Back to Basics:

Crossing the Bridge between Training and Conservation

Cincinnati, Ohio

April 24-28, 2017

The Animal Behavior Management Alliance

2017 Annual Conference

www.theabma.org

Disclaimer

One of the core values of the ABMA states that:

"The sharing of knowledge and new ideas is fundamental to advancing animal behavior management. "

We do this in many ways, such as through our conferences, publications, and social media. Our written publications feature many fascinating and thought-provoking papers and articles. Some you may agree with, others may challenge your perceptions and ideas. And while the content that you read reflects the views of the author and does not necessarily represent the feelings of the ABMA or the board of directors, we think that the diversity of subjects and viewpoints represented by our members, at our conferences, in our publications, and via our social media outlets is one of the strengths of this organization. We encourage you to take in all that you read with an open mind, because you might be surprised by what you learn. Thank you and enjoy the proceedings!

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Keynote Speaker

Megan Parker PhD

Working Dogs for Conservation

Megan received a B.A. from Middlebury College and an M.S. in raptor ecology from Boise State University. She returned to her home state of Montana to earn a Ph.D. from the University of Montana in Wildlife Biology on the scent-marking behavior and territoriality of wild dogs in Botswana. She began pioneering training methods for conservation detection dogs in 1996. Megan has been involved in dog training, obedience, and search-and-rescue since childhood. She is interested in the international use of conservation working dogs to help under-funded projects acquire excellent data, reduce costs and preserve endangered species.

Working Dogs for Conservation is the world's leading conservation detection dog organization. We combine expert canine data collection with cutting-edge laboratory techniques to help answer some of the most pressing questions in conservation. Building upon techniques from narcotics detection, cadaver detection, and search and rescue, we have pioneered ways to use dogs' extraordinary sense of smell to protect wildlife and wild places.

Our dogs can detect weeds before they break the surface, animals that live below ground and aquatic organisms invisible to the human eye. Our co-founders were the first to train dogs to detect wide-ranging carnivores non-invasively, to uncover illegal snares in Africa, and to find invasive plants, insects, and fish. We are also at the forefront of the fight against wildlife trafficking, training dogs to detect ammunition, guns, poisons, snares, ivory, rhino horn, and pangolin scales.

Research and Evaluation Workshop

Shape of Enrichment Workshop

Enrichment Overview

This talk will introduce the topic of enrichment and cover the two core SHAPE principles that we teach in every workshop. The first principle is the five categories of enrichment; social, cognitive, physical habitat, sensory and finally food-based enrichment (either novel/unusual food items or the presenting the food in ways requiring work or thought to acquire). By creating enrichment programs around the five categories we aim to design holistic programs that provide animals with as many opportunities as possible within each captive situation. The second core principle is the use of the Framework to create goal-oriented enrichment programs, which are measurable and focused on the needs of the individual animals being enriched. This introduction will be expanded upon in the subsequent workshops.

Enrichment Framework

During this exercise, we will work in small groups to brainstorm enrichment ideas to meet specific goals for specific animals. Rather than working with hypothetical goals and random species, we would prefer to use real situations select participants are experiencing.

Behavioral Problem Solving

During this exercise, the group will work its way through the process, resulting in ideas to try to resolve a specific behavioral problem. Rather than working with hypothetical problems, we would prefer to use real situations select participants are experiencing.

Optional Fire Hose Practical

All participants will have the choice between this workshop and the 'Mesh Box Practical' (sign up at registration). This practical will allow participants the opportunity to gain skills in working with fire hose. Participants will be split into groups and provided with the instructions, tools and materials required to create woven items, including hammocks, cargo/scramble nets, spider webs, and cubes.

Optional Mesh Box Practical

All participants will have the choice between this workshop and the 'Fire Hose Practical' (sign up at registration). In this practical, participants will gain skills in working with 12-gauge weld mesh to create feeder boxes by hand. Participants will be split into groups and provided with hand tools required to create heavy-duty feeders that can be incorporated into many species enrichment programs as long-term reusable feeders. Our aim for this workshop is to enable participants to create these feeders quickly and efficiently, without the aid of cutting and grinding power tools.

Workshops

Enrichment Safety Workshop
Heidi Hellmuth
St. Louis Zoo

Do either of these sound familiar? Aaaaah, I'm sure it'll be OK, they've never hurt themselves on things like this before. Or, no, we can't possibly try that, there's a chance that something could go wrong! Instead of the two extremes of ignoring risk, or being afraid of any risk at all, this workshop helps to look at enrichment safety more objectively. In this interactive session, we will review some of the important aspects of enrichment safety, and then demonstrate a tool to take you step by step through a process to assess potential enrichment risks, look at ways to mitigate the risks identified, and then to evaluate any remaining risks to make an informed decision about the safety of an enrichment device or strategy.

Heidi has been working in the animal care and training field for 29 years, in roles such as marine mammal trainer, wildlife educator, zoo keeper, behavior management curator, and animal area curator; and is currently the curator of primates at the Saint Louis Zoo. Heidi is one of the founding directors of the ABMA, and has served in a number of leadership roles within the organization. She is also owned by three parrots, who keep her humble about any delusions she might have about her animal training abilities.

Media Training Panel
Dealing with Couch Conservationists

Media Training Panel – Dealing with Couch Conservationists

Topic: How to interact with couch conservationists- tools to defend your passion and strategies for avoiding dead end conversations. With the current environment, people are being engaged in conversations through social media, family and even the grocery store. These experts in the field will offer tips on how to be prepared for the conversation, what not to say to open yourself up and when to walk away.

Thane Maynard, Director, Cincinnati Zoo
Cody Sowers, Bird House Senior Keeper, Cincinnati Zoo
Suzi Rapp, Animal Programs Director, Columbus Zoo
Tim Sullivan, Curator of Behavior, Brookfield Zoo
Nicki Boyd, Behavior Husbandry Manager, San Diego Zoo
Cindy Wilson, Zoo Operations Technician, Moorpark College

Zipline Demo

Chris Hales

The Shape of Enrichment, Team Building with Bite,

Port Lympne Zoo

During my time as a keeper I have had the opportunity to design and build goal based enrichment for the animals in my care, along with teaching others during our Student Environmental Enrichment Courses and Team Building workshops. Having practical skills is a huge advantage to any animal career looking to progress in the zoo world, and of course these skills can help increase the welfare of the animals in your care enormously.

While trial and error can help you develop these skills, learning from those that have already made mistakes and learnt from them can help progress the design and build of these devices a lot faster, saving time, money, and potential injuries.

My aim of this practical demonstration is to show you how simple it can be to create a great enrichment device with multiple uses. This device has been used on a number of species such as equines, reptiles, carnivores and even fish!

Behavior Management Fund Scholarship Winner

Improve Animal Welfare in *Alouatta Caraya* from Illegal Traffic

Maria Florencia Presa

Temaikèn Foundation

A promotional campaign about the fight against illegal traffic with monkeys was carried out in Temaikèn Foundation during winter season last year. Because of this, seventeen monkeys with different issues were brought to the biopark from confiscation or donation. Abnormal behaviors such as self-mutilation, eating disorder, malnutrition, and absence of teeth were only a sample of the distress displayed by the monkeys. Consequently, a specific rehabilitation program was developed. Its purpose was to improve their health, nutrition, and behavior through medical treatment, building same species social groups, providing enrichment and training, and the opportunity of a forage plan as a principal behavior of this species. As a result, monkeys transitioned from being a pet wearing sleeping clothes to sleeping on branches. They stopped eating homemade food and began eating vegetation.

During the first days of process the animals remain very scared, quiet, and shy. The biggest challenges were the change of diet and helping them overcome the absence of contact with their previous "owners". Today, they are able to live in social groups, reproduce, and live in an environment covered with vegetation; vocalizations are a display of change as well. Animal Welfare is an ongoing process, and the commitment of those who work with animals under human care is to increase high standards of well-being through proactive programs.

The range of Howler monkey (*Alouatta caraya*) in Argentina is extended from north-eastern, eastern Formosa and Chaco, the extreme north-eastern section of Santa Fe, northern Corrientes and the southern part of Misiones, Brown and Zunino (1994). This species have ability to adapt to modified habitats. Although the habitat is very fragmented the populations can live in relatively small areas and disturbed forest. The illegal traffic is a great issue, the females are killed and their babies are sold to tourists. Then, when the animals started growing up they showed conflict with the humans. Because of that, some of them are carried to zoos, some others escape from the neighboring house and are rescued by Fauna Nacion (Government institution) or even died because of home accidents.

Fundacion Temaikèn decided to work hardly on a promotional campaign about the problematics around the illegal traffic as part of the Programa de Recuperación de Especies Amenazadas (Recovery of Endangered Species Program). A mass campaign called "Back to being Monkeys" began to rehabilitate those animals that had lost most of their wild behaviors and had the opportunity to "become monkeys again." The awareness campaign had the message "Monkeys are not Pets."

The goals of such campaign were to educate the visitors aware of this problem and to position to Temaikèn Foundation as Conservation Organization. A character, the figure of a boy who protects the nature, placed in the sector of "recovery stories" where visitors take photos and are informed about rescued animals together with videos uploaded to the webpage, chats with the visitors in the Caraya exhibit, and post on social networks about the history of animals that came to the park and news on TV and radio were the means to fulfill these goals.

All the above was developed together with Fauna Nacion, and a Rescue and Rehabilitation Center in Misiones, in the north of the country where the animals were housed.

As Animal Welfare Area, our goals were to evaluate the physical and medical conditions of these animals, develop quarantine, evaluate and improve their behavior and make a transition from home food to folivorous alimentation. During the whole process we had special attention in those animals that had been pets for many years, recording changes in the behavior related to the absence of interaction with human's beings (physical contact).

In other way, inside our garden center we built a place with typical vegetation for Howler monkey where the animals may receive cut branches and renew of pots so that they can cut the leaves.

Up to 2016, seventeen monkeys with different issues had arrived to the biopark from wildlife confiscation or donation. Each case has been different and we have taken three examples.

The first group of Black Howler monkeys which arrived at Fundación Temaikèn was formed by five animals: three males and two females. Previous to the confiscation which brought them to Fundacion, they were housed in a precarious zoo for some time. The exhibit was based on old cages without necessaries conditions to ensure their welfare. These animals arrived in bad health, malnourished and dehydrated with problems to remain hanging from the branches. They displayed fear towards the keepers when they approached.

Their environment was modified to give them the opportunity to gather the food themselves, foraging and pulling on branches in order to get the plants which were chosen from their place of origin.

Whereas in the animals´ first time in quarantine, they behaved shyly and cautiously in the presence of keepers. They were always together with lowly active. When they arrived to the exhibit they showed a different behavior. While we offered branches of different plants to eat they preferred pull up the leaves and fruits of the trees as a typical behavior of foraging and they showed eagerness to eat the grass on the floor. The enrichment applied in this group was based in contra-freeloading.

Over time, the behavior began to change: the animals showed dominance between each other and there was a development of grooming among them, too. We used to see them performing a typical Howler Monkey behavior where the animals are on top of each other as an important social behavior. They began to select the leaves as part of their food, and progresses in vocalizing different environmental sounds. A year later, their behavior was evaluated and was decided to send four of them to Misiones.

While, we remember each animal and the personal history, some of them develop a behavior very different from a wild Howler Monkey. These unnatural behaviors are directly related with the life of a pet. One of the most stunning cases was about a female which was abandoned by "owners" at the entrance of a zoo. This female was constantly seeking for human contact and displayed abnormal behaviors as biting hands and feet, pulling the hair from the body and scratching the whole of it and in some opportunity would accompany that with shouts. Its behaviors were present in the night house an exception of the whole body that was developed in all spaces. The female was used to consume human food and sleep with cloths on. Although the animal won't be sent to the Rehabilitation Center we have developed a training and enrichment program with the goal to stimulate her natural behaviors and decrease those abnormal and therefore to incorporate her to a social group.

Because this animal developed an abnormal behavior when interacting with the keepers, we set some reinforcement criteria to evaluate the different type of reinforces or consequences that had added these unwanted behaviors. We worked hard to build trust with the animal and trained all the cooperative behaviors. Then, we move on to more complex training goals.

During the first step of enrichment we used objects similar to those which the females were used to interact with at home: clothes, balls, a kennel to sleep, etc. Sometimes, when the keeper would forget to deliver the clothes, it would steal some of keeper's rags from the floor.

At the very beginning, the animal wouldn't dare to taste the leaves and only ate the fruits; but little by little we incorporated a forage plan to stimulate a natural feeding behavior through diversity of vegetation. Because the female used to move on the floor by walking, we added some aquatic plants and different types of grass (to the environment) too. We would be able to observe it using the branches with her prehensile tail some time later.

The next step of the goal was to incorporate the animal with other individuals of the same species. We started with one female and, later on, we achieved positive interaction with three males and one female in different ways: rotating them in different groups to give them the opportunity to integrate and get to know each other. In those situations where the individuals had had negative interactions with a female, an aberrant behavior was displayed.

During the year we have been working with this animal, the abnormal behaviors were progressively disappearing. While you can see Howler monkeys scratching their body as a normal behavior to remove parasites we notice that the specimen performed this behavior with a little more frequency. Whereas her rehabilitation involved a difficult adaptation process, nowadays the female lives together with a male and they had a baby. The female, Anga, has become our ambassador, delivering the message against the "petting" of wild animals and educating the population about this issue.

Inside our Rehabilitation Program we have received a male called Toby which had been living in a house with a family for over ten years. He had a close relationship with the females of the house but he was a continuous problem with the males in agonistic interactions. For the first few days it fed normally and the interactions with the keepers were positive. Inside our program we offered the opportunity of forage and exploratory enrichment and training sessions. Limited and not limited interaction visual with others animals was also contemplated.

Days later we observed a change in the behavior. It began to be quiet and to eat less. It developed decay, depression and vomiting. The poor nutrition the animal had during the 10 years produced irreversible consequences in his liver and such high imprinting that the separation could have generated a considerable amount of stress.

Even though previous investigations has suggests that primates have ability to adapt in different environments and social context the habituation in the rehabilitation carries risks. In animals that have been pets the stress brought by interaction with unknown humans, changes in the environments and fear can be one cause of the death in wild animals. In this context we started to pay special attention to the developed behaviors to try to reduce the stress. In addition to the rehabilitation program we decided to increase the number of sessions training and keeper's interaction with the objective of enhance social opportunity.

After one week, he died. The animal presented a complex, consecutive multisystem symptoms of a long period of time in captivity under poor conditions and in the last instance may also have gone through a manifestation of stress that complicates all that it brought from base.

Animals from wildlife confiscation or donations are still being rehabilitated. They were deprived of social life as a principal aberration. All animals had malnourished and some of them were in bad physical conditions with old remodeled fractures, trimmed teeth and skin lesion. The abnormal behaviors reported by the old owners were negative interactions as attacks or bites to humans. In the park we have registered the case of female Anga as the most problematic behavior. Today, her rehabilitation has been a great success.

The behavior was evaluated in each and every case, and those animals housed in Misiones, who developed a repertoire of appropriate behaviors, were separated to evaluate a future liberation through a Conservation Program in Misiones. Other animals with different issues as illness or abnormal behavior were housed in exhibits. Nowadays we continue working in the rehabilitation of this specie with the goals to educate our visitors and give the animals the opportunity to improve their welfare, appropriate conditions and social life with our own species.

Presentations

Strengthening Connections between Field Conservation Projects and Zoo Ambassador Efforts

Craig Bickel

Busch Gardens Tampa

The SeaWorld & Busch Gardens Conservation Fund since its inception in 2003 has been able to support over 1,000 conservation projects in 70 countries. Representatives from the SeaWorld, Busch Gardens, and Discovery Cove parks have traveled to these projects to work with and support the conservation efforts being done in the field. This presentation will highlight some of the ways that we have incorporated the knowledge that our animal care specialists gained from their travels into the daily care of our animal collection. The information we have been able to bring back home to our parks has been a huge success in two major areas. The first area we saw an impact in was increasing the variety of animal enrichment through food options and physical environmental changes. Food options were added or modified to include new or more native food and also to create a more natural way of obtaining those food items. Many of the physical enrichment changes were to create a more natural environment and the ability for more natural movement within the animal's environment. The second area that we saw a huge impact in was the increased ability to relay information to our guests as well as our fellow keepers. The detailed information about specific animal species and how they exist in wild, face ongoing challenges and how we can help and conserve them was invaluable.

Information sharing has become the greatest resource available to animal care professionals. We as professionals, look to gain information that we can use for the training, care, and enrichment of our animals. More than that, we look to make a difference in the world for all wildlife that we strive to protect. This means that sharing information about the wildlife with the people we interact with is the most effective way to strengthen the connections between conservation projects and efforts within zoological facilities. The SeaWorld & Busch Gardens Conservation Fund has been able to support over 1,000 projects in 70 countries. With more than a decade of support, there have been projects that representatives from SeaWorld, Busch Gardens, and Discovery Cove parks have traveled to and have been able to work with and support the conservation efforts being done in the field. This presentation will highlight some of the ways that we have incorporated the knowledge that our animal care specialist gained from their travels into the daily care of the animals in our animal collection, the information that the animal care specialist have been able to provide back to the conservation projects they assisted with, and finally, the main focus and largest area of impact is the education of our guests and team members.

The first area we created an impact was increasing the variety of animal enrichment through food options and physical environment changes. Food options were added or modified to include new or more native food and also create a more natural way of obtaining those food items. Many of the environment changes were to create a more natural environment or more natural movement within the environment. The first example of a change was a result from the Gunung Palung Orangutan Conservation Program (GPOCP) in West Kalimantan, Borneo. While at the GPOCP, I was able to study and observe orangutans in the wild, as well as assist on a variety of studies and projects taking place. One of these was specifically about nutrition and what these animals preferred during certain times of the year. While assisting, samples were gathered and sent out for analysis of their nutritional value. Orangutans are frugivores, which explain why the Durian fruit seemed to be very popular when in season. Durian is a unique fruit that has a strong odor, which was described as "garlic, Limburger cheese and some spicy sort of resign." (Morton, 1987). In fact, some hotels even restrict this fruit from being brought on premises in the native regions of Borneo. This is most likely one of the reasons that it isn't a common fruit consumed here in the United States, but we decided to try it for the orangutans in our care to see how they enjoyed it. It was a pretty interesting experiment as about half of our group enjoyed it, while others were not too sure of it. Even more interesting was that some wrapped their hands with browse leaves or other enrichment devices to be able to break the fruit pod open, just as the wild counterparts do.

A browse program has been established within the park; however, it was based on natural flora already growing within the park grounds. After learning about the benefits of browse for animals, a re-vamped browse program and browse garden was created by the nutrition center. After witnessing how much all parts of the foliage was used by the orangutans in the wild, suggestions and requests were sent to the staff in charge of the browse garden program so that we could include more native plants, such as increased banana leaves, and reduced other forms such as oak.

Finally, the nutrition center has just started the process to explore a Jack-fruit operation. This is southeast Asian fruit is the largest tree fruit in the world, weighing up to 100 pounds (Silver, 2014). This tree also doesn't grow as high as most in our region, topping out at 30 to 40 feet, even though they can be much larger in their native region. (California Rare Fruit Growers, 1996) This high fruit yield and nutritional fortified fruit would be a great addition to the browse garden. Adding this item to the enrichment program as a more natural, healthier food option could possibly benefit all of the fruit eating animals within the park.

Another animal area that was able to benefit from connecting with a project, was the cheetah area within the park. The cheetah program at Busch Gardens Tampa is still fairly new, being revitalized in 2010. Two projects that have been sponsored by the fund are Cheetah Outreach Trust (COT) in South Africa and Cheetah Conservation Fund (CCF) in Namibia. These programs are helping the wild population as well as maintaining an education population. Three animal care specialists from the cheetah area were able to visit COT, covering different stages in the life span of cheetahs. One of those three and a fourth team member from the same area went to CCF. As an example of how we were able to gain and use the knowledge from these projects, one if the animal care specialist went during cub rearing season and development. While there she learned that they were feeding cubs a formula that was different than what was going to be used by the park. Not only was the formula different, but they had established weaning protocols and an exposure time line for new environmental factors to assist with cheetahs weakened immune systems. (McKeel) Once that animal care specialist came back, she was able to include what she learned into our cub rearing program, compare nutritional data and success of the formulas, implement weaning time lines, and establish an environmental exposure time line.

While those food options were just a few changes that were made from the effort and support from conservation projects, the next changes are more about the animal's movement or ways to get food. It can hard to create natural ways of obtaining food items for animals or sometimes even harder to create more natural ways of movement when animals are in zoological facilities. Many of the complications are from working within the design and parameters of habitats, access to resources, durability of products, or even if the animals are in groups. Often, it was a matter of being creative with some forms of enrichment that was already available. After observing the way the orangutans would move through the forest or climb trees to get fruit while at GPOCP, I noticed it was often a more of a vertical progression instead of lateral from branch to branch. When the orangutans would move through thickets of bamboo, it looked more like very controlled falling, instead of climbing. This observation was later supported in a published project titled, *Recapturing the Canopy: Stimulating Bornean Orang-utan Natural Locomotion Behavior in a Zoo Environment*. To simplify the findings, this project stated that orangutans with vertical structures spent more time off the ground than on it and were more active. (Roth, et al 2017) With the research of this publication, and the experience for the GPOCP project, enrichment was changed in some areas to include more vertical apparatus. One change was made by hanging strips of fire hose that would dangle 4-5 feet in length for the orangutans to brachiate with. Also, a climbing rope is being developed to create a vertical and flexible device for them to use as well. While the orangutans seemed to prefer the more vertical aspects, the gibbons in Borneo did seem to move more on a lateral line within the branches in the canopy of the forest. In order to mimic this, bamboo rope ladders were installed in horizontal directions to give the option of swinging or "walking" to the different areas. In both of these examples, the enrichment is able to be adjusted and relocated within the habitat. It creates a more natural way of movement as well as multiple habitat changes. If the information from these projects had not been relayed back, these enrichment devices may not have been created.

In addition to creating a way for the animal to move more naturally, there are ways to increase a more natural way of getting food or primary reinforcement. Since the orangutans get the majority of their food from fruiting trees, which requires them to climb a tree trunk, and forage with one arm while the feet and other arm supports them, a device was created to mimic that specific behavior. This required a milk crate, 55 gallon plastic barrel, a metal bar, and a bungee rope. The drum had the top cut off, a hole drilled out of the bottom, two holes drilled on the sides near the bottom and across from each other. The food was placed within the milk crate; the milk crate was then place in the upside down drum, with the top of the milk crate against the bottom of the drum. The metal bar was then run through the two holes on the barrel and threading the handles of the milk crate, locking it into place. Since orangutans are

very intelligent and strong, this metal bar was locked into place with padlocks. Then the bungee rope was threaded through the hole at the bottom of the barrel and around the metal bar. This allowed for the bungee and the entire apparatus to be secured above the ground, near a climbing pole. The orangutan had to climb up to reach the food, support itself with three of the four limbs, and work to get the food from the apparatus. The body posture and dynamics were the same as orangutans in the forest of Gunung Palung.

While in the forest of Borneo, I also noticed that the gibbons there could reach their long slender arms into thickets of thorns to reach berries and the sweet flowers of some plants. To recreate this behavior, just without thorns, milk crates were used once again. Two of them were stacked and attached to one another. Small sections were cut out of the bottom of the top crate, just large enough for the animals hand and arm to easily fit in. The food was then placed in those holes and in the lower milk crate. This apparatus was then suspended from areas within the habitat so that the animals would have to search to find them, and then hold themselves up while retrieving the food. The change in the animal's habitat and the devices to change the way they obtain their food were designed directly from the information received from the projects in the field. However, the communication with these projects is a two-way street.

At both cheetah projects, animal care specialists were able to bring back valuable information on the different stages of development of the cheetahs. Both of these programs were/are set up for the protection and preservation of animals in the wild. Recently, these projects have begun to utilize ambassador animals for a number of reasons. With new animal ambassador programs, training experience was limited. Fortunately, the animal care specialists assisting were able to share information on the training and care for the ambassador animals in their collection. One of the examples where we were able to share knowledge back was at the COT project. The animal care specialist that went to this project was able to show them the training techniques used to harness train and leash walk the animals back at Busch Gardens. Likewise, starting the young cheetahs on a training program and establishing the learning curve was another area that the training experience was able to be passed on. (Mangel)

The information shared back in Borneo was based more on social dynamics. Orangutans are solitary or semi-social by nature. In controlled settings, such as zoological facilities, orangutans have been able to sustain small social groups, so long as there is only one male. With the ability to have these animals in this setting, it has allowed for more experience in the forms of communication amongst one another. In the wild, as these interactions are rarer, not as much experience with the communication has been observed at this project. While I was on the project I was able to provide details about similar communications that happen within the social groups at BGT. The example that can best highlight this communication is from an encounter that happened between a young non-cheek-padded male and an adult mother with a 2 year old female offspring in Gunung Palung. The adult female was foraging for food with her offspring, when the young male happened upon them. He decided to move close and even forage in the same tree as them. Then anytime he tried to move closer, the female would produce a noise that was similar to a kiss squeak followed with a bellow type of sound. This would cause the male to hold back a bit. I shared details of how one of the females at BGT would perform a similar sound when she was unsure of changes that were happening within the house or on the habitat. Usually, she would do this during construction or maintenance. This was able to shed some light on the forms of communication from an animal that often has little to no interaction with other members of the species.

All of these examples and ideas have come from the communication between the people in the field and the people caring for animals at BGT, but there is still another group of people that we share this knowledge with as well. All of the care provided, the enrichment created, the knowledge exchanged, and the research done is relayed to park guests and all team members within the park. The following focus is to show how the information from field projects, the changes from those projects, and the experience gained can strengthen the connection between our animals and the conservation projects.

There is static communication such as signage, blogs, and videos to name a few. The most common and easiest way we have been able to incorporate the work and efforts being completed in the field are signage throughout the park. The viewing area for the orangutans is called the Orangutan Outpost. This area has a large glass viewing area, as well as an interactive touch screen display. This display has different menus that allow the guest to interact with and learn about the animals. Some of the information is about the threats orangutans face in the wild, while other information shows the conservation needs. Additionally, this building was designed to be free of air conditioning and ventilated much like the buildings in Borneo. The signage within the Outpost displays this and how it impacts the environment. A video monitor is playing a looped video from a research and rehab center in Borneo on an outlook for the habitat. The video provides information to the guests about those facilities efforts while they are able to view the orangutans on the habitat. Just across the pathway is the tiger viewing area, Tiger Lodge, which has a large window viewing area with much the same features a the Orangutan Outpost. There is a video that plays with information given

by one of the animals care specialist that has been able to assist with projects in the field. There is also a coin vortex that provides a fun way for children and adults to donate money to the conservation fund and provide an alternative to guest using the water of the habitat as a wishing well. In fact, all of the animals habitats have signage provided to describe the animal, their range, current protection status, and if the SeaWorld & Busch Gardens Conservation Fund are supporting any projects to assist them.

Blogs have become another excellent outlet to provide information to people. All of the animal care specialist that have gone to and assisted any of the conservation fund projects have written blogs over a series of days to describe their experience and what they learned. This is an excellent way to include many of the projects that are located domestically and may not have an animal habitat within the park to correspond with. One such example would be an animal care specialist went to the Audabahn Raptor Rehabilitation Center. At the time, there were raptors within the park, however, they were education raptors located behind the scenes. The blogs allowed for employees and the public to learn about what happens at the raptor center and learn about our education raptors behind the scenes, which bring us to the other form of interactions, dynamic interactions.

Dynamic interactions are with any of the animal care specialists or any representative of the park, the fund, or project ambassadors. These interactions are going to be very different from one another and tailored to the people that are in the interaction. One of these interactions is in the form of classes. Classes such as "Professional Organizations" are responsible for ensuring the animal care specialists are aware of all the major organizations involved with conservation efforts, animal care, and even information sharing. ABMA is example of this. An additional class that is aimed strictly at highlighting the conservation fund is provided to educate about the projects foreign and domestic. This class also helps set up volunteer efforts for those people in the class to get involved in projects such as the oyster restoration projects, crab pot removals, beach and bay cleanups, and scallop searches. When individuals have been able to participate in some of these efforts that are happening in their back yard, they are able to share this information with others, including in what is our most common forms of interactions.

Tours and talks are by far the most common interactions and the best way that we can create and strengthen the connection between conservation projects and the efforts happening in the zoo. The vast majority of people in these interactions are guests with some professional tours as well. Most of the animal areas within Busch Gardens Tampa have "Meet the Keeper" talks throughout the day. This is when an animal care specialist is available to interact with the public to discuss and educate about the animals they work with. This includes any conservation efforts, changes made from those efforts, and basic information about the species and individual animals in the habitat. This also allows for the public to field any questions they may have about the animals or issues they have in the wild. One of the best examples within the park is the elephant area. This "Meet the Keeper" talk has an interaction wall that the elephants are able to come very close to the public. While here the guests can watch training demonstrations while learning about the animals that are both here and in the wild. One of the projects that the fund has supported in the past was in Thailand, where a young elephant stepped on a post war land mine and lost the lower portion of a leg. This project was able to build a prosthetic for the elephant so that he could survive. As he outgrew different prosthesis, one was brought back to the interaction area so that guests could see it and learn the story. To coincide with this, the elephant team can demonstrate some areas of elephant foot care and husbandry at this interaction.

Tours are an even more personal interaction. These are commonly behind the scenes and limited to a per-determined number of people. Once behind the scenes, the tour guests are able to see examples the husbandry, housing, training, enrichment, and discuss information with the animal care specialists. In addition, signage is also located within the houses to ensure an opportunity to provide information is not lost. An excellent example of a tour that covers all of these aspects is within the tiger area. This tour is available for up to 12 guests, and they are able to come behind the scenes and see the tiger housing area. While behind the scenes, the guests are able to learn about the food provided and how it relates to wild feeding schedules, learn about the animals at the park and how they assist wild populations by being ambassador animals, and ways the guests can assist in conservation efforts. During the entire tour, signage and information about projects happening in the wild are provided to keep the guests engaged even while walking through the house.

In order to be able to share with as many people as possible, it was clear that not everyone would be able to come to the park or participate in one of the talks or tours. With the popularity of social media and other applications on the internet, Skype has become a satellite type of interaction with classrooms. The cheetah area has been able to utilize this option to provide educational talks and outreach options to classes as part of their curriculum. In these talks, the animal care specialists are able to discuss the cheetahs, conservation efforts, and even show artifacts to engage them.

Another satellite form of interaction is Facebook live. This allows social media users to be able to get involved

in an interaction and even be able to interact with questions and comments. This has been most recently used on a conservation fund sponsored project in the area. A camera and a representative for the fund were able to connect with Facebook live users while on site for the project, its importance, and the impact it was making, and even how to help.

The final example of a way information from conservation efforts has been shared is by creating an entire display just for that project. Rising Tide is a coastal and marine life project local to the Tampa Bay area. Working so closely has allowed for a great deal of interactions and assistance from Busch Gardens Tampa. A display of marine life has been established in a central area of the park. This display has information available, and results of the project. The most notable being some of the first Tangs bred in human care.

The SeaWorld & Busch Gardens Conservation Fund has been assisting conservation efforts in the wild for more than 13 years. This has just some highlights of how communication between the projects has strengthened the importance of the zoological counterparts. Busch Gardens Tampa has been able to benefit in the area of increasing the variety of animal enrichment through food options and physical environment changes. Food options were added or modified to include new or more native food and also create a more natural way of obtaining those food items. More importantly, the largest area that the park has been able to benefit is in the ability to share the information and research that has been done with the employees and the guests of the park. The goal is to increase knowledge and awareness with all of these people. Ultimately, the goal is increased support and funding for these projects so that they may be able to continue to grow and work for conservation efforts around the world. I hope that we have been able to share some information that will inspire new and additional ways of sharing information and utilizing that information to the care of animals in zoological facilities.

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Thinking outside the Shell for Conservation: Inspiring Zoo Guests by Training Behaviors in Tortoises for Public Encounters

Lauren Etzkorn

Columbus Zoo

Tortoises have survived successfully for well over 200 million years. Due to human activity, however, they are now amongst the vertebrates most at risk of extinction. Despite their historic and intrinsic value they are not commonly appreciated by the public for their relatability in the same way as many of their mammalian counterparts. It can be difficult for many guests to empathize or identify with species of the cold-blooded variety. At the Animal Encounters, animal care staff aims to provide opportunities for the public to relate to reptiles in a way that might change their perspective. Zoo-goers can visit a number of tortoises of various species in the Village's Tortoise Yard. One of the most popular occupants there is Grouchy, the Sulcata tortoise who has been target trained for daily walks with zoo guests. During Grouchy's trainer-accompanied treks, guests observe positive reinforcement training-in-action and sometimes have the opportunity to reward Grouchy with grapes. Radiated tortoise Ted, a member one of the most endangered species in the world, was trained to enter through a door onstage and slide down a ramp in order to get close enough for guests to touch his shell. Each of these experiences gives the zoo guests a chance to see these species making choices and demonstrating control over their environments. This paper outlines the ways in which training behaviors for guest interaction, in unexpectedly "intelligent" species such as tortoises, allows the public to relate to and ultimately become invested in their long-term protection.

Introduction

The mission statement at the Columbus Zoo and Aquarium is as follows: "To lead and inspire by connecting people and wildlife." Nowhere is that philosophy more pervasive than at the Animal Encounters Village, an interactive and dynamic attraction that combines show presentations with one-on-one guest interactions. In this space, zoo visitors become personally acquainted with a variety of species, none more misunderstood than the numerous reptiles that inhabit the "Village," as to which it is affectionately referred. In developing our daily "Tortoise Talk," I, along with my peers, faced the dilemma of engaging guests in getting to know our several tortoise species and subsequently to become invested in their specific plight in the wild. This paper explores the Animal Encounters Village model and outlook, the process of training our endangered radiated tortoise (*Astrochelys radiata*) Dia, and the ways in which each of those components has the potential to change the minds of our zoo guests and in turn, impact species survival.

The Animal Encounters Village

Upon entrance to the Columbus Zoo, the zoo guest would find the Animal Encounters Village located in Jungle Jack's Landing immediately to their left, flanked by child-friendly rides and our own stingray touch pool experience, "Stingray Bay." The colorful village façade hides enclosures for the majority of our 70 species collection. Quite congruent with the zoo's larger mission statement is the Village's private motto: "touch the heart to teach the mind," a slogan coined by previous Zoo Director, Jeff Swanagan, and reiterated amongst staff at every turn. That motto has become a part of the culture at the Animal Encounters Village where not only permanent but also seasonal staff are encouraged to be creative in the development of new opportunities for engaging guests with our animals.

At any given time, a guest could meet one of our staff, internally dubbed "villagers," in front of the village or on the path leading to it, with an animal in tow. Opossums, ferrets, rabbits, flamingos, and sugar gliders are some of the most well-loved village inhabitants and among the 15-20 species that guests have the opportunity to touch. Also in that grouping are the more often misunderstood reptiles. A variety of lizards, snakes, turtles, and tortoises are species common to see at the Animal Encounters Village. The village has several exhibit spaces including a rotating mix-species yard, a flamingo yard, and a tortoise yard. In these spaces staff serve as interpreters to the public and work hard to create unique experiences for each passing guest. At pre-designated times of day zoo visitors have the opportunity

to catch several mic'd encounters: one of our four behavior-packed shows featuring kinkajous, macaws, cheetahs, hawks, porcupines, skunks, coatis and many others; penguin swims; sloth encounters; and finally, the Tortoise Talk.

The Tortoise Talk

Prior to the development of the Tortoise Talk, the Village boasted a relatively diverse tortoise yard with as many as six species roaming about at any given time as well as a "Grouchy Walk." As a solution to a logistical challenge, villagers had trained a large sulcata tortoise (*Centrochelys sulcata*) named Grouchy to target to a red bucket in order to walk from his off-view housing across the Zoo's entry plaza ending in the Village's tortoise yard where he spent summer days trucking along, knocking other tortoises out of his path. On his own, Grouchy was quite the draw. Grouchy, a former pet, was responsible for busting many myths and misconceptions regarding speed, strength, and most interestingly intelligence. As a seasonal at the time, I was given the privilege of participating in Grouchy Walks—though in the 90 degree heat of August those sometimes 45 minute treks did not always feel quite like a privilege. In that role, however, I had many encounters with guests revealing to me their astonishment at Grouchy's "intelligence" as it was demonstrated to them by his ability to target his beak to a red bucket. Those interactions offered numerous opportunities to explain the effectiveness and importance of positive reinforcement as a training method but also served to plant the seed in the minds of myself and the other Village staff that training even simple behaviors, like targeting, in species that guests perceived as unintelligent could have a powerful effect.

As part of an annual goal, I was given the task of evolving our tortoise experience by my manager, an individual particularly passionate about tortoises. We knew we wanted to continue to incorporate the Grouchy Walk when we could but that we also needed to find a way to capitalize on the excitement of discovery that guests experienced when watching Grouchy perform his behavior in way that would allow us to highlight some of the more endangered species in our tortoise yard and to potentially even raise funds for them. The dialogue of the talk initially stressed some of the common threats to endangered tortoises but as we began to implement the talks, I realized that the staff was having trouble making the connection for guests between Grouchy, a species not at all threatened in the wild, and the far more vulnerable radiated tortoises (*Astrochelys radiata*) for whom we had begun to try to raise funds up to that point, unsuccessfully. It wasn't until a staff member, Shane Gorbett, began to train Dia, one of our new (at that time) radiated tortoises to do Grouchy's same targeting behavior, that we began to gain traction on the fundraising front.

Training Dia

Shane, at the time a one-year veteran of the Animal Encounters Village, began his first project as a primary trainer in the early summer of 2015 along with the help of myself and several others. We planned to get Dia, the smallest but most confident of the three new radiated tortoises, going on a target-trained walk as an alternate to Grouchy. However, it was a matter of just a week or two we realized that this particular tomato-obsessed tortoise, was the most perfect tool for the job of connecting people to his species. The tortoise talks turned temporarily into mic'd training encounters while guests watched Dia, at a speed and with a motivation that surprised even us villagers, plow after his target around the village.

Shane trained Dia in just 2 weeks to target to a bucket and at that point, the both of them needed a new challenge. So we developed a plan which involved Dia making his own entrance on stage to end one of our four daily themed shows. The original goal was to have Dia enter the stage through a human door, walk to the edge of the stage and be picked up by one of the speakers as we did not believe he would be able to navigate the stairs built into our stage in order to get close enough for guests to see him. Using the target initially and working in small approximations, we trained the behavior backwards beginning at the edge of the upper part of our stage and working all the way back to Dia's entrance from the stage door. The target was an instrumental prompt in getting Dia to make his way from the dark interior of the building to the bright outdoors and particularly in navigating over a metal lip at the base of the doorway. After 10-15 reps of entering through the door and making his way to the corner of the stage, we were able to fade back the target. At that time, it was a point of discussion amongst staff as to whether the trainers had become a target themselves or whether our presence was more of a prompt.

Because the process was so quick, we decided to come up with a way that Dia could potentially make the commute from the top of the stage, down the stairs, and along to the front of the stage to be within clear view of the public. A short wooden ramp, approximately 2 feet long and 1.5 feet tall at the highest end, used for our black footed penguins (*Spheniscus demersus*) to slide onto the lower stage, became the perfect hardware for Dia! As an experiment, but anticipating that it would need to be worked in smaller approximations, we set the ramp up in the spot to which Dia had worked his way at that point in the training and positioned the target bucket at the bottom of the ramp. Without hesitation, Dia plummeted forward from the top of the ramp, sliding swiftly down and touching his beak to the bucket. After that first repetition we were concerned that Dia would demonstrate hesitation as the speed at which he slid down the ramp was alarmingly fast, even to those of us watching. Yet once he was reset right at the

top of the ramp, he immediately came sailing down a second time.

The highlight (and thrill) for the audience became the portion of the behavior which involved Dia turning a slight corner along a long box used as a stage prop, with his trainer out of view, and subsequently sliding down the long ramp. The corner of the box proved to be the most challenging part of the stage behavior, particularly when other staff was present out front of the Village and within Dia's view. If a staff person stood too near the stage within his line of sight, Dia would sometimes change direction in pursuit of them. Several sessions became dedicated to Dia being reset at the box and simply walking along the long box and turning the slight corner to find his target and get reinforced. At that time, we worked in small approximations on fading first the red bucket and then the prompt of the trainer's body out of view with the most immediate step-back being the training popping back into Dia's line of sight. After Dia had become solid at rounding the corner and sliding down to his target, the target was quickly faded out altogether. Soon, the behavior was fully trained and passed off to a number of others. We added dialogue about the species' heartiness and ability to overcome both direct obstacles in the rough terrain of their spiny forest habit and indirect obstacles such as habitat loss and illegal trafficking in order to tie in the ramp sliding and stage navigating behavior. With that, Dia had become a regular finale to our 11:00 show as well as the star of our Tortoise Talk.

Conservation and the Guest Experience

With Dia's regular performance in our shows and tortoise talks we began to get feedback from the guests—amplified echoes of things we had heard in the process of walking Grouchy in years prior. People were amazed and constantly made connections between the species' intelligence and their ability to learn what to guests appeared to be a challenging behavior. Though more quantitative research would need to be conducted in order to prove this definitively, it seemed to us as employees that the perception of the tortoise as "intelligent" was correlative to the guests' affection for them as a species.

We used what seemed to us to be a newfound excitement for the tortoises as an opportunity as educators to go more in depth in the details of the radiated tortoises' specific plight and to develop our conservation messaging. During Dia's multiple behavior demonstrations each day, the staff began to outline the threats to the species and the things that the Columbus Zoo was doing to combat them, namely supporting the important work of the Turtle Survival Alliance (TSA), an organization with a multi-thronged approach to beating the extinction of dozens of turtle and tortoise species. TSA is one of few organizations working on the ground in Madagascar on radiated tortoise conservation. Specifically they are focused on the rescue and rehabilitation of tortoises as well as numerous educational outreach programs. Speaking to the public on the strong partnership between our organization and TSA had the wonderful effect of increased participation from the guests in our fundraising efforts.

With Dia as the star, and with the help of a bright and well-trained redfronted macaw (*Ara rubrogenys*) named Nico who collects two dollar donations from guests in exchange for tortoise conservation pins, the funds we were able to raise to support TSA grew exponentially. Prior to Dia's participation in our Tortoise Talk and 11:00 adaptations show, we raised on average 2-6 dollars per day in support of tortoise conservation but once he was up and "sliding," we were pulling in at least $30 day, occasionally upward of $70. Most of the donations come in the form of just two dollars, handed over to our bird friend, Nico. In that first summer of 2015, in our area at the Animal Encounters Village alone between the months of May and October, we raised $4,330.00 of which 100% of the proceeds went to support TSA. Last year, in the same amount of time, we raised $5,462.00.

In just two summers Dia helped us to raise nearly $10,000, of which almost every donation was made in the amount of $2. That meant that as many as five thousand zoo guests, in 2 years, made the choice to contribute to tortoise conservation while visiting the Animal Encounters Village. It is my belief, and I know that of many of my peers, that we could not have accomplished those fundraising achievements without the training and demonstration of Dia's quick-learning as an individual and amazing adaptations as a species. The affect that this process had on our ability to raise funds to support tortoise conservation was indisputable but it may also have made an important impact on the way that our staff understood training. Grouchy and Dia were among the first reptiles that we had trained and with such great success (after years of working with dozens of mammals and birds) and will most certainly not be the last.

Afterward and Conclusion

I am sad to have to include in this paper that its incredible subject, Dia, passed away after that first summer of changing hearts and minds. He was an amazing ambassador for his species and taught we villagers a lot about his species and about the true impact of positive reinforcement training in its ability to influence public perception and ultimately to motivate change. In the year and a half since his passing, our staff has begun working with both of his radiated tortoise counterparts, Ted and Ray, on similar behaviors. This process has truly demonstrated to us the truth behind "the study of one": that is to say, no two individuals of the same species are the same and not all of them are the right tool for the same job. Ted, for example, has successfully learned the stage and ramp behavior but is much

larger and incidentally *much* slower. Due to that reality, he is not well suited to the fast pace of our 11:00 show but remains an effective representative of his species for our Tortoise Talk.

This year, we will begin to train Ray to do the stage behavior with a twist at the end. When he reaches the edge of the stay we plan to offer reinforcers, in the form of his favorite food—grapes, to be delivered to him at the end of a long stick by audience participants. This modification of Dia's original behavior came as an idea as a way to overcome the challenge of reinforcing Ray who was inclined to tuck his head swiftly into his shell when the human hand came forward bearing treats, no matter how slowly. Hopefully the antecedent arrangement of the reinforcer at the end of the stick will not only resolve that particular issue but will, more importantly, serve as yet another opportunity to break down barriers between our human guests and the incredible reptiles they meet at the Animal Encounters Village. Capitalizing on the model of Dia, who was able to surprise and astound zoo visitors, we hope to continue to work on training projects with all of our animals but especially those creatures more commonly unappreciated by the public in order to not only excite our zoo guests but ultimately to inspire them as well!

Mariana Fruit Dove: The Journey from Exhibit to Show

Rebecca I. Grimm

Disney's Animal Kingdom

Last year, Disney's Animal Kingdom® introduced many new species into our animal population. One of those species is the beautiful Mariana fruit dove, a native of the Mariana Islands. Disney's Animal Kingdom® is involved with the Marianas Avifauna Conservation (MAC) project that works to conserve this species and many other species on the Mariana Islands. We wanted to share this species' conservation story with our guests. Our Mariana fruit dove, Smithers, came from an institution where he was housed individually due to his incompatibility with other birds and potential mates. We brought Smithers into our collection hoping to make him the first Mariana fruit dove ever to be an animal ambassador. The challenge seemed a little daunting, but positive reinforcement got us there. We started by building a positive relationship with Smithers and creating clear communication through reinforcement. Consistency and patience are key in training any species. Join us on the journey from exhibit to show as we share with you the successes and challenges in training the first Mariana fruit dove to be an animal ambassador.

