinctions led the authors to recommend the elevation of the three subspecies to full species. These taxonomic changes have several consequences when planning conservation efforts for the critically endangered Indochinese box turtle. As captive propagation is an important aspect of species recovery, these taxonomic changes need to be reflected in captive colonies. Currently the North American studbooks of FBT, IBT and SFBT are relying on morphological distinctions through photographs of each specimen to distinguish species. However, many animals included in captive breeding regimes are confiscated from Asian markets (Hudson and Buhlmann, 2002; Turtle Conservation Fund, 2002) with resulting shell deformities impeding appropriate identification. Furthermore potential hybridization both in captivity and in the wild confound identification.

The Turtle Survival Alliance (TSA) began the Turtle Survival Center in January of 2013 as a dedicated center to build robust captive populations of critically endangered chelonian species that face an uncertain future in the wild. Today this center holds some of the most endangered chelonians in the world, including all three species in the *Cuora galbinifrons* complex. Recently the TSA imported 105 turtles from a private collection in Hong Kong. All of these turtles were rescued from the food and medicinal trade during the infamous Asian Turtle Crisis and rehabilitated. These turtles were added to the North American Association of Zoo's and Aquariums (AZA) regional studbooks. With the addition of these turtles, all three studbooks are closer to meeting their goal of ensuring the sustainability of a healthy, genetically diverse and demographically varied population. In order to better manage the captive population of these three species, as well as increase the sample size of species used for the proposed taxonomica changes in 2004, a genetic evaluation of the captive poulations was proposed.

Methods: Letters requesting genetic samples from FBT, IBT and SFBT were distributed to all studbook participating institutions and individuals. Upon agreeing to partipate, supplies consisting of a styrofoam cooler, two ice packs, syringes, vials pre-filled with Ethonyl, and instructions for sample collection were shipped to each participant. Most institutions were asked to send a blood sample from each adult wild caught turtle and mix it with the provied 1 ml buffer. Blood was to be collected by a veterianarian from the subcarapacial vein. The samples were then put on ice and shipped overnight to the Smithsonian National Zoological Park where they were frozen at -20°C. Because the turtles at the Turtle Survival Center were newly imported, the TSA opted to submit scale clippings, which were collected from the front or rear legs and stored in the same manner as the blood samples.

Once a critical mass of samples has been collected, export permits will be completed with the NZP Registrar and samples will be shipped on dry ice to a scientist's lab in Germany for genetic analysis at the

University of Leipzig. Mitochondrial and nuclear genes will be sequenced and microsatellite loci used for inferring genetic differentiation and gene flow among the three taxa involved. In addition to these samples, the lab has several type samples from each species banked for comparison. This will help ensure proper breeding recommendations as well as support the basis for elevating IBT and SFBT to full species as was suggested in 2003.

Results: To date scale clippings from 110 turtles and blood samples from 17 additional animals have been collected. This is composed of 66 FBT, 47 IBT and 14 SFBT. Samples are currently stored at NZP and awaiting the completion of the CITES permit to be sent to Germany. Once sent to the lab, mitochondrial and nuclear genes will be sequenced and microsatellite loci used for inferring genetic differentiation and gene flow among the three taxa involved. Once the analysis is complete, the results will be relayed to each participating institution as well as entered in the studbook for each individual turtle. Additionally a peer reviewed manuscript will be prepared and submitted for publication.

Conservation Siginificance: Although the results of this study are pending, the imporantance of this type of study is noteworthy. AZA studbooks provided an excellent method of collecting vast amounts of data on a large sample size of animals. Often one institution will only house a few individuals of a certain species, making sample sizes for conducting research difficult. As AZA studbooks document each individual in the North American population, they also create a large network of institutions with a vested interest in a species and its conservation. When taxonomic changes occur, AZA institutions and managed programs provide the ideal avenue to collect data. It is vital that captive propagation of species for conservation remain relevant. A key role of zoological institutions is to contribute to the conservation of the species they manage. By conducting valuable research that would otherwise be expensive and time intensive in the field, animal keepers can contribute valuable information to species conservation.

Agknowledgements

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An Organized Mob: The 'tail' of station training a mob of meerkats for voluntary x-rays.