Cast members from Disney's Animal Kingdom® have been involved with the Marianas Avifauna Conservation (MAC) project for many years. One of the goals of the project is to safeguard the unique avian diversity of Rota, Tinian, Saipan, and the Commonwealth of the Northern Mariana Islands (CNMI) from potential extinction. The Mariana fruit dove (*Ptilinopus roseicapilla)* is one of the five species of birds that the MAC project works to save. Each year, keepers and vet staff go to the Mariana Islands to assist with trapping, evaluating, and the translocation of birds. In addition, the group also participates in education and outreach to teach local people about the plight of the birds. Due to the connection our cast members have with this conservation project, we wanted an effective and engaging way to tell this story. Smithers, our 4 year old Mariana fruit dove, was the perfect candidate to fill this role. To learn more about the project go to www.pacificbirdconservation.org/mariana-conservation-program-mac.html

Building the relationship

Smithers arrived at Disney's Animal Kingdom® in September 2015. Once Smithers had adjusted to his new environment, we began spending more time around and near his enclosure. This was our first step to developing a positive relationship with him. We watched his food consumption to determine favored foods that could be used for training. Some of his favorites are grapes, melon, papaya, blueberries, strawberries and peas. When we noticed he was comfortable flying to perches near our hand while we were placing food in his enclosure, we began offering those favored food items from our hand. We continued hand feeding sessions each day and established a bridge. Establishing a station point on a perch in the enclosure for Smithers to go to each time the enclosure was opened was one of the first behaviors to be brought under stimulus control.

Because we wanted to free fly him in a flight enclosure (199" X 186" X 8') and fly him on an outdoor stage, we outlined the behaviors that would need to be brought under stimulus control. The list of behaviors that we needed to train included: a recall, send, shift, scale and crate. The planned show behavior involved Smithers entering stage left from a crate backstage, flying to the trainer's hand, and exiting stage right to a crate in a window. Training him to stand on the hand was the first step to training other behaviors. This training was accomplished by placing the left hand flat in front of him and reinforcing with the right hand. Once he was reliably stepping onto the hand, the cue was introduced. We selected cues that would be easily transferred to multiple team members. These cues would ensure clear communication for both Smithers and the keepers. After the station, recall and send behaviors were established, Smithers was moved to the flight enclosure. Before we could start free flying him during the day, we needed to train him to shift into his enclosure (5' X 28.5" X 78") that was now inside the flight enclosure. Shifting was essential for his safety overnight. Shifting also allowed us to manage his diet and, in turn, curbed the sparrow population in his enclo-

sure. Utilizing the recall and send behaviors, we were able to transfer shifting to most of the team. He was free flying in the flight enclosure and shifting reliably within the first 3 months of arrival at the area. Shortly following shifting, the scale behavior was brought under stimulus control.

Crate training was the next behavior to be trained. Smithers' initial crate was a Vari Kennel. While he would enter the crate on a regular basis in his flight enclosure, he was not consistently entering the crate in new spaces. We decided to use an open wire crate because it would replicate the enclosure he shifts into overnight. This change proved to be beneficial, and we were able to progress further using the new crate. Early in the crate training, Smithers chose to stay on the trainer's hand and not to enter the crate. In order to solve this problem, we incorporated a perch near the crate entrance. We would send him to the perch and then cue him to enter the crate. This change resulted in success.

Shaping the turn

To prepare Smithers for the stage behavior, we started shaping the behavior in his flight enclosure. Using the station point in his enclosure, small approximations were made to have him fly from the left hand to his station. Initially, the trainer was facing the station, and in 30 degree increments, the body of the trainer was turned in a counter-clockwise direction away from the station. The final behavior had him 180 degrees away from the station, and he would fly from the left hand around the trainer to his station in an arc (Fig. 1-4). This behavior was easily transferred to his crate behavior. The same approximations were made using the crate as the end point of the behavior.

Working in the different environments

Smithers was doing well with all behaviors in his flight enclosure, but we needed to ensure that he was reliable in a variety of environments. We started training him in outdoor enclosures and indoor classrooms. The outdoor enclosures were used first. They provided a safe space to train and added flexibility if he did not crate in the new space. Once his recall and crate behaviors were reliable in the outdoor enclosures, we moved to training in a classroom. Each one of these steps created training opportunities for traveling in the crate. We made small approximations of walking a short distance, stopping, reinforcing, and returning to the enclosure. Once in the classroom, the first few sessions were just reinforcing him in the crate, and returning to the enclosure. Only when he would take reinforcement consistently, did we open the crate. The first few sessions included him flying out of the crate onto the perch, and cueing him to enter the crate. Later sessions added the recall and send behaviors.

Over the past year and a half, we have had a lot of success. Training Smithers to fly to the hand, leave the trainer and fly to station or perch, shift, scale, crate, and shaping a flight behavior for the show. We know that positive reinforcement, consistency, positive relationships, and patience of keepers will take him on the rest of his journey to become an animal ambassador.

Acknowledgements

Thank you to my Zoological Managers: Lori Bruckheim, Jamie Barnard, Missy Lamar, and Mel Solomon for supporting my training endeavors.

Thank you to Michelle Skurski, and the behavioral husbandry team for giving feedback and support through the entire process.

Thank you to Katie Jones, and Megan O'Brien for taking pictures and video for the paper and presentation.

Figure 1: early approximation of shaping the turn

Figure 2: 3rd approximation of shaping the turn

Figure 3: 4th approximation of shaping the turn

Figure 4: final approximation of shaping the turn

Positive Reinforcement Training Increases Positive Behavior in Red-Tailed Hawk

Ellen Dreyer

Brevard Zoo

Brevard Zoo houses 0.1 red-tailed hawk (Buteo jamaicensis), a rehabbed bird with an old fracture to her left wing, preventing her from being released. She was previously tethered to a perch during the day and placed in a small mew overnight. To improve her welfare, she was transferred to the zoo's vulture aviary where she could have the choice to move around and fly. After transferring her, keepers noticed an increase in negative behavior including screaming excessively, footing staff, charging staff, and biting the equipment when she was on the glove during daily walks. Keepers immediately labeled her as unhappy in the new exhibit. But before moving her back to her old perch and reducing her ability to make meaningful choices, an ethogram was created and behavioral observations began in order to collect data to determine exactly when the negative behavior was occurring and what variables could be changed to decrease the behavior. Observations revealed the behavior was exclusively directed at staff or at other birds when staff was present. The largest amount of negative behaviors occurred when keepers were handling the hawk. At these times, keepers were using a very low rate of reinforcement for behaviors including flying to the glove and staying still while equipment was put on. Increasing opportunities for positive reinforcement during handling resulted in a decrease of negative behavior and an increase in positive behavior. Her demeanor changed as staff increased their trust accounts with her and she is now called a happy bird.

Introduction

Birds of prey have been kept in human care since 2,000 B.C. Traditional techniques used to train birds of prey for falconry include using hoods to restrict vision, tethering birds using anklets and jesses, and food restriction. However, many zoos have been moving away from traditional techniques when handling birds of prey and instead using the least restrictive and most positive techniques to improve animal welfare which is a hot topic in the zoological community. Individual animal welfare is something animal care facilities must continually evaluate. Brevard Zoo is home to many rehabbed birds of prey that are deemed non-releasable. Gezabelle or Gez, a female red-tailed hawk, came to the zoo in 2002. Since then, she was displayed to the public tethered to a hawk ring during the day and transferred by glove to a small mew at night. She had a reputation among her keepers as being feisty because she often charged them after being placed on the ring and footed them while on the glove. In March 2016, the decision was made to find a more suitable exhibit for her where she could make meaningful choices including moving and flying without the restriction of being tethered (Fig. 1). She was transferred to the zoo's vulture aviary which houses 1.0 black vulture, 0.2 king vultures, and 0.3 juvenile king vultures. Initially, she was placed in the exhibit during the day and returned to her mew at night while she and the other vultures acclimated to her presence. After about a week, she began staying in the aviary overnight.

Figure 1. Gezabelle flying in the vulture aviary.

During the spring and summer of 2016, the amount of aggression Gez showed toward staff and the vultures began to grow. Keepers became concerned she was not happy in the exhibit and requested she be moved back to her old perch where she would be tethered again or placed in an open exhibit with her wings clipped. Before restricting her ability to move and fly and possibly impacting her welfare negatively, the Director of Animal Programs requested a study to determine if the exhibit was the cause of the aggressive behavior. Observations began immediately to help us determine why the behavior was occurring rather than assuming the behavior was related to her new home in the vulture aviary.

Method

An ethogram focusing on agonistic behavior was created (Table 1). Aggressive behaviors were defined then categorized as either directed at the vultures or directed at keepers (Dawson & Mannan, 1991). Focal sampling occurred at 2 minute intervals for a total of 20 minutes. All-occurrences of aggressive behavior was recorded. Observations were conducted both when staff was not present and during staff interactions.

Behavior	Description of action	Classification
Supplanting	Hawk flies toward a vulture and the vulture leaves its perch as the hawk approaches. The hawk then perches there.	Agonistic
Direct Attacking	Hawk flies directly toward and strikes vulture.	Agonistic
Direct Attacking, keeper-directed	Hawk flies directly toward and strikes keeper.	Agonistic
Chasing	Hawk closely pursues a vulture.	Agonistic
Chasing, keeper-directed	Hawk closely pursues keeper.	Agonistic
Foot Grabbing or Stomping	Hawk stands next to or on top of vulture and makes contact with feet.	Agonistic
Foot Grabbing or Stomping, keeper-directed	Using feet to squeeze talons into keeper including gloved arm, un-gloved arm, or any other part of keeper's body. Also, includes stomping feet up and down while on glove.	Agonistic
Threat Posturing	Hawk holds body in a near-horizontal position with neck arched, head facing down, wings drooping, and feathers raised on neck and back.	Agonistic
Charging	While on ground, runs rapidly toward vulture.	Agonistic
Charging, keeper-directed	While on ground, hawk runs rapidly toward keeper.	Agonistic
Mantling	Hawk wraps wings slightly out from body with puffed up feathers.	Agonistic
Puffed	Hawk spreads feathers to appear larger.	Agonistic
Bating	Attempts to leave glove resulting in hanging from the jesses.	Agonistic
Biting, keeper-directed	Use beak to cut or attempt to cut something.	Agonistic
Chirping	Short, sharp, high-pitched sound.	Vocalization
Screaming	Long, loud, piercing cry.	Vocalization
Preening	Straighten and clean feathers with beak.	Self-care
Rousing	Lifting all feathers then shaking them, usually done with the bird is comfortable.	Self-care
Walking	Use feet to locomote on ground.	Movement
Flying	Moving through air with wings.	Movement
Perching	Bird is motionless on branch, rock, or platform.	Movement
Ground	Bird is motionless on ground.	Movement

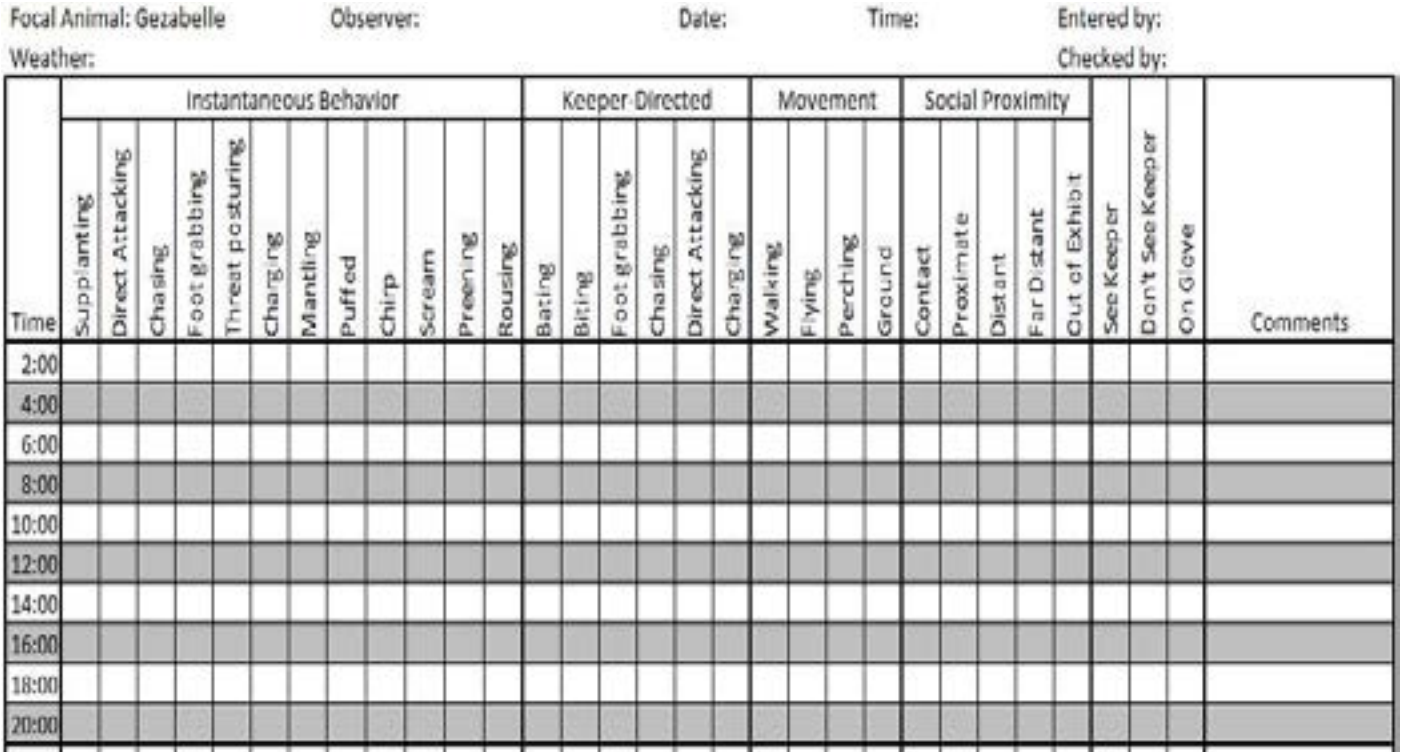
Table 1. Ethogram of behaviors recorded during observations.

Social proximity was also recorded during scans to determine how close Gez was to the vultures during behavior events (Table 2).

Behavior	Description of social proximity measures	Classification
Contact	Hawk is touching another individual.	Social Proximity
Proximate	Hawk is within a wingspan of another individual.	Social Proximity
Distant	Hawk is between 1 and 5 wingspans away from another individual.	Social Proximity
Far Distant	Hawk is farther than 5 wingspans away from another individual.	Social Proximity
Out of Exhibit	Hawk is not inside exhibit.	Social Proximity

Table 2. Social proximity measures recorded during behavioral observations.

Other details recorded on the scan sampling data sheet included weather, if she could see a keeper, if she could not see any keepers, and if she was on the glove (Fig. 2).


Focal Animal: Gezabelle Observer: Date: Time: Entered by:
Weather: Checked by:

	Instantaneous Behavior												Keeper-Directed						Movement				Social Proximity								
Time	Supplanting	Direct Attacking	Chasing	Foot grabbing	Threat posturing	Charging	Mantling	Puffed	Chirp	Scream	Preening	Roosing	Baiting	Biting	Foot grabbing	Chasing	Direct Attacking	Charging	Walking	Flying	Perching	Ground	Contact	Proximate	Distant	Far Distant	Out of Exhibit	See Keeper	Don't See Keeper	On Glove	Comments
2:00																															
4:00																															
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10:00																															
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Figure 2. Scan sampling data sheet used to record Gezabelle's behavior.

Results and Discussion

Gez's negative behaviors clearly showed she was not comfortable with something. Her typical behavior pattern including lots of screaming as soon as she heard the lock on the gate move indicating that keepers were approaching, puffing up her feathers, flying at the fencing when keepers were standing on the other side, mantling, threat posturing, and jumping on the vultures in the exhibit to foot them. She was also not always participating in training sessions. Keepers sometimes resorted to grabbing her jesses to get her to step up on the glove where she bit at the swivel, footed the glove, bated, and screamed when returning to the aviary. Her aggression escalated to the point that she would chase keepers as they left the enclosure and try to foot them with her talons, drawing blood on at least one occasion. Unhappy certainly seemed like a fair label to sum up her actions.

Observations were conducted from September 2016 through January 2017. A total of 81 full observations totaling 27 hours were recorded with partial observations being excluded from the results. Data gathered during observations showed that the negative behaviors occurred only during staff interactions or when staff was present. Zero agonistic behavior was observed when keepers were not visible. Additionally, only 4% of the aggressive behaviors were directed at the vultures. The rest occurred during training sessions while keepers were either taking Gez out on the glove or when they returned her to the exhibit.

The first observed training session provided many important insights. Rather than giving Gez lots of opportu-

nities to earn reinforcement during the session, the keeper often did not reward her for completing behaviors. For example, the keeper cued Gez to fly to the glove and then put the jesses and leash on which required her to remain still. After this, the keeper walked out of the exhibit, shut and latched the door, and took a few more steps before pausing to give her a reinforcer. Next, the keeper walked through the zoo with Gez on the glove. She was alert but relaxed on the walk and occasionally given pieces of mouse. But as soon as they approached her enclosure at the end of the walk, she began screaming and puffed up her feathers. Once inside the aviary the keeper removed the equipment and cued her to the fly to a perch then left, without reinforcing these final behaviors of the training session. After watching and discussing how they handled her with the team, we identified the variables we thought might be causing the unwanted behavior including a lack of reinforcement, a low rate of reinforcement while on the glove, a need for more relationship building, and a lack of choice and control on whether she could choose not to participate.

The keepers were eager to improve the way they trained and handled Gez in hopes of reducing the problematic behaviors. The first step was simple; they needed to reinforce the behaviors we did want. So, every time Gez did a behavior the keepers gave her a piece of meat immediately. Initially, she was rewarded for every single step in the process of putting equipment on including between each jess, after attaching the swivel, and after positioning the leash. Even if she footed the glove when she flew to it or stomped her feet up and down while the jesses were attached, she was still reinforced for the behavior and for choosing to participate in the training session. The keepers had to first build up their bankrupt trust accounts by giving consistent and immediate reinforcers so that Gez would learn that she would be reliably rewarded if she did what was asked (Martin & Friedman, 2013). Later, the behaviors were cleaned up and the criteria raised to remove the footing behaviors entirely.

To increase the rate of reinforcement, keepers realized they had to start cutting her mice and rats into much smaller pieces so they would have more reinforcers available to give her. Three or four bites of mouse did not last long in a 15 minute training session packed with opportunities to earn rewards. Smaller pieces also allowed them to ask for more behaviors because she didn't take as long to eat them and she didn't get full as fast. Another important change was allowing Gez to say no. Previously, if she didn't want to get on the glove keepers would put the jesses through her anklets and hold them so that she had no choice but to step up. Part of this was because the keepers that took care of the vultures needed Gez out of the exhibit while they worked because of her unpredictable nature and increasing aggression. She was also used for weekly meet a bird of prey talks with the public and keepers felt pressured to make sure she was there. But, we decided we had to eliminate forcing her to comply entirely and give Gez back the control. Now, if she chooses not to get on the glove, she does not have to. Instead, keepers work on new things in the aviary like having her fly to different perches when cued which keeps her focused on them and ensures everyone's safety.

Gradually, the keepers built up their relationships with Gez, increasing their trust accounts through repetition and consistency (Martin, 2007). Over the first 3 months of the study, agonistic behaviors decreased following the changes in training and handling practices (Fig. 3). Nine days after the changes were implemented, she chirped while on the glove. Chirping is an affiliative behavior in wild red-tailed hawks often done between partners in close proximity (Fitch et al., 1946). It is a positive behavior and one of the best indicators of contentment we could measure. Her keepers, who had not heard her chirp since moving to the new exhibit, were ecstatic to see that the changes they were making in their training and handling was having a positive impact. This also demonstrated a correlation between negative behavior decreasing and positive behavior increasing (Fig. 4).

Figure 3. There is a correlation between negative behaviors decreasing and positive behavior increasing and vice versa.

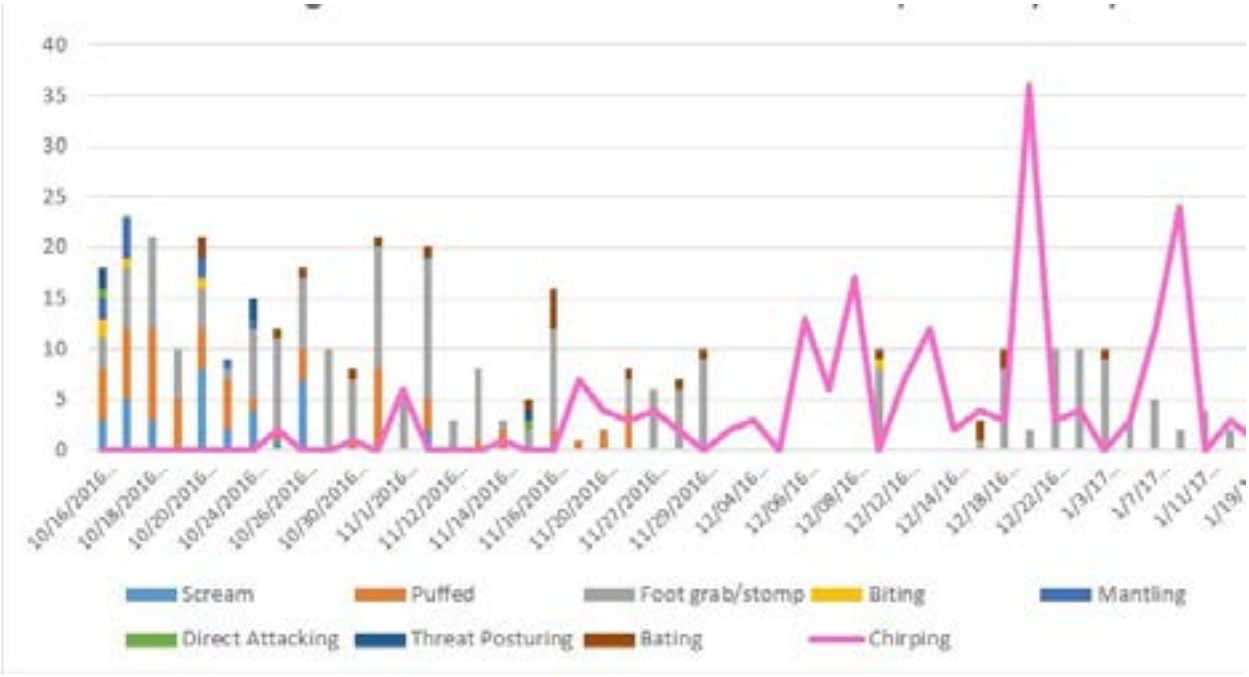

Figure 4. Breakdown of negative and positive behaviors by day showing the correlation between decreasing negative behaviors and increasing positive behavior.

In December, keepers had 6 days in a row of training sessions with no aggressive behaviors and lots of chirping! She was immediately flying to the glove when cued and being used in the weekly public presentations (Fig. 5). She no longer chased keepers out of the exhibit or screamed when returning to it. In January, two new people joined the team and began working with her. During this time, a few unwanted behaviors increased such as foot stomping and bating while being handled by them which showed she was less comfortable with the new staff. The amount of chirping also decreased slightly, depending on who was working with her. This further illustrates how important relationship building is. Both new keepers spent most of the month working on increasing their trust accounts with her by giving her lots of opportunities to earn reinforcers.

Figure 5. Gezabelle chooses to participate in a training session.

Gezabelle's case is a great example of how gathering observable data can guide management decisions for the best welfare of the animal. It also shows how easy it can sometimes be to change problem and even aggressive behaviors simply by reinforcing desired behavior. In addition, the keepers involved were given the opportunity to learn and improve their skills as trainers which strengthened the entire team and benefited the other birds of prey in

their care.

Acknowledgements

A huge thanks first and foremost to Michelle Smurl, Director of Animal Programs, for her constant guidance and support. I'd also like to thank Kerry Sweeney, Curator of Animals, and Lauren Hinson, Collection Manager, all the Wild Florida area keepers, and Gezabelle, a wonderful ambassador for her species.

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Use of Fission-Fusion to Decrease Aggression in a Family Group of Western Lowland Gorillas

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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 by 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 two-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 2017) 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

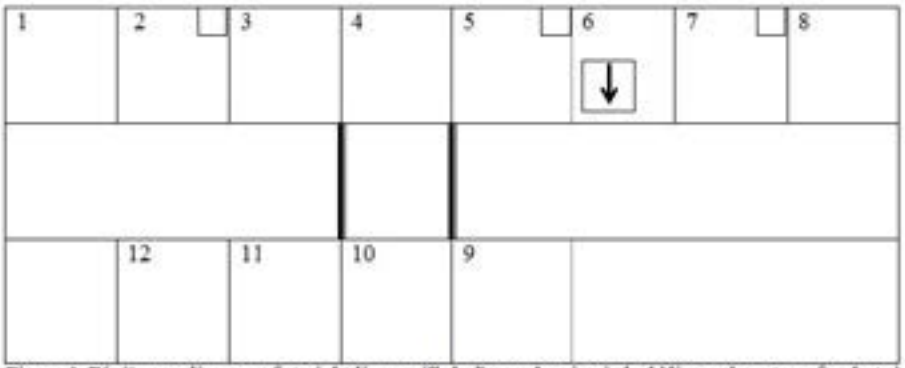

Figure 1. Bird's eye diagram of straight-line gorilla hallway showing in bold lines where transfer chute is located and the small box in "holding 6" leading down to the day room. The small boxes in holding 2, 5, and 7 are access points to the outdoor exhibit.

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.

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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The Watering W"Hole" Experience: Training Multiple Species to Tell a Conservation Story

Stephanie Shop

Columbus Zoo & Aquarium

The Watering Hole in the Heart of Africa at the Columbus Zoo and Aquarium is a unique exhibit where guests can stop throughout the day and watch multiple African species actively using the space around them. While this alone draws in a lot of visitors, there is no denying that the most popular moments at the Watering Hole are the cheetah runs. Though guests come for the "cheetah run," what they see is a cohesive story showing multiple levels of the African ecosystem through the use of additional species. In an effort to take our guests on an African safari, we begin with a prey species (warthogs) grazing and conclude with scavengers (black-backed jackals) cleaning up anything that might have been left behind. Our interspecies cheetah runs demonstrates that the African savanna is not only about apex predators like the cheetah, but instead about the many species that exist and function cohesively to make a complex ecosystem. As the guests are watching this story unfold, we interject with our conservation message and educate guests about how they can help both now and in the future. This paper will focus on what goes on behind- the-scenes and underneath our guests' feet to make the experience come together; the methods involved in shifting and training behaviors that help us engage guests and help spread our conservation story.

Telling the Story

In 2014, the Columbus Zoo and Aquarium opened its newest region—Heart of Africa, an exhibit designed to make guests feel as though they had stepped off a bush plane and were going on safari in Africa. Equipped with lions hopping onto a plane wing, an expansive and uninterrupted view of the African savanna, and opportunities to feed and interact with giraffe, the area could only be complete with a place for animals to gather and get a drink of water, a watering hole. At the watering hole, guests have the opportunity throughout the day and see the many members of the savanna that are stopping by to take a drink, scavenge for scraps of food left behind by others and if they're lucky, might have the chance to spot the fastest land mammal in the world. Three times a day, every day, guests watch the fastest land mammal show off their incredible power and speed. On a busy summer day, the boardwalk area above the watering hole is packed with guests, making it the perfect opportunity to educate many about the problems the African cheetah is facing out in the wild and, perhaps most importantly, what they can do to help. This includes accepting donations for cheetah pins and bracelets and opportunities to talk to our docents and employees about what they can do at home to help. However, to take full advantage of this educational opportunity and give guests an accurate depiction of the complexity of the African savanna, other watering hole species should be incorporated into the cheetah runs.

There was a need to revamp the traditional keeper talk to immerse our guests in this experience, by telling the story a tourist would see if they were on safari and watching a watering hole from their vehicle. The warthogs start the show by running to the trainers, showing off natural behaviors while the trainer talks about the adaptations of this species. The discussion focuses on the fact that a watering hole is often a valuable resource, a refuge, and a place of gathering for many species. The conversation then iterates that, though often peaceful, a watering hole is not a place to relax, but instead a place that animals must be on high alert. Then, the warthogs run away from the trainers, tails up, and disappear into a shift-way directly underneath the guests' feet. In the next moment, a cheetah comes bolting out of a small door, tearing around the watering hole and chasing a fluffy dog toy at top speed. The run culminates in the final stretch and ends in a cloud of dust. As the cheetah exchanges the lure ball with the trainer, the discussion shifts to the perils that the cheetahs are facing in the wild and conservation efforts that are currently underway in Africa to help. Once the cheetah has gone, again disappearing under the feet of the guests, another species makes their appearance. Emerging from the same door as the cheetah, the black-backed jackals appear with

the same intensity as a cheetah on the chase. The entrance of the jackals is the finale of the cheetah run experience, though guests can stay to observe as they scavenge around looking for any snacks the cheetah might have left. With the interspecies cheetah runs, the African savanna is not only about top predators, such as the cheetah, but about how all of these species exist and function together to make an amazing, cohesive, and wild ecosystem. Though the guests get to see this story unfold right in front of their eyes, what they don't know is the complexity of what happens under their feet and what has gone on behind-the-scenes. While the story is a natural one, much training and planning has gone into training the different species how to shift to and from the exhibit area.

The Setup

In 2017, Heart of Africa will open for its fourth season. With three years of experience under their belts, many of the animals have been shifting to and from the watering hole for several years. However, once it was decided to tell a more complete story of a watering hole, new shifting behaviors needed trained and in the case of the jackals, begin their shift training. Not only did the animals learn new ways of shifting but also had to think through the logistics of the back holdings and shift-ways.

Since there are five different species using the same shift-ways to access the watering hole, a few options are needed to best accommodate our animals. Warthogs, aardvarks, jackals and hyenas all use the same shift-way when they are released from their indoor holding. This takes them to a 90-foot long section of shift-way that leads them towards the watering hole and ends with an option to go straight or left. Both options have gates which can be used to give or restrict access. The straight option, which is 21 feet long, is the "under the boardwalk" area and is where our female warthogs shift to and from the watering hole. This option is used when shifting our cheetahs home after the cheetah runs as it is where our cheetah catch areas are located. The left option (the "long way") in the shift-way takes our animals through a 125 foot long section which brings the animals to the "tower". The tower area stores tools and cleaning supplies. It houses a guillotine that opens into the watering hole. The "long way" is used for our protected contact animals. It is also used for the cheetah runs because of the run path setup in the watering hole; when the cheetah emerges from the "tower" area they can immediately begin the chase. The cheetahs do not enter the shift-way at the same point as the mixed-species animals. A separate guillotine at the end of an indoor hallways opens to the first section further along than where the warthogs, jackals, aardvarks, and hyenas start their journey. In total, cheetahs shifting into the watering hole independently travel through 255 feet of shift-way.

Once planning for the watering hole cheetah run had begun, behind-the-scenes logistics needed to be thought through; with different parts to the shift-ways gates needed to be switched around to accommodate the different animals that would be participating in the run. For the cheetah runs, different positions are assigned for the trainers. In the case of the cheetah run described, an extra person is added who switches the gates around for the appropriate animals, along with catching and releasing animals. The watering hole pre-run, run, and post-run setup requires gate setting switch six times and involves opening and closing several back-holding gates as well. While this sounds like a daunting task, the guests are unaware of what is happening behind-the-scenes and right underneath their feet. All they are left with is a smooth production showing off the natural behaviors of the animals.

Training the Warthogs

The story begins with the warthogs. In most cases, they have been grazing in the watering hole for several hours. In past years, with the opening of a gate, the warthogs would run into the shift-way and return to their indoor enclosures. For the watering hole story to work, the warthogs needed to stay with the speaker/trainer in the watering hole until specific dialogue was spoken, after which the warthogs would run under the boardwalk where the shift-way starts.

This process begins by first shifting in our male warthog, Randall, who is worked protected-contact. He shifts through "the tower" and runs through the shift-way to find a reinforcer waiting for him in his house. Once Randall has left the watering hole and been secured off-exhibit, the trainers enter the watering hole and are typically greeted with warthog kisses from the two female warthogs, Binti and Zuri, who were hand-raised by the staff. Their training started at a young age; until they were about 2 years old, they could be found walking on harnesses throughout zoo grounds. When they were trained this behavior, the criteria was that the warthogs walked alongside staff and stopped when staff would stop. The harness and leash was utilized only as a safety precaution and was not used to pull or restrain. On these walks, there would often be pauses for guest interactions, allowing people to take photos of the girls and learn a little more about one of Africa's fiercest grazers. While stopped and interacting with guests, it was helpful for the warthogs to continue having a job; they were taught to sit and remain seated until the walk continued. Utilizing this heeling behavior, staff walk around the front of the watering hole with the two warthogs and periodically reinforce

them with apples and grapes when they stop at different locations. While walking them around, guests get a close-up look at some of their adaptations and the opportunity to learn a little more about what makes the warthog such an amazing species. Not only do staff talk about what warthogs would be doing naturally in the wild, but also about how smart they are, and the different things they are trained to do.

The next step in the process was to teach the female warthogs a new cue for leaving the watering hole. As mentioned earlier, they would normally run home once a gate was opened and they would often be found waiting at the gate as soon as Randall was shifted in. The gate opening was still to be the cue for the warthogs to leave, hoping that they would leave the speaker once the gate was opened, preferably with their tails in the air. They would receive part of their diet once they made it all the way back to their indoor home. However, what was quickly realized was that the watering hole, the treats, and perhaps interacting with the speaker were all more reinforcing than the reinforcer originally set in place. Due to this, a prompt was added that was faded out later. In order to get the warthogs attention while they were walking with the speaker, another trainer used a container of treats and shook it loudly as the gate opened underneath the boardwalk. The speaker/trainer would also prompt the warthogs by walking with them towards the exit until they would run-off on their own towards the gate. Once the warthogs ran into the shift-way but were still underneath the boardwalk, they were immediately given watermelon, a high-value reinforcer not found in their everyday diet. From this point, they would then shift the rest of the way home for the remainder of their regular diet. Once the warthogs started to associate the gate opening with the high-value reinforcer, the sound prompt was faded and the warthog girls now keep one eye on the gate and one on the trainer. With two warthogs, one will occasionally leave early in hopes the gate opens on her way; if this happens, the person under the boardwalk continues to do what they were doing (i.e. prepping gates and setting out reinforcers) and the trainer waits until that warthog comes back and increases the rate of reinforcement until the gate opens.

Just as leaving the trainer too early can be a problem, not leaving can also be an issue. To help, a small prompt is given by taking a step toward the gate area. Once the behavior of staying and leaving at appropriate times was under stimulus control, the last piece of the puzzle was adding in a second person to the watering hole to string our cheetah lure. To keep the time between animals short and maintain the fluidity of the story, this person would come into the watering hole and begin the process of prepping the lure machine as the warthogs were walking around with the speaker. This was a fairly easy addition because the warthogs quickly learned that if they strayed away to the "lure person" they would receive no treats and would make their way back to the trainer. Once this happened, the trainer would relax their criteria and increase the rate of reinforcement until the warthogs consistently stayed with them once again. The end goal of this training project was to have the warthogs interact with the speaker until predators were mentioned, at which point they would run away with their tails in the air, signaling the main attraction, the cheetah run.

Teaching Old Cats New Behaviors

As mentioned previously, parts of the training were already in place since cheetah runs had been occurring for three years. However, this past summer a new addition to the shift-ways for our cheetahs included loading and catch areas. These were sections of the shift-way where cheetahs could be pre-loaded and caught for up to two cheetahs prior to and after the run, respectively. This allowed for a smoother and more fluid viewing experience for the guests and allowed the use of the warthogs and jackals in the cheetah run experience. While the cheetahs were already trained to shift though the shift-way, the new training experience for them was loading them into these areas and waiting until prepared for the run itself. This process began by shifting the cheetahs through the shift-way with the doors halfway open. This was necessary because several of the cheetahs ran through the shift-way like it was part of the chase itself. Staff wanted to make sure they were aware the new addition was present. Once the cheetahs were slowing down in order to navigate the barriers, the first door was closed completely and used a bowl with meat to catch the cheetah's attention and to reinforce them for coming into the loading area. When the cheetahs appeared comfortable in the loading area, staff began closing the second door behind them and giving them a second reinforcer for remaining in the area while the door closed. As soon as the second door was closed, staff would immediately open the first door and reinforce the cheetahs by letting them out to run.

After the cats were comfortable with the door closing behind them, staff began the process of getting them accustomed to spending more time in the loading area while hearing the sounds of guests' feet directly above their heads. It was important for them to be comfortable because the show would start with the cheetahs already loaded. It was important that they were going to feel safe being in the loading cages for as long as the warthog introduction would take. For most of the cats this didn't pose much of a problem and often they were found laying down while waiting in the load cages. Once the speaker announces the entrance of the cheetah, a staff member opens the loading

door releasing the cheetah into the watering hole. Directly inside the watering hole is a dog toy on a string that is connected to a lure machine. Upon the cheetah's arrival, the lure (and therefore the cheetah) begins to race around the perimeter of the watering hole. After running, the cheetah exchanges the toy for a food reinforcer from a team of two trainers who then walk with the cheetah to the gate through which the warthogs had previously disappeared. With the warthogs safely inside their houses, the cheetah gets another bite to eat under the boardwalk. This area is connected with the catch areas. A similar process was used to introduce the cats to them. The first approximation was leaving the door open, a bowl inside with a trainer standing with the bowl; if the cheetah chose to go in we would give them another reinforcer and then, if they chose, they could walk back out of the catch area and shift to their houses inside the building. Once they were going into and staying in the catch area on their own, staff began closing the door behind them and slowly increased the time they spent in the area. The reason staff needed the catch cages was to hold the cheetahs and shift them all the way home once the run was complete instead of shifting them home immediately, which would mean a larger period of time in which no animals were in the watering hole area. In the case of the cohesive watering hole experience, the jackals needed to be able to come out into the watering hole as quickly as possible as the finale of the run.

New Kids in Town – Our Jackals

The newest addition to our watering hole, the jackals, joined in the spring of 2015 and had the most training to go through. When they arrived, they were two weeks old and too small to go out into the large watering hole area. Their first experience with the watering hole and the shift-ways came once their formal training started almost a year after they had arrived. With three jackals (Padfoot, Sirius, Lupin) it was decided that the easiest method would be to teach them to individually shift from their indoor enclosure to the watering hole, then teach each of them a specific area in the watering hole for reinforcement so that they were all able to be reinforced for shifting simultaneously. For the jackals, staff utilized the protected-contact shifting route to avoid proximity with the cheetah holding area. Prior to their first season, the jackals were left to "play" in the shift-way to get them used to the area. Once their formal training started, staff worked on moving to a certain point in the shift-way and immediately returning to their indoor enclosure. A prompt (metal bowl) was used to indicate the desired distance and once they made it to the bowl area food would be dropped in. To help them shift home, a trainer would walk with the jackal, as a prompt, until they started running home where they received another reinforcer. The prompt was quickly faded out and once the jackals finished eating they would turn around and run home. Once the jackals showed no hesitation, the bowl was moved farther through the shift-way eventually making it the distance to the watering hole. As the jackals went farther into the watering hole, staff chose different areas for each, where they would be able to eat their treats without other jackals stealing reinforcers from each other. To teach the jackals where their spots were, a trainer stood near the specific area. When the jackals started running straight to their area, the trainer started moving away from the spot and eventually removed themselves from the watering hole completely. Even though there would be a speaker in the watering hole with the jackals, they needed to always always go to their spots when people weren't in the watering hole.

The cheetah run structure can vary day-to-day and the jackals are not always part of the cohesive production. The jackals moved at different paces through the training process, but once there were two that were solidly going to the watering hole on their own and visiting their individual spots, the process started of having the two go out together. Once this process started, adjustments needed to be made; the jackals would eat at varying speeds and leave their spots to go try and eat their sibling's food. This meant that one of the jackals wasn't getting a high enough reinforcer and his behavior of shifting to the watering hole decreased. Two of the jackals' spots were put close together and their treats spread (exotic canine kibble) around a large area so they would have to "scavenge" around for all the treats. This change worked best once utilized for the cheetah run because it meant that two jackals would conveniently be standing by the speaker as they finished talking about the watering hole experience. Adding in the third jackal to the mix was relatively easy as the other two jackals were consistently going to their spots. The third jackal's spot was farther away from the others to minimize crossover.

The finished product of jackal training was having three jackals shift together into the watering hole and go to individual reinforcement locations. When they are involved in the cheetah run they allow discussion about scavenger animals and what they would be coming to a watering hole to do, look for leftover food. Usually while the speaker talks about scavenging, the jackals have already eaten their treats at their spots and have started to wander around the watering hole truly scavenging and sniffing around for anything that might have been left behind by the species who came before them.

Tying Together with Conservation

Once the training was completed, it was time to piece together a complete story of a watering hole. Using the cheetah run as the focal moment a more complete and cohesive picture of the African Savanna has been created in our guests' minds, of what a watering hole looks like and how they are important to most species on the savanna. While the cheetah is important to protect, as it is the most endangered large cat in Africa, it is important to protect all parts of the African ecosystem because the different predators, prey and scavengers all rely on each other to survive. The first two years the Heart of Africa was open, staff talked about species' dependence on one another. If staff had the resources to show this relationship instead of just talk about it, our guests would better understand the complexity of the ecosystem and the importance of each individual piece. The hope is that as a result of showing these interactions, staff inspire our guests to increase their conservation effort: by visiting zoos, purchasing cheetah pins and bracelets, and maybe even continuing their conservation efforts at home. Though guests come to see the "cheetah run", staff utilize the opportunity to connect them with wildlife and inspire them to care about all the different species that frequent a watering hole, immersing them in the wHole experience.

Senior Living: The Challenges of Working with Geriatric, Blind, Critically Endangered Pinnipeds

Noel Buurman

Minnesota Zoo

Five visually impaired or otherwise compromised, twenty-year old, female, Hawaiian monk seals (Neomonachus schauinslandi) arrived at the Minnesota Zoo in May 2015. With them came a unique set of challenges created from their age, visual impairments, medical concerns, and natural history of the animal. The Minnesota Zoo's marine mammal staff was further challenged by a newly modified habitat space and with how to create educational opportunities as designated by their permitting.Over the last 2 years, the Minnesota Zoo's marine mammals training team have worked closely with each other and experts in the field to better understand the seals and support their care. Staff have worked to accommodate each animal's individual behavioral needs which have included start of session locations, medical behaviors, and end of session signals while being mindful of each seals' behavioral history. These training initiatives and experiences have been applied in the seals' daily care, to establish training goals and during daily public demonstrations. Through these public training demonstrations staff have successfully bridged a 1,800 mile gap between Hawaii and Minnesota to bring the message of Hawaiian monk seal conservation to the forefront of the Minnesota Zoo's mission.

Materials

The Hawaiian monk seal (*Neomonachus schauinslandi*) is a rare marine mammal found along the coasts of Hawaii and is currently listed as a critically endangered species. Hawaiian monk seals were hunted during the fur trade which lasted until the early 1900's. As with many animals, the trade decimated the monk seal population in Hawaii. This, in combination with distribution of remaining individuals, overfishing, and pollution have created a less than ideal environment for their recovery and survival. (NOAA Fisheries, 2016) Recent data indicates that fourteen hundred Hawaiian monk seals remain along the coasts of Hawaii. The recent numbers indicate a slight increase in populations but scientists agree that they are still well below a threshold that would allow the seals to be removed from the endangered species list. (NOAA Fisheries, 2017)

While Hawaiian monk seals have been in the spotlight for conservationists for nearly thirty years, their time under human care has not been as well highlighted, due in large part to the small number of Hawaiian monk seals at zoos and aquariums. Currently, there are 3.6 Hawaiian monk seals being housed at animal care facilities around the world. Five of those females were originally part of a larger group of 12 that were rescued in 1995 with the hope of rehabilitation. After their rescue, the majority of the seals exhibited different eye conditions causing the whole group to be deemed non-releasable. (Hanson, 2009) For most of their lives, this group of females was housed at SeaWorld: San Antonio. In 2015, the remaining five females from this group found their new home at the Minnesota Zoo.

Created by the state of Minnesota, the Minnesota Zoo opened in 1978 with the mission of connecting people, animals, and the natural world to save wildlife and provide world class habitats and animal care for the wildlife that calls the Minnesota Zoo home. Today, the zoo is home to sixty four endangered and threatened species. Over the years, the zoo has worked closely with researchers in the field creating a substantial impact for critical species and habitats in Minnesota and around the world.

In 2012, the zoo's bottlenose dolphins were permanently relocated to begin refurbishment of a twenty year old habitat. During this time a partnership was formed between the Minnesota Zoo and SeaWorld San Antonio. The conservation story of the Hawaiian monk seals was a natural fit for the Minnesota Zoo and in May 2015 the five seals arrived at the zoo. With them came a unique set of challenges created from their age, visual impairments, medical concerns, and natural history of the animal. The Minnesota Zoo's marine mammals staff was also challenged by a newly modified habitat space that was substantially different from the seals previous animal areas. The zoos stadium was a space originally designed for dolphins and it includes deep pools with limited deck space as well as the ability

to shift animals via land gates or water channels. Further, staff needed to create educational opportunities as designated by the monk seal permitting.