By
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Abstract:
In September 2015, one of our seven meerkats presented with symptoms of labored breathing and lethargy, which led to an emergency knockdown. Our veterinary staff discovered that he had an extreme amount of fluid around his heart; they were able to drain off the fluid and he recovered. Keepers at Cheyenne Mountain Zoo (CMZ) were then left with a burning question: How do you monitor the compromised heart of an aging meerkat without numerous stress inducing knockdowns? Answer: with voluntary radiographs, of course! Sounds simple enough, but add in the challenges of a diet change, competing environmental stimuli, mob hierarchies, and strict containment requirements, and the end goal becomes much more difficult to reach. As all of you know, nothing motivates zoo keepers quite like the health and well-being of the animals in their care. CMZ's staff put their heads together to solve this problem. With the combination of positive reinforcement training and great antecedent arrangement, it has been possible to provide excellent preventative care for all of our aging meerkats without the need for frequent immobilizations. This paper will outline the steps that we took to get to the end goal of voluntary x-rays on our meerkats, including how station training our mob played a critical role in the process.

Introduction:
At CMZ we have six meerkats (*Suricata suricatta)* that are living in two separate groups. Within those groupings, we have four geriatric meerkats that will be turning 11 years old this year. As our meerkats age, they are presenting with more and more age related health concerns. One meerkat in particular, Bomani, has a heart condition involving fluid buildup around the heart that was first noticed during a routine yearly examination, and now requires frequent monitoring. Luckily, our vet staff was able to consult with cardiologists to remove the fluid that was surrounding his heart. He continues to do very well with medication and monitoring of the fluid buildup, paired with occasional immobilizations to drain the fluid.

After learning that Bomani had a heart condition that would require more than one immobilization a year, we started to think about how we could make it easier to monitor his condition without the stressors that accompany frequent immobilizations. We thought that training for voluntary x-rays to monitor his condition would be a great place to start, so we started brainstorming possible options to accomplish this. As it turned out, the brainstorming was challenging for many reasons, including the social structure of our mobs, USDA regulations for transporting meerkats, and that our holding is not really set up for a lot of extra equipment.

After consulting with other keepers in the area, vet staff, and our Animal Behavior Program Manager (ABPM), we came up with a plan to build a device that would allow us to take voluntary x-rays in the holding area of our meerkat exhibit. In the beginning stages, we discussed building an acrylic box that a meerkat would voluntarily enter which could then be closed, secured, and then taken up to the vet clinic. After discussing what the training plan

would look like for that, it became a lot more complicated than previously thought, so we went back to the drawing board.

After a couple more ideas that just wouldn't work, our ABPM, Jeremy Dillion, had the idea to use a PVC tube that could attach to the front of the meerkat holding dens (see figure 1). We wanted to make the device removable when not in use, as our holding is already fairly small. Jeremy designed the PVC device and built it with materials that CMZ had on grounds. I was very eager to start the training process but I quickly realized that there was a lot of training that needed to be done with the groups before I could start x-ray training.

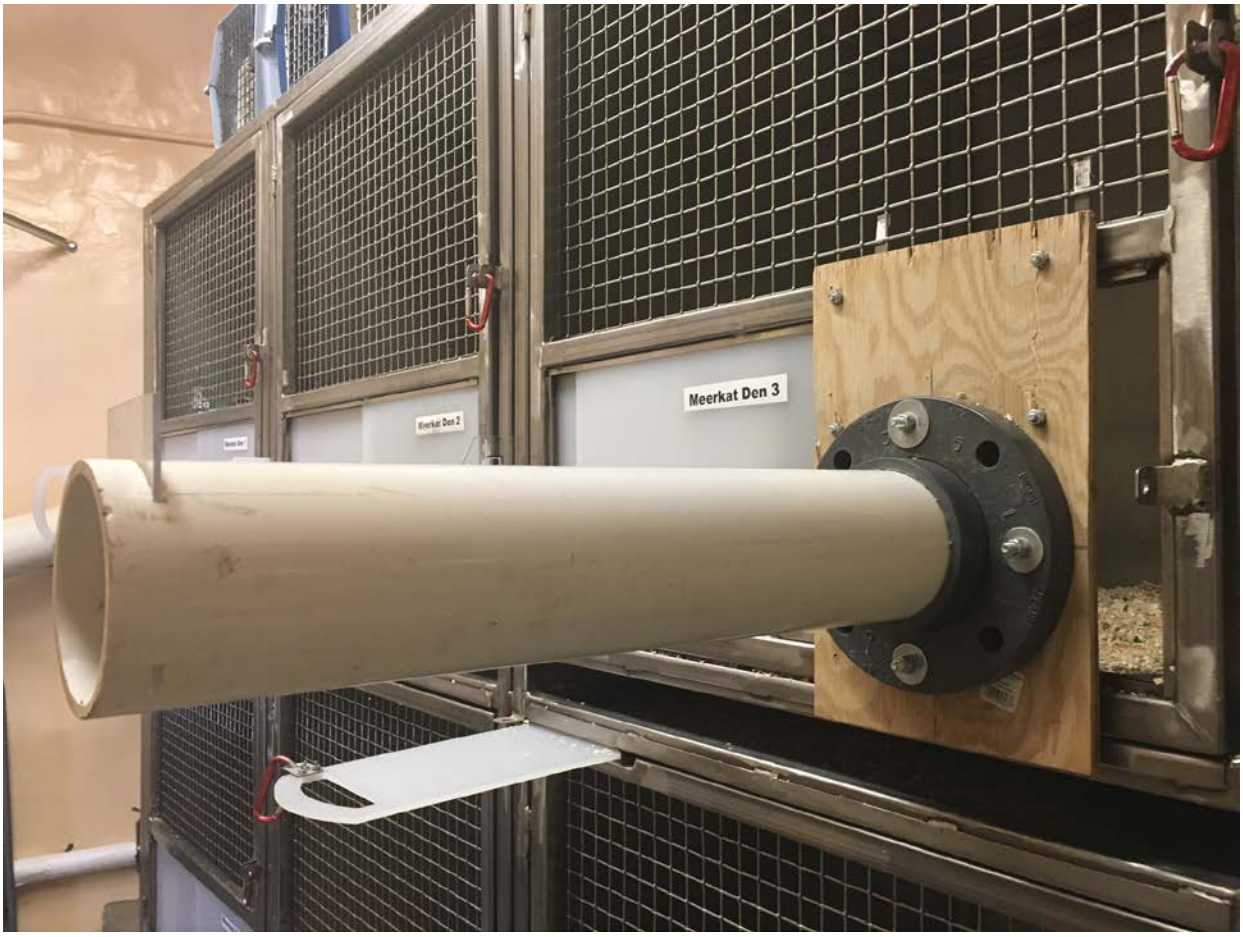

Figure 1: Custom built x-ray tube made with materials on hand at CMZ.

Process:

We prioritized teaching animals to enter the PVC tube based on their health assessments. Due to Bomani's health condition, we chose him as our highest priority for completing the behavior. We decided to make Mojita our second highest priority, as she has been recommended to breed. She's been with one of our males for almost four years, and while we've seen signs of possible pregnancy, we have never had any births. We thought that x-rays might help us figure out why. The rest of the meerkats would be trained as needed.

After we picked our line up, we decided to move forward with building our equipment. The custom built x-ray tube was finished at the end of November 2015, and I was able to start the training process in December 2015. I started by trying to familiarize the meerkats with the tube and make it a positive space. I attached the tube to the front of the den and opened the door. I had a little part of their diet set aside in the off chance that one of them would make it to the end of the tube where I would be able to offer them food reinforcers. Meerkats are curious by nature, and since we have given them PVC tubes as enrichment in the past, it didn't appear that the tube was overly aversive. Bomani and his brother, Akanste, were the first two in the tube and they both came to the end of the tube the very first time they were in there. Since they both made it to the end of the tube, I gave them both a food reinforcer.

From that point on, however, it was a contest between the two of them to see who would get into the tube first, and whichever one got there first would refuse to come out of the tube. This became my first obstacle in getting all of our meerkats to voluntarily walk into the x-ray tube. For all the future training sessions that I did I was joined by Rick Hester, a lead keeper from another area, who had taken on the role of my training mentor for anything that I would need help with. Rick and I discussed what we would like the end behavior to look like, which was for each meerkat to be able to be called into the x-ray tube without other meerkats trying to enter the tube at the same time. We also wanted them to stay in there long enough to take an x-ray. Our last goal was for the meerkats to exit and reenter the tube for multiple shots.

During the initial startup of the training program, a typical session consisted of the meerkats intermittently coming inside while we were in the holding area; if they did come in, there would usually be mild conspecific fighting over food resources. Also, they would run between dens trying to figure out where they could get food. It was extremely difficult to manage a training session with just one person.

We brainstormed a solution, and decided that with two trainers, it would be much easier to catch the meerkats doing the behavior we wanted and reinforce them. We started by having two meerkats enter den 5 for reinforcers; the other meerkat would come into den 6 for reinforcers.