Pinnipeds have been housed under human care for many years and offered a general knowledge base for the Minnesota Zoo staff. However, the knowledge specific to Hawaiian monk seal husbandry was and continues to be small. For this reason, marine mammal staff consult with trainers from SeaWorld for their experiences with the seals. For instance, because of their different medical conditions certain animals had always been housed together or separate in San Antonio. SeaWorld staff suggested social situations that may be most optimal and the Minnesota Zoo staff adopted these suggestions as their protocol with little modification.

Each seal was estimated to be twenty years old upon arrival at the Minnesota Zoo. NOAA scientists estimate that Hawaiian monk seals life expectancy in the wild is twenty-five to thirty years old. (NOAA Fisheries, 2016) While scientists anticipate a longer life expectancy under human care there is uncertainty as to how long that might be. Although considered to be geriatric, the five monk seals housed at the Minnesota Zoo are in good health despite some special needs. To summarize: Paki and Opua are completely blind, Koas vision has been described as partial blindness- able to see some shapes and shadows, Ola is fully sighted, and Nani has limited vision in her right eye and is blind in her left. Nani also exhibits paralysis in the last third of her body, from mid-back to her flippers. It is most evident when Nani attempts to haul out of the water where she struggles and her back end appears to be limp. Despite x-rays and other diagnostic testing a reason for this paralysis has never been determined.

The modified space, the natural history of the animal to spend time alone, and the visual impairments of the four females have played a significant role in developing a husbandry program. Paki and Opua were two seals that were housed together at SeaWorld. At SeaWorld's suggestion this pairing was continued upon their arrival at Minnesota. The two seals appear to cohabitate well together but early on trainers noticed the seals tendency to anticipate the start of session. As a result, aggressive altercations before the start of session were not uncommon.

Methods

Trainers devised a plan to alleviate gate rushing at the start of session. Set stations in the two larger back pools (East and West holding) were established. These pools were chosen because gate rushing appeared to be the most prevalent in these pools and at the time were the two areas Paki and Opua were introduced to. Trainers used two separate walls to distinguish a start of session location for each seal. It was noted that Opua tended to remain stationary until called while Paki reacted to noises such as trainers walking or opening a gate. Once a start of session location was created, Paki began anticipating her station. Once the behavior was established, a verbal cue was introduced ("Paki, station") to clearly communicate the session was starting and that trainers would be meeting her at her pickup station. Trainers felt this step was pertinent to eliminate confusion and any frustration should staff simply be walking by or opening a different gate. As a result of this training, aggression prior to the start of session has been greatly reduced between the two seals.

The other paired seals, Koa and Ola, had their own training challenges. They spent the majority of their first six months together in the front presentation pool, only being shifted when necessary for diving. On one occasion, after being shifted Koa refused to shift back to the presentation pool with Ola. As a result, Koa was left in the East holding pool alone. Koa has a history of being nervous is tight spaces and past trainers have speculated her "partial vision" may play a large factor. It is unclear if natural history of the monk seal being solitary and/or Koa's training history were also factors in her refusal to shift but trainers became unable to shift Koa for several weeks. Short approximations in the shifting process seemed to trigger higher anxiety and created less productive training sessions. It was only during a brainstorming session that trainers began to put the pieces together. Hawaiian monk seals are described as solitary and the result of Koa choosing not to gate was that she got to be alone. Trainers realized they had inadvertently negatively reinforced Koas' refusal to shift.

To re-establish Koa's shifting a plan was created. In addition to the small approximations being taken to re-establish shifting, Ola was brought back into the pool with Koa and left for several days while the approximation training took place. When trainers felt ready, Koa was asked to shift first into an empty pool. If she committed, Koa would be shifted into a new pool by herself. If she refused, Ola would remain in the pool with her. By using small approximations and the social factor of having Ola in the same pool, it took Koa only two sessions to complete a successful shift. It became clear that being alone in a pool was a strong reinforcer for Koa.

This experience caused trainers to reassess shifting protocols and social situations for each animal. Each paired group (Opua/Paki and Ola/Koa) are given adequate time apart and trainers make an effort to vary pool locations for each animal. These social observations also led to a discussion about social groups and the need to establish different options depending on medical and social needs.

Nani's limited mobility also created new challenges in management and training. While she can move on land and often chooses to do so outside of training sessions, hauling out and moving around on land does seem to be a challenge. Her deck behavior was limited to once a day which meant that trainers needed to focus on ways to examine Nani in the water.

Nani had an established "float" behavior. This is a layout position where she rests her front flipper on the side of the pool and positions the rest of her body parallel to pool deck allowing trainers to conduct a body examination. Originally, this behavior was only trained for her sighted side (the right side). Trainers now have successfully trained a float to her left side. In addition a roll both directions allowing trainers to reposition her onto her back in the water for a clear view of her stomach has been trained. It should be noted when in her float position to the left she struggled with learning to roll to her left. Trainers believe her limited vision in her left eye may have been a factor. Having already established a left roll with her right float, trainers began approximating her roll to the left in her left float and quickly had success. These behaviors are significantly important for body inspections but could also aid in voluntary ultrasounds and other diagnostic testing.

The seals vision impairments played a factor in more than just how and why staff trained new behaviors. Immediately after their arrival, it quickly became apparent that the seals were confused by trainers walking away at the end of session. The seals with vision impairments would attempt to follow trainers or collide with their pool mate. Ola, who is fully sighted, has an established routine for trainers leaving her enclosure that includes a "stay" with intermittent feeding as the trainer exits. Having seen the benefits of a clear end of session signal, staff began to develop one for the remaining four seals. Ice is used to cover seal buckets before feeds and as a secondary reinforcer. It was decided that any left-over ice would be dumped at the end of session and animals would be given the verbal "all done" before trainers walked away. After introducing the end of session signal door charging and collisions with pool mates was drastically diminished and has been almost eliminated.

The adjustments in training protocols and establishing new behaviors proved essential to the success of the seals in acclimating them to their new habitat, establishing relationships with their trainers, and facilitating public educational demonstrations for zoo guests. The Hawaiian monk seals were designated unique permitting that included a mandatory educational component. This created a new challenge for staff as they worked to create an impactful message about an animal that lives over 1,800 miles from Minnesota.

This was achieved with a combination of videos and a training session with one or two seals in the presentation pool. Initially, these programs focused on husbandry behaviors. As the seals behavioral repertoire continues to grow, the demonstrations have shifted more focus to memorable behaviors like retrievals and A to B points to the slideout space at the front of the presentation pool, allowing guests a closer view of a seal. This spring the zoos marine mammals staff worked collaboratively with our animal ambassadors staff to create a new program highlighting island creatures and their delicate ecosystems. As staff continue to progress new behaviors and new material, a new demonstration is being developed centered around Hawaiian monk seals and the importance of zoos and conservation.

Conclusion

The marine mammals staff at the Minnesota Zoo is excited about continuing to progress training with the seals and the evolution of public interpretation for the Hawaiian monk seal. Caring for the seals at the Minnesota Zoo has been an important opportunity and immense responsibility in sharing the seals conservation story and allowing the seals to be ambassadors to their species. In the last year, over 1.3 million guests have visited the zoo and while demonstration attendance can vary those guests are now among the few people who can say they have seen a Hawaiian monk seal. The five seals are an important part of education and have contributed to research throughout their time at SeaWorld and now at the Minnesota Zoo. Further, the Minnesota Zoo conservation fund has partnered with NOAA scientists, raising over $18,000 to aid in purchasing new field research equipment. NOAA has declared 2017 as the year of the Hawaiian monk seal as they celebrate an increase in population numbers and strive to continue raising awareness for this critically endangered species. The Minnesota Zoo is honored to be a part of that story.

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Let's Get Physical: Physical Therapy Training for Two Otters with Metabolic Bone Disease

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In 2016, the Downtown Aquarium Denver received 0.2 North American river otter pups. These pups were orphaned from their mother at only a few weeks old. As they grew, their gait was observed as abnormal. After labs and X-rays, it was determined that they were suffering from metabolic bone disease. Once the otters arrived in our care, we began to format their care to allow them properly heal and grow.We began working with an animal physical therapist and orthopedic surgeon veterinarian. We devised various exercises that would strengthen their muscles, thus helping their bones grow stronger and straighter. We trained exercises to support their legs in a "normal" position, strengthen core muscles and teach them to pull their legs from a splayed position to an upright position.We currently train them six times a day on their physical therapy circuit. All the training is done through free contact. We train them to run a treadmill, pivots, back up, run in a chute and wobble logs. We are also training medical behaviors to assist with their immobilizations for X-rays. These include voluntary injection and voluntary inhalation of anesthesia.Each subsequent X-ray we take shows more bone density and the bones are correcting by growing straighter. We are learning more about their conformation at each immobilization and that allows us to create exercises tailored precisely to their needs. Their physical therapy elevates cooperate healthcare training to a whole new level of preventative and medical management for our otters.

On May 19, a call went out on the Association of Zoos and Aquariums otter listserv needing placement for 0.3 North American river otter pups. Their mother was found by a dog under a citizen's porch. He trapped her and released her far from the den site. When he returned he found the pups. They were taken into human care on May 18th. 0.1 died shortly after due to aspiration pneumonia. Because of the sensitivities of the care that followed, the facility in which they were temporarily housed will not be named in this paper.

On July 16, the facility sent us a video of the otters walking with a slight concern that they were not walking normally. However, their vet stated it was "probably developmental with exercise and time should straighten out." After seeing the video, we became concerned that this was not in fact normal. We sent the video to Dr. Gwen Meyers, the otter Species Survival Plan veterinary advisor. Dr. Meyers stated that, "Normal pups do not move like this. I would be concerned about metabolic bone disease based on posture, movement and the reported diet of beef and salmon." We immediately asked them to order radiographs.

The radiographs came back with mixed results. Their vet stated that he did see "mild osteopenia related to nutritional secondary hyperparathyroidism (NSHP). NSHP has been reported in otter pups fed diets deficient in vitamin D and calcium following weaning and lack of exposure to natural sunlight." Our vet did not see fractures, but Dr. Meyers saw "abnormal femoral bones and I believe they have bilateral pathologic fractures most likely due to metabolic bone disease from inappropriate diets." We received a second set of radiographs 12 hours before shipment. This set of images showed there were obvious fractures to both front legs on the female with the more severe splayed legs, Emilia, but Emilia and Oliva were already in transport when we received the radiographs.

Once we received the otters we began looking critically at their records to find out what we could change to their diet to improve their physical condition. We found a few problems that could have caused their bones to be so weak. However, we can't rule out genetics playing a role, as well as how long they were without their mother – which is unknown.

It is recommended in "Successful Hand-rearing and Rehabilitation of North American River Otter," that otters should be fully weaned at 16 weeks old, starting the process at 6-8 weeks old. These otters became aggressive over the nipple and bowl feeding was only tried twice. The keepers then decided they were ready to be weaned and discontinued formula overnight at 9 weeks. The otters were started on salmon puree – no skin or bones – at 6 weeks old. They were kept on this diet until 10 weeks old, increasing weekly from 40g to 120g daily. At 11 weeks old they were

discontinued off salmon and given 120g Triple A Brand meat.

When formula was discontinued, their diet was not changed to account for the missing calories. In addition, it is recommended that otters are fed every 4-5 hours after 7 weeks old, while these otters were fed on average of every 6 hours. Finally, otters are recommended to receive 450mg calcium daily. While on the salmon diet only diet from weeks nine and ten, they were only receiving 11mg daily based on USDA nutritional analysis of salmon. On average, the otters were fed 46% less food by body weight than recommended (assuming diet is 30% body weight as suggested in "Successful Hand-rearing and Rehabilitation of North American River Otter"). It does not appear they were offered any supplements, such as thiamin, and started receiving ¼ tab of tums starting on July 24, 2016 to supplement calcium. Dr. Meyer's said that they would need "4.5 regular tums which seems like a lot to me. Tums/caco3 is not well absorbed, so better to get ca through appropriate diet items."

Once we received the otters, we immediately went from 135g to 240g of food daily, adding whole capelin in the diet. We increased the diets pretty rapidly over the first week to increase the calcium uptake. We added capelin, trout, and smelt over five days and increased them to 320g over two weeks. The otters were extremely food aggressive and were being free fed together. We started feeding them separately or with two trainers. We began conditioning them to a clicker and working targets and shape recognition.

On Aug. 11, 2016 we anesthetized them with isoflurane for radiographs. They found decreased bone density and thinning of the cortex of all visible bone structures. The long bones had many fractures of various stages of healing resulting in abnormal angulations. There was also a concern that the pelvic bones were also angled and thickened. It was recommended to increase their sunlight exposure to help with vitamin D activation. Because of the amount of fractures and risk of further injury, we tried to keep the otters quiet and on soft surfaces. We crate trained them and worked on calm stations, shapes and targets.

On Sept. 22, we re-checked fractures under isoflurane. At that point, bone density was improving and fractures were healing. They were then released to begin physical therapy. An animal physical therapist and orthopedic surgeon began advising us on exercises for these otters. Wolff's Law states that "bone grows and remodels in response to the forces that are placed upon it. After injury to bone, placing specific stress in specific directions to the bone can help it remodel and become normal healthy bone again."

Based on this, we created a physical therapy circuit of exercises to meet our goals. We focused more heavily on Emilia because she naturally defaulted to the splayed position, while Olivia tended to support her weight better on her hind limbs. We made the decision to work these otters free contact, which made training behaviors easier. But because these otters were nutritionally compromised we had to deal with food aggression. We decided to also feed them individually, and we quickly moved away from hand feeding due to the aggression. Once their weights were steady and diets were brought to the proper amount, the vocalizing and aggressive nature in which they took food subsided.

We first trained them to crate so we could move them to the outdoor yard daily and feed them separately. Our first physical therapy exercise was to create a chute that would promote active adduction (movement of limbs toward midline) of the hind limbs to strengthen the legs into the correct anatomical "otter" position. The chute would be inclined to promote hind limb strengthening. We began training them to walk up and down the chute on cue. We placed 2x4's on the inside of the chute to be able to increase the width of the chute as they grew. We also placed rungs on the bottom to help them grip when the chute was on an incline. We added platforms as well to have them go under and over in the chute.

To strengthen the gluteals in the correct anatomical position we trained a back-up behavior in between their enclo sure and the wall. We point followed them in the gap and point followed them backward. To produce co-contractions (movement of muscles around a joint) of the hind limb muscles we created a mini chute out of a box and taped that perpendicular to a skateboard. We had Emilia go through the chute and stop with her hind legs in the chute and her back legs on the ground. We then moved the skateboard back and forth to shift her weight. She quickly outgrew this exercise due to limitations of the chute size and durability.

To promote digit muscle contractions, extension of the spine muscles and extension of the hip joints, we made sure she would have to do a small amount of climbing in her enclosure. Her pool is 4 feet off the ground with a stump as a stair step so this allows for some passive physical therapy. We did some general conditioning as well to strengthen her core, such as sit-ups, walking down a wobble log, turns and rolls.

There was a concern that the chute was mechanically putting her legs in the correct anatomical position and this was not allowing her to actively use the hind muscles as much as we would like. We decided to get a cat treadmill and place obstacles on the edges at alternating spots. The goal of this was to have her walk on the treadmill and have her actively adducting the hind limbs to clear the obstacles. We started by gluing cut up pool noodles alternating on the rim of the treadmill. The pool noodles didn't hold very well so we changed to vacuum hose screwed on, alternating with her stride.

In October, Emilia became lethargic and refused to crate. Within 12 hours her hind paw was swollen and she was limping. We took her to the vet hospital and anesthetized her – fearing new breaks to her bones. It turned out she just had an abscessed foot pad. Because she doesn't support all her weight on her hind limbs she has hyperkeritinized paw pads. One of the pads had opened and become infected. She was restricted to indoors for a week and given antibiotics. She healed quickly and was back to training within days. She suffered another abscess to the opposite hind foot in November but it was not as severe and healed just as quickly.

Because of the repeated abscesses, we decided to train a foot present behavior to allow application of salicylic acid to her feet to alleviate the pododermitis. We trained her the foot present in an open PVC chute. We asked her to put her back foot on the mesh and hold for a spray of the medicine. We used the same chute to train voluntary injections for vaccines. We are currently in the process of training a voluntary mask for inhalant anesthetic. We inserted a target pole into the top of a soda bottle and phased the target pole out. We are now working on duration and holding their face in the mask. In addition to husbandry behaviors, we are using these otters as animal ambassadors. They do training sessions in a classroom with our guests. Guests do targets with them and take pictures with them.

We also have trained voluntary radiographs. We trained them to roll over on the backs and lay on their stomachs on a donated radiograph plate. We desensitized them to a replica of a portable radiograph generator by making a yellow shoe box with a light in the bottom of it. We also wore aprons while doing our practice sessions. At the first session with the vets, Olivia came over to the radiograph plate but refused to flip onto her back. Emilia was very hesitant to even come near the radiograph plate. We are currently working to strengthen the behavior of them rolling on their backs by introducing new people as the "vet" and adding in a horse smell to our sessions (the radiographer vet is an equine vet) by adding horse blankets under the radiograph plate.

Ahead, we face several challenges with these otters. There is concern from the vets that because of the fractures to the pelvis, they may have difficulty giving birth if they ever become pregnant. We are planning on spaying Emilia and possibly Olivia if radiographs show a narrowing of the birth canal. We currently now house 2.3 otters, one of the males being 19 years old. We are contemplating group dynamics of introducing Emilia to the younger male and if she will be able to manage him with her physical limitations. Finally, while we are still free contact with these otters, we understand this may change at any moment and always take our training day by day.

In conclusion, although medical advancements for our captive animals have come a long way, we still need to educate and ensure that anyone who has wild animals in their care is properly taking care of them. Small errors can cause lifelong impacts when raising young rehabilitated animals. Through training, physical therapy and strict diet control, we were able to rehabilitate these otters and hope they will lead a long life at our facility.

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Formula amount in ml
amount in ml
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120
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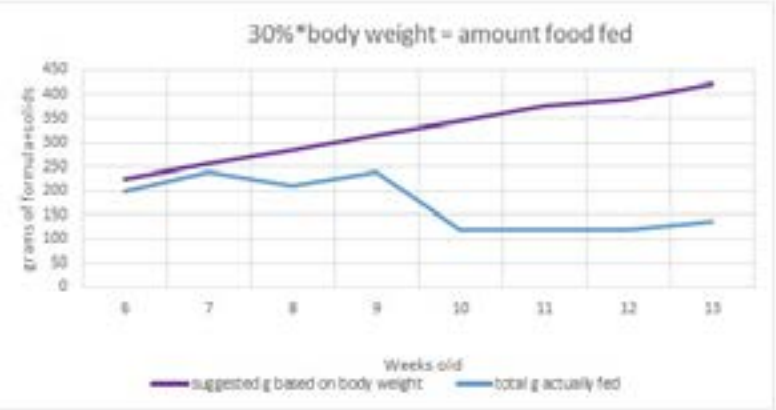
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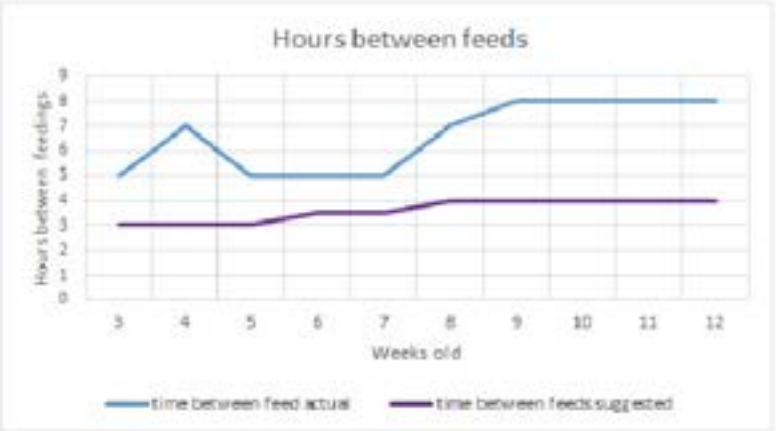
Hours between feeds
Hours between feedings
9
8
7
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3 4 5 6 7 8 9 10 11 12
Weeks old
time between feed actual
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Amount of food total fed
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Every Successful Bridge Starts With a Solid Foundation

Jeremy Dillon

Cheyenne Mountain Zoo

Cheyenne Mountain Zoo has a very unique way of bridging the gap between the conservation messages we want our guests to discover and showcasing our animals amazing abilities. This is most apparent in our natural behavior shows where you might see a leopard attacking a fake prey item or a goat showing off its amazing climbing abilities all in their own exhibit! However, none of this would be remotely possible without a solid animal behavior program to set the foundation for all of this amazing work. Part of this foundation is built from the comprehensive training and mentorship program designed to develop the entire keeper staff into solid behaviorists. This presentation will share the successes that we have developed with our program including details about our in-house training workshops and our peer trainer mentorship program.

Culture: Why would culture be such an important piece of setting a solid foundation? It is probably the most important part of what has helped us. If you consider all the great countries that we all dream about visiting in our lifetime, one of the biggest draws for us is to go and experience the culture that those places have built. These cultures are often rooted in united goals and philosophies that have driven their development. At CMZ, our culture starts with our Mission and Vision statements.

- Mission: A leader in conservation, captive breeding, and animal care, Cheyenne Mountain Zoo connects people with wildlife and wild places through experiences that inspire action.
- Vision: Every Kid, Every Time, Goosebumps!

Every kid, of any age, will have an experience for a lifetime with every visit.

These statements aren't just about who we are but also what we are committing to anyone who comes through our gates. If you just imagine that vision statement for a moment. It means that we are committed to making sure that *every guest* that comes through our gates has an amazing experience. It is a tall order, but all of our staff is committed to reaching that goal.

Part of our zoo's culture also comes from our training philosophy. This philosophy is based on the least intrusive, most reinforcing training procedures available. We use Positive Reinforcement training where each and every correct response to a cue is backed up with a primary reinforcer. We follow this guideline as our primary means of training all our behaviors, and if that procedure is no longer the right tool for the job then we follow the ethical hierarchy of behavior intervention procedures that Dr. Susan Friedman has proposed and illustrated on her website www.behaviorworks.org . The illustration maps out a path for moving from the least intrusive (R+) to most intrusive methods (P+). This isn't the only way to train successfully, but we find it plays a role in our successes, and everyone on our team believes in training this way.

Who we hire has become a huge part of how we are able to maintain the culture of our zoo. In fact, culture has become important enough to us that it has become a main piece of our selection process. We have interview questions that are designed specifically to address those cultural aspects. Questions like…

1. On a scale of 1-10, what is your comfort level with taking risks?
2. At CMZ our primary training strategy is to pair each and every correct response with a primary reinforcer. How do you feel about this strategy?
3. Give us 5 examples of ways you can promote great guest experiences that take less than 2 minutes.

By having a clear definition of our culture and who we are as an organization it has allowed us to easily identify

the type of person we are looking to hire at the zoo. As our CEO, Bob Chastain, often quotes from the book Good to Great by Jim Collins "You have to get the right people in the right seats on the bus". By developing a team of people with similar views and beliefs, we have been able to create an amazing amount of staff buy-in. Everyone at the zoo, from our CEO to our Keeper Assistant staff, is committed to our institutional goals.

Staff Development: Have you ever had that annoying reminder bar to update some program on your computer pop up? How many times do you just put it off because it is inconvenient at the time to update it, only to finally kick yourself later when you can no longer binge watch your favorite TV show? We all know that if we routinely take care of those software updates, we are able to run our computers more efficiently. This is a great analogy for staff development; you have to be continuously and purposefully updating your staff's "software".

Our staff development started back in 2008. The zoo entered into a partnership with Steve Martin from Natural Encounters Inc. The goal was a simple one: create a number of species appropriate natural behavior shows in our animal's current exhibits. Part of this program involved an intensive series of "in-class" learning, as well as hands on mentoring of animal behavior and training techniques. During this time, the Animal Behavior Programs Manager(ABPM) position was created to continue to support and foster our zoos goals.

The ABPM's role is to manage the zoo's training and enrichment programs as a whole, continue to educate and grow keepers' skills, and assist with training and enrichment wherever necessary. In this position, I try to maintain a well rounded approach to our staff's continued education through hosting in house behavior workshops. I also lead and maintain a solid mentorship program and expose staff to outside education whenever possible.

CMZ's In House Workshops: The training workshops I run are structured to give our staff a compact experience of immersion in our zoo's training philosophy and culture. Due to the difficulty of scheduling keepers for the workshop during work hours, we hold the workshop over a 4 hour period for 4 consecutive days. We have found the zoo can facilitate a maximum of 6 people attending at a time. The days are divided up into classroom PowerPoint presentations that focus on the science of applied behavior analysis, training terminology and philosophy. We also run hands on exercises and group discussions, which helps us tap into all learning styles.

My favorite hands on exercise is the training game played using a Mr. Potato Head toy. During this game, the workshop attendees break into 2 groups and are tasked with picking out 5-10 toy pieces that will be used to construct their team's Potato Head masterpiece. Each group has 10 minutes to create and write a training plan for how someone from the other group will be trained to assemble their masterpiece. Then, the training begins! We have found that this particular game has a lot of variables that arise, and it really allows for great opportunity to discuss training concepts. We have enacted discussions surrounding "training at the animals pace", how easy it is to move away from your training plan (and not being afraid of that), as well as a lot of other great observations.

The other half of the workshop involves hands on training with either our chickens or domestic goats from our guest 'contact areas'. During these sessions, we have the attendees focus on building relationships, picking a behavior, develop a training plan, and then training the behavior itself. The goal for these sessions is not necessarily for the trainer to complete the behavior by the end of the workshop (it is very reinforcing when they do) but to get the experience of working through the training process. This is also the time that each trainer is paired with the ABPM or one of the zoo's Training Mentors and receives one-on-one coaching. This experience helps to lay the groundwork for the participants to get feedback during their training sessions. It also helps build relationships between all the staff and the Mentor Team.

CMZ's Continued Education: Our Mentor Program is made up of those individual Keepers at our zoo that have shown a high level of skill with Applied Behavior Analysis. They also, must be great trainers, and most importantly be great at giving and receiving constructive feedback. We currently have 5 individuals that are in our mentor program. They are always striving to help in the success of elevating keeper staff to their own individual next skill level of training. As part of our mentor program, we also developed a code of conduct that allows the entire Animal Department staff to hold the Mentor program to a certain standard. This has proven to be very helpful in creating an atmosphere of openness and willingness to give and take feedback.

We strive to support staff in continued education outside of what the zoo offers in house. Many of these opportunities have been for keepers to attend behavior workshops like the Natural Encounters workshop or the AZA training workshop. We routinely have staff attending conferences of their interest, often times encouraging them to present on a behavior related achievement. Additionally we encourage and support staff to take college level courses like Dr. Susan Friedman's Living and Learning with Animals. In all of these situations the zoo has supported the staff

by allowing them to take professional development paid time and in some cases the zoo has taken on some or all of the financial requirements for these events.

Summary: The final component to our foundation has been the teamwork that the entire zoo staff shows. Having such a clearly defined culture has afforded us to develop a strong sense of teamwork. This teamwork extends to all the departments within the zoo, and our upper management shows their teamwork through the support they give us in many ways. One way that our CEO has done this is by recognizing that the time it takes to do the extra training can dip into the other aspects of our job. Due to this, he has supported the hiring of part-time Keeper Assistants to help with the regular work load.

The other benefit to having such a strong, unified set of goals is that we have an incredible amount of staff buy-in. By establishing these common goals it eliminates the trouble that can be encountered when individuals have disagreements. We are always able to focus on the common goal and work on a unified path to realize it.

The final piece of having a strong team is feedback. By fostering a program that encourages people to give and receive feedback in a constructive and respectful manner we have been able to help people be more successful. Our zoo wasn't always so open to getting feedback from their peers. A big part of what helped foster this is when our CEO encouraged everyone to read the book Crucial Conversations by Patterson, Grenny, McMillan, and Switzler, by offering anyone who read the book and came to him to have a brief discussion about it $100. (Yep, he knows how to use positive reinforcement effectively!). We have found the book to be very beneficial to creating a cohesive team, and even though most of us read it years ago it has become a key part of our culture and we reference back to it frequently. In the book it talks a lot about giving and receiving feedback and as our staff developed these skills and consequently saw the benefits to being open to receiving feedback, very few of them shy away from feedback and many often seek it out.

For all things, solid foundations are crucial for developing programs that will have long lasting and impactful success. Not all programs are created the same, and they will work differently based off of a variety of factors. The concept of a "Study of One" is just as relevant in developing each and every program due to the different individuals and goals that those programs have. The specific examples shared in this paper are things that have helped us, but may not work in every situation. Don't get disheartened if you had the thought "That will never fly at my institution". It might not, but hopefully it will give you an idea of how to adapt it to fit for your situation.

Using Radio Frequency Identification (Rfid) Tags to Measure Swimming Behavior in Little Blue Penguins While Monitoring the Treatment and Prevention of Bumblefoot (Pododermatitis)

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Cincinnati Zoo and Botanical Garden, Antioch College

Bumblefoot, or pododermatitis, is the inflammation of the foot caused by an initial infected site in connection with pressure necrosis (AZA Penguin Husbandry Manual, 2003). Factors that have been related to the prevalence of bumblefoot in penguins have included sex, weight, enclosure substrate, and behavioral factors (Erlacher-Reid, et al. 2012; Reisfield, et al, 2013). The purpose of this research is to quantify the behavioral changes necessary to reduce, prevent, and potentially eliminate bumblefoot from the little blue penguin colony housed at the Cincinnati Zoo and Botanical Garden. Radio-frequency identification technology is implemented in order to collect the continuous and instances of swimming behavior for each individual penguin. Bumblefoot severity in the little blue penguin colony is measured during baseline and across multiple treatments that involved behavioral and environmental enrichment. Results are pending.

Introduction

The prevalence of bumblefoot, or pododermatitis has been linked with a variety of factors in penguins such as weight, substrate, periods of inactivity, and time spent swimming (Erlacher-Reid, et al. 2012). The development of bumblefoot has been documented in penguins rescued from oil spills for treatment prior to being re-released (Michael, Gartell, Morgan, McConnell, 2012). One stark difference between penguins in their natural habitat, and in captivity (even for short periods following rehabilitation), is the amount of swimming.

The potential link between swimming behavior and bumblefoot has been investigated most directly by Reisfield, et al (2013). The researchers noticed bumble lesions appearing on multiple penguins within their care. They then implemented an enrichment programed aimed at increasing the penguins swimming behavior The results of this study showed significant decreases in bumble lesions for the majority of penguins (and in some complete disappearance) following the implementation of enrichment. This study provides interesting data linking decreases in bumble lesions with changes to the environment, but fails to provide any behavioral data (that is, changes in the swimming behavior of their penguins). What is left to be determined is how much swimming is necessary to produce these constructive results, and if these results are typical for penguins with varying degrees of bumblefoot (minimal to severe).

Answering these questions requires continuous data collection on the swimming behavior for each individual penguin. This is possible through the use of Radio Frequency Identification (RF-ID) tags. Once installed, this technology allows for data on swimming behavior to be collected continuously for multiple penguins with ease. RF-ID tags have been identified as an opportunity to enhance captive animal welfare and environmental enrichment (Kim, Kim, Park, 2010), without increasing the time required by staff for data collection (Hoy, Murray, & Tribe, 2010), and all the while not significantly altering a penguin's natural behavior (Agnew, Lalas, Wright, 2013).

Using methods that have previously been shown to increase penguin's swimming behavior (Kinley, 2002) as the environmental manipulations, the goal of this research project is to quantify the relationship between swimming behavior and the severity of bumblefoot lesions.

Methods

Subjects

Fourteen Little Blue Penguins (*Eudyptula minor)* were used as subjects. Subjects were of various ages (from 17 years old to 3 months old), and both male and female. Each penguin was tagged with a radio-frequency identification (RF-ID) tag between January 2 and 19, 2017. The RF-ID tag was attached to a band that was placed on the wing of the bird (just like an wing tag). Of the fourteen subjects, only three had evidence of bumble lesions and one had only a slight discoloration (potential precursor to bumble lesion). Over the course of the data collection, another penguin (Pink/White) developed a bumble lesion. In total, four of the fourteen penguins had evidence of bumbles (see Table

1).

Name	Sex	Date Tagged	Bumble(s)
White/Orange	F	1-2-17	None
Mango	M	1-2-17	Left and Right feet
Bronco	M	1-2-17	Discoloration on right pad (photos taken)
Truffle	F	1-2-17	None
Cookie	M	1-2-17	Left and Right
Pink/Black	M	1-2-17	None
Little Caesar	M	1-2-17	Left Foot
Lazzie	F	1-8-17	None
Renesme	F	1-8-17	None
Martin'	F	1-8-17	None
Green	M	1-8-17	None
Spot	M	1-8-17	None
Pink/Blue	F	1-19-17	None
Pink/White	F	1-19-17	Developed small lesion on left foot on 3- 3-17

Table 1. The names, sex, date tagged and location of bumble lesions at time of tagging.

Measures

Swimming

Four antennas (which read the individual RF-ID tags) were built and installed in the penguin's indoor holding area. Two antennas were placed immediately outside the pool entrance area, and two were placed within the pool itself. When a penguin with a tag stepped/swam across any antenna, the tag ID (indicating the individual), date, time and antenna was recorded. The antenna placement allowed for the detection of a penguin entering the pool, swimming in the pool and exiting the pool, which allowed researchers to collect the swimming behavior, continuously and reliably, for each tagged penguin.

RF-ID data was downloaded weekly using CoolTerm (terminal for communication with hardware connected to serial port software) and analyzed using R (R Core Team, 2013). The raw data included columns indicating date, time, antennae, and RF-ID number. Swimming bouts were identified by a detection from one of the antenna at the entrance of the pool, followed by (at least one) detection from one antenna inside the pool, ending with a detection from one of the antenna at the entrance. If this sequence was not found, it was determined that the penguin had not entered the pool (did not swim). Video recordings verified the accuracy of the system. Cumulative daily swim time was calculated by adding up all of the swimming bout durations within a given day.

Bumble Lesions

Each week, the feet of all penguins participating in the study were viewed for evidence of lesions, and specific measurements of existing lesions were taken. Three different measurements were taken of each lesion; the length and width of the visible bumble lesion and the circumference of the entire foot (to get a measure of swelling). Of the penguins that did not have a lesion per se (but did have discoloration—a precursor to a bumble lesion) photos of the feet were taken.

Experimental Manipulations

Baseline. During the winter months the penguins were consistently housed indoors and had access to a single pool. The first step of the project consisted of getting baseline data. That is, how much was each penguin swimming cumulatively, how did they allocate swimming over their day, and the length of each swimming bout.

Food Dish. Following a period of baseline data collection of approximately 45 days, a food dish was added near the entrance of the pool. The food dish was kept in this location for 30 days before it was moved to the back of the pool. At this point, the fish on the plate were only available if a penguin entered the pool and either ate while swimming, or climbed onto the back of the pool ledge. It should be noted that there were other sources of food available to the penguins that did not require swimming.

The goal of this manipulation was to expose the penguins to fish in the pool, and potentially eating out of the food dish while swimming. This is the first approximation to regularly feeding the penguins in the water (a final goal when the penguins are out on exhibit with access to the larger pool).

Results

Figure 1 shows the total daily swim time for 11 of the 14 subjects in the study. The three that were omitted engaged in no swimming behavior (they were never recorded entering the pool) and also did not exhibit any bumble lesions or discoloration throughout the study. For the sake of space, they will be omitted from this analysis. The vertical lines indicate the dates when the food dish was added to the entrance of the pool (first dashed vertical line) and when it was placed in the pool (second dashed vertical line). Each panel of the figure indicates an individual penguin.

The red line indicates the average swim time across all days for that individual penguin. The blue dots indicate the days

that the penguins were given access to the outdoor portion of the exhibit (these days occurred in the spring when the weather permitted outside access). It is possible that one these days the penguins engaged in swimming behavior outside that was not recorded (equipment was not yet installed in the outside exhibit area).

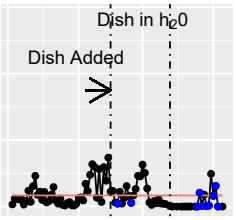

Figure 1. Daily swimming behavior for 11 of the 14 subjects in the study. Each panel indicates the swimming behavior of an individual. Dashed vertical lines indicate when the dish was added near the pool, and when the dish was placed in the pool. Blue dots indicate days when the penguins had access to the outdoor enclosure. The red line indicates the average swimming time across days for that penguin.

Figure 1 indicates that the swimming behavior across individuals is quite variable. Within a penguin, swimming behavior is also quite variable day-to-day. There did not appear to be any relationship between swimming and days of the week, temperature (they were recorded indoors), or enrichment schedules.

The daily swim time averages were used as a broad sense of how swimming behavior might be related to the appearance of bumbles. The raw data of swimming averages can be found in Table 2.

Penguin	Average Swim Time (s)	Bumble Lesions
Mango	333	Left and Right
Bronco	1037	Discoloration
Truffle	132	None
Cookie	0	Left and Right
Pink/Black	763	None
Caesar	406	Left Foot
White/Orange	618	None
Martin	593	None
Green	161	None
Pink/Blue	1389	None
Pink/White	491	Left Foot on 3-3-17

Table 2. The penguin, their overall average swim time and if they had bumble lesions at some point in the study (Bronco was treated as a penguin without bumbles).

Figure 2 shows graphically how the average daily swimming behavior relates to the presence or absence of bumble lesions. This figure indicates that the majority of penguins that do not have visible bumble lesions have greater daily swimming averages than the penguins that do have lesions. Note that this not for all the penguins, and there are more penguins that do not have lesions than penguins that do have lesions.

Figure 2. Each datum point indicates the presence or absence of bumbles and the daily swimming behavior of each of penguin in the study.

The addition of the food dish in the water did not have the desired effect on the penguin's behavior, which was to create and sustain an increase in swimming behavior. Without large scale changes in behavior with before and after measurements of bumble lesions for comparisons, natural changes in the penguins swimming behavior were used for comparison. For one penguin, Mango, her natural molting period provided a great opportunity to look for changes in bumble lesions in response to decreases in swimming.

Figure 3 shows the area (the length multiplied by the width) of the lesions on Mango's left (top panel) and right (middle panel) feet. The third panel shows Mango's swimming behavior over the same period of time. The vertical dashed lines show the period of time when Mango was molting her feathers. As would be expected, Mango's swimming behavior decreased as she approached her molting period, until she almost never swam between March 10 and March 23. Bumble measures were taken in between these periods. The two measurement points within this time period indicates an increase in bumble lesion in both the right (from 0.48 cm on March 15, to 0.64 cm on March 22) and left foot (from 0.24 cm on March 15, to 0.30 cm on March 22). Following the molting period, Mango's bumbles remained consistent in size on her right foot (down to 0.56 cm on March 29), and slightly decreased (0.29 cm on March 29) before increasing back to previous levels in her left foot (0.36 cm on April 5).

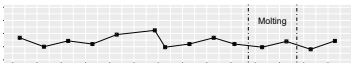

Figure 3. The area (length multiplied by width) of Mango's bumble lesions on the left (top panel) and right foot (middle panel). The bottom panel indicates the daily swimming behavior of Mango. Vertical dashed lines show the period in which Mango was observed molting her feathers. Blue dots indicate days when penguins also had access to the outside pool.

Another natural change in swimming behavior observed was in Pink/White. Looking back at Figure 1, there is a clear decrease in swimming behavior in Pink/White between the time the food dish was added near the water, and when it was moved into the pool. Figure 4 shows the measured bumble lesions for Pink/White as well as the swimming behavior.

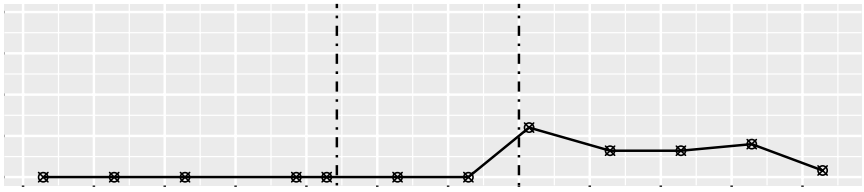

Figure 4. The area (length x width) of Pink/White's bumble lesions on the left (top panel) and right foot (middle panel).

The bottom panel indicates the daily swimming behavior of Pink/White. Vertical dashed lines show the period in which decreased swimming behavior was observed. Blue dots indicate days when penguins also had access to the outside pool.

It should be noted that Pink/White is a young penguin. Discoloration was noted before an actual lesion was observed on March 7, 2017. Pink/White's swimming behavior decreased to next to zero beginning approximately February 14. When Pink/White returned to swimming gradually (approximately around March 4), the bumble on the left foot appeared (measured at 0.30 cm on March 7). By the next week, the bumble on the left foot had decreased in area (to 0.16 cm), remained stable for the next three weeks (0.16, 0.16, and 0.20 cm respectively), before decreasing during the last week of measurement (last measurement was 0.04 cm). The week prior to this final lesion measurement, Pink/White appeared to return to the baseline swimming behavior. Continued data collection will show whether this decrease in bumble area and increase/maintenance of swimming behavior continues.

Discussion

Using RF-ID technology, the continuous swimming behavior of 14 captive penguins (11 were shown here) was recorded for approximately 120 days. Attempts to systematical increase swimming behavior (making food available for swimming behavior) across penguins failed, but natural changes in swimming behavior allowed for changes in swimming behavior to be related to bumblefoot lesion size for two penguins.

For one penguin, Mango, molting of feathers was the clear reason for changes in swimming behavior. Mango almost completely stopped swimming for a period of two weeks. This decrease in swimming behavior paralleled an increase in her bumble lesion size in both feet. When she completed her molt and returned to the pool, her bumble lesions remained fairly consistent throughout the next few weeks.

For the second penguin analyzed here, Pink/White, there was no clear reason why swimming behavior decreased (potentially due to the food dish changes). But similar to Mango, there was a period of approximately 2 weeks where Pink/White swam very little. At the end of this period of little swimming, a bumble lesion developed. Though the lesion was small and only appeared on one foot, the appearance of the lesion corresponded with a period of minimal swimming. Following this period Pink/White returned to the pool, and for the next three weeks, the area of the bumble remained a similar size. On the fourth week the bumble decreased in area--- from 0.20 cm to 0.04 cm.

The patterns of Mango and Pink/White's bumbles may shed light on potential relationships between bumbles and swimming behavior. First, after a period of no swimming, both penguins showed worsening/visibility of bumble lesions. Pink/White had previously shown no bumbles before a bumble developed after a period of no swimming. Mango had existing, larger bumbles that grew in size following the period of minimal swimming. It should also be noted that after 3 weeks Pink/White's bumbles began to decrease in size (from 0.50 cm on March 28, 2017 to 0.04 cm on April 5, 2017), while Mango's bumbles did not show this same level of decrease following a return to swimming. It may be the case that Mango's larger, more persistent bumbles may require more time of continuous swimming to show the effects. It may also be the timing from the period of formation for the bumble (that is, how long the bumble has been present). Future manipulations are aimed at illuminating these differences.

Conclusions

The data presented here suggest a link between swimming behavior and bumble lesions. Continuous data collection, made possible via the RF-ID technology, and continued data collection across multiple manipulations will allow for this relationship to be explored even further. With spring approaching, the Little Blue penguins will move to their outdoor enclosure, which includes a larger pool and more space for swimming. This change in environment may be enough to produce significant changes in swimming behavior, but will also allow for other interventions to be implemented including training penguins to swim more frequently, and the implementation of enrichment. In addition to continuing to gain valuable knowledge regarding the relationship between bumble lesions and swimming behavior, other factors effects on swimming (such as water and air temperature, swimming prevalence throughout the day, differences between in and off exhibit, etc.) will also be evaluated.

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Back to Basics: Applying Enrichment and Training to Small Pets

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In 2016, there were an estimated 1 million pet rabbits, 0.7 million pet guinea pigs and 0.4 million pet hamsters in the United Kingdom. With the pet shop being the most popular place to purchase these pets, it is evident that pet shops have a fundamental role in educating pet owners on correct animal care, including leading by example. This education is of key significance, considering the rabbit is one of the most neglected pets in the United Kingdom. Beyond basic husbandry, enrichment is a key element to improving welfare, with opportunities to provide mental and physical stimulation. Dobbies Garden Centre incorporated shop-bought and recycled enrichment into daily husbandry and uses these examples to educate and inspire pet owners on providing opportunities for their pets to perform natural behaviours. The introduction of treat balls, cardboard boxes, paper bags and tubes has shown to enrich the animals' lives in the pet shop and can reduce "problem behaviours" through promoting natural behaviours. Additionally, training and enrichment encourages pet owners and children to play a more active role in improving the welfare of their pet and enjoy their pet more due to increased activity. This presentation will also consider how positive reinforcement training can improve handling and reduce stress associated with husbandry and veterinary care for small pets, as this is often overlooked. It is hoped to collaborate with welfare organisations in the future, to provide more information for pet owners with regard to improving small pet welfare through enrichment and training.

1.0 Introduction

The Pet Food Manufacturing Association (2017) 2016-2017 annual report indicated that there are around 0.8 million pet rabbits in the United Kingdom, which is a gradual decline from 1.3 million during 2012-2013. Despite being a popular pet, a survey conducted by the Rabbit Association and Fund (2012) recorded an average of 67,000 pet rabbits being relinquished to rescue centres per year, and a recent survey identified that up to 75% of pet rabbits are being mistreated, with issues including; incorrect housing, incorrect food, and incorrect socialisation (McVeigh, 2011). This study also identified 60% of those surveyed as not recognising rabbits as an intelligent animal or that rabbits require mental stimulation. This supports a concern that is frequently identified in veterinary practices, that the ignorance of an animal's needs is one of the most common causes of poor husbandry (Stapleton and Hedley, 2015). Additionally, veterinarians have indicated that three-quarters of rabbits suffer from overgrown teeth or other dental issues (Burgess Pet Care, 2015), and one in four rabbits have a weight problem (The People's Dispensary for Sick Animals (PDSA), 2015). Many of these issues can be reduced through promoting natural behaviours including gnawing, hiding and digging, which also increases activity levels. With the cost of keeping a rabbit at £1,000 per year of its life span (PDSA, 2015), finding effective enrichment is also relevant.

In addition to the issues surrounding mistreated pet rabbits, there are also welfare concerns for other common small pets, including guinea pigs, hamsters, chinchillas, gerbils, ferrets, rats and mice. Despite there being approximately 0.5 million pet guinea pigs, 0.3 million hamsters, and about 400,000 gerbils, mice or rats in the UK (Pet Food Manufacturing Association, 2012; Pet Food Manufacturing Association, 2016), research regarding the welfare of these pets is limited. However, Fawcett (2011) highlighted that poor husbandry and diet are the leading causes of morbidity and mortality in guinea pigs, and owners are often unaware of common health issues associated with these. Additionally, there is evidence of mistreated guinea pigs when searching online for rescue centres, with many stating the poor conditions in which these animals are found in.

Enrichment was trialled with pet shop species including rabbits, guinea pigs and small rodents, to promote species-specific behaviours. Additionally, enrichment provided the public with enrichment ideas for species that are often overlooked in terms of intelligence, husbandry and welfare requirements. The focus of the enrichment investi-

gated in this paper will be primarily on rabbits, but many examples are applicable to other small pets.

1.1 The Role of Pet Shops

Pet shops are often associated with a negative stigma as a result of welfare concerns. For example; studies have suggested that pet shops; provide inadequate space; have incidences of abnormal behaviour, such as pacing and circling; and inappropriate human-animal interactions, such as shouting or banging on the glass of enclosures (Casamitjana, 2003). Despite this perception, the pet shop continues to be the most popular place to purchase a rabbit or other small animal, with the PDSA (2016) survey finding 40% of pet owners purchasing a rabbit from a pet shop. There has also been an increase from 14% to 16% in rescue centres being used since 2011, and a decline in people obtaining pets from relatives (PDSA, 2015). In addition, 22% of rabbit owners in the PDSA (2016) survey took advice from a pet shop, demonstrating that pet shops have a relevant influence on the care and welfare of animals, both in the pet shop environment, and beyond the pet shop.

1.2 Aims

- How can welfare be improved in the pet shop and set an example to improve welfare beyond the pet shop?
    - What enrichment and training opportunities can be provided to enhance natural behaviours of rabbits, and provide a mentally stimulating environment?
    - How can education be improved in the future to enhance involvement and care of pets, improve human-animal relationships, and potentially reduce the number of pets being rehomed or mistreated?

2.0 The Importance of Enrichment

Enrichment has numerous definitions, but one example states; modifications to the captive environment that enables the animal to enhance physical and psychological wellbeing through providing stimuli that meets the species specific needs (Baumans, 2000). Enrichment programmes were initially developed in the zoo environment, in order to enhance the lives of captive animals (Shepherdson, 1998), but enrichment is becoming a more integral part of domestic animal husbandry. It is the owners legal duty to ensure the environmental (for example; exercise space, hiding places, bedding) and behavioural (for example; gnawing, digging, hiding, exercising and foraging) needs of the animal are met by the owner (RSPCA, 2016; Animal Welfare Act 2006), demonstrating the significance of enrichment.

Research on rabbit welfare has identified that a barren environment can result in a lack of mental stimulation and the inability to perform natural behaviours (Katsarou *et al*., 2011). Consequently, The Royal Society for the Prevention of Cruelty to Animals (RSPCA) has identified that mistreated pets may display abnormal behaviours such as excessive grooming and aggression (Srivastava *et al.,* 2014), or health issues, including obesity, malnutrition and overgrown teeth (McVeigh, 2011). Furthermore, the issues associated with barren environments are not limited to rabbits, and similar issues have been identified in other small pets, including guinea pigs and small rodents, including hamsters. Additionally, many rabbits and guinea pigs are housed alone, which can be controversial considering their naturally sociable and group behaviour in the wild, and extra stimulation to compensate is vital for animal wellbeing (RSPCA, 2016). Enrichment can assist with promoting natural behaviours and reducing the risk of issues associated with barren and under-stimulating environments.

2.1 Types of Enrichment

Enrichment can include; environmental enrichment, habitat enrichment, sensory enrichment, food enrichment, social groupings and behavioural conditioning (Association of Zoos and Aquariums, 2014), and all of these can contribute to enhancing natural behaviours and improving animal wellbeing. The enrichment investigated has included all varieties, and the success of these to improve activity, provide mental stimulation and to provide ideas to the public for their own pets has been monitored. Both synthetic and natural enrichment were used and these were further defined to shop-bought and recycled enrichment, to demonstrate that effective enrichment does not need to cost a lot, and it may be more accessible than previously thought. Some of the observations that have been recorded can be seen in Table 1.

Enrichment	Shop-bought/ Recycled	Observations
Plastic Treat Ball	Shop-bought	Increases foraging opportunities, locomotory activity and mental stimulation.
Plastic Tunnels or houses	Shop-bought	Provides a hiding place, and promotes locomotory behaviours such as running and jumping.
Puzzles (such a slider puzzles)	Shop-bought	Promotes mental stimulation, foraging, and demonstrates intelligence to the public.
Wooden Shop-Bought Toys	Shop-bought	Promotes throwing and gnawing behaviours. Shown to deter from undesirable behaviour such as gnawing on cage bars, particularly in hamsters.
Plant pots	Shop-bought	Provides a hiding place and an object to manipulate, such as throwing.
Cardboard/Hay Tubes	Recycled and shop-bought	Different shapes and sizes for different uses. Can put food/hay inside to encourage gnawing or put holes in the tube so animal has to manipulate the tube to get food reward, so can provide mental stimulation. Large tubes can also act as a hiding space, also the opportunity to gnaw, and chew if made from hay.
Scent Enrichment - Other animal scents, or natural scents such as lavender	Recycled and shop-bought	Promotes digging, and scenting behaviour (particularly chin scenting in rabbits).
Cardboard Boxes	Recycled	Large boxes can act as a hiding place, promote jumping, digging and gnawing behaviours. Small boxes can be thrown around, food can be hidden inside boxes to promote mental stimulation, gnawing and digging behaviours.
Willow Branches	Recycled	Promotes gnawing behaviours in various species including rabbits, hamsters and gerbils.
Paper	Recycled	Paper bags or other paper products, such as newspaper, promotes throwing, digging, gnawing behaviour. Food hidden inside can enhance mental stimulation. Paper also acts as good nesting material for small rodents to collect and manipulate as required. Tissue paper also manipulated by rabbits, digging, scenting, and running around with it.
Box with Hay/Paper	Recycled	Promotes gnawing, chewing and locomotory behaviours, such as digging
Grass Box	Recycled	Digging, chewing, scenting behaviour (particularly chin scenting in rabbits)

Table 1: Examples of shop-bought and recycled enrichment used for rabbits, guinea pigs and hamsters, and associated observations between August 2015 and March 2016

3.0 Benefits of Enrichment

The key benefits of providing animals with enrichment are promoting natural species-specific behaviours, such as, gnawing, foraging and scenting, and these benefits were observed when providing pet shop animals with enrichment. Providing animals with the opportunity to perform these behaviours can reduce the likelihood of some of the common animal wellbeing issues mentioned, such as overgrown teeth, inactivity, and behaviours related to boredom, such as aggression, gnawing of household items, or other undesirable behaviours (PDSA, 2016). Additionally, increasing activity levels as a result of having more activities to do, such as foraging, gnawing, or hanging enrichment down into the enclosure, can counteract the risk of obesity. Some of the behaviours and benefits of enrichment will be explored in more detail.

3.1 Gnawing

Gnawing and chewing are important physical and psychological behaviours for species, including rabbits, guinea pigs, hamsters and other rodents. Gnawing is significant when considering general activity budgets of rabbits, with gnawing and chewing behaviours making up 70% of a rabbit's daily activity (Baumans, 2005; McBride *et al*., 2006). A rabbit's teeth can grow 3mm a week (Meredith, 2007), guinea pig teeth can grow 2mm per week (Harris, 1984) and hamster, gerbil and mice teeth also continuously grow. This highlights the importance of providing animals with opportunities to promote gnawing, to reduce the risk of future dental health problems, including overgrowth, as identified particularly an issue in the rescue rabbit population. This is significant considering rabbit dental costs can vary between £40 and £200, and rabbits with chronic dental problems may require treatment every 4-8 weeks (RSPCA, 2012), so providing opportunities to perform these behaviours are significant to reduce these risks and associated costs.

It is also important to emphasise the importance of enrichment to promote gnawing in small rodents, such as hamsters. Hamsters are prone to behaviours, such as gnawing on cage bars, which can result in damaged teeth and can be dangerous if ingested or leaving sharp edges. This behaviour is commonly identified within pet shops, pets beyond the pet shop and the laboratory environment. The latter example has been researched by Hauzenberger *et al*. (2006) and Gebhardt-Henrich *et al*. (2005), finding that providing more enrichment opportunities to increase locomotory activity, including digging and running, reduced this common behaviour. This demonstrates that it is important to educate on species behaviours, to promote enrichment, and to not overlook smaller pets, as these similarly require a stimulating environment which promotes natural and safe behaviours.

3.2 Foraging

Foraging is a natural behaviour in rabbits, guinea pigs and small rodents and this is identified in both domesticated species and wild species, as a result of consuming high quantities of fibrous foods with low nutritional quality (Magnus, 2005; Stapleton & Hedley, 2015). When accounting for the time spent foraging, it seems illogical to provide food in a bowl in a determined place (unless for reasons, such as monitoring food intake), and more so when considering the space restrictions in captivity. In doing this, prey species have a limited physically and psychologically stimulating environment that can result in destructive behaviours, or other undesirable behaviours, that are discussed further in section 3.3 (Stapleton & Hedley, 2015). Therefore, providing opportunities to forage through activities including, scatter feeding and hiding food inside or under cardboard tubes, boxes or other objects, can increase the time spent actively searching for food and is more mentally and physically stimulating.

3.3 Social Stimulation

Rabbits, guinea pigs and chinchillas are social species, yet 52% of rabbits (PDSA, 2016), 27% of guinea pigs, and 53% of chinchillas in the UK population live alone (PDSA, 2015), which causes potential welfare concerns. Conversely, the confinement of captivity can increase the likelihood of territorial behaviours and fighting, so pairs or groups of animals are not always suitable (Myers *et al.,* 1961). This highlights the importance of educating pet owners on the compatibility of individuals and species where suitable, as well as emphasising the requirement to interact with their pets, and provide animals with a physically and mentally stimulating environment, to alleviate potential boredom or frustration and improve wellbeing. Common behaviours in rabbits, guinea pigs and hamsters that are socially isolated or in an under-stimulating environment include destructive behaviours, which can be household objects or even the animal itself, including overgrooming or furpulling (Hansen & Berthelsen, 2000; Gun & Morton, 1995). Many of these behaviours may be reduced through ensuring pets are provided with opportunities to perform natural behaviours.

3.4 Education

Displaying enrichment in the pet shop can enhance customer interest and interactions, and therefore can

increase the opportunities to educate on improving pet care. This is particularly important as the RSPCA found those who bought rabbits lost interest after 3 months on average (BBC, 2006). Educating the public on enrichment, the necessity to use enrichment, and the benefits of enrichment, such as increased activity, and playing a more active role in the care of their pet, could potentially highlight the complexity of these animals before purchasing one, or increase pet interest for those who are already pet owners. Make Mine Chocolate (2010) found in over 4,235 rabbits surveyed in rescue centres, nearly a quarter were originally purchased for a child. Furthermore, 34% of the rabbits entered a rescue centre because the child lost interest. Enhancing education for the parents may highlight the complexity of these pets, as well as providing ideas to parents to get children involved with making enrichment could also be beneficial. Additionally, promoting recycled enrichment ideas may be beneficial to increase the likelihood of using enrichment, when considering the price of keeping a pet. Finally, using enrichment in the pet shop can demonstrate how to promote a mentally and physically stimulating environment, as well as educate on common behaviour problems, such as inappropriate gnawing, which may reduce the numbers of mistreated and abandoned pets.

4.0 Training

In addition to the enrichment discussed, training through positive reinforcement can also be a useful tool to provide pets with mental stimulation, as well as training for behaviours that can improve husbandry and care. It is important to highlight that small pets, including rabbits and guinea pigs, are prey species and therefore being picked up or handled is unnatural, so these species often respond by trying to flee. Regularly pairing human presence and handling with reinforcement can create a positive human-animal relationship, through building trust over a period of time. Rabbits that are not handled regularly or have been handled in a rough way may find human interactions distressing, and considering a study by Rooney *et al*. (2014) found 61% of rabbits being considered as not calm when being handled by the owner, it demonstrates there is probably a lack of understanding regarding training for handling. Good handling is also beneficial for creating a patient that will voluntarily participate with veterinary care (Brown, 2012). For example, litter training, target training, scale training, and habituating animals to being handled around areas such as the mouth and ears, to monitor health more intricately are all benefits of training that can improve care and wellbeing.

However, training is a complex topic, and considerations must be given to educating owners on basic positive reinforcement, as opposed to punishment which can be detrimental to the human-animal relationship (Rabbit Awareness Week, 2016). Prospective pet owners should be made aware that training for basic handling can be a lengthy process, depending on the individual. Further advice should be provided on how to maximise the effectiveness of training mechanics if using tools, such as clickers or antecedents, understanding the impacts of both human and animal behaviours, and training session frequency and duration. Additionally, nutrition must be considered, with regard to understanding the reinforcer value to the animal (if food is used as a primary reinforcer), as well as being aware of how reinforcers could contribute to nutritional imbalances if not monitored. These are just a few examples of areas that must be reviewed before commencing training with any animal, but further education on this is required in the small pet population, to improve human-animal interactions and animal wellbeing.

5.0 Problems with Enrichment

Using enrichment and trialling new ideas is not without problems, and the benefits and issues vary between species and individuals. For example, some guinea pigs and rabbits soiled the cardboard boxes and required replacement boxes each day, which became unfeasible. However, this was not every individual, so owners must continue to monitor the suitability of enrichment for their pets, with regard to hygiene and practicalities. Soiled cardboard also proves an issue for recycling, as these products will lead to contamination of new products, so owners must be aware that soiled materials cannot be recycled. Another concern with enrichment includes the potential of territorial behaviour or fighting when using enrichment in a situation with more than one animal. Owners must be aware of the importance of providing various opportunities for animals to engage with enrichment, and supervise these activities to ensure the safety of pets.

5.1 Other Considerations

Providing enrichment in the pet shops also counteracts some of the negative stigma demonstrated in research, such as reducing incidences of abnormal behaviour and promoting natural and safe behaviours, such as cage biting in hamsters. Additionally, enrichment can increase positive human-animal interactions, through spending more time with animals in the pet shop. Furthermore, it is important to utilize the role of pet shops to convey information, considering the number of pets bought from pet shops, and the statistics supporting pet owners relying on information from pet shops.

It is not yet known whether improving enrichment and education in pet shops has directly reduced mistreatment and abandonment outside the pet shop, as this is something that would be difficult to quantify, especially in the timeframe of this work. However, feedback from customers indicated that enrichment in pet shops is beneficial to appreciate the intelligence of the animal, and provide more opportunities to perform natural behaviours, in ways that are safe and often inexpensive, due to using recycled materials in the home. The potential of enhancing enrichment opportunities to influence animal wellbeing in pet shops, and to help to drive education of pet owners, to appreciate and fulfil the mental and physical capabilities of their pets, has been identified in some studies. For example, Edgar & Mullan (2011) suggested that properly trained pet shop staff and veterinarians have the potential to be the best source of up-to-date and accurate information on rabbit health and welfare. Additionally, pet shops have an important role in educating owners on aspects of diet, housing and social needs.

Finally, the number of pet shops selling live animals has decreased from 73% of 3,500 pet shops in 2005 to 45% in 2014 (OneKind, 2014). It must be considered whether this has an effect on whether pet owners approach pet shops for care and welfare advice, as retail staff may be employed as opposed to animal care staff, but it is hoped that pet shops do take advantage of any opportunities to improve pet care while they are available.

Despite all the benefits of enrichment highlighted in this paper, it must be appreciated that there are various reasons that pets may be abandoned or mistreated. There are also many other concerns with regard to breeding of pets and the dietary requirements and the effects on health, such as using pellet diets rather than muesli diets and ensuring correct hay quantities are provided. Furthermore, constraints in the retail environment with regard to money, support, understanding, and time that must be acknowledged. It must also be considered that behaviour problems may require further veterinary or qualified behaviourist expertise; therefore, using enrichment and educating on enrichment may be restricted or have restricted benefits.

6.0 The Future

PDSA (2015) found a rise in the number of rabbits that play with toys on a daily basis, rising to 49% in 2015 from 38% in 2011, as well as 46% rabbits having the opportunity to play in a run and 40% in the garden. Only 24% of rabbits were given the opportunity to dig on a daily basis, which suggests there are still improvements that can be made to help keep rabbits mentally and physically stimulated. As research has suggested, pet shops evidently have an important role in advising pet owners, and it is anticipated that opportunities in pet shops are undertaken to promote good welfare. Ideas could include running workshops for children and families to continue to educate on animal care, and influence the right decision on whether to commit to a pet or not. Another example is to provide leaflets on enrichment ideas so information is accessible beyond the pet shop, and this provides another format of education. This is important considering PDSA (2016) found 19% rabbit owners did not do any research before purchasing a rabbit. However, additional data found 34% rabbit owners looked on the internet before purchasing the rabbit, and 22% took advice from a pet shop, so this information can assist improvements on educating pet owners on correct pet care, using popular formats. Additionally, rabbit owners who looked online for information mostly used, breed specific websites, charity websites and professional body websites, so this data can be used to target these sources. Creating online resources and paper leaflets for pet shops with more information regarding small pet enrichment could highlight intelligence, commitment and costs, assisting potential pet owners with their decision, or providing ideas for current pet owners to increase interest or reduce problem behaviours.

7.0 Conclusion

Although the topic of applying enrichment and training to small pets may seem mundane, it is evidently a key area of animal care and welfare that continues to require improvement. Data indicates that the lack of knowledge regarding pet intelligence and commitment, from both physical and financial perspectives, is an issue that is resulting in a high proportion of mistreatment and abandonment. Therefore, using different formats to educate pet owners on small pet enrichment, such as online resources and leaflets in pet shops, is important to improve small pet welfare. Additionally, the popularity of purchasing small pets from pet shops means that pet shops play a vital role in promoting; high welfare standards, enrichment, high quality animal behaviour and care knowledge, and have the ability to convey this information to pet owners to improve animal welfare beyond the pet shop.

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Mother Nature as a (De)Motivator Finessing Motivation through Weather and Seasonal Changes

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Minnesota Zoo

The Close Encounters department at the Minnesota Zoo facilitates a variety of programs with animal ambassadors throughout the Zoo. Additionally, we collaborate with other departments to develop and progress training initiatives with animals in their areas. The Close Encounter's collection recently moved to a new space with visual access to natural light and weather patterns which has created wonderful natural enrichment for the animals. However, we have found ourselves battling Mother Nature as the exposure to natural elements has effected the motivation of our animals due to their natural response to seasonal changes. To maintain behavior and progress our animal's training, we have implemented the use a variety of techniques. These approaches include more variable timing of feeds, variable length of sessions, diet adjustments, encouraging other biological needs as motivators, finding new types of reinforcement and daily changes in environment to influence and increase motivation. These techniques as well as a lot of trainer patience and flexibility, have helped to keep our animals on track. Conversely, other species we work with (such as our moose) thrive in the cold so their motivation spikes in the winter allowing staff to capitalize on their high motivation. This paper will discuss in detail what has worked and what hasn't worked to finesse techniques to combat weather and seasonal changes to keep animals motivated throughout the year.

The Close Encounters Department is new to the Minnesota Zoo, starting within the last five years. It has evolved and is now a valuable team of three full time trainers and a small collection of animal ambassadors that includes seven mammals. We present programs to groups of all sizes in varied settings throughout the zoo and rely heavily on our small collection of ambassadors to relay the zoo's conservation message to our guests. Our collection is small, so an animal choosing not to participate in training sessions or encounters can have a significant impact in our ability to satisfy our commitments for programming. Thus, maintaining a high level of motivation with all of our animals is incredibly important.

In January of 2016, due to a generous private donation, we were thrilled to relocate our collection to a new holding and work space. Our previous space, lovingly known as "The Cave", was in a tunnel under our main building. This previous space had multiple rooms and did not have direct access to outdoors. We had artificial lighting, controlled consistent temperatures and a recirculated air handling system. Our new facility is a big change for everyone; it's light and bright! We have windows which allow visual access to natural light cycles, weather patterns and doors/windows to let in natural scents and breezes. But, as fantastic as this sounds (and it is) we found that all of these natural cues made a major impact on our animal's motivation, specifically our native Minnesota species such as our 0.1 Striped Skunk (*Mephitis mephitis*) and 1.0 North American Beaver (*Castor canadensis*). These animals went through a stronger, more exaggerated winter torpor from what we've experienced in the past. We observed lack of motivation for food, training, and interaction as well as decreased activity level overall. Wake time was much later in the day, if not past when trainers leave for the evening. Movements were slow during their wake periods and they showed little to no interest in training. Additionally, this behavior extended further into the spring than has been observed in previous years.

This situation was new to me. I've worked with ambassador animals for 20 years, but previously in sunny San Diego. Lack of motivation during winter was not typically a problem, instead we dealt with the opposite, lack of motivation in the extreme heat. Extreme heat is different from a long cold winter in many ways but lack of motivation is ultimately the same issue. While I was part of the Behavior Management Department at the San Diego Zoo Safari Park, we hosted a daily cheetah running demonstration with our ambassador cats. Motivating cats to run top speed during the heat of the day could be a real challenge, but these animals are consistent and motivated. Being a part of the process set forth by Janet Rose Hinostroza, Animal Training Supervisor, to maintain highly motivated runners, gave me some inspiration regarding how to deal with this lack of motivation. (see Appendix A)

Our objective was to avoid relying solely on a large diet adjustment. Instead we came up with a plan that included a few other strategies, in addition to a small diet cut. Many of these techniques were trial and error.

VARIABLE TIMING OF FEEDS

We observed that as trainers we had developed a pattern. When unsuccessful in trying to motivate these animals for a session, we tended to leave large portions of their diets for the animals to forage on at the end of the work day. This was not setting ourselves up for success the next day so we decided to change criteria. We did not require participation for reinforcement and instead would offer food in small portions throughout the day. The goal of this step was to increase activity and spread intake throughout the day as would be routine in an animal participating in multiple training session and/or encounters.

SCHEDULE CHANGE

Due to other area needs, our work schedule changed to allow one trainer to come in earlier. This change in schedule added an additional hour of activity in our space and extended trainer activity in the workspace to 9.5 hours of trainer interaction, training sessions and enrichment.

VARIABLE SESSION LENGTH

In trying to increase active minutes we decided to attempt as many sessions throughout the day as possible. Even if it was just a hello and a piece of food. This allowed us to assess motivation regularly and time more in depth sessions to set ourselves up for success.

DIET ADJUSTMENTS

Diet adjustments were warranted. Due to low activity and increase in body weight both the beaver and the skunk's base diets were decreased. High value foods such as produce were maintained at the same level, while the least desirable food such as their dry diets was the portion that was decreased. If the animals did choose to participate, we wanted to have the highest value primary reinforcement that was available.

BIOLOGICAL NEEDS=GREAT MOTIVATORS

In the winter, we observed that the beaver was just as motivated by his biological need to chew as he is by food. We were able to capitalize on this highly reinforcing natural behavior by offering him browse for both crating and going "home" after a program.

NOVEL REINFORCEMENT

We researched and found higher value reinforcement such as canned chicken for our skunk and banana for the beaver. Although this worked mid-winter, it has been unnecessary since!

CHANGE OF ENVIRONMENT

Our animal holding area has several extra enclosures that were designed as holding areas for cleaning, management needs, social needs and exercise areas. During the day, we are able to shift many of the animals from their overnight homes into larger exercise areas. These daytime areas are set up with stimulating and novel enrichment to encourage exploration and increase activity. It also allows us to rehearse crating and handling.

IF A PLAN DOESN'T WORK, CHANGE IT!

Some of our initial training goals with our skunk were to allow harnessing, pick-ups, and be calm on a presentation platform while a trainer is interpreting. We decided to change up the focus of her training goals and focus on behavior that would be novel and increase activity. We have been working on moving between stations and plan to train a routine on stage. These new behaviors have helped to keep her more engaged and interested in her training sessions.

MOTHER NATURE EFFECTS US ALL IN DIFFERENT WAYS

We have also found that it's not only ambassador animals which have seasonal changes in motivation. Another focus of our position is collaborating with other departments to initiate and progress training initiatives with animals in other animal care areas. We are currently assisting with the zoo's moose (*Alces americanus*) training program.

The zoo cares for 2.4 moose whom where orphaned three years ago in northern Minnesota. The Minnesota Department of Natural Resources (DNR) placed them at the Minnesota Zoo when they were around two weeks old and needed to be bottle fed. Providing a home for these orphaned moose led to a very important working relationship as the zoo partnered with the DNR to research a cause of the recent decline of moose population in Minnesota.

The moose population in Minnesota decreased from 8860 in 2006 to only 4020 in 2016. (DelGiudice, Forest

Wildlife Populations and Research Group, 2016. See Table A1). This rapid decline has been puzzling to the MN-DNR. Studying the blood and hair samples of these orphans is of high priority to get baseline numbers to compare with the wild moose population. This means we need to have very solid blood draw behaviors, which means we need to have very motivated moose!

A few of the challenges; moose thrive in cool weather and lose all motivation in warm weather. Also, we have six moose in our collection; the exhibit is only large enough for two, so they rotate which animal(s) is on exhibit. Training sessions are conducted on exhibit limiting the times per week each moose is trained. These challenges mean, we need a very dedicated team to make sure training sessions are conducted daily to ensure each individual participates in a training session multiple times a week. Staff even continues to work with the two young adult males during rut to take advantage of any moments they may be motivated to partake in training sessions and progress behavior.

Our training plan does change seasonally to account for changes in behavior due to weather and hormones. The biggest change is timing of sessions. During the summer, 1:00pm is the latest we have found that we can conduct a training session that the moose will choose to participate. Additionally, once the males are in full rut we no longer open the training wall, which gives us access to their head and neck, during their sessions.

This collaborative effort between the moose keeper staff and Close Encounters has paid off! We've been successful in regularly acquiring both blood and hair samples with all six of our moose.

This winter has been an incredible learning opportunity for not only our animals but our staff as well. Our animals are coming back strong and I feel confident that this spring we will pick up where we left off last fall. I believe the most important part of all this trial and error has been the knowledge we gained. As we learn to work with the seasonal changes, we hope that applying these practices and improving our ability with these techniques will result in effectively being able to work with our animals during seasonal changes.

Appendix A

Providing the desired product while setting our animals up for success can be challenging and certainly requires planning. The Cheetah Run is the most extreme example: asking a cheetah to run 100 meters in 5-6 seconds in over 100 degree heat (not to mention the aversive stimuli in that environment - crowds, lions and giant balloon taking off and landing "on top of them"). Cheetah Run happens at 3:30 PM every day for marketing reasons. Unfortunately the 3-4 PM hour is also the hottest time of day at the Safari Park. There are many prongs to the strategy of stacking the odds in our favor for a cat to choose to participate, as well as keeping the event behaviorally and physically enriching without causing heat stress or over-exertion. Above all, I find the principals of animal choice and the ABC's of training to be the best guide for the success of the animals and the team.

1) Choice/Consequence: The "running game" is a fun game. Utilizing their favorite toy and a guaranteed magnitude reinforcement for participating.

2) Choice: The cats run on a rotating schedule. They are not asked to perform the behavior daily and have variable running opportunities. They are set up for success with their individual run schedule fitting their individual personality, age, and overall health, 1-3 times per week depending on the individual. AKA cats that seem to desire and/or require the "running game" do get to play it more often then cats that prefer to lounge.

3) Antecedent: The cat that is slated to run has had a minimal diet the day before the run and has access to an A/C room for a 24 hour period to avoid heat stress and fatigue. The A/C room does have furniture and a window with a view.

4) Antecedent: The running cat will have a breathe rate taken prior to event to insure they are not compromised from the heat prior to running.

5) Choice and Antecedent: The cat that is "the runner" for the day will have great care taken to insure they are comfortable: locked into the A/C room if they are panting prior to the event, asked to participate by marking up for equipping (they can choose not to participate from the first step as Trainers do not approach

animal - animal must choose to approach Trainer), travel crate will be kept in a cool place, traveling to the site in an A/C vehicle and receiving a bonus diet (making up for the decreased diet the day before) AND their preferred bonus protein for participating in the run. Some cheetahs prefer lean beef chunks, some prefer rabbits and all receive a rib bone or femur bone in conjunction with the run behavior/event.

6) Behavior and Consequence: The running cat will receive a one time opportunity to perform the behavior - running a 100 meter A to B - if they do not choose to perform, the consequence is they will be taken away from the area without getting to play the game or receive their "bonus" reinforcement items and a different cat will be given that opportunity.

7) Consequence: Post run Trainers will ensure the cat remains as comfortable and content as possible by: taking a breathe rate post each run and responding as needed for the cat: rest, shade, A/C vehicle/room, frozen blood, cold water mixed with food to hydrate and bring down the cats body temperature.

Table A1
2017 Aerial Moose Survey
Glenn D. DelGiudice, Forest Wildlife Populations and Research Group MNDNR

Table 1. Estimated moose abundance, 90% confidence intervals, calf:cow ratios, percent calves in the population, percent cows with twins, and bull:cow ratios estimated from aerial surveys in northeastern Minnesota, 2005–2017.

Survey	Estimate	90% Confidence Interval	Calf: Cow	% Calves	% Cows w/ twins	Bull: Cow
2005	8,160	6,090 – 11,410	0.52	19	9	1.04
2006	8,840	6,790 – 11,910	0.34	13	5	1.09
2007	6,860	5,320 – 9,100	0.29	13	3	0.89
2008	7,890	6,080 – 10,600	0.36	17	2	0.77
2009	7,840	6,270 – 10,040	0.32	14	2	0.94
2010	5,700	4,540 – 7,350	0.28	13	3	0.83
2011	4,900	3,870 – 6,380	0.24	13	1	0.64
2012	4,230	3,250 – 5,710	0.36	15	6	1.08
2013	2,760	2,160 – 3,650	0.33	13	3	1.23
2014	4,350	3,220 – 6,210	0.44	15	3	1.24
2015	3,450	2,610 – 4,770	0.29	13	3	0.99
2016	4,020	3,230 – 5,180	0.42	17	5	1.03
2017	3,710	3,010 – 4,710	0.36	15	4	0.91

Polar Bear Conservation Training at the Oregon Zoo

Sara Morgan, Amy Cutting, Nicole Nicassio, Amy Hash, Robert Draughon, Jen DeGroot

Oregon Zoo

In 2008, the polar bear (Ursus maritimus) was classified as a threatened species under the U.S. Endangered Species Act. Given the impending climate change crisis facing wild bears, zoos are striving to not just manage their collection, but also to use cooperative voluntary training, or conservation training, to help better understand the impact of a warming Arctic on their wild counterparts. After a successful voluntary blood draw from 1.1 polar bears at the Oregon Zoo in 2012, a researcher from the United States Geological Survey (USGS) asked us to participate in a nutritional ecology project. This development of a new technique for studying wild bears required adjusting the bears' diets and obtaining frequent voluntary blood and hair samples to determine how certain isotopes in a bear's diet are incorporated into their tissues. This successful collaboration led to an additional project with the USGS Alaska Science Center. That relationship developed into an ongoing energetics research collaboration with the University of California, Santa Cruz (UCSC) and USGS. Thus far, this research has included training a 0.1 polar bear to wear a satellite collar, walk on a treadmill, and swim inside a metabolic chamber. We are excited about improving animal welfare through cognitive challenges and at the same time gaining a better understanding of the effects of declining Arctic sea ice on bear behavior. Looking forward, the Oregon Zoo will continue to support conservation research as the organization develops and builds a new polar bear habit for the next generation of polar bears.

In 2008, the polar bear (*Ursus maritimus*) was classified as a threatened species under the U.S. Endangered Species Act. Recent documented declines in polar bear body condition, survival, and population size have been linked to a reduction of sea ice (Stirling & Derocher 2012). Little is known about polar bear behaviors while on the sea ice to help identify what is causing these declines. Zoo bears provide unique access and direct observation of polar bear behavior that is largely unavailable for wild bears. Given the impending climate change crisis, zoos are now doing more than just caring for their individual bears. The Oregon Zoo is helping scientists better understand the impact of a warming Arctic on wild polar bears by utilizing a new kind of training to assist in conservation research. The Oregon Zoo calls this "conservation training".

The Oregon Zoo began to focus on conservation training with 1.1 sibling polar bears, Conrad and Tasul, who participated in multiple research projects until their deaths at the age of 31 in 2016. In 2011, Conrad and Tasul were the first polar bears to allow for voluntary blood draws in a zoo setting (DeGroot et al. 2014). After hearing about the success with blood draw training, Dr. Karyn Rode from United States Geological Survey (USGS) asked the Oregon Zoo to participate in a nutritional ecology project that required obtaining frequent blood and hair samples from both bears. Understanding how polar bear diets have changed over the decades can help shed light on some of the challenges wild bears are facing as Arctic sea ice is closely related to polar bear prey availability. Researchers have over 40 years of banked blood and hair samples from two different free-ranging polar bear populations in Alaska but did not have any samples from a polar bear in a controlled environment. Two bears from Alaska Zoo and two from the Oregon Zoo were included in the study. For 10 weeks, Conrad and Tasul were fed a terrestrial diet (polar bear chow, freshwater fish, beef suet, fruits, and vegetables), followed by 10 weeks on a high-fat marine diet (capelin, salmon, herring, and salmon oil) while frequent blood and hair samples were collected. The two bears housed at the Oregon Zoo had been trained to allow blood draws and hair sampling, offering more frequent sampling than the Alaska bears that also participated in the study. To collect the sample, staff trained Conrad and Tasul via the following steps: enter a crate, roll over on their side, put their foot through an access panel, allow shaving with clippers to collect a hair sample, tolerate a tourniquet and hot pack in place, and allow for a blood draw on the dorsal metatarsal vein (Fig. 1). The two Alaska zoo polar bears were sedated at the beginning and end of the trials which allowed for collection of fat biopsies in ad-

Figure 1

dition to hair and blood samples. The data collected helped to establish the rate at which carbon and nitrogen isotopes turn over in polar bear tissues, and helped to improve the use of stable isotopes to estimate diets of free-ranging polar bears (Rode et al., 2016). Testing the banked samples from wild bears in years with differing ice conditions will now allow scientists to accurately estimate the diets and long term diet trends of these bears in varying ice conditions.

The isotope study will help scientists to quantify what polar bears were eating when they cannot be directly observed, but the question remains: "What are they doing?". Declines in Arctic sea ice as a result of climate change are expected to increase movement rates across much of polar bear ranges and reduce the availability of prey. Biologist Anthony Pagano from the USGS Alaska Science Center proposed a second research collaboration intended to help remotely identify polar bear behavior using tri-axial accelerometer devices. The project required Tasul to voluntarily wear a research collar mounted with an accelerometer while being videotaped. Staff at the Oregon Zoo trained Tasul to the collar by feeding her through a head cage with a high value reinforcer (capelin), desensitizing her to the feeling of a collar by draping carwash around her neck, and eventually attaching the research collar (Fig. 2). In July of 2013, Pagano spent 5 days on site collecting data. Tasul wore the collar for ten, one hour sessions while Pangano videotaped her movements. She did no more than two sessions a day. While wearing the collar, staff asked Tasul to perform certain behaviors such as sit, down, roll over onto side, walk from point A to point B, stand up, and swim (Fig. 3). Tasul was one of three captive female polar bears to participate in the study. Alaska zoo immobilized their female to place a research collar on her, then had it remotely discharge to fall off when the study was concluded. Staff from San Diego Zoo collaborated with Oregon Zoo trainers to modify the training technique and was also able to train their bear to accept the collar voluntarily. Since then, researchers have placed numerous collars containing video cameras as well as accelerometers on five wild polar bears on the sea ice of the Beaufort Sea to supplement the captive polar bear data. The paired data helped to calibrate collar signals with actual behaviors and reliably distinguish the three most common polar bear behaviors in the wild: resting, walking, and swimming (Pagano et al. 2017). This data will be used in combination with GPS location data from collars to begin to quantify the energetic demands on polar bears. Quantifying energetic demands will support efforts to understand the effects of forecasted declines in Arctic sea ice on polar bear behaviors and the implications for polar bear reproductive success and survival. It was notable that accelerometers mounted on zoo polar bears provided data more closely correlated with signals from wild polar bears than collars placed on captive brown bears.

Figure 2

Figure 3

After the completion of the collar study, the next phase of the project was to measure the oxygen consumption of captive adult female polar bears while resting, walking on a motorized treadmill, and swimming in a metabolic flume. By linking the previously acquired accelerometer data with measurements of oxygen consumption (metabolic rate) researchers identify specific animal behaviors and their associated energetic costs. In 2016, Oregon Zoo installed a horse treadmill modified by USGS, UCSC and Washington State University to accommodate a polar bear's size and strength. The airtight chamber was surrounded by acrylic panels on all sides with a feeding box at one end, a sliding door on the other, and controls on the side that could adjust speed (Fig 4). Staff gave both Tasul and Conrad free access to the treadmill, which protruded out from the keeper access doors and allowed for bear observation of the keeper workspace. Tasul was offered her morning diet in the treadmill and was allowed to enter and exit at will. Tasul was commonly hand fed and asked to participate in simple training sessions while inside the treadmill. This created a positive association. The next step was to turn the treadmill on while Tasul was outside of the unit and the door was closed. This allowed

keepers to introduce the sliding door as well as desensitize Tasul to the noise of the treadmill at various speeds. Next, Tasul was asked to participate in training sessions in the treadmill while a second person stood by controls. Finally the treadmill was turned on at the slowest setting while staff used a continuous schedule of reinforcement. During this time, Tasul was required to remain with the feeder as the reinforcement was given. Reinforcement was removed if Tasul began to back out of the treadmill. The planned step was to then shut the door while Tasul was inside. Unfortunately, Tasul had a strong fear response to the door closing. This set-back was too strong to work through in the time allowed for the study, and instead, staff used carwash, a material often used as bedding, as a door to the treadmill. Later, keeper staff began to approximate for longer periods of time in the treadmill and longer time between reinforcement delivery and speed while the carwash material was in place. During a 3 day period in July 2016, Tasul ran through multiple trials on the treadmill at different speeds for different lengths of time while wearing the accelerometer collar (Fig 5). The treadmill has subsequently travelled to the San Diego Zoo, where staff has collected resting data from their adult female polar bear and are currently working toward training her to walk on it. Staff at the two facilities continue to work closely and share training ideas.

Figure 4

Figure 5

The next step in quantifying the energetic demands of polar bears is to understand the energetic costs of swimming. Although known to be strong swimmers, polar bears are thought to be energetically inefficient in water. As a semi-aquatic mammal, the costs of swimming are likely to be considerably greater than walking and these data are greatly needed to understand the energetic demands imposed by swimming. Pagano then asked the Oregon Zoo to train Tasul to swim in a metabolic chamber while wearing an accelerometer collar to record oxygen consumption. After 4 months of design and 3 months of construction, the Oregon Zoo repurposed the exhibit's wave machine room into a metabolic chamber equipped with an Endless Pool™ motor to allow for adjustable current (Fig 6). Pagano plans to use previously obtained behavior signature library to identify wild polar bear behaviors and link these behaviors with their associated energetic cost based on the oxygen consumption data collected from captive polar bears. Unfortunately, Tasul passed away in November of 2016 before completing her training. This information is needed to understand the potential implications of long-distance swimming due to declines in sea ice.

Figure 6

To further advance the use of conservation training and scientific collaboration, the Oregon Zoo is currently in the design phase of a new habitat, Polar Passage, set to open in 2020. This new habitat is forecasted to house a new generation of polar bears and incorporate design aspects, such as an improved metabolic swim flume, needed to continue conservation training and science. It is important to note the advances that have come from conservation training could not have come from studies of animals in the wild alone. The hypotheses put forth by biologists to explain polar bear population decline can only be tested by the use of controlled populations, consistency, and repetition that zoos can provide.

The benefits of research and conservation training with zoo bears are numerous and varied. It has helped to improve understanding of bears in the wild and aid management decisions while reducing the number of wild bears that need to be captured for research purposes. Animal care staff, meanwhile, has the opportunity to improve individual animal welfare through unique cognitive challenges and novel enrichment for zoo bears. Conservation training generates public and media interest. It promotes the zoo's role in supporting conservation in the wild. Finally, conservation training has allowed the opportunity for greater connectivity of zoo staff with field researchers to help better quantify the impacts of declining sea ice on wild bears.

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Co-Rearing of Animal Ambassadors for Effective Programs and Increased Animal Welfare

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San Diego Zoo

The relationship between a trainer and an animal ambassador is one of the most important factors of a successful ambassador program. This relationship allows a lot of the operant conditioning we rely on to take place. Because of this, animal ambassadors have traditionally been hand raised by their human care takers. While zoological institutions have dedicated much research and expertise to developing and refining formula composition and hand rearing techniques, animal care professionals have begun to question if welfare could be improved by allowing the ambassadors to be raised by their mother. In recent years ambassador programs have been a focal topic of many professional zoological organizations including the AZA. Specifically the Ambassador Animal Scientific Advisory Group seeks to improve welfare within the ambassador community and explore ways education and research can contribute to animal handling and management standards. One of the ways San Diego Zoo has addressed this movement and proven their dedication to advancing the highest level of care is through the co-rearing of ambassador animals alongside their mothers. Linnaeus two-toed sloth, African serval, and Rock hyrax are all species that have been raised while living with their mothers and receiving daily visits from animal care staff. This process has shown that positive relationships, powerful educational messages and successful animal programs can result while neonates receive the balanced nutrition of their mother's milk and the socialization of conspecifics. The results have been confident animal ambassadors willing to work with a large and diverse group of trainers and handlers.

Historically zoos have simply been seen as public attractions with a focus on entertainment. The goal of the modern zoo, however, is shifting away from this image and moving towards the recognition of being a center for conservation, where the purpose of the collection is to conserve and research endangered animals (Carr and Cohen, 2011; West & Dixie, 2007). With this focus, zoological organizations are emerging as leaders in the fields of conservation and education. One factor that must be addressed, if zoos are to succeed in these roles, is the engagement and participation of their audience and guests. Zoos will not be successful in leading a conservation battle if there is no one there to listen and to follow.

The general public, especially youth, lack a personal and physical connection with nature and the environment (Louv, 2005; Miller, 2005). Over half of the world's population live in urban areas (Louv, 2011) and what "wild" places are left are often protected and their use restricted (Louv, 2005). People live in a very technologically-based environment, and outdoor activities are being replaced by indoor ones such as video games and television programs (Weilbacher, 2009). Zoos are working to close this gap and provide a safe and comfortable place for people to learn about the world around them. In addition to focused programs, such as summer camps and internships, zoos more often provide passive learning opportunities to our guests. A growing body of literature focuses on the emerging role of zoos as informal educators; helping to influence the public's opinions on the importance of biodiversity and conservation through informal learning opportunities such as exhibit graphics, shows, and interpretations (e.g. Clayton, Fraser, & Saunders, 2009; Packer & Ballantyne, 2010; Swanagan, 2000). While zoos are promoting that education is a primary reason to visit, many people still choose to visit zoos for recreation and entertainment with education being an afterthought. Zoos embrace the ability to turn this recreational outing into an educational one but it needs to remain fun and engaging for the guest in order for this objective to be met.

One of the most popular ways that zoos are demonstrating their dedication to conservation initiatives is through animal ambassador programs. Studies have shown that people will pay closer attention and retain more of a conservation message if it is presented in an engaging manner with an animal present (Anderson, Kelling, Pressley-Keough, Bloomsmith, & Maple, 2003), a situation not easily supported outside of a zoo program. The reality is

that many people living in urban areas, especially in developed countries, may never have the opportunity to interact with wildlife outside of a zoo or through a zoo based outreach program. Through the opportunity to make a personal connection to the animals housed in zoos, guests may feel more inclined to care about the protection of these animals in nature. Conservation education must recognize that forming personal relationships and perceptions is important (Jenkins, 2003). Social norms and perceived accessibility to conservation action can have a greater impact on actual behavioral change than simply educating the public with facts and figures (Monroe, 2003). This emotional connection to conservation is enforced when guests are able to share the experience with a group, such as occurs with a zoo presentation.