At this point, we were only doing two training sessions per week; the other five days, the meerkats were being fed in random locations. We decided we needed to be more consistent in our training process, and in order to communicate better with the meerkats we needed to enlist the help of our coworkers. They started to feed the meerkats the high value part of their diet, i.e. meat and bugs, in their assigned dens only. After about two weeks, Rick and I started to notice a significant difference in their behavior. Bomani and Akanste would see us approaching the exhibit to train and they would run inside and wait in their assigned den. The third meerkat in that group, Sekitimi, was routinely the last one to shift inside. Sometimes, especially at the beginning of the training period, we wouldn't see him for the entire session. After about three weeks, however, even Sekitimi started shifting into his assigned den when Rick and I would be about half way through our training session with Bomani and Akanste. Presently, he is following his brothers and waiting in his assigned den when he sees us approach.

After the meerkats were consistently shifting and separating, Rick and I felt that Bomani and Akanste were ready to start working with the x-ray tube. We decided to station Bomani on the left side of the den while Akanste got into the tube. Initially, we thought we could then swap them around whenever we needed by calling them back and forth. However, we found that they would fight. They would fight over the tube on the right side of the den or they would fight over the left side of the den which made getting them refocused on what we were asking them to do very difficult.

Rick and I discussed what our next step would be and how we could move forward. We decided that if we could station Bomani into the third, unoccupied den (den 3, see figure 2) we would be able to eliminate the challenge. During our next training session, I worked on reinforcing approximations of Bomani shifting into den 3, while Rick worked on stationing Akanste into den 5 and Sekitimi into den 6. Lucky for us, Akanste and Sekitimi helped us out by delivering some positive punishment to Bomani any time that he went into either of the other dens during a training session. Within two sessions, he was reliably separating and stationing in den 3.

Figure 2: Den setup and configuration at CMZ.

This stationing and separating behavior gave us the means to work with a mob of meerkats without conspecific fighting. It also helped to build up the relationships between each meerkat and their keepers. The team was able to create great reinforcement history in the dens, so now whenever the meerkats see us approaching the exhibit, they run inside to their assigned dens

and wait for the training session to start. What was once a potentially stressful environment for them has been changed into an opportunity for them to work for their favorite reinforcers with their favorite keepers.

Once each meerkat was stationing in their own den, we started working towards our goal of having them both get into the x-ray tube, as well as stay long enough for an x-ray to be taken. As trainers, we decided that we could reduce the amount of anxiety and stress before a training session by always entering the exhibit prepared. Before Rick and I would enter into holding, we would come up with a plan, divide up the food for the session, and be completely ready to go before entering the building. As soon as we would walk in, we would quickly start the session. Rick would station Akanste and Sekitimi in their respective dens while I worked with Bomani.

Since Bomani was one of the two that initially went into the tube, it wasn't hard to get him to the point that he would enter and stay at the end of the tube long enough to take an x-ray, and Akanste was the same way. He immediately got into the tube, went all the way to the end, and would stay there until we ran out of reinforcers.

While working on stationing the 3.0 group of meerkats, we were simultaneously working on stationing our 1.1 group. We would train with the 3.0 group first then move over to our 1.1 group. They progressed at about the same pace; there was just one less meerkat to work with which made it a little easier. Rick would assume the same role of stationing one meerkat, while I worked on approximating the other meerkat into the tube. Mojita was the third meerkat to be trained but the first one that I actually had to actively shape the behavior of walking all the way into the tube; the other two meerkats we had trained with the tube had offered the behavior on the very first try. The difference was a bit on the challenging side; she would walk up to the opening, sniff and then run away.

I started her training by bridging and reinforcing for the behavior of approaching the tube. By selecting for progressive approximations, she eventually worked her way up to sticking her head into the tube. At this point in her training, I baited her by holding a piece of food on the end of tongs, and sticking them as far back into the tube as I could. After one session, though, I realized that it was going to be impossible to get her to come into the tube far enough to reach the food. We looked at how we could change the antecedents in her environment in order to set her up for better success.

I decided to drill two holes into the side of the tube so that I would be able to reinforce her at different points throughout the tube as she made progress. The two holes were drilled about one-third and two-thirds of the way into the tube. This way, I was able to deliver food for smaller approximations as she made her way up the tube. Once she started making it all the way to the end of the tube, the next challenge with Mojita presented itself. Any time that she would get a reinforcer, she would back all the way out of the tube to eat it. We tried different sized and different types of reinforcers to see if there was a preference of what she would eat inside the tube, but there wasn't. Rick suggested building duration on the amount of time that she had to wait at the end of the tube before she got reinforced. This way, we could still get a good x-ray, and she could leave and come back by the time we were ready to take another one. We started building small approximations on the duration of time that she sat at the end of the tube. As we built duration, we began seeing less backing out of the tube after she received her reinforcers. Turns out all we really needed to solve the problem was more positive history in the tube.