Zoos are using this information in many ways, from keeper talks and interpretation at the front of animal habitats, to scripted shows featuring elaborate choreography and training. Animals in zoos are filling an important role as ambassadors for their species. The American Association of Zoos and Aquariums defines an animal ambassador as "an animal whose role includes handling and/or training by staff or volunteers for interaction with the public and in support of institutional education and conservation goals." This can vary from things like giraffe that are trained to participate in public feeds, to free flight birds soaring above guest's heads, to a cheetah racing a lure, to a wolf on a stage! To a zoo guest though the terms animal ambassador and program or education animal are probably synonymous.

There are several characteristics that are present in good ambassador animals. A good ambassador must enjoy what they are doing, be engaged in the training session, and be handled in a safe and professional manner. Animal trainers, and zoological organizations as a whole, need to be able to communicate to the guests with actions, in addition to words, that the animal ambassadors are not pets or props but that they are active participants in the education and conservation mission of the facility. Working in such close contact, it is evident that the relationship between a trainer and an animal ambassador is one of the most important factors of a successful ambassador program. This relationship allows a lot of the operant conditioning trainers rely on, to take place. A new trainer is not going to walk up to an unfamiliar animal and expect to have their cooperation in a program! Relationships are built on trust and an understanding of positive reinforcement.

It makes sense that to build trust the earliest connection possible with the animal is sought. Historically, this meant that animal ambassadors were pulled from their mothers at a very early age and raised by their human care takers. On the other hand, it is quite common for ambassador animals to find their home in educational programs through rehabilitation facilities that have deemed them non releasable. Typically this is seen with smaller animals and, for obvious reasons, almost always with native species, yet animal care staff is able to build relationships and communicate effectively with these "wild" animals through the tools of operant conditioning.

As educators, animal care staff rely on a diverse and intriguing collection of ambassadors to gain the interest of their guests and help to effectively convey the many important conservation messages delivered daily. Non-native species are often incorporated into programs to help with specific messages and to hold the guests' attention. Zoos need to look to their collections, and to the zoological community as a whole, to fill this role and a set of best practices is needed to determine whether an animal will become an ambassador.

Animal welfare is a trending topic in our daily lives; from pets, to food, to the animals cared for in zoos, concern for animal welfare is all around us. It is the responsibility of animal caregivers to ensure that animals living under human care receive the best possible opportunities to thrive. Specifically ambassador animals have become a hot topic in the zoological community; many of them live behind the scenes and out of the elaborate exhibits zoos construct for guest viewing. The understanding and knowledge of animals' natural behavior and needs by trainers and handlers are vitally important to the development of enriching experiences both in public view and out. Do ambassador animals actually enjoy their role? How can this be measured? Are there better practices and policies to give ambassador animals more opportunities or allow them to fill additional roles in conservation? The AZA has recognized these questions and many more and has dedicated committee time and resources to this topic. Specifically, while zoological institutions have dedicated much research and expertise to developing and refining formula composition and hand rearing techniques (e.g. Bell, et al., 2007; Petzinger, et al., 2014; Shibata, et al, 2017), many animal care professionals have questioned if welfare could be improved by allowing animal ambassadors to be raised by their mother.

Case Study 1: Two-Toed Sloth (*Choloepus didactylus*)

In the summer of 2009 the San Diego Zoo's Children Zoo (CZ) received a breeding pair of Linnaeus Two-toed sloths, later named Consuela and Nico, who in August of 2011 produced their first offspring. The CZ keepers, lead, and manager met to discuss the possibility of raising the baby as an animal ambassador. Rather than pulling the baby to be raised in the zoo's nursery it was decided that the baby would be parent reared until the age of 6 months when this

species of sloth would normally leave its mother. An agreement was made with the primary sloth keeper to opportunistically try to desensitize both the dam, Consuela, and the baby to being touched and eventually the baby to being handled during routine enclosure servicing. The baby was sexed as a female and named Jacinta Bella De Valentia. Unfortunately, without the oversight of the training team, desensitization of the sloths did not take place as planned. When Jacinta was separated from her mother, it became evident to the trainers that she was not an ideal candidate for use as an animal ambassador. Jacinta has since become a successful breeder for the two-toed sloth species survival plan.

After this initial failed attempt at training a mother reared sloth ambassador, San Diego Zoo staff decided to regroup, gather more information, and better set themselves up for success. Through both research and observations, it was known that this species of sloth only nurses for roughly 27 days for female young and only 15 days for male young. The young will also start eating solids when they are only days old; Jacinta had been seen reaching into Consuela's mouth and removing food to eat herself. Conversations with a reputable private breeder cautioned against hand raising a sloth due to stool quality issues. Armed with this information, CZ trainers decided to again attempt to co-rear the next baby sloth born. This time the approach would be slightly different as the trainers would not rely on the regular keeper staff to help with the desensitization but rather develop training plans and goals themselves.

On 24 April 2013 a second female sloth, who was named Xena, was born to the same parents. At this time the sloths were being housed off exhibit and being cared for by another of the zoo's training teams, Back Stage Pass (BSP). Two primary CZ keepers, their lead, and animal care supervisor worked closely with two BSP trainers to begin interactions with Xena when she was just over a week old. Due to the desensitization training and relationship building that had been started almost 2 years prior, Xena's mother, Consuela was a much calmer animal at this point. When cleaning the enclosure trainers would touch Xena as much as possible and try and hand feed her as much as she would take. At one month of age it was recorded that Xena had begun reaching towards her trainer's hand in order to pull the food closer so she could eat it. Trainers also worked to hand feed Consuela as much as possible, and to have her remain calm while they interacted with her baby.

Consuela soon allowed trainers to take Xena from her during sessions. One trainer would feed Consuela and lead her into a position for the second trainer to have better access to Xena. The second trainer then would try and coax the baby onto a stuffed animal that was held up. These sessions started out quick, only lasting a couple of minutes, and trainers soon realized that Xena preferred to bypass the stuffed animal and instead climb directly onto them. During these initial sessions Xena would vocalize when she was moved away from her mother but Consuela appeared to only react if the baby pulled too hard on her hair while moving away. Training sessions began to slowly extend both in length of time and distance of separation between mom and baby. The vocalizations slowly diminished over time and when Xena was approximately one and a half months old trainers started taking her for car rides. During these sessions Xena was held by a trainer and if she appeared nervous the trainer would slowly message her ear pinnae; this really calmed her down. As Xena became more accustomed to the movement of the vehicle and confident away from her mother, trainers introduced her to a vari-kennel type crate. In order for Xena to still feel secure in the crate, a stuffed animal was added so that she could hold onto this during travel. With trainers now being able to comfortably transport Xena she began to participate in short animal programs and made her debut as an ambassador for her species.

In the later part of August, Xena began daily visits to the CZ lasting about an hour and progressing from there. Unfortunately, these longer periods of separation from her mother caused a re-occurrence in vocalizations, prompting trainers to carry Xena with them as they carried out other duties. Interestingly, at this same time trainers started to notice that when they arrived at the natal enclosure in the morning, Consuela often would stretch out, appearing to offer the trainers better access to Xena. Low and behold almost on cue with mom, Xena started to climb right on to her trainers extended hand without the need for any coaxing at all. Starting in mid-September Xena was separated from mom every day, spending most days at the CZ, but would be returned to the natal enclosure each evening. Finally on 10 October 2013 Xena moved to the CZ full time.

After her move to the CZ, Xena continued to interact with the BSP trainers and participated two or three times a week in their daily shows. CZ trainers soon noted that Xena demonstrated increased aggressive behaviors after she had visited the BSP area. Differences in handling were ruled out as the cause and it was theorized that since Xena was not as familiar with the enclosures at BSP (she was moved a couple of times) that she was not getting the needed amount of sleep during the day. Luckily, Consuela and Nico produced a third offspring who was raised in the same manner as Xena and filled her role at BSP, leaving Xena as a full time ambassador in the CZ. Xena now participates in a host of programs and often is still found holding on to her trainers. In addition, Xena is trained to hang from a presentation tree and will move across a presentation rope.

In early 2016 the SSP made a breeding recommendation for one of San Diego Zoo's female sloths to breed with a male housed in Canada. San Diego Zoo approached the SSP and explained Xena's history, requesting that the male instead be brought to Xena. The SSP agreed, excited that being an ambassador no longer excluded an animal from its breeding programs. In September of 2016 the male sloth arrived. They have been living together but are rarely seen interacting and as of now Xena has shown no signs of pregnancy. Although no signs of breeding activity have been seen, trainers are still hopeful since Consuela and Nico were never observed breeding either.

Case Study 2: African Serval (*Leptailurus serval*).

African servals are a common felid seen in ambassador programs and one where a positive relationship is imperative for the safety of the handler as well as zoo guests. In an effort to create and maintain this relationship it has been the common practice for zoological facilities to bottle feed and human rear the kittens from birth to program. San Diego Zoo has a long history of working with ambassador servals and trainers can attest to the positive human-animal bond demonstrated by the usual greeting of purring and head butts from the serval to the trainer. We are able to shape behaviors through direct physical contact and we are able to provide a sense of confidence and security to the cats through the trainer-animal relationship.

1.1 serval kittens were born at the San Diego Zoo 13 May 2015 and it was decided that they would be raised with the intent of becoming animal ambassadors. Rather than moving the kittens to the zoo's nursery, they would remain with their mother and a team of CZ staff comprised of two keepers, the lead keeper, animal care supervisor, and San Diego Zoo's Behavioral Husbandry Manager began the process of co-rearing. Animal trainers from another of the zoo's program animal units had successfully co-reared a single serval kitten from the same mother the previous year. Armed with the knowledge of this first experience, CZ keepers worked closely with the animal care staff charged with the day to day care of the kittens and their mother to develop a rearing plan. Since there were two kittens in this litter, the plan needed to take into account that the kittens had each other to take comfort from and to play with.

From the very beginning both kittens had their own personalities and attitudes. Visits began when the kittens were just 12 days old and at first they only lasted for a couple minutes, just enough time for trainers to pick them up and sit for a minute. Upon arrival to the serval enclosure their mother would be asked to move to another holding area and reinforced with a high priority food item for doing so. If the kitten's mother refused to leave her kittens and shift to the adjacent holding pen trainers attempted to return later in the day and if this was not possible or the mother still refused then no interaction occurred that day with the kittens. Under our veterinary team's guidance an abundance of caution was taken and the kittens were treated as if they were under quarantine. Due to the fact that another unrelated serval and various other carnivore species were housed in the CZ, visits required either a clean uniform or a dedicated pair of overalls to be worn by the CZ staff along with dedicated boots and a thorough cleansing of all exposed skin.

As the kittens grew CZ trainers began to initiate play with a variety of cat toys and were able to hold their interest for longer periods of time, up to about 45min. The kittens began to show an interest in their mother's diet at approximately 1.5 months of age. They were allotted their own meat ration which was reserved for use during training sessions to further help build a positive relationship with the kittens. This did not stop their mother from saving some of her diet for them, especially the mice, and so her diet too was altered to allow for the kittens to consume a portion of it. A crate was introduced once the kittens were showing an interest in solid food and they were directed to move in and out of the crate freely while chasing a toy or being baited with a piece of meat.

Formal training began when the kittens were approximately 2 months old and started with the basic objective of having the kittens approach the trainers and initiate interactions themselves. Trainers then began conditioning a clicker bridge and desensitizing the kittens to a collar. Collars were brought in and investigated and trainers moved to draping them over the kittens' necks. About this same time, a week following the kittens' first vaccinations, twice daily visits began allowing a substantial increase in training time. At this point the kittens were spending more time outside in the enclosure than they were inside the bedrooms. Keepers were forced to compete with the kittens wanting to play and interact with their environment versus engaging in a training session. Daily sessions were tailored to the kittens' locations and temperaments at the time; flexibility and patience were key.

Two weeks following the second vaccination, on 28 July, the quarantine procedures were lifted. This also meant that the kittens could now be taken outside of their enclosure. As the kittens were now quite comfortable in the crate, desensitization progressed to fully removing them from the enclosure. The Behavioural Husbandry Manager's office was approximately 50 yards away from the serval enclosure and so this was used as a training area to develop confidence in unfamiliar areas and to fortify the crate behavior. Trainers were now having difficulty engaging the female kitten in training sessions, she would willingly take food but was not interested in the "training game". At the time of the third vaccinations the decision was made that CZ trainers would focus primarily on the male, now named

Cheka, and that the female kitten, now named M'Kali, would not continue ambassador training.

At three months of age, trainers began desensitizing Cheka to the noise and vibrations of the CZ vehicle, eventually leading to him being transported across the zoo for daily daycare with the CZ team. Visits began at the beginning of September and lasted approximately 4 hours at first and quickly increased to him spending full days at the CZ, returning to his mother and sister overnight. Behavior of all three servals was closely monitored throughout this time and no significant changes were noted until after his first overnight stay at the CZ on 6 October. Following this stay he seemed to be highly motivated to enter the crate at the start of any training session and unwilling to perform any other trained behaviors until he was crated and at the CZ. On 21 October Cheka was moved permanently to the CZ and formally filled his role as an ambassador for his species.

Working with Cheka is very different than working with a human raised cat. Despite being handled from such a young age he still moved away from human contact (he later was conditioned to a "touch" cue which was generalized all over his body) and sees his trainers more as food dispensers than companions. Bridge conditioning and a strong training foundation are vital since the trainer-animal relationship is built around clear communication and not an emotional attachment. Cheka is however, an extremely confident cat who is keyed in to his surroundings and adapts to new situations easily. He has never paused coming out of his crate in a new area, he doesn't need any reassurances, and new experiences such as video cameras, crowds or props do not faze him at all. On the flip side, because he is so tuned into his environment and does not rely on trainers for confidence or direction he has a habit of zoning into one particular environmental variable and it can be very difficult to regain his attention.

Despite the challenge of keeping him engaged, working with him has been a great experience for all his trainers. He is offered choice and control over his participation in a session by asking him to jump up on a stump and sit while the collar is put on. Should he not want to come out he can refuse to go to the station, although he never has. Since he is much less forgiving than a hand raised cat, working with him has helped to improve his trainers' bridge timing and has caused his trainers to brainstorm new ways to train common behaviors. He is now approaching 2 years old and has settled into his role as an ambassador for conservation and for his species. He holds behaviors better than most hand raised cats in the CZ and relies on a terminal bridge for communication. He now will move about to different pieces of furniture when asked, sit, target and come when asked, and walks well on the leash. He is learning to jump on cue, will climb a tree on cue and is learning an open mouth. He will voluntarily enter a squeeze crate and allow himself to be positioned for vaccinations without any protest.

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A Tale of a Tail:
Choice and Control with a Male Lion

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Providing choice and control is a basic building block to providing optimal welfare for animals in captivity. Giving animals the option to participate in training but also decide on their own terms when they are comfortable being touched or moving the behavior to the next step can instill a level of confidence that will grow exponentially. Our male lion, Themba, once labeled as aggressive and uncooperative, spent the early years of his life being tricked into shifting and pan fed with little keeper interaction. By giving him control over his environment and choice to be in holding or on exhibit at night, keepers started to slowly gain his trust. As this trust grew, keepers were able to get him on a scale and work as a team for more advanced behaviors such as injections and tail treatment. Once again keepers employed choice and control to train Themba to give his tail as opposed to keepers hooking his tail out. When given this option, the behavior not only solidified but also gave him the confidence to trust veterinarians and to begin to approach strangers during tours, two things that keepers have not seen in the last 4 years. His tail tip, which had been broken open and bled intermittently when he would whip it around, was treated daily and finally healed after years of not being able to treat it and he now thrives on keeper interaction. By employing basic behavior modification techniques, keepers were able to greatly improve Themba's welfare.

Introduction:

A male African lion (*Panthera leo*), Themba, at Milwaukee County Zoo presented with a cracked tail tip with hyperkeratotic skin that would intermittently break open and bleed when he hit his tail on the walls, doors or windows. This wound developed over time but keepers were never able to treat it due to the absence of a solid operant conditioning program stemming from a lack of keeper/animal relationship and a wary, fearful lion. By giving Themba control over his environment and choice to be in holding or on exhibit at night, keepers started to slowly gain his trust. As this trust grew, keepers were able to get him on a scale and work as a team for more advanced behaviors such as injections and tail treatment. This paper will detail the steps taken to gain Themba's trust, train him to give his tail to keepers and greatly improve his welfare by employing basic behavior modification techniques.

Themba's History:

Themba was born in July of 2003 at Henry Vilas Zoo in Madison, WI. He was a single cub and therefore received undivided attention from his mom, affectionately earning him the nickname 'Chunky' which has stuck with him. He was transferred to Milwaukee County Zoo in March 2005 at 19 months old to be paired with a new female lion once building renovations were completed for Big Cat Country. While in quarantine and after his initial move to the building, Themba did not like to shift into holding for cleaning in front of keepers and would bang at doors or refuse to move. He was quickly labeled as aggressive and uncooperative and therefore spent the early years of his life being tricked into shifting and pan fed with little keeper interaction. At the time, operant conditioning programs were just being developed for many areas at the Zoo. A cat that did not seem to thrive on keeper interaction was not necessarily a candidate for this technique which was new to the experienced keepers working the area. That combined with frequent separations from the lioness in order to either control breeding or when cubs were present, resulted in Themba not shifting off exhibit regularly. Therefore, he was routinely baited into a small holding area where he spent the majority of his time alone. He generally did not trust most keepers and would chase after them as they walked away, whipping his tail and hitting it on the walls and doors. He would also do this on exhibit sometimes as a play behavior with guests and staff, and sometimes as an aggressive behavior, but both ways he would hit his tail on the glass. First mentions of his tail bleeding were in 2008. Although at the time it was uncertain where the blood was coming from, by 2010 keepers were able to see the wound on his tail, which was partially healed at times. By 2011, after a change in staffing due

to retirement, keepers began to focus more on working with Themba and started an operant conditioning program. By this time, his trust of keepers was challenged further by the need to dart him for vaccines and work ups for ingrown nails. He also refused to enter the one holding stall that was the only area keepers could work with him due to the size of the mesh and the large gaps in the other stalls. Without a way to directly reinforce Themba, progress was slow on earning his trust and his training program was not consistent.

Building Trust:

Historically most of the animals in Big Cat Country were locked off both their indoor and outdoor exhibits at night. This meant the animals were spending 16 hours off exhibit in small, sterile holding areas. This was done to ensure that exhibits were ready to be cleaned right away in the morning without having to shift animals off exhibit. It also meant that the animals had no choice where they could spend their time and they knew the only way they would get food that day was to come off exhibit. As a result, many animals, including Themba, did not want to shift readily or keepers developed games in order to get them to shift. Keepers wanted to try giving the animals more choice and control over where they spent their time. The hope was that this practice would help to improve shifting and gain trust with some of the harder to manage cats like Themba and our female snow leopard. Permission was given to leave access to indoor and outdoor exhibits of most of the cats overnight, giving them not only more space, but more choices about how and where to spend their time. In addition, once the last of the lion cubs was sent to her new zoo, in early 2013, Themba was allowed to stay with the female lion overnight for the first time which greatly increased his confidence. Over time he began to shift better, though there were definitely days when the exhibit did not get cleaned. Keepers were no longer tricking him to get him to move or hiding in the shadows to trap him when he came through a door. He began to eat in front of keepers and keepers were able to start hand feeding him, something he thrives on to this day. However, he was still quite untrusting of the keepers that were there when the vets darted him with a vaccine. Keepers were now able to intermittently train him, get him to shift nearly 75% of the time asked, and get him to enter the large holding for weights and even a nail trim once or twice. (Figure 1) The goal was to be able to vaccinate voluntarily and someday get a good look at that tail wound when it broke open again. Another change in staffing and renewed commitment to training helped keepers reach this goal.

Figure 1: Themba being weighed

Letting Themba Lead:

In late 2014 keepers started to focus more on building the operant conditioning program with Themba. With the addition of two new keepers who had never been involved in any negative experience with him, this program grew by leaps and bounds in a very short time period. Keepers were able to consistently get him on the scale and shift off exhibit even in the mornings. He also now solicited attention from keepers as he continued to be allowed to make choice when possible. If he chose not to shift, he was not pushed instead just given the option. He began to approach the training wall at the outdoor exhibit for food in the morning and for tours which was not something he would have done in the past. Vaccination training was progressing nicely. His tail would still break open on occasion but had greatly improved since he was getting more opportunities to be where he wanted. He was less aggressive with keepers also, even as they were walking away while he was in holding. However, a new challenge presented itself with the addition of 2 three year old female lions to the area in early 2016. This pair was to be rotated between

the exhibits and holding areas with the lions and the hyenas, which also are housed in that area. There are no plans to introduce Themba to them until his current companion, Sanura, passes. The addition of these young, cycling females resulted in the increase of tail whipping and banging on doors. On an almost daily basis, there would be blood on the walls and the exhibit glass. At this point, with the wound re-opening and healing for so long, veterinary staff did not think Themba had much feeling at the tip of his tail due to the buildup of the scar tissue. The concern was for infection and other issues that come with an open wound, such as maggots. Staff felt that it was important to find a way to treat his tail on a regular basis without the need for work ups or trapping him into a squeeze which he already did not like. Initially, the keepers new to the area worked exclusively on lining Themba up with his side parallel to the mesh, first with his primary trainer then adding another trainer (Figure 2). Once this was established, the other keeper that Themab did not trust was able to be added and finally relief keepers were added. We found that Themba would allow keepers he trusted less to feed him but preferred certain keepers at his tail. For each step in the tail behavior, Themba required keepers to follow this hierarchy until he trusted that none of the keepers were going to do something he did not approve of. Eventually, he would let all three primary keepers in Big Cat Country work his tail in any combination. Initially, keepers attempted to hook his tail out under the mesh or use a tool to bring it closer to the mesh so it could be grabbed but this did not work consistently. He seemed to not want keepers to touch his tail some days. After working on a blood draw behavior with one of the jaguars, one of the keepers realized that like the jaguar, Themba wanted to have control of when he let us grab his tail and not be surprised by it. Keepers then started reinforcing any movement of his tail and put that behavior on a cue. As long as Themba moved his tail close to the mesh, he did not mind if keepers grab it and hold it for an extended period of time. The next challenge was how to get an eight year old wound nearly the size of a quarter to heal completely while it was continually being re-abrated. (Figure 3)

Figure 2: Themba lining up

Figure 3: Themba's tail before any treatment January 4, 2016

Healing the tail:

In May of 2016, keepers were consistently able to line Themba up and most times get a hold of his tail. It was decided to make attempts to apply Silver Sulfadiazine 1% cream (SSD) once a day or as often as he allowed. At this time he still was not allowing keepers to grab his tail daily and some days the correct combination of keepers were not working in the area for him to allow it in his developing hierarchy. The SSD cream did help the wound some but it was not healing it, just helping it from becoming infected or getting worse. After a month of plain SSD use, keepers were now consistently able to get his tail after changing him to a voluntarily "give tail" cue. (Figure 4) Veterinary staff added insulin to the SSD cream as a topical treatment at the end of June. Progress in healing was apparent after a week, but after two months of treatment the middle of the tail was still not healing over. This area was the only place where there was consistent movement from the pulsating a vertebrate extruding at the tip of his tail. At the end of August, treatment with Collasate began. Collasate is a wound healing product consisting of medical hydrolysate of type 1 collagen for the management of postoperative and trauma sites. Up until this time, keepers did not have to hold on to Themba's tail for more than the 5-10 seconds to apply the SSD cream. With the Collasate, keepers had to hold the tail

long enough for the liquid to dry and set at least some. Ideally this would be from 2-5 minutes or as long as Themba would allow. Again, keepers let him decide what was going to work for him, but the majority of the time he allowed keepers to hold on to his tail as long as there was food to reinforce him. He also allowed keepers to blow on his tail while relaxing his hierarchy as now any of the three primary keepers could work the tail position in any combination. Within 2 weeks the tail was almost completely healed (Figure 5). There was still a small spot in the middle that took some time to heal but keepers began to give the Collasate more time to set and only did treatments every two to three days. By the end of November, the tail was 95% healed (Figure 6) and it was completely healed by the first week of January 2017 (Figure 7). The tail tip is still dry and most likely will never grow hair back but the keepers try to treat it once a week with SSD cream to keeper it from breaking open again.

Figure 4: Themba's tail after SSD and insulin treatments for ~1 month, July 2016

Figure 5: Themba's tail partially healed after ~1month of Collasate treatments, October 10th, 2016

Figure 6: Themba's tail nearly healed, November 20, 2016

Figure 7: Themba's tail completely healed January 7th, 2017

Discussion:

By giving options for choice and control, keepers were able to greatly improve the welfare of a naturally fearful lion. His confidence greatly improved and his aggression was greatly reduced. Not only did his quality of life improve, keepers time spent on shifting and management was greatly reduced. Visitor perception was improved as now there is not a visible wound on Themba. Providing animals with control over aspects of their environment, even if it is choosing when to come on and off exhibit, provide an important element for improving their welfare. Although it may seem counterintuitive to allow an animal to choose when they shift, by doing this with Themba keepers found that he shifted much more reliably knowing he would get more options. Themba not only gained confidence in shifting, he now usually shifts before his companion, Sanura, and will even go back on exhibit to encourage her to shift. He also initiates keeper interaction, lining up on his own and sometimes flipping his tail out before a cue is given. In addition, this laid the framework for the trust bank that was built up by the primary trainers and was passed to other trainers with whom he had a very negative trust bank. Not only were keepers able to treat Themba's tail wound to completion, during the treatment his primary trainer was able to inject him voluntarily for his yearly vaccination with a veterinarian present (Figure 8)and will attempt to hand inject him for his upcoming exam. Themba also has chronic overgrown nails which keepers hope to train for regular nail trims. Keepers hope that this tale of a lion's tail will en-

courage others to reject labels, provide more choice and control, and work as a team to improve the welfare of the most challenging animals in their care.

Acknowledgements:

I would like to thanks my fellow keepers Katie Kuhn, Big Cat Country Area Supervisor (Themba's primary trainer and his biggest fan) and Sheri Guay, Big Cat Country Keeper (Themba's secondary keeper and his second biggest fan). Without their dedication and attention given, Themba may have eventually lost the tip of his tail. Their strong relationship with Themba was invaluable as they added me back in as a trainer for Themba. We, the keeper staff in Big Cat Country, would also like to thank all the veterinary staff for working with us on solving the problem of Themba's tail and the countless hours they spent helping us ensure the highest level of care and welfare for our animals.

Challenges of Target Training a Blue-Tongued Skink for Guest Presentations at the National Aquarium

Kristen Frizzell

National Aquarium

There are always going to be challenges and obstacles when training animals. It's important to keep in mind there are numerous ways to train a behavior. Often times when we are faced with difficulties, we find ourselves cutting back on training or putting the behavior on the back burner only to never go back to it. However, persistence in training can lead to a more successful outcome.

A blue-tongued skink at the National Aquarium provided such a challenge when learning a tongue- to -target behavior. In order to achieve the desired behavior, the trainer broke down each obstacle and restructured the training plan. With determination, consistency, and practice the skink learned to touch his tongue to a target. This behavior was then incorporated into animal presentations to engage and connect our guests. The National Aquarium has developed presentations specifically for teaching guests that all animals have cognition and can learn. In turn, we hope this inspires our guests to better care for animals, formulate positive relationships with them, and initiate conservation efforts. These trained behaviors are important for not only cognitive stimulation but may be useful to help bridge the gap between training and conservation.

At the National Aquarium, we train our animals various behaviors for husbandry, enrichment, and guest presentations. As trainers, we envision desired behaviors and create training plans only to have our animals show us a completely different training plan. We frequently become frustrated when hitting roadblocks while working through behaviors. The communication barrier between animal and trainer can lead to behaviors being placed "on the back burner" for revision, only to be forgotten. It is important to keep in mind that there are multiple ways to teach every behavior. Just because one way isn't producing the desired results, it does not mean you should quit. Rather you should go back, reassess the plan, the tools, the environment, and even the trainers to restructure your plan and set the animal up for success.

Challenges when training lead to the most creative thinking; creativity you never knew existed inside of you. The Animal Programs department, tasked with the husbandry of education animals and daily guest encounters of the ambassador animals, decided to include a blue-tongued skink in the education animal collection. Our ultimate goal is to share the National Aquarium's mission to inspire conservation of the world's aquatic treasures with our guests. One of the ways we help support that mission is through training demonstrations during our animal encounters. As with any new behavior, the trainer ran into some challenges when teaching a blue-tongued skink a tongue-to-target behavior for guest presentations and had to reassess many aspects of his training plan.

Our blue-tongued skink was originally housed in our Australia department, and was not accustomed to being handled. When staff attempted to pick him up he backed away, had labored breathing, opened his mouth, and even bit. Using gradual desensitization and counter conditioning, staff were able to improve his comfort with handling and have him participate in occasional programs. Still, he showed little interest in human interaction and staff would mainly find him under his enrichment or newspaper. Due to this behavior, we believed further interaction, including target training, may be aversive so we tended to overlook him when creating training plans.

Part of our commitment to providing exemplary animal care includes ensuring an exceptional level of welfare for our animals. We find it is important to provide enrichment to all our reptiles. Burghardt (2013) compiled various enrichment studies to support the inclusion of reptiles as animals that benefit from enrichment. Enrichment is a great way to stimulate animals and re-create a habitat that mimics natural environments and elicits natural behaviors. One of the ways we provide enrichment to our animals is through supervised exercise activities. We give the animals the opportunity to explore areas outside of their enclosure and provide them different things to interact with during their

exercise period. One day our blue-tongued skink was offered a ping pong ball to interact with during his exercise period and it stimulated him to chase after and try to bite it. This led to the inspiration of the implementation of a training plan for a tongue-to-target behavior. Martin (2015) suggests that allowing animals to interact with their environment and teaching them species appropriate behaviors, ultimately creating more positive outcomes, is one of the highest forms of enrichment that we can provide our animals. By training a tongue-to-target behavior, we're encouraging species appropriate behavior to locate food with their tongues (due to their Jacobson organ).

Our first step was to determine his favorite food item through food preference trials (Image 1); orange was consistently his first choice. It was then extracted from his diet and used only during training sessions. Our second

Image 1

step was to begin desensitization analysis. Clicker sounds were evaluated first, then feeding location. Since our blue-tongued skink was affected by the slightest change in variables, the trainer wanted to see if the sound would be too loud causing him to display more negative behaviors such as flinching, opening his mouth, backing away, etc. When exposed to the sound of the clicker, he did not react so desensitization to the clicker was deemed unnecessary. He previously had only two places in which he ate food; his enclosure and his travel bin. Since training would take place in the hallway, our third step was to evaluate the new location and make sure he was comfortable with eating there. Upon presentation of food, his response time was acceptable so desensitization was deemed unnecessary for new feeding locations as well.

Another factor to consider was that our blue-tongued skink has sensitive gums and recurrent gingivitis. The trainer decided to cushion our usual metal feeding tongs with airline tubing (Image 2). This airline tubing would be soft enough that, if he bit it, it shouldn't aggravate his gums and potentially become aversive.

Image 2

Once the trainer had the appropriate food, bridge, training location, and feeding method determined, she began clicker training. She was able to build an association between the behavior of sticking out his tongue and receiving orange by bridging and reinforcing him every time he stuck out his tongue during training sessions. Once the frequency of sticking out his tongue was high enough, she was ready to add in a target. Initially, it was a blue "lollypop" target: a blue ball on the end of a pole (Image 3). The trainer now presented the target and started shaping the tongue flicks to the desired behavior of facing the target, moving towards it, and touching it with his tongue. The target was first presented in close proximity to the blue-tongued skink to help set him up for success, but as he would get closer to the target, he would start trying to bite it. This was very challenging because the criteria of the behavior excluded biting. With no successful progress in decreasing the biting behavior, the decision was made to switch targets. A flatter target was chosen because the blue-balled target was similar to the ping pong ball and biting was inadvertently self-reinforcing. A flat target also provided more surface area which made it more difficult to bite.

Image 3

The new target yielded success in his behavior. The target was placed close to his face, and as soon as he touched it with his tongue, the behavior was bridged with the clicker and reinforced with orange. Since the behavior was progressing nicely, the trainer began increasing

Image 4

the distance between our blue-tongued skink and the target. Upon moving the target, it was observed that he was not moving forward in order to touch the target. Another evaluation of the behavior was done and it was determined that the blue-tongued skink may not be moving because there was a large gap in between the bridge and the reinforcement and the bridge was not strong enough. The trainer was placing the orange behind her back, and after the tongue touched the target it took a long time for the orange to reach him. That large time gap gave him ample time to do other things, and ultimately, he was being reinforced for those other behaviors rather than the target behavior that was our goal. The trainer then decided to hold the reinforcement closer, keeping it behind the target, allowing reinforcement to be more immediate when the correct behavior was observed. With this change, progress resumed. The target was gradually moved to a greater distance. The blue-tongued skink would approach the target in order to touch it with his tongue.

In conclusion, we learned that there is more than one way to train a behavior. Road blocks are going to happen. We can't possibly predict everything that our animals are going to do but we can plan our next moves and evaluate our actions and our animal's reactions. Critical and creative thinking are essential to designing where to go next in a training program. Martin (2015) expressed that the right tool for the job is crucial to the success of your behaviors, and that every animal should be assessed as an individual; what may work for one, may not work for another.

Not every behavior may be completed in the timeframe you envisioned, but that's ok. What is important, is that you take your time, take a deep breath, and keep trying new solutions. There will likely be moments of frustration, but do not be afraid to look at your own behavior differently or ask other trainers for help. Each of the animals we are caring for is an ambassador for their species.

Although teaching our blue-tongued skink a tongue-to-target behavior is great mental stimulation, it also increased his social behavior. His tongue flicking has increased since his training which indicates a more curious behavior and comfort level during programs. Not only does it increase his comfort level, but guests are able to see this natural behavior and experience the unique coloration of their tongues first hand.

Including training programs during our encounters serves a great purpose: to help represent species and inspire conservation. It is important not to limit conservation messaging to guests understanding of complex environmental issues, but to incorporate a sense of appreciation and stewardship for the animals and the environment (Povey & Rios, 2002). And how do we do that? We engage guests and get them involved. We teach them something they didn't know was possible. Something that is instinctive and natural for our animals every single day. The reason inspirational experiences are absent in a lot of programming is because they are often based on a tedious list of facts and lack any sort of entertainment value (Martin, 2015). Guests look for entertainment and look for an animal "doing" something. Povey & Rios (2002) showed that guests who encountered active animals in an interpretive presentation were more likely to stay longer, ask questions, and leave feeling positive about the animals overall welfare than guests who saw that same animal in its exhibit enclosure. Anderson et al. (2003) found similar results when they looked at passive exhibit viewing, interpretation-only sessions, public animal training sessions, and public animal training with interpretation. Their results concluded that training sessions with or without interpretation had an overall positive effect on zoo experiences, training perceptions and animal welfare than just passively viewing an exhibit or an interpretation-only program (2003).

When an animal is active, guests are more likely to be engaged and curious. If guests are more engaged, they are more likely to learn about the animal. When learning about an animal, it strengthens the connection they have with it, ultimately inspiring them to want to take action to help protect the species. When partaking in conservation, we work together towards a common goal of protecting the animals and ensuring a future for them. No matter how big or how small the conservation effort, every little bit makes a difference. All our presentations at the National Aquarium have a strong conversation message, and our teams continually assess the impact that our encounter programs have on our guests. By using training demonstrations to teach guests about various animals' cognitive abilities, we can bridge the gap between programming and conservation.

Connecting the 'Spots' Between Visitors and Cheetahs with Companion Dogs

Kaylee Maple

Columbus Zoo and Aquarium

With the recent recommendation for uplisting of the African cheetah to "endangered", it is clear that educating zoo guests about cheetahs is crucial to increasing awareness and encouraging conservation-based actions (Durant et al., 2016). Pairing cheetahs with domestic dogs can be seen at multiple zoos across the country. The Columbus Zoo and Aquarium uses the cheetah and dog friendship to give the cheetahs confidence while connecting people with wildlife as an Animal Programs ambassador. We saw the potential for our dogs to be more than a companion animal to our cheetahs; the dogs convey a message for cheetah conservation with the way groups, like the Cheetah Conservation Fund, are utilizing dogs to save cheetahs in Africa. In our Heart of Africa region our dogs show off their speed chasing the lure, just like their cheetahs, in our rotational Watering Hole exhibit. After winning the crowd over, the dogs are trained to bring the lure to the presenter and follow them to the public pathway where they station in front of the cheetah habitat to interact with guests. There, volunteers are waiting with cheetah bracelets and pins in exchange for donations to conservation. Allowing the dogs to connect with guests increased donations compared to previous years. With guests in Heart of Africa more frequently asking "when will the dogs be out?" we are confident we are forging a deeper connection and understanding between zoo visitors and cheetah conservation.

Introduction

When you walk into the Heart of Africa region at the Columbus Zoo and Aquarium, you feel like you have just landed in the middle of the African savanna. With no visible barriers, it appears as if lions are on the savanna with a variety of hoofstock and bird species. As you walk along the boardwalk watching all the animals in the savanna, you come up to a watering hole. Just like a natural watering hole, you never know what you are going to see. You may see some black backed jackals searching for food, spotted hyenas playing in the water, warthogs wallowing in the mud, or a cheetah showing off their speed. If you are one of the lucky ones, you may even see the most popular animals in the Heart of Africa, the Labrador retriever.

Before the Heart of Africa Watering Hole: The Cheetah and Dog Program

The Columbus Zoo's Animal Programs Department has four yellow labs (Carlisle, Coby, Cash, and Cullen) that have helped raised 16 cheetahs over the last 7 years. The labs are companion animals for the cheetahs; traveling with them to programs to help give the cheetahs confidence and to serve as a message for cheetah conservation. One of the reasons cheetah numbers are declining is due to human-wildlife conflict. Conservation groups, like the Cheetah Conservation Fund, found a helpful solution to the problem by providing farmers with guard dogs, commonly Anatolian Shepherds. The dogs are placed amongst the farmer's livestock and they act as a deterrent to any predators that may come onto the farmers' land looking for a meal. This in turn saves the cheetahs' lives because the farmers no longer have to worry about terminating predators that come onto their land. The Columbus Zoo cheetahs and dogs allow us to tell that great conservation success story and, in turn, raise awareness for cheetah conservation. These ambassador cheetahs are the same ones that show off their speed in our Watering Hole during our daily cheetah runs. With the opening of the Heart of Africa region and our new cheetah runs, we explored other roles the dogs would serve for our cheetahs.

The Start of Cheetah Runs

The Watering Hole at the Heart of Africa is uniquely designed. The exhibit itself is located below the public boardwalk, giving guests the ability to look down into the watering hole while also viewing animals located beyond in

the savanna. Almost all of the species (cheetahs, jackals, hyenas, warthogs, aardvarks, and hornbills) that utilize the watering hole are housed in the same building. However, this building is located on the opposite side of the boardwalk, behind the cheetah habitat. With the building located on the opposite side of the public pathway, there is an intricate, long shiftway for these animals to access the exhibit. There is one pathway from the building that splits allowing two different entrance points into exhibit, and both of these routes are actually below the public pathways. The longest part of the shiftway leads to a tower where the cheetahs enter the exhibit to start their lure run. The running course is shaped like a "U" with the cheetahs starting and ending at the same location. Despite ending at the entry point, the cheetahs actually will exit the watering hole at the other shift door located under the boardwalk which allows a second animal to be ready to shift into the exhibit.

The new watering hole and shiftway proved to be a big change for our cheetahs. These areas are utilized by multiple species and the 200-foot-long shiftway is less than ideal for quickly shifting cheetahs to the exhibit. The dogs were a great training tool to help the cheetahs build their confidence in the shiftway and the watering hole. The dogs would confidently travel through the shiftway and explore the exhibit with their cheetahs following along behind them. Guests loved getting to see the dogs and cheetahs interacting in the watering hole for "play time." This typically was the only way for zoo guests to see the labs and cheetahs together.

One day we stumbled onto how engaging and exciting it was for the guests to see the dogs run the same lure course as the cheetahs. There was an employee who was new to running the lure machine and he wanted to have a practice run without a cheetah. We thought a dog was the perfect substitute to test the system. Coby came sprinting out of the tower and tore across the watering hole in pursuit of the lure ball. The guests loved it, the trainers loved it, and Coby loved it! The dogs started making regular appearances in our cheetah runs and were commonly asked about.

The dogs quickly became a staple in our cheetah runs without much training or help from us. At the beginning of our show, we discuss the importance of a watering hole and how it makes a good hunting ground for predators. After the cheetah shows off their burst of speed, we describe the adaptations that make the cheetah the fastest land mammal in the world. The lure is being restrung while we talk about the human wildlife conflict cheetahs are facing in Africa with farmers. We highlight the success of the Cheetah Conservation Fund and the use of dogs. When the lab makes their appearance, their job as a companion animal is explained and guests are informed on how they can also help by supporting conservation.

The dogs were clearly getting the attention of the guests, but both dogs had a different way of ending their run. Coby would immediately take the lure ball to the shiftway under the boardwalk where his favorite treats were waiting. His quick exit from the watering hole left the speaker to end their dialogue without an animal for guests to look at. Cash on the other hand was more charismatic. Once he would catch the lure, he typically would run straight to the water for a swim. The swimming was cute, however, it was distracting from the conservation message and Cash would not shift inside until he was done having fun.

As a speaker in the Watering Hole, you can feel a little disconnected from your audience because the audience can stretch across 500 feet above you. I wanted a way to really connect with them to deliver a strong conservation message at the end of our cheetah runs. What is a better way to draw your audience in than to use the animal that they are connecting to? I wanted to find a way to utilize the dogs to help deliver a strong ending to our cheetah runs in a way that would bring the audience's attention to the conservation message.

Training the Behavior

As I brainstormed what I wanted the behavior to look like, I aimed to find a good balance between Coby and Cash's behaviors. I wanted the dog to stay out long enough the audience was still able to connect with the animal, but I also wanted them to shift out of the watering hole when cued to do so. I determined I wanted the dog to catch the lure and then run to the speaker with the lure ball in the middle of the exhibit. The dog would sit next to the speaker, drawing the audience's attention there, before the dog and speaker exited the watering hole together to greet guests on the boardwalk.

Coby was the first dog to learn the new behavior. In order to train the behavior while still having cheetah run shows, I separated myself as the trainer, allowing the speaker to focus on the show. I waited at the end of the run course with a bowl of dog treats to trade him for dropping the lure. Once he was done eating, he got to pick the lure up and run under the boardwalk. Each repetition I would position myself closer to the speaker with the bowl until I was standing next to the speaker. In order to remove the extra person, I became the trainer and speaker, keeping a bowl stashed behind a rock. Once Coby was successful, I faded out the bowl and just reinforced him from my hand for dropping the lure and staying with me. I shaped the behavior so that Coby would sit next to me and face the audience while I gave my closing dialogue. At the end of the show, Coby and I would exit the watering hole together.

When this part of the behavior was complete, I wanted to take it another step further. I knew from doing programs off zoo grounds, that people loved getting to meet the dogs. As part of my closing dialogue, I would encourage guests to visit our volunteers at the cheetah exhibit to donate to conservation in exchange for pins and bracelets. I realized the dogs would be a huge draw to the cheetah exhibit which, in turn, may encourage guests to donate.

To achieve this, a "station" behavior was incorporated near the cheetah habitat. Station training began in the building with a small wooden box. I started by reinforcing Coby for sitting on the box while standing in front of it. I was able to quickly add in the cue "station" with a finger point to the box while I was standing in front of it. With quick approximations, I was able to stand farther away from the box while giving the cue and Coby would run over to sit on it. Soon after this was trained in the building we headed up to the box on the boardwalk. There was a box positioned behind a barrier that Coby would sit on. This one was much larger but Coby had no problems translating the behavior over to the new location. Since we were in front of the public, people were quickly introduced as part of the behavior and Coby was intermittently reinforced for remaining sitting on the box while people would come up to pet him. Coby's presence on the boardwalk definitely got the attention of the guests. We found that when the dogs ran in the show and were present on the boardwalk afterwards, people were more likely to go over to the cheetah habitat and donate to conservation.

Cash was the second dog to learn the behavior and one that greatly benefited from it. Cash's favorite thing to do was to run around the watering hole with the lure (sometimes tangling the string around trees and rocks) and then going straight into the water to play. This was enjoyable for the guests, but again it took the attention away from the speaker's dialogue and the conservation message. He also had a very weak cue to shift inside. We could call in a high pitch, excited voice and wave a full bowl of food around but he would not come inside until he was ready. One day, Cash claimed the watering hole for twenty minutes before finally shifting in.

While the same training plan was used with Cash, the lure ball itself held a much higher value for him. It was important to his success that he be able to take the lure ball under the boardwalk as he exited the watering hole. If the speaker had picked up the lure ball, Cash would be so focused on it he would not shift inside and the behavior of him going to the speaker likely would have broken down over time. Once the dialogue was finished, Cash could pick up the lure and run under the boardwalk with the speaker. He would then drop the lure for high value reinforcers and then continue up to the boardwalk to greet guests. This new behavior allowed Cash to become a successful part of the cheetah and dog run, just as Coby had done.

The New Cheetah/Dog Run

What started as a way to show off the astounding speed of the cheetah, developed into an amazing story about their conservation. The role of the dog grew from being a companion while doing ambassador work, to being a key component in touching hearts and teaching the minds of our zoo guests in our new exhibit. There is no doubt that giving the dogs a role in our cheetah runs has helped connect the story of cheetah conservation groups to our guests. The experience of seeing our dogs involved in the run opened the door for the story, but having the opportunity to meet the dogs on the boardwalk is what really drove the message home. Our donations to conservation grew with the presence of the dogs on the boardwalk greeting guests, but most importantly, guests were walking away with a deeper connection to cheetahs and conservation.

Citations

Durant et al. (2016). *The global decline of cheetah Acinonyx jubatus and what it means for conservation*. Proceedings of the National Academy of Sciences, 114 (3), 528-533.

The Effect of a Novel Enrichment Device on the Territories, Social Structure and Behavior of African Grey Parrots (*Psittacus Erithacus*)

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This study investigated the effect of an enrichment device (a metal tray containing bark chips) on the behavior, territories, and social organization of a group of 47 African grey parrots (Psittacus erithacus) in a naturalistic aviary. This study's aims were to: (1) Describe behaviors performed by the parrots at ground-level; (2) Ascertain whether parrots have ground-level territories; (3) Analyse the effect of provision of an enrichment device on individual parrots and on the group; and (4) Assess whether enrichment provision causes disruption to social structure and parrot territories. Baseline observations of parrot locations were used to map territories. The enrichment devise was then placed on the ground in different territories and behaviours and locations of parrots were recorded. It was found that: (1) Nearly half of the parrots performed digging, locomotory, mulch-chewing, foraging, and social behaviors at ground-level; (2) one individual performed more inactive behavior (sleeping, standing, autogrooming) during baseline than when enrichment was present, P=0.046, two-tailed randomization test; (3) The enrichment device appeared to increase foraging behavior of three individuals but not of the group; and (4) the social network and territories were generally stable over time, but enrichment provision had a local effect on the size of two territories. Social dynamics and territoriality limit the welfare benefits of a single enrichment item, so providing enrichment items within each territory is recommended to prevent social distress and increase resource access.

INTRODUCTION

Many parrots are maintained in captivity. There were 5.35 million pet exotic birds in the Netherlands in 1991 (Roe, cited in Rodríguez-López, 2016) and approximately 11 million in the United States in 2007 (AVMA, cited in Hoppes and Gray, 2010). African grey parrots (*Psittacus erithacus*) are one of the most popular species of companion parrots (Levine, 2003) and over one thousand African greys are housed in zoos (WAZA, 2016). Welfare of captive birds should be promoted by preventing distress and allowing birds to perform natural behaviour (FAWC, 2009). This requires knowledge of African grey behaviour.

African greys are social and roost in groups of over one thousand individuals (Martin et al., 2014). Social isolation may cause neurotic behaviour of captive African greys (e.g., Lumeij and Westerhof, 1988). Studies of other parrot species indicate the importance of social-housing. Amazons perform less stereotypic behaviour when housed near conspecifics (Garner et al., 2006) and are less fearful than individually-caged birds (Meehan et al., 2003). Budgerigars are also less fearful when socially-housed (Nicol and Pope, 1993). African greys are more likely to develop stereotypies if they are removed from their parents at an early age (Schmid et al., 2006) and it is likely that socially housing African greys improves their welfare.

Unfortunately, abnormal behaviours are prevalent among companion parrots (Gaskins and Bergman, 2011). Nearly 40% of companion African greys perform abnormal feather-picking behaviour during their lifetimes (Jayson et al., 2014). African greys also perform self-mutilation (Andre and Delverdier, 1999) and compulsive polydipsia (Lumeij and Westerhof, 1988). Abnormal behaviours such as these can negatively impact physical health and are signs of poor welfare (Broom, 1991).

To reduce abnormal behaviour, environmental enrichment can be added to enclosures (Young, 2003, p.51). Environmental enrichment is a 'process in which changes to structures and husbandry practices are made with the goal of increasing behavioural choices to animals and drawing out their species appropriate behaviours and abilities, thus enhancing animal welfare.' (BHAG, cited in Young, 2003). Environmental enrichment reduced self-preening in conures with a history of feather-picking (van Hoek and King, 1997) and fearfulness in amazons (Meehan and Mench, 2002). Puzzle-feeder enrichment devices increased African grey foraging times (van Zeeland et al., 2013). Parrot enrichment is a new field and more studies are needed, especially of the effects of enrichment on group-housed parrots (Rodrí-

guez-López, 2016).

Socially-housed animals may exhibit dominance and territoriality which can limit access to resources and restrict space-use (e.g. Miura, 1984). The social dynamics of group-housed animals can limit access to enrichment devices (Paquette and Prescott, 1988). The dominance-hierarchy within an African grey aviary affected access to food (Woppel, 2003), and the social structures of parrot groups could affect resource-access within aviaries.

There is a growing demand for sanctuaries to shelter groups of parrots as companion animals are relinquished (Hoppes and Gray, 2010). A challenge of managing parrot sanctuaries and zoo collections is to balance physical health and behavioural requirements of social groups. Social network analysis reveals relationships between individuals within groups and can be used to illustrate the effect of environmental changes on social stability. Understanding the role of an individual within a group, and understanding the effect of environmental changes, such as enrichment provision, on social group stability can allow caretakers to predict triggers of aggression and social distress and to predict which individuals will have access to resources. (Beisner and McCowan, 2015; Makagon et al., 2012). An aim of this study is to use social network analysis (e.g., Hobson et al., 2014) and behaviour sampling to evaluate whether access to an enrichment device is limited by territorial behaviour at the ground-level of an aviary. Social dynamics could decrease the welfare-benefits of enrichment provision within an aviary. This research into the interplay between social dynamics and enrichment will inform sanctuary management decisions.

HYPOTHESES

1. African greys parrots perform varied and complex foraging, affiliative and agonistic behaviours.
2. African greys have territories.
3. An enrichment device will change behaviour of individuals and affect behaviour at the group level.
4. Providing an enrichment device will alter territories and results in social disruption.

METHODS

Study Subjects

The study subjects were 47 adult African grey parrots (*Psittacus erithacus*) of both Congo (*erithacus*) and Timneh (*timneh*) subspecies at Project Perry, the Central Virginia Parrot Sanctuary in Louisa, Virginia, USA. A single Senegal parrot (*Poicephalus senegalus*) was also housed in the African grey aviary, but data from this individual was excluded during analysis. One African grey Congo parrot named Max was also excluded due to his abnormal behavioural fixation on interacting with human observers. All subjects were adults over one year of age. Many subjects had been given gendered names by previous owners, and mating behaviour had been observed by sanctuary staff, so it was assumed that the sample included males and females. Personal interviews with the sanctuary director indicated that there was no concrete evidence that gendered names corresponded with sexes. DNA sexing had not been performed, so it was not possible to determine sexes of individuals. Two individuals, ChuckChuck and Chloe, performed receptive mating postures during data collection, and can be assumed to be female. Approximately half of the subjects were captive-bred and half were wild-caught. Subjects had been examined by an avian veterinarian and determined to be healthy prior to the study. Subjects had been relinquished to the Project Perry from various sources, but all were full-time sanctuary residents and had lived in the aviary for at least six months prior to the study.

Diet

Subjects were fed a diet consisting of a variety of fruits, vegetables, shelled nuts, sprinkled with cinnamon and palm oil. A glass tray (Pyrex®) containing food and a tray containing water were placed on top of each of the two feeding tables at 9:00 every morning and remained so that all subjects had free access to food and water throughout the day.

Housing

Subjects were group-housed in a naturalistic aviary with indoor and outdoor areas. The total aviary floor area was 1097.28m^2 (3600f^2), 9.14m (30f) wide x 36.58m (120f) long, with a curved roof which was 4.57m (15f) tall at its highest point. The indoor portion was the focus of this study and was 9.14m (30f) wide x 15.24m (50f) deep. The aviary contained wooden perches, plants, rocks, cinder blocks, a water pump spigot, plants, natural dirt floor, unevenly distributed pine bark mulch chip substrate (added to the aviary 7 years prior to this study), and two food tables. The indoor portion was climate-controlled and constantly remained approximately 21°C (70°F).

Figure 1. Interior view of the indoor section of the African grey aviary at Project Perry parrot sanctuary showing doorways in which an observer sat to record observations of the ground area.

Figure 2. Exterior view of the large African grey aviary at Project Perry, the Central Virginia Parrot Sanctuary (BirdTricks, 2012).

Experimental Enrichment Device

The enrichment device was a stainless steel metal tray (60 x 60cm, 15cm high) containing pine bark chip mulch (Garden Pro® by Harvest™ Pine Bark Nuggets).

Figure 3. African grey parrots interacting with an experimental enrichment device (a stainless steel tray containing pine bark mulch chips).

Figure 4. An African grey parrot interacting with an experimental enrichment device (a metal tray containing bark mulch) within a large aviary at Project Perry the Central Virginia Parrot Sanctuary.

PROCEDURES

Preliminary Observations

Twenty hours of preliminary observations were conducted during July and August 2015 and March 2016. This allowed for reliable identification of individual birds based on characteristics including unique feather patterns, face shapes, leg-rings, small scars or abnormal wing positions from previous injuries. This period also allowed the parrots to habituate to the observer entering the aviary.

Ground-level Focus

The ground-level of the aviary was selected as the focus of this study. Preliminary observations revealed that many behaviours were performed by parrots at ground-level. These behaviours included social interactions and substrate manipulations. Interviews with staff indicated that enrichment items were placed on the aviary floor and that a potentially disruptive management procedure, rotating substrate with a rake so earthworms could process food and waste, occurred at this level. Starting from the bottom of an enclosure is recommended when conducting enrichment research (Young, 2003, pp. 124-126) and identifying markings were most clearly visible when individuals were on the ground.

Behavioural Ethograms

Ethograms were created using behavioural observations collected during the preliminary period. An extant but limited African grey parrot ethogram was translated from German to English to inform the creation of ethograms (Woppel, 2003).

Behaviour	**Description**
Chase	Low intensity agonistic behaviour, walking toward a conspecific, displacing a conspecific
Flee	Low intensity agonistic behaviour, walking away from a conspecific, retreating, being displaced by an approaching conspecific
Stick-bang	Lifting a large stick with beak and repeatedly and rapidly lowering head and body to strike the stick against the ground, in what appears to be a display of strength
Head-bob	Repeatedly moving head in an up-down motion
Neck-Fluff	Piloerection of the feathers on the neck while lowering head, usually while approaching another individual during an agonistic displacement interaction
Bow	Piloerection of feathers on body, raising both wings above back so that shoulders are close together, extending tips of wings, and leaning toward ground with body, usually rhythmically and in unison with a conspecific
Allogroom♥	Affiliative behaviour in which the beak is used to groom and preen the feathers of another individual
Kiss♥	Affiliative behaviour in which two individuals lock beaks and may regurgitate

Mate♥	Affiliative behaviour involving mounting, placing feet on top of an individual's back, presenting and displaying cloaca, cloacal contact, vocalizing with repetitive wheezing sound, lifting one wing at a time while another individual moves rhythmically beneath the lifted wing or moving in this way beneath the wings of another individual

Table 1. Ethogram of African grey parrot ground-level social behaviour. Affiliative behaviours are denoted with a heart (♥).

Behaviour	Description
Autogroom	Using beak, foot or a tool to groom or preen own feathers
Sleep	Standing or leaning on keel with eyes closed, static
Stand	Standing still, static perching or sitting

Table 2. Ethogram of inactive African grey parrot behaviours

Behaviour	Description
Bite Stick	Bite stick, clench beak around a wooden stick
Bite Wall	bite wall, grasping metal or wood on the wall or roof of the aviary using beak
Beak Contact*	Contacting the side of steel enrichment tray using beak and/or tongue
Foot Contact*	grabbing or touching top edge of tray with foot
Chew Leaf	Using beak to masticate the leaf of a plant
Climb*	climb onto edge of tray using feet or a combination of feet and beak
Chew Mulch*	Use beak to masticate and pulverise pieces of pine-bark chip mulch
Chew Plant	Use beak to masticate plant piece (dried bamboo stalk)
Chew Plastic	Use beak to masticate a plastic toy, often while holding toy in foot
Chew Shell	Use beak to masticate an empty peanut shell casing
Chew Wood	Use beak to masticate a block of wood, wooden toy (not pine mulch)
Dig*	Dig
Drink	Drink water from puddle on ground by lowering and then lifting head
Dig Side*	Dig at side of tray
Dig Tray*	Dig inside mulch tray
Grab-Drop*	Grasp a mulch piece with foot, lift and hold it, then quickly drop it
Hold Leaf	Use foot to grasp and hold the leaf of a plant
Hold toy	Use foot to grab, lift and hold a toy
Hold Wood	Hold wood block in beak
Investigate*	investigate, look into tray with distinctly elongated neck, peering into tray
Knock*	Knock beak on side of metal tray repeatedly to produce rhythmic sound
Play	object play, use feet to stand and balance and to slowly spin/rotate on top of a plastic Easter egg-shaped toy, grip a hanging toy with feet and hang upside down, repetitive non-functional interaction with an object
Perch*	Perch on side of tray using feet
Rub*	Rub beak against a log, another item, or against the ground
Sort*	Use beak and feet to intentionally sort through mulch to choose a preferred piece
Edge Walk*	walk along edge of tray
Eat	Use beak and/or foot and beak to grasp and eat a food item found on the ground such as a nut, pea, or piece of a fruit or vegetable
Walk To*	Walk toward the enrichment tray

Table 3. Ethogram of ground-level foraging and interactive behaviours of African grey parrots. An asterisk (*) marks behaviours designated as interaction with the enrichment device.

Study Phases

Study Phase	Length (Days)
Baseline	7
Experimental Enrichment	19
Post	4

Table 4. Number of days of data collection during each study phase.

Baseline Study Phase

The ground area of the indoor portion of the aviary was divided into 12 rectangles (hereafter referred to as 'grid-squares') delineated by the equally spaced metal tubing supporting the curved roof of the structure and using the door frames as spatial references. Focal items inside the aviary were also used to confirm zones. A recording sheet with grid-squares labelled as zones A-F, 1-12 was created (See Appendix Figure 1). An instantaneous scan sample (Martin and Bateson, 2007, p. 50) of the ground-level of the indoor portion of the aviary was performed every two minutes to yield data to assess territoriality and typical behaviour. The grid-square locations and behaviours of all individual parrots observed at the ground level were recorded. Any birds that could not be identified were recorded as 'Unknown'.

Territory mapping procedure

Location data was used to create a map of territories. The number of times that any bird was observed in each location and the number of times that each individual was observed in each location were determined. Using this information, a territory map was created immediately after the completion of the baseline study phase. A unique colour was assigned to each individual or mated pair. Space-use was graphed onto the grid-square sheet. Solid colours were used to indicate the most frequently occupied areas. Slashed lines indicated areas that were used consistently, but less frequently. Dots indicated single instances of an individual within a grid zone (Figure 9).

Habituation period

Parrots are considered to be neophobic (Fox and Millam, 2007). To reduce neophobia, the empty metal tray component of the enrichment device was placed in the centre of the indoor portion of the aviary floor (zone C5) and remained there for 24 hours until birds were reported by sanctuary staff to be approaching the tray and contacting it with their beaks.

Experimental Enrichment Phase

Days were divided into Morning (9:00 – 12:00), Afternoon (12:30-15:30) or Evening (16:00 -19:00) segments. A random number generator (Random.org) was used to randomize the time of each observation period. To meet the requirements for randomization statistical tests (Todman and Dugard, 2001, pp.51-61), the random number generator was also used to select the time at which to begin and terminate each observation period within the Morning, Afternoon or Evening day segment. Observation periods were between one hour and three hours long with the majority of observation periods being two hours long.

The random number generator was also used to select the location of enrichment tray placement. First, the baseline territory map was used to define areas of the ground as individual territories or 'shared' space. The shared space was the area around the food tables in which multiple unique individuals were observed but no particular individual or pair spent the majority of their time. The five most frequently occupied ground zones were squares F1, B1, A4, D6, and C7. A specific individual was observed in one of each of these six zones more than in any other area, so these were defined as 'territories'. Between baseline and experimental phases, the individuals Chewy and Dylan who had occupied A4 and D6 moved to solely occupy A4. Individuals Dick and Bam consistently occupied zone E2, so E2 was substituted for territory D6 during the experimental phase. A random number generator was used to assign one of these territories or the shared space (C4) to each observation period.

Enrichment Device Location	Observation Time (Minutes)	Number of Scans
A1	214	107
A4	118	59
B1	552	276
E2	72	36
F1	24	12
C4	540	270
C7	16	8

Table 5. Locations of enrichment device placement, randomly assigned observation periods, and number of scan samples performed of each location containing the device.

At the beginning of each observation period, a brief scan of the aviary was performed to ensure that the birds

were in good health. The full tray was then carried through the outdoor section of the aviary, into the indoor portion and carefully placed onto a specified location of the ground. After placing the tray, the observer walked back to the main entrance area and waited there out of sight of the subjects for a five-minute adjustment period. The observer then walked to a chair in the doorway to the indoor aviary and sat and recorded observations on data-collection sheets in a binder. A focal scan sample of the zone containing the tray was performed every two minutes. Behaviours and names of individuals within this zone were recorded. A scan sample of the entire aviary floor was performed every ten minutes. A less frequent interval was chosen than for the baseline observations because every ten minutes was found to be adequate. Most parrots tended to remain in one location for that duration and this interval allowed time to perform scan samples of the enrichment device vicinity every two minutes. Parrots' names, locations and behaviours were recorded.

Post Study Phase

A scan sample of the aviary ground-level was performed every ten minutes and names, locations and behaviours of individuals were recorded. This phase was terminated due to confounding factors including the provision of novel enrichment items by sanctuary staff and the presence of visitors. This phase was intended to be as long as the baseline phase (seven days), but it was only four days long.

ANALYSES

1. *Behaviours at ground-level*

To assess whether parrots performed foraging, affiliative and agonistic behaviours at ground-level, the total number of individuals observed at ground-level was counted. The percentage of parrots observed on the ground out of the total number of birds housed in the aviary was calculated. The number of times that each individual was observed at the ground-level of the indoor portion of the aviary during baseline and experimental enrichment phases was counted. The percentage of time during which each identifiable individual parrot was visible at the ground-level of the indoor portion of the aviary during the baseline and experimental enrichment phases was calculated and graphed. The number of times each behaviour occurred during baseline and experimental enrichment phases was counted. Behaviour frequencies were graphed.

2. *Territories and resource-access*

Territory maps were created using location data from the experimental enrichment phase following the same procedure used for baseline data. To test the hypothesis that territories limited resource-access, behaviours involving interaction with new pine bark chips or the tray were grouped to create an Interaction behavioural category. The number of Interactive behaviours displayed by each individual in each territory map zone category (own, neighbour, other and shared) were counted. It was predicted that an individual would perform the most interactive behaviour when the tray was in his/her own zone followed by shared, then neighbour, then other. Randomization tests were performed, and the proportion (P) of 1000 randomly sampled data divisions giving an outcome at least as large as the experimentally obtained result is reported.

3. *Enrichment effect*

To perform statistical analyses of the effect of the enrichment device on behaviour, extra data was removed to make time-periods of baseline and enrichment phases equivalent to meet the requirement of a single-case randomized treatment randomization test (Todman and Dugard, 2001, pp. 63-64). This was done by systematically calculating the length observation time and the number of scans in each treatment that was being compared. The length of observation time for the treatment with the shortest observation period or the number of scan samples for the treatment with the fewest scans was used. Only the first equivalent section of observation time or the first equivalent number of scans were selected from the comparison treatment data. The additional time or scans were removed and disregarded.

Behaviours were also grouped into Inactive (sleeping, resting and self-grooming) and Active (all other social and foraging behaviours) categories. An Interactive behavioural category was also created (indicated by asterisks on Figure 6). Additionally, Mulch-Chewing and Digging behaviours were individually counted. Baseline behaviour counts or rates were compared to Experimental phase and Post phase for individuals and for the entire group. Randomization tests were performed, and the proportion (P) of 1000 randomly sampled data divisions giving an outcome at least as large as the experimentally obtained result were reported.

4. *Social Structure*

Proximity, excluding agonistic behaviour occurrences, was used as a proxy for affiliation as in Hobson et al. (2015). Parrots' locations were used to analyse social structure. The number of times that each individual shared a grid square with each other individual was counted, excluding instances when individuals shared a grid-square but were performing an agonistic behaviour (Chasing, Fleeing). These proximity data were used to create social network graph. The nodes of the resulting sociograms were colour-coded to match the colours assigned to individuals and pairs in the territorial maps. Line weights were used to show how many times the individuals had shared a grid square. Solid lines were used for edges between individuals who were observed performing mutual affiliative behaviours (mating, allogrooming, 'kissing', see Table 1). Dashed lines were used for edges between individuals that were never seen mating, allogrooming, interlocking their beaks or regurgitating. This was repeated for experimental enrichment and post phases.

Ethical statement

This study was approved by an ethical review committee at the University of Edinburgh. The project was developed in consultation with the director of Project Perry, the Central Virginia Parrot Sanctuary. Parrots could exit freely through a door to the outside area of the aviary and retreat to areas out of sight of the observer. Humane endpoints were established prior to the beginning of observations and it was agreed that any instances of parrots bleeding would be reported to the sanctuary director immediately (this never occurred). Care of subjects exceeded national animal welfare standards (National Research Council, 2011).

RESULTS

1. African grey parrots perform varied ground-level behaviours.

Nearly half (49%) of the total birds housed in the aviary were observed at the ground level (23/47 birds) during this study. Anecdotally, the majority of the remaining birds were located on high-level perches within the indoor portion of the aviary, while a few individuals were in the outside section.

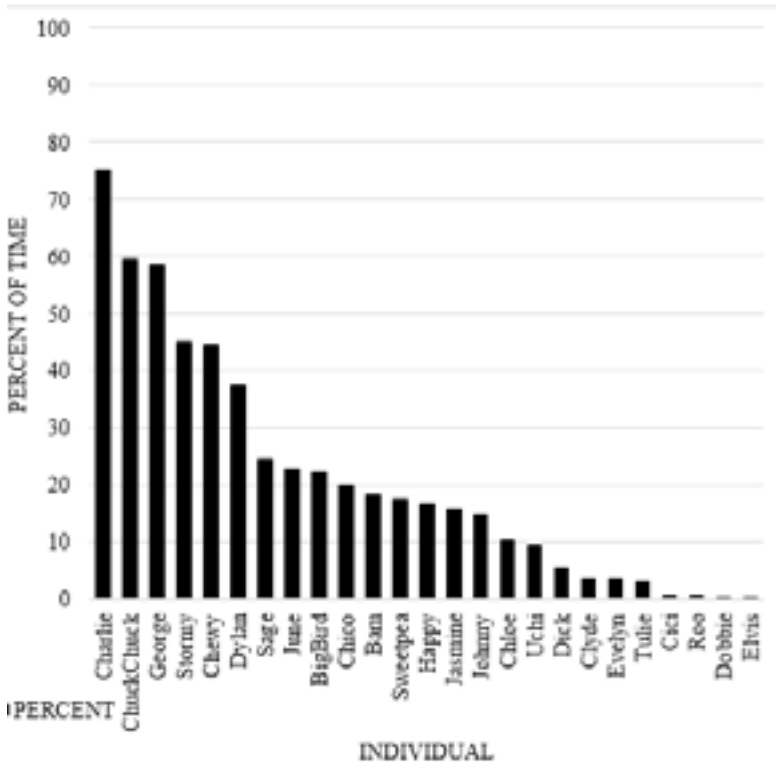


Figure 5. The percentage of time during the baseline phase for which each identifiable individual parrot was visible at the ground-level of the indoor portion of the aviary.

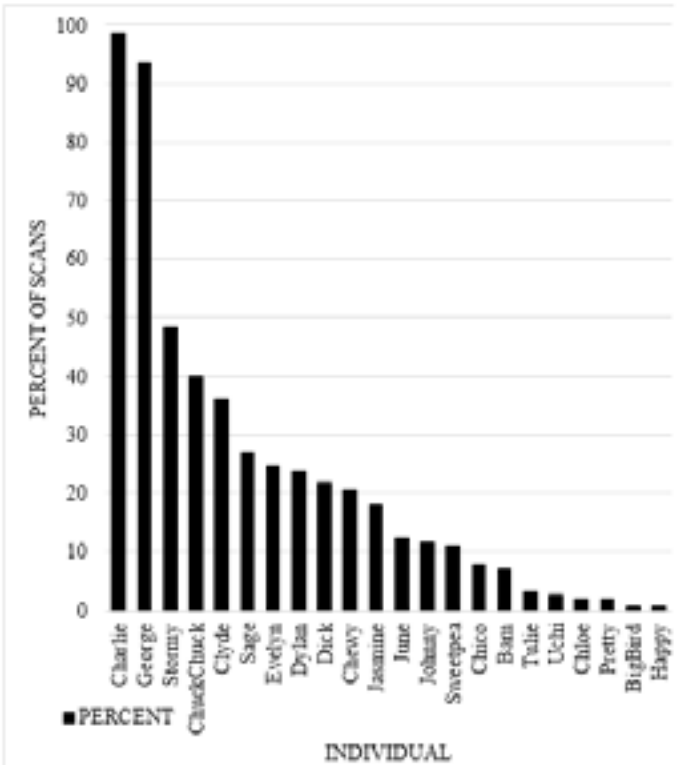


Figure 6. The percentage of time during the experimental phase for which each identifiable individual parrot was visible at ground-level of the indoor portion of the aviary.

These parrots performed varied social and foraging behaviours that are described in ethograms (Tables 1-3). Total instances of each behaviour observed during baseline and experimental enrichment phases are displayed in Figures 7-8. The most common active behaviour at ground-level was digging followed by locomotory walking, mulch-chewing, and eating.

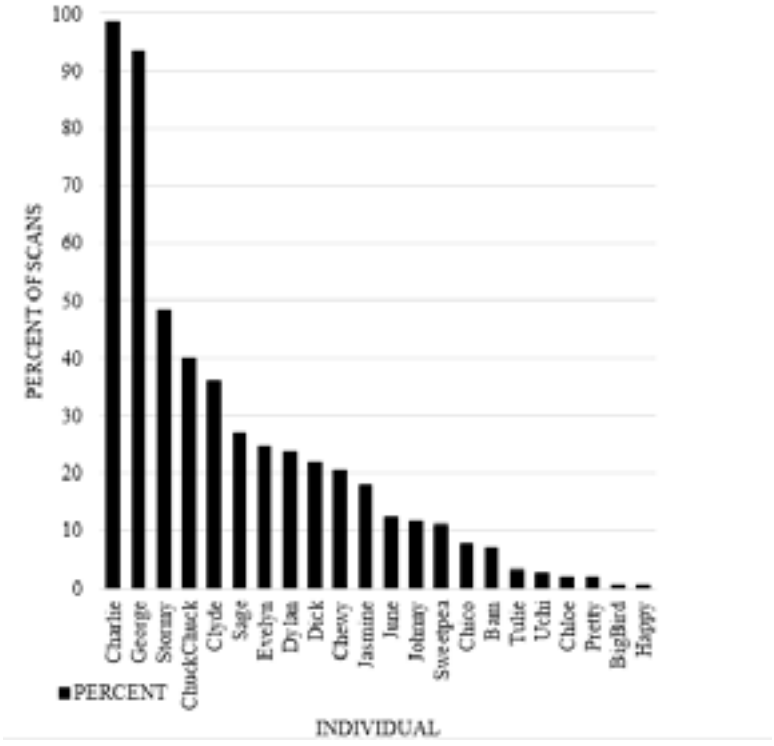


Figure 7. Counts of behaviours seen during the baseline phase observations of African grey parrots at the ground-level

of an aviary.

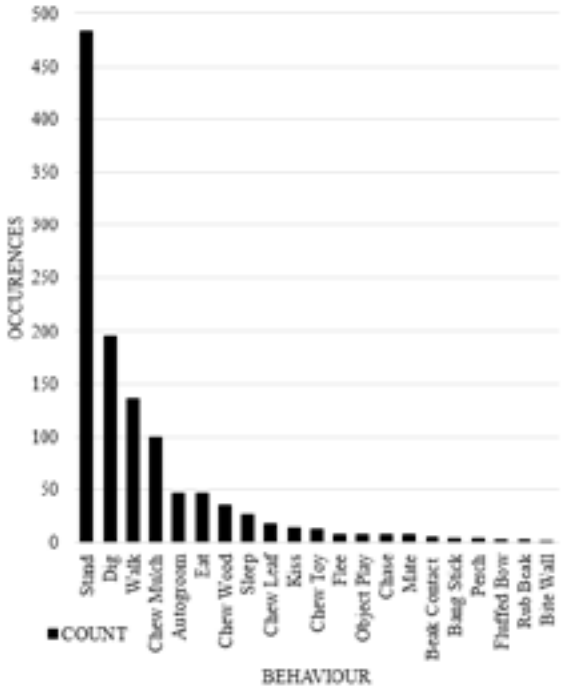
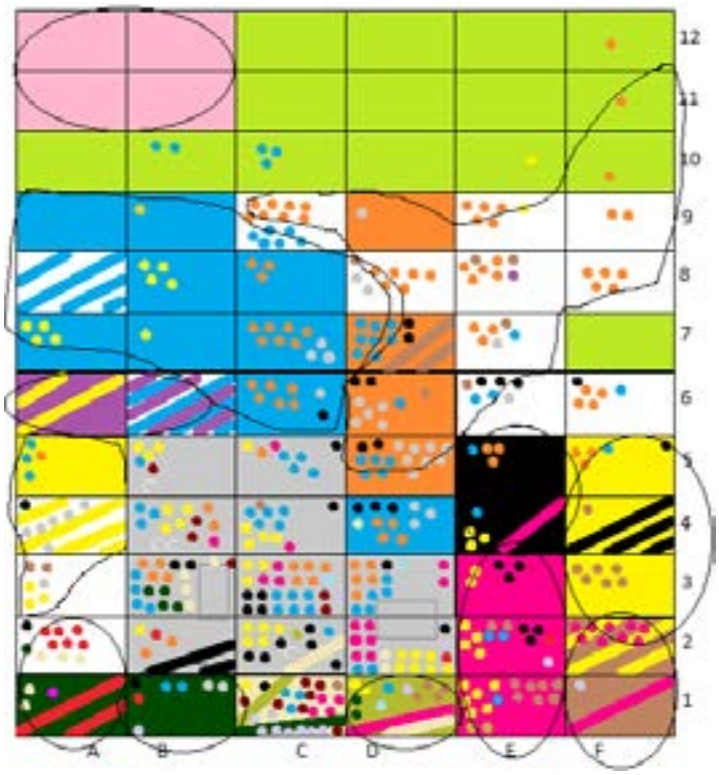


Figure 8. The number of times each behaviour was seen during the experimental enrichment phase observations of African grey parrots at the ground-level of an aviary.

2. *Territories*
Baseline phase space-use



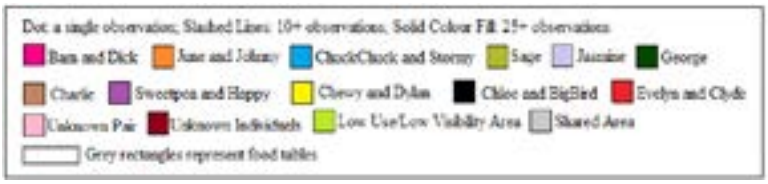


Figure 9. Ground-level space-use of a group of African grey parrots during baseline observations in an aviary. Black lines encircle estimated territories.

Experimental enrichment phase space-use

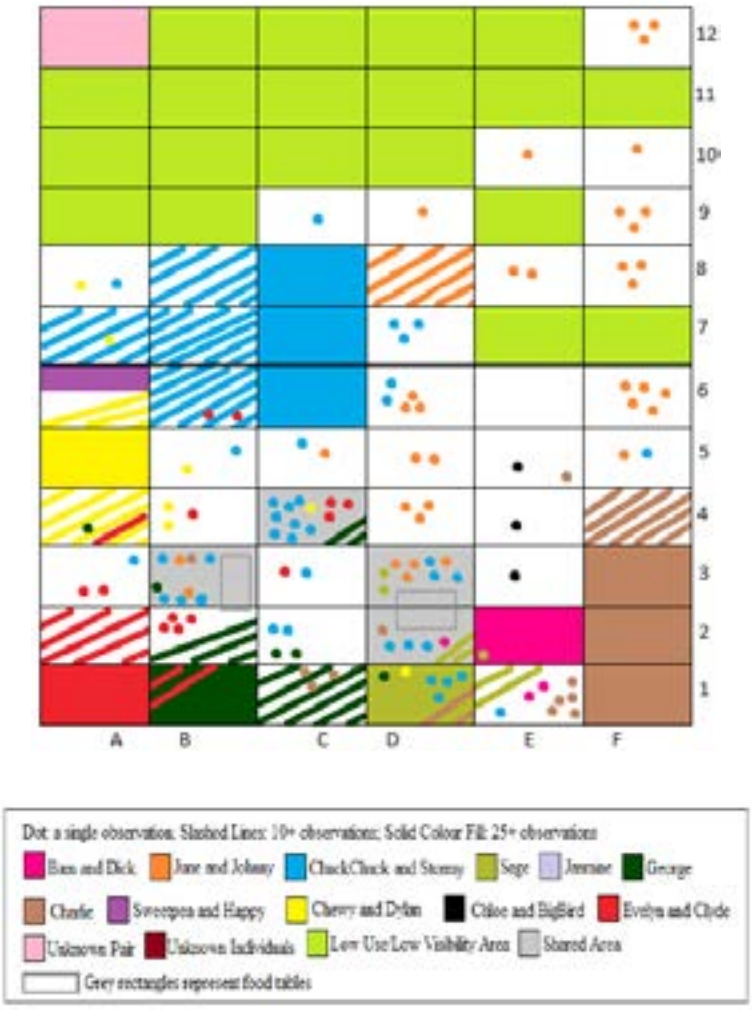


Figure 10. Ground-level space-use of a group of African grey parrots during experimental phase observations in an aviary containing a novel enrichment device.

Location and resource-access

1. *Individuals*

George performed more interactive behaviours with the enrichment device in his own zone (208 interactions) than in the shared zone (one interaction) (P= 0.034, two-tailed) or other zones (one interaction), P=0.04; one-tailed. *Clyde* interacted more with the resource when it was in his own zone than in the neighbour zone of B1 (P= 0.034, two-tailed); however, the opposite pattern was observed for Evelyn. *Evelyn* interacted more with the device when it was in the neighbouring territory, zone B1 (134 interactions) than in her own territory, zone A1 (0 interactions). When

randomization tests were performed for other identifiable individuals with ground-level territories, results were not statistically significant, possibly due to the fact that the enrichment device was less frequently placed in territories other than A1, B1 and Shared C4.

2. *Group*

A greater number of unique individuals interacted with the tray when it was in the shared zone (13 identifiable individuals) than when it was in other locations of the aviary floor (2 individuals in zone A1; 6 individuals in zone B1; 2 individuals in zone E2; one individual in zone F1; three individuals in zone A4; and no individuals in C7). A randomization test of the prediction that a greater number of individuals would interact with the device in the shared area than in other locations, the difference in the number of unique individuals was not statistically significant. Shared zone C4 (13 individuals) vs. zone B1 (6 individuals), P = 0.063, two-tailed. Shared zone C4 vs. zone A1 (three individuals), P= 0.094 two-tailed.

3. *Enrichment*

a. *Individual*

George performed significantly more Inactive behaviours (standing, autogrooming, sleeping) during baseline phase (81%, 195/240 behaviours) than experimental enrichment phase (23%, 60/265 behaviours), P= 0.046, two-tailed test. George performed more Active behaviour when the tray was present during the enrichment phase 77% (205/265 behaviours) than during the baseline phase 19% (45/205 behaviours), P=0.049; two-tailed test.

George, Evelyn and Clyde performed more digging during the enrichment phase (George = 57, Evelyn = 69, Clyde = 36 instances), than the baseline phase (George= 1 instance, Evelyn = 0 instances, Clyde = 0 instances). All other identifiable individuals seen at ground-level during this study performed more digging during the baseline phase than the experimental enrichment phase (17/20 birds). A similar pattern was seen with chewing behaviour. George, Evelyn and Clyde performed more mulch-chewing during the experimental phase (George = 128 instances, Evelyn = 17 instances, Clyde = 33 instances) than during the pre-enrichment baseline phase (George = 5 instances, Evelyn = 0 instances, Clyde = 1 instance). Other identifiable individuals seen at ground-level performed mulch-chewing either less frequently or at approximately the same rate during baseline and enrichment phases. Due to time constraints, statistical tests were not performed on these data.

b. *Group*

At the group level, Interactive/foraging behaviour did not increase from baseline to enrichment phases. Instead, mulch-chewing and digging accounted for 23% (879/3883) of all observed behaviours during the baseline phase and only 19% (339/1835) of behaviours during the enrichment phase which is a slight decrease in digging and mulch-chewing. Due to time constraints, statistical tests were not performed on these data.

1. *Social Structure*

Affiliative social networks were not completely connected. Fewer individuals were observed at ground level during experimental and post-study phases than during baseline phase. An individual, Stormy, was more socially connected during the enrichment and post-study phases than during baseline observations, possibly due to provision of the enrichment device. There were some changes in social structure over time, but mated pairs

June and Johnny and ChuckChuck and Stormy remained highly connected throughout the entire study period.

Baseline Phase

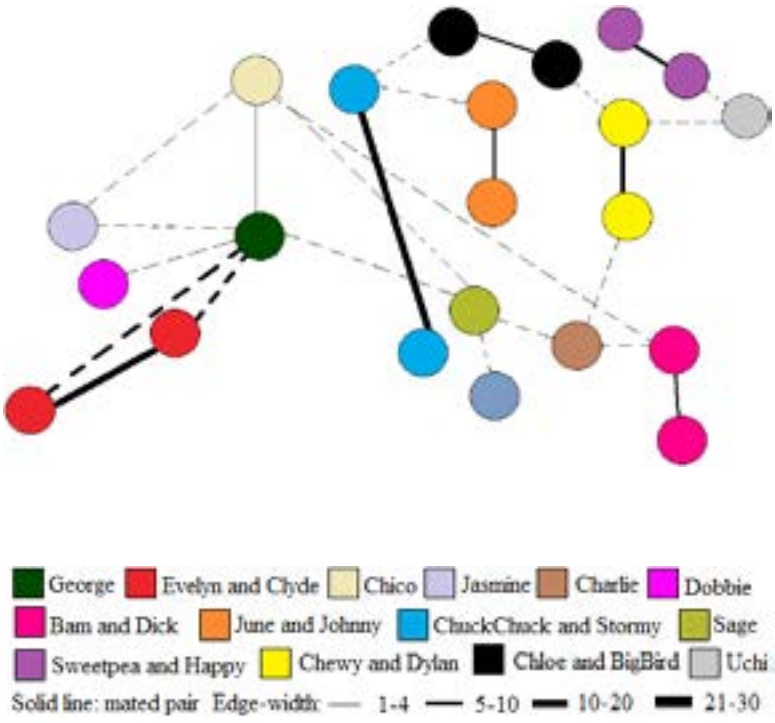


Figure 11. Baseline affiliative social network, colour-coded by most-frequently used floor location with edge width indicating number of instances that the parrots were in close proximity.

Experimental Enrichment Phase

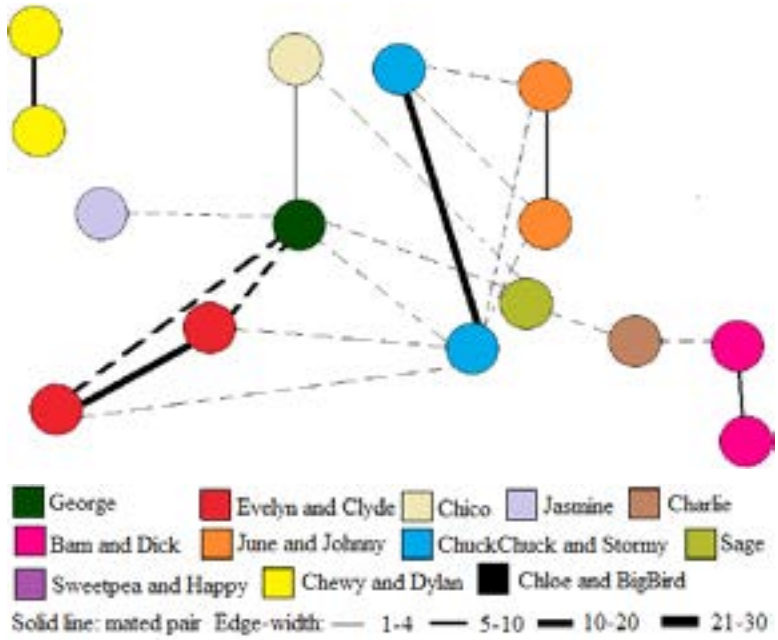
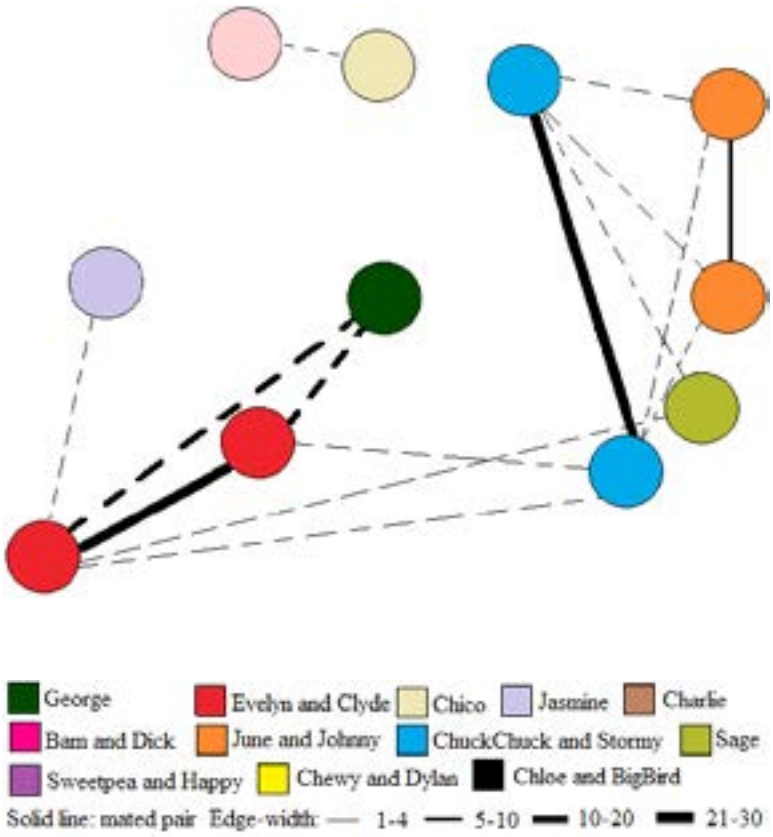


Figure 12. Experimental phase affiliative social network, colour-coded by most-frequently used floor location with edge width indicating number of instances that the parrots were in close proximity.



Post Phase

Figure 13. Post study phase affiliative social network, colour-coded by most-frequently used floor location with edge width indicating number of instances that the parrots were in close proximity.

DISCUSSION

The first aim of this study was to determine which behaviours were performed by African grey parrots at the ground-level of a naturalistic aviary. Nearly half of the total parrots housed within the aviary were observed on the ground-level performing various inactive and active behaviours including digging, chewing, eating and social behaviours. A second hypothesis that greys hold territories was confirmed. Individuals or mated-pairs occupied small areas of the ground throughout the study which remained fairly constant despite provision of an enrichment device. The effect of a novel enrichment device on the behaviour of individuals and the parrot group was tested. It was found that the device was enriching to certain individuals, but did not increase active ground-level behaviours for the majority of the group of parrots. The effect of enrichment provision on social structure was also assessed and it was found that African grey territories and social networks are fairly stable; however, one individual became more socially connected and one territory expanded into an adjacent territory while the enrichment device was present.

1. *Ground-level behaviour*
    a. *Individuals at ground-level*

African greys have been observed spending time on the ground in the wild (May, 2001) and at the bottom of cages in captivity (van Zeeland et al., 2013). The results of the present study indicate that specific individuals were much more likely to spend time on the ground than others. Just under half of the individuals from the group of parrots

housed in this aviary spent time on the ground level of the indoor portion of the aviary during observation periods. Anecdotally, the majority of individuals perched at high-levels of the indoor portion of the aviary during the study, while a smaller number of birds spent the majority of their time outside, possibly occupying a few ground-level territories in the outdoor section. Two identifiable individuals, BigBird and Chloe, spent time in the visible indoor ground area during baseline observations, were seen in the outside section of the aviary during most of the experimental enrichment phase. One individual, Charlie, was seen on the ground for nearly all of the observation time. Individuals had different preferences for locations. These may be very stable like Charlie's or vary due to weather or observer-presence like those of BigBird and Chloe. Anecdotally, Happy and Sweetpea were not visible during the enrichment phase because they remained in their ground-territory while foliage grew and hid them from sight. Individuals, especially those not socialized to humans, may have feared the observer and moved to leafy out of sight areas during observation periods.

2. *Behaviours at ground-level*

a. *'Digging'*

'Digging' was the most common ground-level active behaviour. Despite current research interest in 'geophagy', the ingestion of soil by parrots (e.g., Brightsmith and Muñoz-Najar, 2004), the goal of soil-manipulation appeared to be to excavate cavities. While 'digging', parrots lowered their heads, leaned forward and kicked their legs behind their bodies in an exaggerated motion. A hole or depression in the ground resulted from this behaviour. Sometimes, the beak was used to grip soil or to lift soil and throw it away from the hole. This behaviour is called 'Chicken Scratching' by parrot owners (Africangreyparrot.com, 2016; Peteducation.com, 2016) and occurs as a vacuum activity in the home (Blueeyes, 2016; Nibeck, 2010). Digging could be a natural behaviour to access roots which are part of the diet of wild greys (Juniper and Parr, in Schmid, 2004) or it may serve another function.