Once we had three meerkats that were holding long enough that we believed that we could get x-rays, we scheduled a time for vet staff to bring the equipment down and take x-rays. Vet staff

brought all their necessary equipment and set it up in meerkat holding. While the equipment was being set up, all of the meerkats had access to the dens so they could watch everything that was happening. Rick and I would occasionally give the meerkats pieces of food for coming into their appropriate dens because we wanted them to know that they were doing the right thing by coming inside. It took about ten minutes to get all the equipment set up and ready to go. Once everyone was ready, Rick and I treated it just like all the training sessions done previously.

During this “training for real” session, we got readable x-rays from Bomani, Akanste, and Mojita. The entire process took about 45 minutes total. It also seemed to be reinforcing for the meerkats, they continued to eat food and participate in the sessions even with extra people, equipment they had never seen before, and noises. Vet staff’s diagnostic images were able to see that Bomani’s heart looked great. They didn’t see any fluid around it, and the voluntary x-rays spared him from an unnecessary knockdown.

After we had completed the x-rays on the first three meerkats, we shifted our attention to the two remaining “lower priority” meerkats, Scotty and Sekitimi. Luckily through our other processes, they were already station trained. Sekitimi is part of the 3.0 group, and was the only meerkat of that group that did not initially get right into the tube. We trained him with small approximations of entering the tube, just like Mojita. Unlike Mojita, though, he would readily eat inside the tube; once he realized that he got fed in the tube he had no issues getting in it.

Scotty is the male in our mob of 1.1 (he lives with Mojita). He entered the tube and went all the way to the end the first time it was presented to him. The obstacle that we encountered with Scotty was that once he got to the end of the tube he would scratch the clear plastic piece that was there to prevent the meerkats from coming out of the tube (see Figure 3). Normally it wouldn’t be an issue but if he was scratching, there was no way to get a clear x-ray due to the movement. We tried waiting him out to see if he would stop, but he would continue to scratch and it would become more intense. We also tried calling him out of the tube if he scratched and then back in but were unable to decrease the scratching behavior; finally we tried giving him significantly larger pieces of food right as he got to the end of the tube and before he started scratching. The large food items worked very well because once he had the food he would sit calmly at the end of the tube, and it gave me time to get the next reinforcer ready so I could offer it to him before he had time to offer the scratching behavior again. In time I was able to increase the duration of him sitting calmly between reinforcers. Using larger reinforcers meant that during each training session we would have fewer repetitions with him because we would run out of food faster. It was worth the tradeoff, because a month and a half after getting x-rays of the first three meerkats we were able to get x-rays of Sekitimi, Scotty, and a repeat on Bomani.

Figure 3: Clear acrylic piece at the end of x-ray tube.

Conclusion:

For Bomani, it's a great, low stress way to ensure that we continue to provide the best possible care for his condition and monitor it on a regular basis. Currently, he gets an x-ray once every other month to monitor fluid around his heart. On one regular check, vet staff noticed that there was a buildup of fluid and he was immobilized to have it removed. The recovery from that procedure was a lot less stressful than previous knockdowns because there was significantly less fluid around his heart that needed to be drained than previous times when the only way that we knew he wasn't feeling well was because he was showing outward signs and by that time the condition had escalated to life threatening levels. It was because of this training that we were able to catch the low fluid level and drain it before it became another serious, life threatening episode. On the opposite spectrum, we are now able to spare him unnecessary immobilizations when he is doing well and has no fluid buildup.

Starting with an idea to get voluntary x-rays of our meerkats turned into something even better, having a mob of meerkats that will voluntarily station into separate dens. Not only does that allow for the voluntary x-rays but now we have the foundation set to begin other husbandry behaviors that may require the meerkats to station separately. On an everyday level, the station training is a great asset in many ways. One such example is that it allows keepers to be able to administer medicine to the correct meerkat without the possibility of another meerkat stealing it and receiving incorrect medication. We hope that with this training we will be able to monitor and catch many of the ailments that present themselves with geriatric meerkats before they become a larger issue but also be able to provide vital information on our younger meerkats as they age.