Interestingly, presentation of the enrichment tray elicited digging behaviour. The first device-interaction behaviour that occurred after the presentation of the tray was digging at the bottom edge of the metal tray side. The tray on top of the soil ground appeared to create a ledge-like structure that elicited digging. This occurred during the habituation phase when the tray was empty and continued to occur frequently during the experimental enrichment phase. Interviews with the sanctuary director revealed that digging is also elicited by ground-level provision of logs or flat items such as cement or rock slabs. This 'tray-edge-digging' was performed by various individuals including mated pairs and individuals. When mated-pairs performed edge-digging, one mate perched on the top edge of the tray and watched the other mate dig in the soil below, then switched places. Digging was also performed by individuals without mates. Future studies should assess whether there is a relationship between mating and digging. Digging also occurred inside the mulch tray. Parrots consistently faced inner corners of the tray, lowering their heads into a tray corner while kicking mulch behind their bodies. The relationship between edge-perception and parrot digging would be an interesting area of future research.

Studies of Orange-fronted (Hardy, 1963) and Orange-chinned (Power, 1967) parakeets describe parrots in an aviary performing nest excavation behaviour in cork replicas of termite nests which they excavate to create nest sites in the wild. The description of this excavation behaviour sounds analogous to the digging in the present study. Nest boxes are not provided inside the aviary at this sanctuary. It is possible that the greys are digging to excavate nest sites. A future study could add multiple nest-boxes to the aviary and measure the frequency of digging when nest sites are present to determine if this is the case. Although adult parrots in this mixed-sex group do not receive medications like leuprolide (Klaphake et al., 2009) to control reproductive hormones, no eggs have ever been laid inside this aviary (Smith, 2016, *personal interview*) and none were laid during this study. Withholding nest sites can supress reproduction while providing social enrichment and avoiding laborious procedures like egg-removal (Hawkins, 2010); however, removing nest sites distresses hens (Duncan and Wood-Gush cited in Hawkins, 2010) and may also distress parrots. Future research could test the effect of nest-box provision on African grey welfare.

3. *'Mulch-Chewing'*

May (2001) also describes wild 'Greys chewing the bark of thin young branches of a tree. The parrot clips off a piece of bark, chews the piece for 1-2 minutes, and then drops the piece.'

This description of chewing bark sounds identical to the mulch-chewing behaviour observed during this study, except that bark chip pieces are found on the ground of the aviary instead of branches. Grey-headed parrots (Symes and Perrin, 2003) and Black-cheeked lovebirds (Warburton and Perrin, 2005) eat bark and Rüppell's parrots chew bark (Selman et al., 2002). Bark-chewing may be a natural African grey behaviour and future research should assess whether there is a physiological reason for bark-chewing. It is also possible that bark-chewing is related to nesting. Selman et al. (2004) observed wild Rüppell's parrots 'gnawing' away bark at the edges of tree cavities when nesting and found some nest sites lined with wood chips. Lilac-crowned parrot nests are also lined with wood chips (Salinas-Melgoza et

al., 2009).

Finally, this could be redirected nut-cracking behaviour. Wild African greys eat large seeds (Chapman et al., 1993) and their skulls, jaws and beaks likely evolved to efficiently crack nut shells (Sereno et al., 2010; Bhattacharyya, 2013). The parrots in this aviary rarely receive nuts in shells due to concerns about removing old shells to maintain cleanliness. Since these Greys are not able to perform natural nut-cracking behaviour, it is possible that mulch-chewing is an outlet for this behaviour and that bark-chip substrate serves as a 'foraging substitute'(van Zeeland et al., 2013). Future studies could quantify whether mulch-chewing decreases if the parrots are provided with nuts or nest boxes to determine whether this behaviour is related to foraging or nesting.

4. Territories

Wild parrots exhibit territorial nesting behaviour, selecting nest sites away from those of conspecifics (Rivera et al., 2012; Salinas-Melgoza et al., 2009). Rüppell's parrots consistently approach nest sites from the same direction, likely to avoid territorial conspecifics (Selman et al., 2004). Similarly, greys in the present study appeared to avoid territories held by conspecifics to prevent agonistic interactions by walking in specific directions. In the present study, territories of different sizes and shapes were present and remained fairly stable over time. It was possible to create maps of these territories by performing scan samples of the aviary and recording parrots' locations. This is a useful way to predict future ground-locations of individual birds and to ascertain which individuals are mated pairs. These territories should inform husbandry decisions. Resources should be available in every territory area. Mapping territories can indicate which individuals will be distressed and more likely to attack when specific sections of the floor are entered or raked by sanctuary staff. It is also likely that parrots will be distressed if they are moved by staff into a territory that they do not possess. Future research could assess whether this territoriality is stable throughout the year or only present during mating seasons.

These greys exhibited 'micro-territoriality' as seen in Orange-chinned Parakeets in an aviary (Power, 1967), possessing small, defined areas of the aviary floor. These micro-territories can be influenced by the presence of a valued resource, but this only occurred within a single quadrant of the floor occupied by a social group (mated pair Evelyn and Clyde and non-mated individual, George) in the present study. Evelyn and Clyde extended their territory into George's territory. An enrichment device was in that area of the aviary (zones A1, B1, C4) for a longer period of time than other areas which is likely why the impact was greatest there. It is possible that the personalities of Evelyn, Clyde and George or the social dynamics between these birds also played a role. Evelyn may have been more motivated to approach the device when another individual (George) was using it. This could be explained by social facilitation, social learning, or because Evelyn was motivated to assert dominance and compete for access to the resource in the territory adjacent to her own. As demonstrated with captive primates, aggression may be more likely between individuals if enrichment items are limited, not distributed throughout all territories (Paquette and Prescott, 1988).

5. Effect of the 'enrichment' device

The tray containing bark chips significantly increased George's activity and increased mulch-chewing and digging behaviour for George, Evelyn and Clyde. It did not seem to increase the activity, mulch-chewing or digging behaviours of the total group of parrots, which could indicate that territoriality limits the benefit of a single enrichment device. The device was near George's territory longer than it was in any other area. It is possible that the tray would have had a similar effect on other parrots if it had remained a different area of the aviary for a long period of time and birds had more time to habituate to and learn how to interact with the device. It took African greys approximately eight days to learn how to use puzzle feeder devices (van Zeeland et al., 2013), so this study should be repeated with longer periods of enrichment device provision. It is also possible that George's history, personality, or lack of access to resources caused him to be more interested in the device than the other birds. Interestingly, the device also increased mulch-chewing and digging behaviour for Evelyn and Clyde who have the territory adjacent to George's. This provides more evidence for a local effect of the device. It is possible that other individuals were afraid to interact with the device due to an understanding that the device was the 'property' of George, Evelyn and Clyde as theorized by Darwin (1871). Inferential reasoning has been demonstrated by African greys (Pepperberg and Carey, 2012; Pepperberg et al., 2013), but further studies could test whether these parrots truly have an understanding of 'property' (Darwin 1871). It is possible that the other individuals were afraid to interact with the device due to neo-phobia. A future study could present a tray of bark chips to multiple independent samples of parrots to see if the decrease in inactive behaviour and increase in interactive behaviour displayed by George, Evelyn and Clyde is representative of this species.

African grey foraging time increased with provision of a cardboard box enrichment device because they could shred and manipulate the material (van Zeeland et al., 2013). Marbles also increased foraging time because were manipulated by African greys (van Zeeland et al. 2013). Marbles, cardboard and other destructible materials like bark chips may serve as 'foraging substitutes' (van Zeeland et al. 2013). Bark chipping substrate provided foraging enrich-

ment for parrots in a zoo and has been recommended as an ideal floor-covering for zoo aviaries (Field and Thomas, 2000). Nicol et al. (2001) found that hens provided with wood-shaving substrate performed less feather-pecking than those without wood-shavings. Self-directed feather-picking is a common abnormal behaviour in captive African greys (Jayson et al., 2014). Many of the parrots in this study had a history of feather-picking and had patches of bare skin. Others had feather-less patches on the caudal aspect of their heads as a result of intense allogrooming. The very few instances of feather-picking that were, anecdotally, seen by the observer were performed by birds at high-levels of the aviary, so feather-picking was not included as a behaviour in this study; however, autogrooming, a precursor to feather-picking, was included. Autogrooming was included in the 'Inactive' behaviour category during analysis. Inactive behaviour decreased for George during the enrichment phase of this study. Future parrot enrichment studies should include physiological measurements to provide more evidence that increased bark chipping foraging behaviour correspond with increased welfare. Physiological research would also determine whether pine bark is ingested by the African greys and how this effects their nutritional health and digestion.

6. Social Structure

Social networks were not completely connected when looking solely at the ground level. This contrasts with a group of aviary-housed Monk parakeets that was perfectly connected (Hobson et al., 2015). Future research should record three-dimensional locations of African greys within the aviary to see if certain individuals do not appear to be socially connected due to the fact that only one level was assessed or due to personalities of these birds. Social units included single individuals (e.g. Charlie, Sage, George) and mated pairs (ChuckChuck and Stormy, June and Johnny, Evelyn and Clyde, Chloe and BigBird, Bam and Dick, Chewy and Dylan). The mated-pair is an important social unit for African greys as it is for Monk parakeets (Hobson et al., 2014). Larger connected affiliative groups consisting of mated pairs and individuals in adjacent territories shared quadrants of the aviary floor.

Social structure was quite stable within the group, but it changed over time when the mulch tray was provided and then removed. The presence of key resources can impact a parrot social network and increase connectivity of key individuals, however, affiliative sub-groups are relatively stable over time regardless of resource-provision resource access. The number of birds on the ground decreased with the provision of a novel enrichment device. Despite there being fewer birds on the ground, the device caused an individual, Stormy, to interact with more different individuals than he did when they device was not present. This could help Stormy establish himself within the social order of the group, which could improve his welfare; however, increased proximity to other individuals could cause agonistic disputes and distress. Stormy only fled from other birds a total of three times during the experimental enrichment phase of this study, so it is unlikely that increased social connectivity caused him much distress. Social interactions are an important part of parrot life. Social enrichment benefits parrots (Garner et al., 2006; Meehan et al., 2003; Nicol and Pope, 1993), but there is a balance between this welfare benefit and the possible distress due to fights. To balance welfare benefits of enrichment provision with social dynamics, enrichment items should be provided to each social unit within an aviary. Mapping social networks and territories can be a useful tool to reveal social dynamics and make management decisions which positively impact welfare of group-housed animals (Beisner and McCowan, 2015).

CONCLUSION

Many behaviours are performed at ground-level by African Grey parrots in an aviary including foraging and social behaviour. Space used by individuals follows a predictable pattern which relates to the parrots' social structure, predominantly mated-pairs occupying small ground territories. A tray containing pine-bark mulch promoted active behaviours including foraging and digging for certain individuals, but did not change behaviour at the group level. The effect of enrichment was localized, likely due to these parrots exhibiting micro-territoriality.

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APPENDIX

Name	Subspecies	Identifying characteristics
Bam	Congo	Many red feathers, previously injured right wing held at an abnormal angle, small head, silver band on left foot says “12”, red spot on eye beside pupil
Big Bird	Congo	Very large, red feathers on both legs, wild-caught round band printed with “NNY”, large beak
Charlie	Timneh	Fully feathered, dark head, no band
Chewy	Timneh	Small, bare spot at back of head
Chico	Congo	Round wild-caught band: “NNY”, right foot missing nail and toe tip, toe is abnormally curled toward foot
Chloe	Timneh	wild-caught round band on left leg
ChuckChuck	Congo	Small, round silver band, small head, slightly crossed wings
Clyde	Congo	Medium
Dick	Congo	abdomen appears distended, dry skin on face around beak, asymmetrical nares (right nare bigger than left)
Dobbie	Congo	Growth above nare, flat silver band on right leg and round wild-caught silver band on left leg
Dylan	Congo	Fluffs when approached, medium, fully feathered
Evelyn	Congo	Lower half of abdomen is bare (feather-picked), round wild-caught band on right leg, red feathers on back of neck and upper portion of chest
George	Congo	Fully feathered, longer feathers at the back and top of head than other Congos, large
Happy	Congo	Medium
Jasmine	Congo	Small, missing nail and tip of toe on right foot, right wing crosses over left wing
Johnny	Congo	Entire head is without feathers and bare
June	Congo	Wings are always completely crossed
Sage	Congo	Medium, fully feathered, blue band on right leg
Stormy	Congo	Flat silver band “1ANYS9716”, 2 red feathers on chest
Sweetpea	Congo	Blue band, missing feathers beneath chin, small head, red feather on right leg
Tulie	Congo	Small head, bare areas from feather picking under wings and on chest, a few pinfeathers on chest, red feather on back of neck by left wing, silver band with numbers on it on right leg, long toes, small nares, fluffy, white down feathers on shoulders
Uchi	Timneh	7 pink feathers on back of head
Ziggy	Congo	Large, perfectly rounded beak, perfect body condition and ideal feather quality, fully feathered

Table 1. A table of the names, species and characteristics of individually identifiable African grey parrots living at Project Perry, the Central Virginia Parrot Sanctuary.

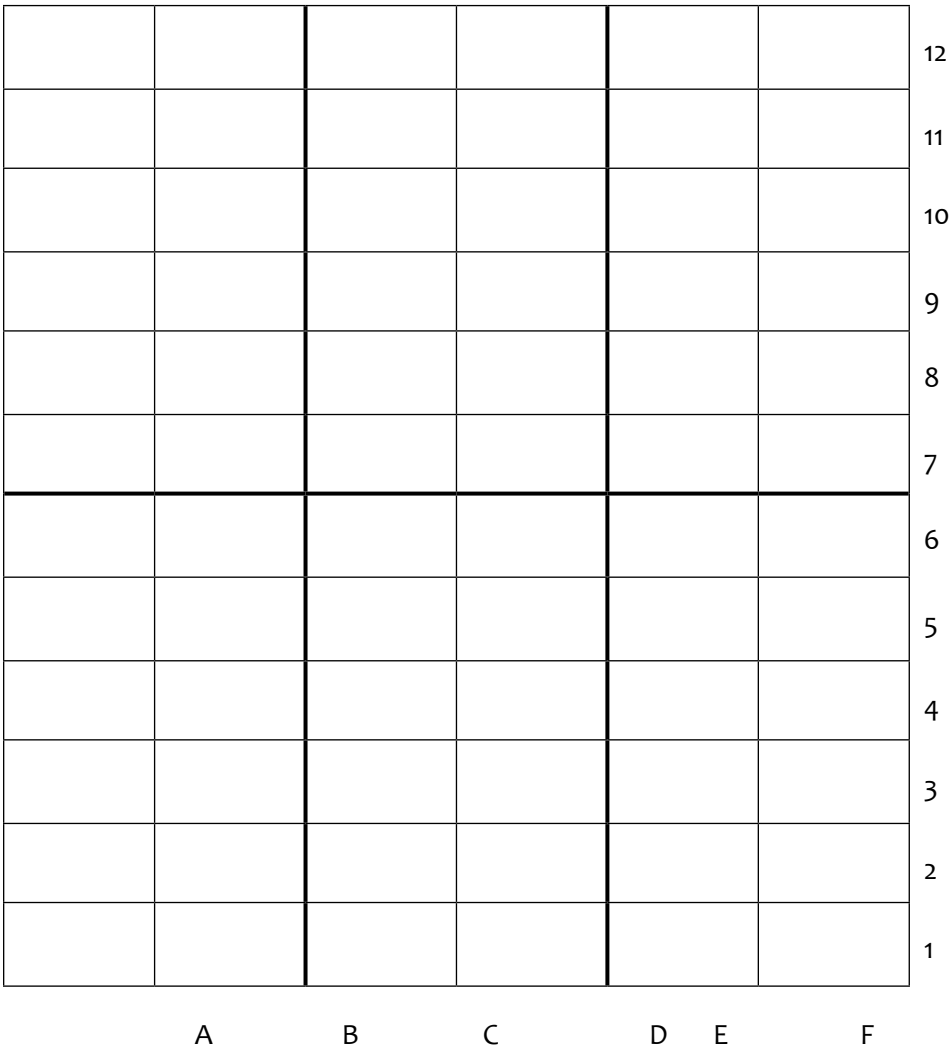

Figure 1. Aviary ground zone grid used for data collection

Training Sloth Bears (*Melusus Ursinus*), Grizzly Bears (*Ursus Arctos Horribilis*) and Andean Bears (*Tremarctos Ornatus*) for Voluntary Blood Draws in a Restricted Contact Setting at Cleveland Metroparks Zoo

Curt Gindlesperger, Angel Mitchell, Patty Young,
Kevin Roxbury, Michael Murray
Cleveland Metroparks Zoo

At Cleveland Metroparks Zoo (CMZ) sloth bears (Melursus ursinus), grizzly bears (Ursus arctos horribilis) and Andean bears (Tremarctos ornatus) are all involved in an intensive behavior management program including a training program utilizing operant conditioning with positive reinforcement in a restricted contact setting. The Wilderness Trek and Veterinary Services teams at CMZ now have the ability to collect voluntary blood samples from all three species in a restricted contact setting using positive reinforcement training. In concert with an innovative training program, teamwork, problem solving and communication, the 1960s era bear holding facilities at CMZ were modified to make our blood draw program safe and successful. The ability to routinely obtain blood samples to monitor bear health or provide diagnostic blood samples for future research is invaluable. The impact of this successful program has to potential to benefit individual animal health, population welfare studies, and in-situ conservation.

Introduction

Collecting voluntary blood from our sloth, grizzly and Andean bears was something not previously achieved at CMZ and little information was found on voluntary bear blood draws for these species. Most of the information on bear blood draws relates to giant pandas (Pratte, 2010), polar bears (Jungheim, personal interview, 2014) and grizzly bears (Ware, personal communication, 2014; Zwicker, personal communication, 2014) and this information was used to guide our bear blood draw program. When this program was initiated Cleveland Metroparks Zoo housed two sloth bears (a 7 year old male and a 14 year old female), two Andean bears (a 12 year old female and a 21 year old male), and two grizzly bears (6 year old males). The respective pairs of bears were generally exhibited together, but housed separately at night. The two grizzly bears are housed together on a full time basis.

In February 2015, two meetings were held to discuss the bear blood draw project for all three species. Attending the meetings were Wilderness Trek keepers, curators, veterinary staff, our training advisor and welders from the maintenance department. All of the bear holding areas at CMZ are over 50 years old and some facility modifications were needed.

For sloth and Andean species, it was decided to focus on the bears' forearm for the blood draw. This position was ideal because they readily stand when approached in their holding area and they comfortably interact with keepers in training sessions in this posture. Secondly, their holding area consists of 60.96cm (24 in) wide barred doors with cement block on both sides. Anything done horizontally would result in only a partial view of the bears. Lastly, from a veterinary viewpoint, the forearm had been previously utilized to place intravenous catheters during immobilizations as a known location of blood vessels.

For the grizzly bears, we decided to draw blood from the rear paw as this was the safest for the trainers and veterinary technicians, the most successful method with this species and a posture used in their established behavior repertoire. It was decided to train the grizzly bears to sit and present their rear paw through a stainless steel port at floor level.

A stainless steel mesh forearm sleeve was fabricated to fit both sloth and Andean species of bears. They would be trained to put their forearms into the sleeve to have their blood drawn from the top of the forearm. After evaluating a previously designed blood draw sleeve, it was decided it would be 46.9 cm L x 16.5 cm W x 16.5 cm H (18 ½ in L x 6 ½ in W x 6 ½ in H) with 5.0 cm x 5.0 cm (2 in x 2 in) stainless steel wire mesh. An adjustable wooden peg was created to be inserted in the sleeve to act as a target for the bear's paw. The barred doors had a 15.2 cm x 16.5 cm (6 in x 6 ½ in) port cut out to receive the sleeve attachment (Fig 1 and 2). The blood sleeve was constructed to slide into the opening, and be detachable. The opening was 95cm (3 ½ ft.) from the floor and when not being used was secured with a metal plate. Similarly for the grizzly bears, the foot port is 36.8 cm L x 18.4 cm H (14.5 in L x 7.25 in H). Covering

the port is a 25.4 cm x 45.7 cm (10 in x 18 in) stainless steel removable door, locked with a screw pin (Fig 3 and Fig 4).

Figure 1: Tropical bear forearm port with door removed (Photo credit: Patty Young)

Figure 2: Tropical bear forearm port with removable door (Photo credit: Patty Young)

Figure 3: Grizzly bear port with door removed (Photo credit: Patty Young)

Figure 4: Grizzly bear port with removable door (Photo credit: Patty Young)

Sloth Bear Training Process

Reinforcement

It was decided to use a continuous reinforcement schedule and a reward that could not be dropped (e.g. a pellet or produce), to keep the bear focused. Initially it was decided to use a mixture of 10% pancake syrup and 90% water that could be dispensed from a bottle. However, we found that a mixture of 10% honey and 90% water was a stronger motivator. This high-value reinforcement proved to be very beneficial and motivating during training.

Pre-Sleeve Training

The bears were always separated during training and eventual blood draw procedures. Training began with

the sloth bears prior to the construction of the sleeve to station their bodies and forelimbs in the desired position. The bears were first trained for a stand behavior using the cue "up". After the bears were standing they were trained to place their front paw on the removable metal plate where the sleeve would be placed using the cue "door". This process was completed in a matter of a couple weeks.

Sleeve Training

On April 15, 2015 the blood draw sleeve was used for the first time. The metal plate was removed and the sleeve was installed in the receiving tracks of the opening in the barred door. Additional, guard plates were installed on either side of the sleeve for added keeper and veterinary technician safety.

Once the sleeve was in place, the bears were initially apprehensive, but eventually became comfortable with putting their forelimb into the sleeve. The cue "sleeve" was used when the bears placed their forelimb into the sleeve and were at first rewarded for just putting their front paw into the sleeve, and eventually for holding the wooden peg. The peg was first placed at the entrance to the sleeve for the bears to hold (Fig 5 and 6). We approximated the forelimb down the sleeve until the entire forelimb was in the sleeve and the bear was holding for a few minutes. We found that when we placed the wooden peg horizontal it acted as a target to position the paw and forelimb in a position that the veterinary technicians could access the blood vessels. Both bears were placing their entire forelimb into the sleeve within one week.

Figure 5: Sloth bear investigating the new sleeve with a front paw. (Photo credit: Mike Murray)

Figure 6: Sloth bear using the wooden dowel as a hand target (Photo credit: Mike Murray)

After the bears were continuously presenting their forelimbs we began the desensitization process. We introduced the verbal cue of "touch" not only for touching the leg, but also for trimming hair. The verbal cue "poke" was used for poking with a blunt needle and eventually the actual blood draw. Each training session consisted of "up", "sleeve", "touch", and "poke". The sessions were usually done once a day. We worked on conditioning the bears to hold this behavior for 2-5 minutes at a time to eventually allow the veterinary technicians enough time to locate blood vessels and draw blood.

Blood Draw

On July 1, 2015 veterinary staff observed a training session demonstrating the achieved training approximations which then progressed to the veterinary technicians attending training sessions twice a week. These dedicated sessions were to desensitize the bears to new staff members and determine how to modify the sleeve for vessel access. The blood sleeve was modified by removing four 5.0 cm (2 in) sections of mesh; creating a 5.0 cm x 25.4 cm (2 in x 10 in) window to allow access to the bears' forearm for hair trimming and blood draws.

During the first few veterinary staff sessions, the technicians palpated areas to find a vessel that would line up with the corresponding cut out in the mesh. Due to positioning, the large cephalic vein that runs along the medial aspect of the arm was not accessible. The best option seemed to be smaller vessel branches that ran across the crest of the carpal joint. Also, due to varying sizes between the male and female forelimbs it became evident that the female needed an additional approximation of raising her forelimb higher to allow better access to the vessels.

For the actual blood draw the technicians decided to start with a 25 x 3/4 gauge butterfly catheter. This would allow the bears to become accustomed to the feel of a small needle and if necessary the needle size could be increased to allow for better flow. It was later determined that the gauge and the length of the needle were adequate and no hemolysis resulted due to needle size.

On August 6, 2015 for the female and August 7, 2015 for the male, the veterinary technicians successfully drew blood from both sloth bears. Since the initial blood draws, we have been able to reliably obtain blood samples. In recent months the position for blood draw has changed to more proximal on the forearm to utilize the cephalic vein.

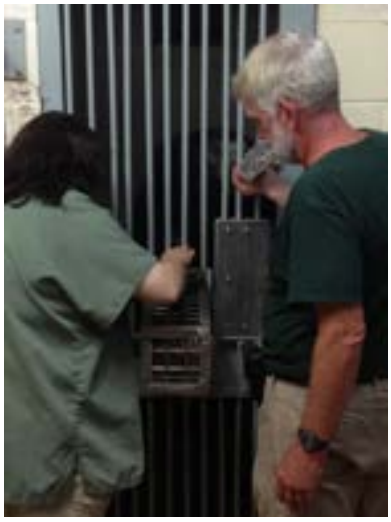

Figure 7: Curt Gindlesperger, Animal Keeper, and Angel Mitchell,
Registered Veterinary Technician work on desensitizing to the needle poke
(Photo credit: Mike Murray)

Figure 8: View of the blood draw and forelimb position from the top of the sleeve.
(Photo credit: Angel Mitchell)

Andean Bear Training Process

Reinforcement

The reinforcement for the Andean bears is the same as the sloth bears, the 10% honey/90% water solution used as continuous reinforcement for the bear during the blood draw training and procedures.

Sleeve Training

The same sleeve used for the sloth bears was used for the Andean bears. To accommodate the universal blood draw sleeve an additional attachment port was cut into their respective door. Again, in order to establish the behavior of the bear properly positioning its paw, a 10.1 cm (4 in x 4 in) metal plate target was attached to the door where the blood sleeve would be placed. The female was first trained to stand up so that her body would be positioned correctly. Using the cue "door", the female placed her paw on the target. Once the blood sleeve was installed, in less than two weeks the female was placing her forearm in the sleeve and positioning her paw on the wooden peg.

The training plan for the Andean bears was exactly the same as the two sloth bears, however, there were a couple of differences in the blood draw training with the male Andean bear. First, he is the largest of our tropical bears with a weight of approximately 350lbs. While the female Andean bear and the sloth bears are able to stand and put their forearm into the sleeve, the male Andean bear is so large, in order for him to use it, he has to sit to place his forearm into the sleeve.

The second difference was no intermediary step using the 10.1 cm (4 in x 4 in) metal plate target. We progressed right to using the cue "sleeve" which worked well. Additionally the male Andean was more cautious. It took him about 3 weeks to put his forearm into the sleeve and another 1-2 weeks to desensitize him to having his forearm shaved in preparation for the blood draw. Also, his forearm is a little too large to fully enter the blood sleeve. He could get about 90-95% of the forearm into the sleeve. Lastly, after the blood draw behavior was established he still takes longer because he investigates the training port and sleeve.

Blood Draw

Comparatively, the blood draws for the Andean bears were more challenging to establish because their vessels are not as easy to palpate. We have found that the vessel runs deep approximately 2.5 cm (1 in) proximal to the

carpel joint along the same plane as the second digit. We have been most successful using a 3 cc syringe, a 25 x1 needle and inserting the needle at a 45 degree angle. The veterinary technicians began working with the Andean bears in February 2016. It wasn't until over a month later on March 23 that the first successful blood draw was accomplished with the female and not until September 7 for the male.

Figure 9: Curt Gindlesperger, Animal Keeper,
and Angel Mitchell, Registered Veterinary Technician
work on desensitizing to the needle poke (Photo credit: Mike Murray)

Grizzly Bear Training Methods

Reinforcement

Like the tropical bears both maple syrup and honey mixed with water in a squeeze bottle was tried as reinforcement but they were found to not be effective. The team decided to use unsweetened applesauce in a 60 ml syringe for continuous reinforcement during a blood draw. A continuous reinforcement schedule was chosen to keep the bears focused on the trainer. During training sessions 3-4 syringes were used for each bear. For an actual blood draw this increases to as many as needed (usually 6-7).

Pre Blood Draw Training

The two bears (Cody and Cooper) were separated for training sessions and alternated due to one accessible training port. The process began by shifting both bears and stationing them in an alternate holding area. Next they were trained for separation. One bear would be called back inside to the stall with the training port while the other stayed in place until the door was closed between them. This was repeated as needed to switch the bears so both had access to the port stall.

Once it was decided to draw blood from the rear paw, they were trained to sit and station their front paws in an incompatible behavior to make it safe for the trainer and the veterinary technician while the bear presented a rear paw through the port. Both bears were trained to sit and present front paws individually on cue then sit upright with both front paws on a crossbar above the port. This became known as the "hands" behavior. Later on in the process a higher cross bar was added to help them sit up straighter which brought their body closer to the door and increased focus on the trainer and not the technician. The original crossbar is 1 m (3 ft.) from the bottom of the port. The additional crossbar is 1.2 m (1 ft.) higher.

Port Training

Once bears were trained in the "hands" position a second trainer was added to start the port training. The door on the port would be opened by the second trainer while the first trainer held the bear in the "hands" position, providing continuous reinforcement during the removal of the port door.

In early sessions when the port door was removed both bears would drop from the "hands" position to explore the opening. When this occurred the trainers would step back until the bear refocused on the trainer. The goal

during this part of the training was for the bears to remain in the "hands" behavior while the port door was removed.

Once the "hands" behavior was established, having them place a rear paw through the port was trained next. After some trial and error it was decided to train them to target a back foot using the target to push on the rear paw and letting the paw relax back to the target and then reinforcing. This allowed them to see, feel and understand what we were reinforcing. Any movement towards the port or the target was reinforced. If a rear paw came through the port, a jackpot reinforcement would be given. The bears quickly learned to target their rear paw and put it through the port. A verbal "ok" was added to end the session; cueing them to pull their paw back through the port so the port door could be installed.

After the bears consistently put their rear paws through the port we began the desensitization process as follows. The verbal cue "touch" was introduced so the leg could be palpated to find a suitable blood vessel and hair trimming. The verbal cue "poke" was used for poking with a blunt needle and eventually the actual blood draw. The training session behavior sequence consisted of "sit", "hands", "door", "foot", "touch", "poke", "ok" and, "door". Training sessions generally took place 4 days per week, depending on availability of a 2nd trainer. Once veterinary technicians were added, sessions took place a minimum of once a week.

Blood Draw

Training for the "foot" behavior for both bears started in December 2015. Cody was the first to offer his rear paw out of the port. In February 2016, there was an interruption in his training due to Cody having to spend months in the hospital to recover from an injury. However, there was no regression in his training as when he returned to the area in May he put his back paw into the port on cue. Cooper needed a little more time to establish the "hands" behavior which was a longer process as he was very intrigued by the port door operation. Cooper first offered his rear paw through the port in June 2016. Once both bears were trained for "foot" (rear paw is out of the port and kept in the correct position while reinforcement is given and held while individual applesauce syringes are switched) training progressed quickly with successful blood draws on both bears on September 8, 2016.

The blood vessel in grizzly bears is easily palpated in the bend of the tarsal joint on the dorsal side. A 25 x ¾ butterfly catheter and a 6 cc syringe is used.

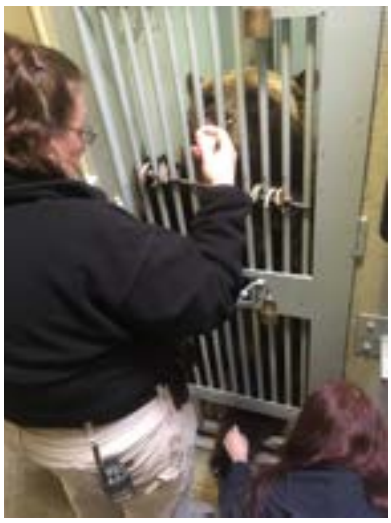

Figure 10: Patty Young, Animal Keeper,
and Angel Mitchell, Registered Veterinary Technician
draw blood from the back foot of Cooper the grizzly bear (Photo credit: Mike Murray)

Conclusion

As there was very little information available specific to these species, transferring what we knew about blood draw techniques in other large mammals proved successful. Once the sloth bears were conditioned to the sleeve, obtaining blood was a very quick process but it took us a while longer with the Andean bears due the fact that the Andean bear blood vessels were difficult to locate. Once the grizzly bears learned to present their paw through the port, drawing blood was a quick process. None of the bears reacted much to the shaving of hair or poking of the needle. The bears were constantly motivated and always willing to participate. We were also able to accomplish this behavior by minimally modifying our older holding space which decreased monetary investment.

The reinforcement that we chose for each bear species was motivating and reinforcing. Since this was a new training process for both the bears and the team, continuous reinforcement was chosen to simplify the procedure and keep the bears focused. Moving forward, the team will move towards using a terminal bridge for the behaviors to minimize the quantity of reinforcement.

The implications of this training has the potential to have a huge impact on bears in human care. We will be able to monitor the blood values of these animals as they age without using chemical immobilization. The Conservation and Science department at CMZ is in the process of studying the nutrition of these animals and obtaining blood samples will help us determine the efficacy of dietary adjustments. Further, this successful training methodology can be applied to bears at other institutions to improve global bear husbandry. The CMZ bear management team hopes to continue to expand the training program of these animals as well as establish blood draw behaviors in the other bear species housed in Cleveland.

Acknowledgments

This was very much a team effort! Thanks to all Wilderness Trek keepers and curators helping and providing positive encouragement and support. Thanks to Jim Nemet, CMZ training advisor for his training advice and everything he told us was incredibly useful. Thanks to Mike O'Brien for making the blood draw sleeve and Greg Sheldon for doing the modifications. Thanks to the entire Veterinary Services department for their expertise and patience in getting successful blood draws.

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How Many Trainers Is Too Many? Managing Behavior of Education Raptors with 45 Trainers

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The Raptor Center – University of Minnesota

How many trainers is too many to work with an animal? 2? 5? 10? 45? At The University of Minnesota Raptor Center, we have 30 education birds and each bird has anywhere from 1-45 handlers/trainers. Our handlers range from full time staff with 30 years of training experience to volunteers learning to handle raptors for the first time. Similarly, our education birds have a wide range of experience and behavior fluency. Some birds are trained for educational programming on the glove, some are trained mainly for display, and some are trained for both. Due to the many variables of our education department, we are always trying to set both animal and handler/trainer up for success. This paper will cover how the University of Minnesota Raptor Center manages its layered behavior management system, maintains behavior of both handlers and birds, and utilizes our diverse trainers to help educate the public on raptors and conservation.

Live birds of prey can be captivating educational tools to teach about raptor natural history, ecology and conservation. Forty trainers at The Raptor Center (TRC) at The University of Minnesota teach about these subjects using these magnificent animals. This paper will explore how TRC staff aims to set up birds and trainers for success to teach environmental education with raptors who voluntarily step up on to the glove, station on the glove, crate, and show comfort signs (fluffed feathers, rousing, preening, etc.) on the glove. In TRC's collection of 28 education birds, three are display only, 13 are trained by staff only, and 12 are trained by most or all handlers. This paper will describe the behavior management strategy of two birds, one trained by all of TRC's handlers and one trained by only a fraction. Ultimately, all animals are a study of one and TRC behavior management reflects that. Not all birds tolerate having 40 handlers or even having 40 handlers train every single behavior. This paper will explore how the bird tells caretakers through behavior how many trainers it can tolerate. Afterwards, the benefits and disadvantages of a behavior management system with dozens of trainers will be explored.

Background

The Raptor Center (TRC) at The University of Minnesota is a rehabilitation clinic within the university's vet school, which specializes in birds of prey. TRC also has an education department, which cares for 28 rehabilitated, non-releasable raptors. Four full-time staff, one part-time staff, ten contract staff, and 25 volunteers handle 25 of these birds in approximately 500 onsite and 500 offsite programs annually. TRC is a small non-profit with limited resources and is dependent on volunteers to operate. Volunteer handlers typically have no formal animal training experience prior to handling TRC birds and handle anywhere from three times a week to once a month. While some of these programs are flight demonstrations, the majority are one-hour experiences where birds step up out of a crate and station on the glove of the handler. Each handler is empowered to know that they are training in every interaction they have with the birds. Therefore, the terms handler and trainer are used synonymously. Every trainer and every new outreach environment creates a different set of variables for the antecedents to the behaviors of stepping onto the glove, stationing on the glove, and crating. The five core staff shape new behaviors and generalize those behaviors out to new handlers in new environments. All handlers are trained to cue behaviors and reinforce behaviors in the same way. However, the natural variation of human behavior causes each handling style to shift over time. As handling styles slowly shift, TRC's birds either learn to generalize out behaviors to a wider set of antecedents, or learn new behaviors that are reinforced unintentionally by less experienced trainers. Sometimes, those behaviors can be undesired ones such as bating or flying off glove, lunging towards food, footing the glove, biting the glove, increased vocalizing, or evading the glove, to name a few. This will describe two birds' behavior management strategies. While TRC does have 40 trainers working with the birds, every bird is an individual and a study of one. Each bird's management is different depending on the bird's ethology and personal history. Ultimately, the goal of TRC's behavior management is that birds exhibit behav-

iors that label them as "confident on the glove." "Confident on the glove" is operationalized at TRC as birds who eat food readily when offered, step up readily onto the glove when cued, step up to a different perch (scale, crate perch, enclosure perch) when cued, station on the glove during programs, station on the glove when going into a crate door, station onto glove when returning to enclosure, and show comfort behaviors on the glove (fluffed feathers, rousing, preening, etc.).

Falconry Equipment

TRC does use aylmeri style falconry equipment as a safety precaution for the birds and people working with them. Some birds are tethered and some are free lofted in their enclosures. Whenever possible, TRC makes an attempt to free loft their birds. TRC may choose not to due to safety for trainers, the bird itself if it regularly hits the mesh or walls, or if birds are temporarily housed in the same space together. TRC handlers are trained to use falconry jesses as a backup while handling if the bird bates (attempts to fly off the glove) to help the bird back on to the glove. Handlers are taught to act as if the equipment is not there while training and use food as primary reinforcement for birds stepping up and stationing on the glove.

<u>Case Study 1 - Artemis</u>

Background

Artemis is a 16-year-old female Peregrine Falcon (*Falco peregrinus*) bred in captivity but properly imprinted onto peregrine falcons. A falconer donated her to TRC's education department when she was not hunting well enough for him. She also developed bumblefoot while prior to her TRC acquisition but TRC is able to manage it with twice a day foot ointments and perch rotation. However, aside from those injuries, she is fully physically able. Since being at TRC, she has become a bird that every trainer works with. Even with 40 trainers and in over 400 programs annually, still consistently steps up when cued, stations on the glove, and crates without hesitation. Artemis is the first bird that many handlers learn to train with. Artemis' consistent behaviors can be attributed to the following factors:

Physical Ability

Unlike some birds in the TRC education collection, Artemis is fully flighted and therefore has normal balance for a raptor. Rehabilitated birds with severe wing droops from healed wings can develop challenges with balance, which can also turn into bumblefoot. (Arent, 2007, p. 32) If moving from perch to perch is challenging for a bird with poor balance, moving from a stable enclosure perch to a glove that moves is even more challenging. Even if the bird receives food when stepping onto the glove and for stationing on the glove, the motivation to stay on a stable perch may be higher than the motivation for food. Since Artemis is fully flighted, that barrier to success is not present.

Enclosure Set Up

Artemis is free lofted in an outdoor exhibit enclosure with different styles of perching on each wall (half circle flat shelf perches, fake rock with astroturf, and a bar perch with rope and astroturf sections). (Image 1) Additionally, all of these perches are at varying heights to give the bird a variety of options and perspectives. Artemis also has a hutch that she can go into to fully remove herself from view if she chooses to do so. The number and variety of perching gives the bird choices to be on or off public display. Therefore, after being on programs, she can choose to be away from the stress of predators (humans) staring at her. However, she still does spend most of her time on the perch closest to the public, regardless.

a

Number of Training Sessions

Because Artemis is susceptible bumblefoot, she is trained at least two times day for application of foot ointment while on the glove. Between that and handling in programs and handler training, Artemis can be in 2-7 training sessions a day. Since some of her behaviors have such a high reinforcement history, it makes sense that she offers those behaviors (step ups and downs, stationing on glove, crating, etc) at a high frequency with little to no hesitation.

How Many Trainers Work Different Behaviors

Although 40 trainers work with Artemis, not all of them train every behavior that she knows. All of TRC handlers work with the birds for the purpose of helping with programs. Therefore, all handlers work with Artemis on behaviors needed for

TRC style of programs: step ups from one glove to another glove, step ups from crate perch to glove, stationing on glove in front of various audiences and stimuli, stationing on glove while glove moves through crate door, and step downs from glove to crate perch. These are the behaviors that are necessary for a trainer to be comfortable with in the style of "on the glove" programming TRC does. Artemis also is trained in some higher skill level behaviors that not all trainers work with her on. In fact, some of these behaviors are limited to staff only, who have high levels of relationship and trust with her. The limited behavior that is most relevant in terms of handling her for programs is stepping up onto the glove from her enclosure before coming in for a program. Raptors can show a different set of behaviors inside and outside of their enclosures. The motivation to stay perched in her home perching could be higher than her motivation to step up for food reinforcement. Her trust level with the trainer therefore needs to be higher to step up from her home perching where she is most comfortable. With those extra challenges, that is why more experienced trainers with high relationship levels retrieve birds from their enclosures at TRC. Depending on the difficulty of the behavior, Artemis might have anywhere from 5-40 trainers working with her on it. (Chart 1)

Discriminatory Stimulus (Cue)	Behavior	# of Trainers
Glove raises above glove she is already on	Step up from one glove to another glove	40
Glove raises above crate perch she is already on	Step up from crate perch to glove	40
Right, un-gloved hand goes behind back of handler	Stationing on glove with wings in and head to the left	40
Crate door opens and glove that bird is on moves into opening	Stationing on glove with wings in while crate doorway	40
Glove lowers below crate perch	Step from glove to crate perch	40
Trainer stands at enclosure doorway; Trainer approaches Artemis	Station on back perch of enclosure with wings in	14
Glove raises above perch she is already on in enclosure	Step up from back perch of enclosure to glove	14
Glove lowers below scale perch	Step from glove to scale perch	40
Glove raises above scale perch she is already on	Step up from scale perch to glove	40
Q-tip approaches foot	Station on glove with head up while foot ointment is applied	33
Ungloved hand approaches chest while bird is on glove	Station on glove with head up while keel is felt	5
Nail trimmer approaches foot while bird is on glove	Station on glove with head up while talons are trimmed	5

High Rate of Reinforcement for Behaviors

While variable rates of reinforcement can increase motivation (Heidenreich, 2014), the majority of TRC handlers offer food reinforcement to birds for every behavior they offer appropriately when cued. However, the type and size of reinforcement does vary to create some variability. The average handler at TRC has little to no training experience prior to handling at TRC. They learn an enormous amount of theory and skill in a few months. TRC has found that their less experienced volunteer handlers are more likely to utilize positive reinforcement training in general when they are not thinking about variable schedules of reinforcement. Additionally, some of Artemis' trainers only work with her once a week or even once a month. TRC especially asks these infrequent trainers to use a 1:1 ratio of behavior to reinforcement to increase their relationships with Artemis as much possible.

Training Process for Handlers

When a new person starts handling at TRC, they begin with one bird and one person training them. To keep the handling style as consistent as possible, only 1 of the 5 core staff trains in new handlers. Once a handler has been trained on one bird, they generalize their skills to two more birds so they can present a full program with three birds. After this point, the new handler begins working with more mentor trainers. However, the training is not done. Every time the new handler is trained in with another bird, the mentor trainer working with them sharpens up handling and training technique that has possibly changed due to natural variation of behavior. Also, handlers are expected to come in once a week for a four-hour shift. Commonly, they will present a program during that time and practice handling. However, if they don't present a program, they are still expected to handle a bird at some point with a mentor trainer. Handlers are expected to come in minimally once a month to work with a bird to practice handling.

Close Observation of Behavior Breakdown

TRC trains trainers to hone their observation skills to notice the slightest changes in Artemis' body language that might indicate she is not feeling comfortable. This can be operationalized as slicked down feathers, flapping wings, rapid head movement, not eating food when offered, shifting of weight on glove, or even bating off the glove. Individual trainers make notes of Artemis' behavior in her behavior log. Every bird in the education department has one primary caretaker who ultimately facilitates their husbandry and behavior management. This person keeps close eye on those behavior notes. If they are noticing a higher frequency of those behaviors labeled as uncomfortable, the primary caretaker will change Artemis' management systematically. The primary caretaker looks for the management variables that decrease "uncomfortable" behaviors and increases behaviors such as eating food readily when offered, stepping up readily onto the glove when cued, stationing on the glove during programs, stationing on the glove when going into a crate door, stationing onto glove when returning to enclosure, fluffed feathers, rousing and preening. If the variable that decreases unwanted behaviors is fewer trainers, then the primary caretaker can use that information to limit her trainers. When Artemis consistently is not showing "uncomfortable" behaviors again, then her primary caretaker can choose to increase the number of trainers gradually. If Artemis begins showing any subtle "uncomfortable" behaviors again, then the primary caretaker knows that this is the current maximum number of trainers Artemis will tolerate.

Ideally, Artemis' primary caretaker will begin to shift her management when Artemis is showing more subtle behavior change before they escalate into larger behavior change. TRC has operationalized a few subtle behavior changes that tend to be precursors to larger behaviors changes. (Chart 2)

Large Behavior Change	Subtle Behavior Change
Hopping to back of crate when asked to step up	Remaining on perch when asked to step up onto glove
Flying away as trainer approaches	-Not eating food from trainer as they approach -More slicked down feathers as trainer approaches -More vocalizing as trainer approaches
Increased bating off glove	Increased crouching, rapid head movement, slicked down feathers on glove

<u>Case Study 2 - Gladdie</u>

Background

Gladdie is a 21-year-old male American Bald Eagle (*Haliaeetus leucocephalus*) and has been in captivity the majority of his life. He is a rehabilitated bird with a right-wing droop caused by a healed luxated right elbow. He is a bird that has not tolerated a high number of trainers in the past and currently only has 10 trainers. Unfortunately, Gladdie used to be managed in a way where he was coerced onto the glove from a tether and learned to either evade or attack the glove when approached. Over the course of the last 15 years, TRC has slowly been shifting its behavior management style to one based more in positive reinforcement. For the past 10 years, Gladdie has been trained primarily using positive reinforcement. However, his previous punishing experiences with the glove are so strong that he can be triggered quickly to offer his previously learned behaviors of evading or attacking the glove. Because of this and his physical disability, Gladdie is managed differently than Artemis to help set him up for success to offer behaviors that label him as "confident on the glove." The following management factors help to set up Gladdie for success:

Physical Ability

Because of his wing droop, Gladdie does have compromised balance. In order to give him the most stability on the glove, only experienced handlers train Gladdie on the glove. Gladdie's balance challenges make the relationship he has with his trainers even more relevant. The trainer needs to keep an extra steady hand, a skill that takes

time and strength for handlers to develop.

Enclosure Set Up

Gladdie is tethered to a hutch that allows him to be on top of the hutch, inside the hutch away from public view or at several mailbox perches around the hutch. (Image 2) He is not free lofted because he does have previously learned behaviors of attacking the glove with his feet. While he does know many incompatible behaviors to attacking the glove, he will quickly offer that behavior if he is unsure of what to do. Tethering him keeps the trainer safe, which is of utmost importance. However, tethering him also does take away some of his agency. Therefore, trainers ask for a specific behavior to initiate training. If Gladdie does not offer this behavior, the trainer does not move forward. This way, Gladdie can decide clearly whether or not he wants to engage. Most of the time, he chooses to engage though. The initiation behavior is for Gladdie to hop onto a portable scale. The discriminatory stimulus for this behavior is that the trainer enters the enclosure, places the scale on the ground at the end of Gladdie's tether radius, and taps on it twice with forceps. Afterwards the trainer can decide to work other behaviors.

Number of Training Sessions

Unlike Artemis, Gladdie does not need twice a day foot ointment so training is not an integrated part of the day. However, Gladdie's primary caretaker does make sure that trainers work with Gladdie 4-5 times a week and that 3-4 of these training sessions include handling outside of his enclosure. When trained at this rate, Gladdie still offers step-ups, step-downs, stationing on the glove and targeting to various perches in his enclosure at a high rate without hesitation.

How Many Trainers Work Different Behaviors

Similar to Artemis, not all of Gladdie's trainers work with him on every single behavior. Gladdie's newer trainers or trainers that are not able to work with him multiple times a week mostly work on easier behaviors with him in programs: stepping up from crate perch to glove, stationing on glove in front of various stimulus, stationing on glove while glove moves into crate and stepping down from glove to crate perch. When a trainer with a lesser relationship with him asks him to step up from his enclosure perches, he is more likely to offer behaviors such as remaining perched on his enclosure perch, vocalizing, stepping away from glove, or flying away from glove. Depending on the relationship level, Gladdie might have anywhere from 5-10 trainers working a particular behavior. (Chart 3)

Discriminatory Stimulus (Cue)	Behavior	# of Trainers
Glove raises above glove she is already on	Step up from one glove to another glove	10
Glove raises above crate perch she is already on	Step up from crate perch to glove	10
Right, un-gloved hand goes behind back of handler	Stationing on glove with wings in and head to the left	10
Crate door opens and glove that bird is on moves into opening	Stationing on glove with wings in while crate doorway	10
Glove lowers below crate perch	Step from glove to crate perch	10
Trainer sets down mobile scale in mew and taps it twice with forceps	Hop onto mobile scale perch	6
Trainer taps any perch twice with forceps	Hop onto tapped perch	6
Trainer approaches where Gladdie is perched in his enclosure	Remain perched, not vocalizing, with wings in and head up	8
Glove raises above enclosure perch he is already on	Step up from enclosure perch onto glove	8
Trainer re-enters enclosure to return bird and he is on glove	Station on glove with wings in and head to the left	10
Ungloved hand approaches chest	Station on glove with head up while keel is felt	3

High Rate of Reinforcement for Behaviors

With Gladdie's past of coercion onto the glove, TRC education trainers reinforce him for every behavior that he offers appropriately when cued. Every opportunity is used to put more trust back into relationship between trainer and bird by giving primary reinforcement for behaviors such as targeting to perches, stepping up onto the glove, and stepping down to cued perches.

Training Process for Handlers

Since relationships are more important for Gladdie, the process for training in new handlers to him is slower that with Artemis. New trainers to Gladdie typically start working on their relationship with him by reinforcing him for behaviors that another trainer with a good relationship cues. If Gladdie regularly takes the food from the new trainer, then the new trainer slowly starts cueing the behaviors themselves. Some of the first behaviors that a new trainer might work on with Gladdie are stepping up from a previous trainer's glove to the new trainer's glove or stepping up from the crate perch to the new trainer's perch. These are behaviors that Gladdie typically offers without hesitation and are easy for the trainer to reinforce. The slower introduction process sets Gladdie and the new trainer up for success to have a well-established relationship.

Close Observation of Behavior Breakdown

Similar to Artemis and all of the birds in the TRC education department, there is one care lead for Gladdie who is in charge of keeping a close eye on his husbandry and behavior. This person is in charge of keeping a close eye not only on the behavior in their own training sessions with Gladdie but the behavior notes from other handlers' training sessions with Gladdie. If Gladdie begins offering a higher number of undesired behaviors such as flying away from the glove when approached, attacking the glove when approached, or bating off the glove, his care lead will systematically change aspects of his behavior management. The care lead changes management systematically until Gladdie offers those undesired behaviors less and desired behaviors such as fluffed body feathers, preening, rousing, and stepping up calming more. One of these management changes might be limiting the number of people who are handling him or even just limiting the number of people who are retrieving him from his enclosure until his behaviors shift back to "confident" ones. Systematically changing management one factor at a time will tell the primary caretaker which variable is the one that altered Gladdie's behavior. If that factor is number of trainers or number of trainers retrieving him from enclosure, then the primary caretaker knows how many trainers Gladdie tolerates working each behavior. As with Artemis, these large behavior changes are not what should trigger management changes. The primary caretaker and other trainers should be noticing more subtle behavior changes that could turn into larger behaviors changes. TRC has operationalized a few subtle behavior changes that tend to be precursors to larger behaviors changes. (Chart 2)

Large Behavior Change	Subtle Behavior Change
Hopping to back of crate when asked to step up	Remaining on perch when asked to step up onto glove
Flying away as trainer approaches	-Not eating food from trainer as they approach -More slicked down feathers as trainer approaches -More vocalizing as trainer approaches
Increased bating off glove	Increased crouching, rapid head movement, slicked down feathers on glove

Analysis

The system of utilizing 40 trainers is not perfect. There are several disadvantages. Time is a valued and scarce resource at TRC. The time that is put into training in new trainers by the five core education staff pulls them away from other tasks such as training more complex husbandry behaviors. Additionally, maintaining both bird and handler

behaviors is a constant challenge. The five core staff needs to constantly be keeping an eye out for subtle behavior breakdown for birds and handlers. The expectation is set for trainers to work with birds weekly, or even monthly as a minimum. However, these are volunteers who have full lives outside TRC and are not always available to upkeep their training skills. Finally, communication is always a challenge. TRC has behavior logs that trainers are expected to write in every time they work with a bird, but it doesn't always happen. With so many trainers, it is always not possible to communicate to every person who works with a bird when change in behavior management happens. Inevitably, mistakes can occur, which impact the birds.

That being said, the use of 40 trainers does have its benefits. Even though they require a high amount of staff time, the TRC volunteer handlers present approximately 500 programs every single year. This results in income for TRC. Also, every time a bird is trained by a different person, that is an opportunity for environmental enrichment. Furthermore, handling is fantastic volunteer enrichment, which has its own benefits. For example, when new handlers begin training the birds using positive reinforcement, the trainers begin interacting and interpreting the birds differently. They are able to interpret the birds' subtle body language to the public in a way that provides deeper appreciation. Not only that, but trainers are excited to share this new knowledge about body language, positive reinforcement and applied behavior analysis. Therefore, not only are there 40 people teaching the community about raptor ecology, natural history and conservation but also about applied behavior analysis and the power of positive reinforcement. TRC trainers are empowered to know that they are influencing these birds behavior for the better, even if it is only once a week. Finally, there are a number of volunteer handlers who go into careers in animal care, training, and wildlife conservation. They take the knowledge and skills learned at TRC and pass it on to other organizations. The powerful relationship between a trainer's first animal can inspire a lifetime of great animal care and a passion for conservation of the ecosystems that we share with those animals.

Conclusion

This paper is not advocating that all animals thrive with 40 trainers. It is simply describing a system of how it can successfully look to manage behavior with 40 different trainers or even 10. Both animal and trainer need to be set up for success in a number of ways. A few ways that TRC tries to set up bird and human up for success are: choosing the right animal for the job, setting up the bird's enclosure so that it feels safe and has a way to opt out of training, training multiple times per week, offering a high rate of reinforcement for behavior, limiting which trainers work on more challenging behaviors, using any opportunity to maintain handler skills, and systematically changing behavior management of birds when a subtle behavior breakdown occurs. Overall, for TRC, this current system's benefits outweigh the disadvantages. However, this might change as the organization develops. The behavior management that works today might not work tomorrow. Hopefully, an already flexible environment will easily facilitate those changes in the future.

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Choice-Based Training Improves Animal Welfare and Program Participation in Ambassador Animals

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Animal ambassador keepers often face pressure to meet program needs that can lead to adverse behaviors within the collection for which they care. When an animal has no choice but to participate, responses sometimes emerge including learned helplessness, aggression, and escape or avoidance. However, animals in programs greatly improve our ability to reach audiences with conservation based messaging. With choice-based training, a strategy that allows animals a voice in their level and quality of participation, keepers are able to not only meet the program needs but also increase their animals' welfare. Keepers at the Denver Zoo observed behavior change in multiple species within the Animal Ambassadors collection after taking a step back and modifying their approach to their program participation. Three case studies will be presented: A prehensile-tailed skink that was biting the glove, a fennec fox who fled from keepers, and a Patagonian cavy who was uncomfortable with keeper interaction. The specific roadblocks, discussions and strategies employed will be discussed, as well as application of the concepts to other animals in the collection. Through increased participation of these ambassadors, Denver Zoo is able to provide quality programming for conservation messaging while optimizing our animals' welfare.

Introduction

The Denver Zoo's Animal Ambassadors Department serves a significant role in connecting people with wildlife in a meaningful way and to ultimately inspire conservation values to secure a better world for animals. Zoo guests experience moments of wonder and reverence at the zoo's Wildlife Show through the demonstration of natural behaviors alongside a keeper's conservation message. Students at a school assembly who have never visited a zoo before can now have an appreciation for wildlife and learn how to help secure habitats into future generations. Animal shows create a connection between humans and the natural world far more than any book, television show or teacher can convey. A close encounter with a live animal can open people's minds and touch their sense of wonder (Martin, 1998). Ambassador keepers are acutely aware of the need for program animals and conservation messaging, and are often faced with the pressure of meeting program needs while delivering entertaining and inspirational experiences. This can sometimes lead to putting an animal in a situation that it is not yet comfortable with. These pressures can blur our view of good welfare for our animals (Martin, 2016). Through choice-based training, the keepers at Denver Zoo were able to empower their program animals by giving them a voice and a choice. Olive the Prehensile-tailed skink (*Corucia zebrata*) told her keepers that she did not want to be picked up by biting the hands of handlers, so she now has the option to walk onto gloved hands presented in front of her enclosure. Zara the Fennec Fox (*Vulpes zerda*) was fleeing from her keepers when they walked into the room, and she is now waiting by her enclosure door to participate in voluntary crate and collar training. Lionel the Patagonian Cavy (*Dolichotis patagonum*) was uncomfortable when being handled by keepers, but is now given the option to participate in training sessions through stationing for a voluntary harness behavior. With choice-based training, a strategy that allows animals a voice in their level and quality of participation, keepers are able to not only meet the program needs but also increase their animals' welfare.

Prehensile-tailed Skink: Olive

Need for training

Prehensile-tailed skinks are an excellent ambassador for conservation education. On Olive's programs, she sits calmly in the hands of a speaker as the speaker walks around an audience and talks about the adaptations of a prehensile-tailed skink and the need for conservation efforts in the Solomon Islands due to deforestation. However, Olive did not appear comfortable being picked up out of her enclosure back at the Denver Zoo when it was time to go on a program. When her enclosure door opened, the handler would be greeted with an open mouth, fast movement and a

strong bite if Olive could manage it. Keepers would receive the same greeting during husbandry and therefore had to tip-toe around husbandry duties to avoid an altercation with Olive. It was time to start asking Olive to come out of her enclosure for programs rather than picking her up from her enclosure. We needed to do this to promote the best welfare for her while keeping handlers safe. We decided that we would present gloved hands outside of her enclosure, ask Olive to walk out onto the gloves and then place her into her cooler all for her favorite items: melon and banana.

Approximations

Starting the training of this behavior was tricky since Olive started her initial sessions approaching the entrance of her enclosure the same way she would if we were to pick her up. Getting bitten during the training of this behavior was not an option. Therefore, for the first week, we gave her fruit every time her door opened whether it was to change her water, mist her moss or simply say "hello" and build up a more positive relationship. Olive's behavior improved drastically just in that week and she had a calmer response to a keeper's presence.

It was time to introduce the gloves. Different gloves were used than the ones she was used to being picked up with to eliminate a negative history, and I also kept my hands out of them until I felt she was comfortable enough to station to them without biting. I first introduced the gloves at the threshold of her enclosure and reinforced calm behavior. I then approximated the gloves inch by inch until they were resting on the floor of her enclosure, reinforcing calm behavior all the while. I then asked Olive to station to the gloves by baiting her with fruit at the end of tongs. She approached slowly, smelled the gloves with her tongue, and calmly ate the fruit. Suddenly, she took a piece of glove into her mouth and shook it back and forth. Needless to say, I was happy my hands weren't in the gloves and knew we still had a long way to go.

Over the span of a few weeks, I continued helping Olive get used to the gloves by asking her to station to them and eventually felt safe enough to put hands inside of the gloves. I then approximated the gloves to be presented outside of her enclosure and asked her to station to them from that point.

Olive's overall behavior changed through choice-based training and empowerment. She learned that she could simply walk back into her enclosure to end a session instead of biting. She also learned that when her enclosure door was opened it no longer meant that she might be picked up; it now represented the start of a training session or non-invasive husbandry duties so she sits calmly in her enclosure during daily routines.

Fennec Fox: Zara

Need for training

The Denver Zoo acquired two fennec foxes, Malika and Zara, as ambassador animals almost one year ago. When the foxes arrived at the zoo, keepers noticed escape/avoidance behaviors immediately. When a keeper walked into the room, the foxes hid, put their ears down, closed their eyes and trembled. We made the decision from day one that we wanted to increase their confidence through choice-based training and would limit interaction as much as possible unless it was their choice. We chose to train a station behavior to teach them to come forward, a crate behavior for husbandry and transportation purposes and a voluntary collar behavior for tactility and safety on programs. The collar behavior greatly improved our relationship with Zara in particular as she demonstrated more confidence and curiosity in the training sessions than Malika, whom we relaxed our criteria with.

Approximations

The first step of this behavior was to get Zara to put her head through the collar while it was clipped and fully extended. I did this by holding a piece of feline meat at the entrance of the collar so she only had to put her nose through. That meat was placed further and further out until she put her entire head through the collar. The bait was then phased out so that her meat became a consequence instead of an antecedent to the behavior. Once this behavior was strong and she was holding her head through the collar for longer durations, I was able to hold the collar with both hands in order to eventually clip the collar and adjust the size to make it more fitted. From that point, the collar started as the circle shape she was used to, but became a straight line to be clipped behind her neck. Zara was now walking forward when the collar was presented and holding still until the clip touched behind her neck.

Now, before we clipped the collar, we needed to make sure that we would be able to unclip it. This was achieved by presenting my hands the same way I would if I were holding her collar, hoping she would distinguish this cue, and she did. Zara stepped forward, held still while I touched around her neck, and appeared comfortable with her ears in an upright position. Zara was now able to voluntarily collar and un-collar for programs.

Through this training, we noticed a vast difference in Zara's behavior with both keeper interactions and overall welfare. When keepers enter a room, Zara comes forward and waits by the door to start her training session whether it's collaring, stationing or crating. Her eagerness to train shows us that we have not only built up her confidence but also gained her trust.

Patagonian Cavy: Lionel

Need for training

Lionel was only four weeks old when he came to the Denver zoo in hopes of being part of the Wildlife Show. While feeding from a bottle, he was accustomed to being picked up and sitting in keepers' laps. However, once Lionel began to eat solid food his "need" for keeper interaction lessened. Soon being around keepers meant he would be picked up or handled and Lionel began to flee to the back of his enclosure. While being held, he often moved so much that keepers feared dropping him. As disconcerting as this behavior was to see in him, it also disrupted the behavior of the other animals in his enclosure and room. The welfare of an entire group of animals was now being negatively affected by keepers simply walking into the room. There was no way Lionel could represent his species and their plight with habitat loss on stage if he continued acting so adversely toward keepers. Since most of his discomfort seemed centered around being handled, it was decided that all physical interactions would stop until Lionel had a way to choose when it occurred. If Lionel was going to wear a harness he would choose to step on a station where the harness would be brought around him. This was also the only location where the leash would be attached. And after much trial and error, we finally found a solid food that was as rewarding as his bottle was: primate sticks. Now Lionel gets rewarded for choosing to participate in his harnessing.

Approximations

Training could not even begin until a strong enough positive reinforcer was found for Lionel. His weaning process was very long and resulted in the rejection of most solid foods. All suitable produce would be eaten last, let alone taken from the hand. After cycling through most herbivore pellets, our nutritionist suggested trying primate biscuits. Finally we had success with banana flavored primate sticks and the training could begin. It started by simply sitting in Lionel's enclosure and hand feeding him. As long as we made no movements toward him, he seemed comfortable with us in there. The next step was training a target. I used my fist with a biscuit in it and since he naturally would sniff my hand it was easy to have him touch his nose to it. A clicker was used every time he touched his nose to my fist and I would open my hand to give him the treat. It was a fast step removing the bait in the hand and he began following my fist anywhere, as long as I was sitting. As soon as I began to move around his enclosure, the fear of being picked up came back. It took about two months to build trust with Lionel so that I could move freely around him and he knew I would never pick him up.

While this trust increased, I began his station behavior since this was done seated. I discovered in the process of training him, that he seemed more comfortable in small spaces, such as the corners of his enclosure. Being a burrowing animal, this made sense, but being cornered seemed to contradict how he acted with keepers. While always giving him a way out, I used this newly found information to my advantage, setting up his station near his food bowl in the corner of his enclosure. I used my body and the mesh of his enclosure to form a three-sided box. Using a target I would maneuver him toward the station, a small plastic step about an inch high. As he started stepping on it he was rewarded until the criteria became two front paws on the station. His harness rested around the station so he was basically stepping into the harness by stepping on the station. The next approximations included my hands and arms near and around him in order to manipulate the harness. It seemed as though Lionel had no problem with this now that he was in his comfort zone and plenty of biscuits were provided. These steps moved quickly and the harness was fastened within about two weeks. At this point he often decided to take a break and walk around his enclosure but usually came back to have his leash attached.

To continue allowing him to have control, once he was leashed he was asked to walk into a crate and physical handling was no longer needed to transport him for demonstrations or onto stage. Lionel has progressed with walking on the leash but has always shown small amounts of discomfort while wearing his harness. He often crouches low and becomes motionless if something spooks him, occasionally running to find a place to hide. Since he has become such a diligent learner we have begun training him for this show season off leash. He is learning a crate-to-crate behavior across half the stage and the largest setback is his lack of fear! He loves wandering around stage to see what's new instead of going in his crate which he also enjoys. Lionel has found a new confidence that is opening doors for us and the programming we can provide with him. Hopefully he will make his grand debut on stage this summer and by winter he may be doing classroom demonstrations.

Conclusion

The behavior change exhibited with these three cases confirmed that choice-based training positively affects animal welfare and improves their quality of participation. The adverse behaviors we originally saw may have prevented a diverse group of animals from reaching an audience, but we are now able to connect people to a range of species

and their habitats. By empowering these animal ambassadors we've gained their trust while also ensuring high-level conservation programming.

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How the Results of a Pilot Study of Captive AZA Orangutan Preference Can Inform the Care, Training, and Future Conservation of Orangutans

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It is well known that the orangutan is adapted to life in the trees. It is the largest living arboreal mammal and it is critically endangered primarily due to habitat loss and wildfires. This is largely in part due the palm oil industry which is an incredibly lucrative crop that covers millions of acres of land in Indonesia and Sumatra where wild orangutans reside. With this in mind, I conducted an interview based pilot study in 2015 to better understand captive orangutans' preference for the different vertical structures in their zoo exhibits. The goal of this study was to gain a better understanding of captive orangutan preference so as to increase our knowledge of how to provide the best care for captive orangutans. The results of this study were slightly different from my hypothesis which was based on the natural behaviors of wild orangutans. This paper will discuss how the results of my pilot study can be utilized to inform the care and training of captive orangutans, future studies, and the possible reintroduction of captive individuals in the future.

Introduction

The two species of orangutan, the Sumatran orangutan (Pongo *abelii*) and the Bornean orangutan (Pongo *pygmaeus*), are recognized as the largest arboreal mammal, spending the majority of their time in the forest canopy (Ancrenaz et al., 2014; Biruté, 1999; Groves, 1999; Muir et al., 2000; Petter & Desbordes, 2010; Zhang etal., 2001). In their natural habitat, researchers have found that orangutans spend the majority of their time foraging and eating (50-60%), resting (25-35%), and traveling (10-15%) (Fox et al., 2004; Galdikas, 1988; Kanamori et al, 2010; Knott, 1998; Mitani, 1989; Mitani, 1991; Morrogh-Bernard et al., 2009; Rodman, 1979; Rodman, 1984; Rodman, 1988; Wich et al., 2006). An activity budget - the total time spent devoted to various activities each day - is a useful tool for evaluating zoo animal's health, expression of natural behaviors, and overall wellbeing (Bean, 1998; Melfi & Feistner, 2002).

From personal anecdotal observations at the Cincinnati Zoo & Botanical Garden (CZBG), the zoo's two orangutans (1.1 P. *abelii*) spend the majority of their time on the ground and relatively inactive. Focal observations of the male orangutan collected over two weeks by volunteers at the CZBG support these anecdotal observations. The male's overall activity budget (Figure 1) shows that the majority of his time is spent resting (62.55%), approximately 16% of his time is spent eating, and 10% locomoting. These observations line up with other studies that have found that zoo orangutans spend about 10-20% of their time feeding and that the rest of their time is typically spent being idle or inactive (up to 70%) (Herbert & Bard, 2000; Pizzutto et al., 2008; Perkins, 1992; Wright, 1995). Studies of wild orangutans suggest that inactivity of zoo orangutans could partially be attributed to their diet and the orangutans' natural feeding strategies (Edwards & Snowden, 1980; Perkins, 1992). A 'sit and wait' or a 'search and find' feeding strategy is employed depending on the fruiting season (Morrogh-Bernard et al., 2009; Bastian et al., 2010; Knott, 1998; Wich et al., 2006). These feeding behaviors are important for zoo management because the daily provision of food by caretakers negates the need to forage and can impact daily activity levels and health (Knott, 1998).

Knott (1998) found that wild orangutans will binge on fruit when it is available, storing the excess energy for when food becomes less abundant. This natural tendency to overindulge on available food, the ability to store fat efficiently, and the common low levels of activity in zoo orangutans could explain the predominance of obesity and obesity-associated diseases in zoo orangutans (Mackinnon, 1974; Maple, 1980; Knott, 1998). Respiratory and parasitic diseases could be associated with excessive ground dwelling due to the close proximity of feces that would normally be avoided by predominantly residing in the canopy of vertical space (Mul et al., 2007; personal conversation Perkin, 2015). Based on the arboreality and preferred height of orangutans in the wild, Herbert and Bard (2000) suggest that environments for zoo orangutans should include at least one location that allows them to increase their altitude and have the option of being out of the public's view. At CZBG, there is one faux tree that provides this

increase in altitude, but it is often only used to retrieve food or an enrichment item keepers have placed there, and is not a preferred location to reside throughout the day (Figure 2-5.).

As zoos have transitioned from small "hard" enclosures to naturalistic exhibits, much has been learned about providing appropriate environments and enrichment to enable zoo animals to elicit species-typical behaviors and increase their well-being (Moss et al., 2010; Rabb, 2004; Robinson, 1998; Shepherdson, 1998; Shettel-Neuber, 1988; Sommer, 1974). A critical part of this includes providing the appropriate levels of social, cognitive, and physical stimulation (Herbert & Bard, 2000). Some of the ways zoos provide these crucial elements come in the form of species-specific enrichment devices, providing opportunities for perceived control, operant conditioning, adequate enclosure size with appropriate vertical and horizontal space, and environmental complexity. These items are important for all zoo animals, but are especially important for those with more intellectual capacity such as our closest living relatives, the great apes (Maple & Perkins, 1996).

Studies have found that enrichment is important for increasing the activity levels of all primate species residing in zoos (Gilloux et al., 1992; Little & Sommer, 2002; Wright, 1995). With their tendency for low activity levels and lethargy, the provision of proper enrichment for zoo orangutans is especially important (Barbiers, 1985; Birke, 2002; Kim-McMormack et al., 2016; Pizzutto et al., 2008; Tarou et al., 2004). Studies have found that activity levels of zoo orangutans increase in accordance with the amount of enrichment items provided and that there is an increase in well-being (decrease of cortisol; increase of estradiol), and natural behaviors when environmental enrichment is provided (Wright, 1995; Tripp, 1985; Wilson, 1982; Perkins, 1992; Herbert & Bard, 2000; Pizzutto et al., 2008). A preference for higher, private locations was also found in Herbert and Bard's (2000) study, and Pizzutto et al. (2008) emphasized the importance of opportunities for activity and brachiation in elevated locations.

While these studies on zoo orangutans have shown a preference for higher, private locations in their enclosures, anecdotal observations of the orangutans at the CZBG and other zoos referenced in this paper suggest that zoo orangutans spend the majority of their time on the ground even with the provision of enrichment. Could this be a personal preference for the ground or would there be a change in preference if there were a variety of vertical options? Beyond the preferences of orangutans at the CZBG, there was interest in the observations of keepers at other various facilities to see if they also observed a preference for the ground. Understanding if there is a preference for locations that allow for increased altitude in zoo orangutans would impact the way orangutan enclosures are designed, and be a huge support for increasing the availability and choice for zoo orangutans to exhibit species-typical behaviors. To begin to answer this question, an informal interview survey was created, and conversations were held

with five individuals at five different AZA facilities.

Methods

A proposal was submitted for this informal survey project to the Orangutan Species Survival Plan (SSP) Steering Committee and Advisors for review. Approval for this project was contingent on communicating through the assigned Institutional Representative (IR) at any zoo contacted. With this approval, a list of the IRs at each of the 55 Association of Zoos and Aquariums (AZA) facilities that are members of the Orangutan SSP were provided to me and the SSP sent out an email with information regarding my project to each IR.

Five facilities, chosen at random, were confirmed to participate in the study. Some facilities required an internal approval processes which required consent forms or additional approval information. Upon approval and agreement to participate, each keeper/IR was given the option of setting up a time to talk on the phone or Skype. For those without the capabilities to Skype or the time to talk on the phone, the questions were sent via email to be filled out and returned. Informal interviews, that lasted typically ~30 minutes, were deemed the best approach for collecting a greater depth of information and higher return rate given the small sample size. Informal survey questions collected information about the individual orangutans at each facility and their indoor/outdoor enclosures to rule out any variable that could influence behavioral activity and structure use (Table 1).

Discussion

From the five conversations, there appeared to be a common anecdotal observation of a preference for locations with a visual stimulus rather than increased altitude for the 14 orangutans discussed. A number of the keepers said they observed a possible preference for locations that allowed for human observation such as visitor viewing areas and locations that the keepers frequent either during feeding or when checking on individuals. Two facilities' keepers observed an anecdotal preference for shade in their orangutans. From these two points of observation there could be a stronger preference for visual or social stimulation and comfort level over altitude and height of location in zoo orangutans.

Another observation from these conversations concerned the perceived stability of the orangutans while using structures that allowed for increased height off of the ground or brachiation between structures. As the largest arboreal mammal, orangutans must be very strategic and careful with where they choose to place and distribute their weight as they brachiate (Ancrenaz et al., 2014; Petter & Desbordes, 2010; Biruté, 1999). From this keeper's perspective it would seem that orangutans might prefer pathways that allow for two to three hand/foot holds. Making pathways and structures with at least two levels of brachiation could increase the stability of movement for orangutans and increase their use of these vertical structures from this observation. This could be important for future orangutan enclosure design. If future enclosures are to be designed with the interest of allowing orangutans to exhibit natural behaviors such as brachiation and a preference for the exhibit canopy, it is vital that they feel stable on these structures.

A difference in activity level between infants and adults was also noted through these conversations. Two of the facilities interviewed had infants. At both locations the keepers commented on the infant's use of all areas of the enclosure and that the females caring for the infant preferred the ground or lower levels of the enclosure when carrying the infant, potentially due to the added weight. One keeper mentioned that due to having a flooded floor in their exhibit, the infant was forced to learn how to climb and brachiate at an early age. She viewed this as a positive aspect of their enclosure because their infant is very active and capable of traversing all areas of the enclosure where it seems like other infants in this age range spend the majority of their time on the ground with their mothers when ground dwelling is available. From this keeper's perspective, eliminating the option of ground dwelling in their enclosure has helped contribute to their orangutans' health, activity level, and overall amount of time spent exhibiting natural behaviors.

While a preference for increased altitude was not noted in any of the orangutans living at the five facilities surveyed, providing more vertical structures for zoo orangutans that allow for stable pathways, as well as areas for active rest, could increase activity levels, overall health and well-being, and allow for more frequent displays of natural orangutan behavior. Studies have shown that the main difference between zoo and wild orangutans' allocation of time is in their resting and foraging. These two activities are almost exactly switched with the zoo population spending up to 70% of their time resting (wild, 23-35%) and 10-20% of their time eating (wild, 50-60%) (Bastian et al., 2010; Herbert & Bard, 2000; Knott, 1998; Perkins, 1992; Pizzutto et al., 2008; Wich et al., 2006; Wright, 1995). With the addition of enrichment items and unique ways in which to break up their day, zookeepers continue to provide the best care and stimulation to these animals. Being prone to obesity and a sedentary lifestyle, it is important to compare the

environments of zoo and wild orangutans. Looking at the habitats zoo orangutans live in, one cannot help but notice that most of the vertical options available are designed for brachiating and locomotion. This is great for encouraging locomotion and activity, however if orangutan's spend 23-35% of their time resting in the wild, and there are not many options for active rest in the canopy, why would we expect an orangutan to use these vertical structures for any other reason than retrieving enrichment and food? Herbert and Bard's (2000) study encourages institutions to provide at least one vertical option for the health and well-being of zoo orangutans, but one option cannot compare to the dense forests this species thrives in. I believe we would see a greater use of brachiation and locomotion structures if there were higher more comfortable options for zoo orangutans to travel to and rest in. Otherwise, one just as well stay on the ground.

Another aspect to consider in the design of zoo orangutan habitats is whether or not we should be designing environments to elicit zoo species-typical behaviors or wild species-typical behaviors. Cases such as the California condor, black-footed ferret, golden lion tamarin, and red wolf have been successful at taking an endangered species, raising them in zoo facilities and releasing them into the wild to live the rest of their lives (AZA, 2017). Studies have found, and experience has shown, that zoo-raised animals, such as the examples previously mentioned, need specialized training and management for reintroduction to the wild to be successful (Gibbons et al., 1995; McPhee and Carlstead, 2010; Robert, 2013). Factors such as not habituating to humans, learning to forage and hunt for food, as well as honing self defense mechanisms are all critical for zoo animals to learn and exhibit before reintroducing them into the wild. Based off of these findings, one would assume that the design of zoo environments for the success of zoo reintroductions would be fairly important; especially when considering the need to be able to express and hone natural behaviors.

The Bornean and Sumatran orangutans are endangered, and critically endangered respectively, but as of 2016 there has only been three zoo orangutans released into the wild, and all three were from the Perth Zoo in Australia; the only zoo in the world releasing Sumatran orangutans into the wild (Cocks & Bullo, 2008; Perth Zoo, 2017; Russon, 2009). With the rate of forest habitat being turned into palm oil plantations, forest fires in orangutan home ranges, and the constant issue of the pet trade and bush meat, scientists have predicted that the orangutan will be the first great ape to become extinct potentially as soon as the 2030's. (Linzey, 2013). Should more zoos be shifting gears towards wild reintroductions? If so, should we be focusing our efforts on determining if natural behaviors such as residing in the canopy for protection from predation and foraging of fruits and foliage are essential to survival in the wild and reintroduction success? Zoo orangutans will need structures and locations that facilitate these behaviors if we are to give zoo orangutans the choice to express natural behaviors that are critical for survival.

For these reasons, it is vital for keepers to begin discussions and conversations of this nature. More studies on zoo orangutans' use of their environments and preferences should be done and more attempts at studies that consider the whole zoo population should be attempted. This will require the joint effort of keepers and scientists across institutions. This study question addressed the use and location preference of all the individual orangutans across all AZA facilities housing this species. The formal methods and process of the approach taken to answer this question can be a great reference for future inquiries of this kind. One aspect that would have improved the approach taken would have been to ask keepers to send photos of the enclosures prior to chatting and asking them to search for or gain access to blueprints if these exist. Blueprints would have been helpful for determining the exact measurements of structures rather than asking keepers to take their best guess at enclosure dimensions.

Another reason why more individual zoo studies on location preference and activity budgets should be done before a survey of all AZA orangutans' use of enclosure structures is the diversity in personalities and individual preferences. Observations of wild orangutans show that daily percentages of each activity (foraging and eating, resting, and traveling) vary between age groups, geographic location, and even seasons (Galdikas, 1988; Knott, 1998; Mitani, 1991; Wich et al., 2006). For zoo individuals factors such as upbringing, previous experiences, and sociality can greatly influence their choices, habits, preferences, and activity. A number of studies between primate group members and enrichment preference have found that factors such as age, environment, and sex, all have an influence on the items primates prefer to interact with, as well as the amount of time they spend with that item (Bloomsmith et al, 1990; Novak et al, 1993; Perkins et al., 1992; Pruetz & Bloomsmith, 1992; Shepherdson et al., 2004; Videan et al., 2005). Enclosure structures can be viewed much like enrichment items that are stationary. The main difference of these items is that they are typically permanent or too difficult to move, rotate, or change in order to provide the variety that would classify them as enrichment. Chamove & Anderson (1989) and Swaisgood & Shepherdson (2005) recommend that institutions regularly evaluate the effectiveness of their enrichment. The same should be done for the environments of zoo animals.

If future studies are going to attempt to draw conclusions from this information, focus should be placed on

collecting data at individual facilities first. Understanding orangutans' allocation of time, use of their enclosure space and location preference at each facility will be important before attempting another zoo-wide survey. It would be beneficial if each facility used the same protocol and approach for collecting data so that a survey of vertical structure use and location preference could be done in the future. This would be a long process but would ensure scientific accuracy. Conclusions could be drawn from this data and one would be able to determine the significance of providing more vertical structures that allow for brachiation to areas of active rest for zoo orangutans.

One of the visions for the continuation of this project is to compare the activity and use of altitude in zoo orangutans to those of orphaned wild orangutans currently going through rehabilitation at reintroduction programs. Infant orangutans go through a learning process or graduated schooling system to learn how to survive and thrive in the forest without the help of humans at locations such as the Nyaru Menteng in Central Kalimantan and Samboja Lestari in East Kalimantan. Both of these locations are managed by the Borneo Orangutan Survival (BOS) Foundation (BOS Foundation, 2017). This is a slow and arduous process as many of these individuals come to these locations at a very young age either due to forest fires, poachers, or their mothers being killed due to the pet trade. Orangutans typically spend six to nine years with their mothers. This is one of the longest weaning periods of nonhuman primates because there are many skills to learn from the mother, such as locations of fruiting trees, how to traverse the forest canopy, and the difficult task of making a nest in the treetops completely out of branches and leaves (Knott, 1998). It would be beneficial for zoo orangutans, and the future conservation of orangutans, to better understand what aspects are most relevant for their success; specifically around the topics of essential survival skills, rehabilitation, and reintroduction. As their habitat continues to be destroyed and repurposed we might see a change in the way orangutans function in the forest without the option of being tree-dwellers. There are studies of Bornean orangutans using the ground to traverse various areas (Ancrenaz et al., 2014). This behavior might be something the orangutan will have to adapt to if future generations are to survive the impact of humans on their environment.

Conclusion

While scientific conclusions could not be drawn from the information collected from this small pilot group, a great deal of information was gained through the process of chatting with orangutan keepers about their observations of their orangutans' enclosures, preference, and use of vertical structures. The approach taken to answer this initial question can benefit future studies and has the potential to act as a building block for future studies of this nature. Zookeepers and scientists should explore the topics and questions that arose from this process and step out as conservation leaders as we find ways to work together, and create partnerships amongst professional institutions for the conservation and protection of endangered species.

We have much to learn about the orangutan. Future studies should focus on the activity and location preference of zoo orangutans at individual facilities and then attempt to take a collective survey of all AZA facilities. This information will be beneficial for influencing zoo orangutan environment design and improving future renovations or additions to current zoo habitats. Conclusions could be drawn from the collection of this data and one would be able to determine the significance of providing more vertical structures that allow for brachiation to areas of active rest for zoo orangutans. These additions could improve the overall activity, health, and well-being of zoo orangutans. The collection and understanding of this information could also be beneficial to compare to sanctuaries and institutions rehabilitating orphaned and injured wild orangutans. Studies of this nature would be beneficial if continued attempts at reintroducing zoo orangutans to the wild are in our future. There is much work to be done if we intend to ensure the survival of orangutans and improve humans' cohabitation and understand of this great ape.

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Table 1.

Orangutan Information	**Rational**
Sex (M/F)	Rule out sex as a variable
Age	Rule out age as a variable
Background (zoo-born/hand-raised/surrogate/ recent transfer)	Rule out if orangutan history influenced behavior and preference
# at Facility	Rule out behavioral differences due to number of orangutans
Social Dynamics (# family groups, # breeding/nonbreeding pairs/# solitary/fission fusion/visual access to other social groups/normal repertoire of behaviors	Rule out social dynamics as behavior influencer
Health (physical ailments/geriatric/on medication)	Rule out health and physical fitness as a variable
Enclosures (Indoor/Outdoor)	**Rational**
Dates of Manufacture	Factor for new/old enclosure design as behavior indicators
Height	Factor for differences in height for behavioral differences
Area	Factor for amount of area
Volume	Factor for volume of enclosure
Renovations (Dates & Description)	Factor for renovations as behavior indicators
Behavioral Differences Since Renovation	Note behavioral differences if any from renovation

Types of vertical space structures: stationary (faux trees,real trees,platforms) / moveable (hammocks, vines, firehose, ropes)	Categorize structures and factor differences in type, availability, and influence on behavior among facilities
Most Used Structure	Rule out or identify certain preferred structures
Preferred Locations	Rule out and identify commonalities amongst preferred locations
# of Orangutans in Enclosure at once	Rule out # of orangutans in enclosure as behavior influencer
Preferred ground areas	Rule out / identify commonalities amongst preferred ground areas

Table 1. Category and questions asked of zookeeper during interviews concerning each facilities orangutans and their indoor/outdoor enclosures with the rationale behind each question.

Engaging the Public and Animals Alike: Innovative Training of the Barnyard Inhabitants at Santa Barbara Zoo

Melanie Baudour

Santa Barbara Zoo

Domestics are an important part of many zoos. They can engage our youngest visitors when the rest of the zoo may still be a bit overwhelming. However, can they do more? Utilizing the barnyard animals and guests together, Santa Barbara Zoo has recently expanded the role of training. This last summer, zoo campers, with one on one guidance from a keeper, practiced reading the body language of animals and reinforced desired behaviors. They conducted a variety of husbandry based activities including giving a practice vaccination to Guinea hogs and luring a single sheep or goat from the main yard to step onto a scale in the side yard. With the passing of summer, the methods utilized during zoo camp are still being practiced with the general public. Thus far feedback has been positive. The barnyard animals are at the zoo regardless, with the ability to be a free contact experience, can they provide resonating hands on learning? Shaping kids and adults alike, can we give them ideas that they can retry with their own pets at home, possibly improving animal welfare beyond zoo grounds?

Untapped Potential

Domestic animals have long been a part of zoos. Though sometimes receiving criticism about why they are there, standing near the rabbit enclosure for even a few minutes on a busy day, will illustrate how beloved they are. Barnyard animals are typically the first animals that children learn about. They are easy to recognize and often approachable either via feeding through a fence, or in a petting zoo area. The challenge addressed these last few years at Santa Barbara Zoo is how these versatile zoo residents can provide an engaging and educational experience beyond their typical role. Most zoos already allow the public to feed, touch, and even enter the exhibit. This can offer a unique link between the way people see and treat their pets at home and their understanding of exotic animals. Like many of the exotics that surround them at the zoo, domestics can be trained: trained to target, station, step onto a scale, allow hoof care, receive an injection and more. Additionally, a key role of zoos is education. Visual and auditory learning methods are often utilized, but a kinesthetic approach, which often encompasses multiple types of learning, is a powerful method. With all we already allow the public to do with the barnyard residents in a zoo setting, the potential new understanding that guests could get from hands-on practice of positive reinforcement training, with a live animal and guidance from a keeper, is difficult to quantify but an exciting opportunity.

Treating Domestic Animals like Exotic Animals

Before engaging the public became a goal, a program based in positive reinforcement was established. Still feeling new as a zoo keeper, and working with animals that had little former training, it was an exciting opportunity to be allowed to train fifteen animals from four distinct species. The two Guinea hogs were especially novel because much of their training was done with a secondary reinforcer—we scratched their bellies. The Guinea hogs learned when a keeper began scratching them near their abdomen to lay down on their side to allow continued scratches. Once laying down, a duration behavior was learned and then the tactile reinforcer was delivered after each of a variety of procedures including: hoof trimming, annual vaccinations, and most recently laying atop an elevated board to allow for x-rays without anesthesia.

The sheep and the goats at Santa Barbara Zoo had been a part of daily public feedings for years, but always through a fence. When people entered the exhibit, the sheep and goats acted with caution and distrust. It took some of them quite some time before they would even eat from the keeper's hand. Nevertheless, our training persisted, each animal always being asked for behaviors at the edge of their expanding comfort level.

One of the largest hurdles was working in an area that had multiple animals with a strict hierarchy and all

of them eventually wanting to participate in training for preferred treats. A specific challenge was how to select out an individual to train. Clear communication and consistency was key. The method utilized was to show open, empty hands to any animal that walked up that was not the target animal at that moment. The other key to this was using body positioning to indicate to the selected individual that it was, in fact, their turn. The keeper would face them directly with an offer of food. When any others approached, they receive open hands until they walked away. This sometimes resulted in the loss of the attention of the selected target, which would then have to be regained. However, as sheep and goats understood that open hands would persist longer than their attention, they began leaving after a shorter and shorter period. Open hands also served as the end of session signal to the selected individuals, allowing the keeper to select the next animal moments after the previous individual walked away.

An Innovative Guest Experience

With our foundation of ever expanding trained behaviors, our comfort with conducting keeper talks, our commitment to educating the public, and our ease with allowing the public close contact with the barnyard animals, the ground was laid to take the next step by allowing the public to do the training themselves. Our zoo camp program was attempting to reinvent itself and when our animal care staff approached our education department with this potential new experience, an exciting program was created. It fit in perfectly with the Junior Zoo Keeper Camp theme: a handful of kids would be allowed to enter the barnyard and each one would get to work one on one with a pig, sheep or goat to get the animal to do a behavior that had only been previously done by a single keeper.

The barnyard animals and the zoo campers both excelled. Many of the sheep and goats were hesitant, but the campers listened well, and with guidance from the keeper, offered reinforcement for the animal behaviors the campers wanted. The children learned patience, resisting the temptation to chase the sheep and goats to get them back and were rewarded by the sheep and goats in turn. If a sheep or goat startled, it was free to leave the session. But most of the time, if the child was still and waited with pellets in their hand, the animal would only retreat a few steps before returning to the session again. Doing this, the children could lure a single sheep or goat from the herd and bring it into the side yard. They then attempted to get it to stand on a weighing platform.

One of the most interesting parts about this endeavor was that it was novel training. Though the sheep and goats did those same behaviors with their keeper, it was a whole new experience for them to do it with the children. Even the sheep that was most comfortable around people learned something new that was at the limit of its current abilities. With this sheep, two children were used and the sheep was trained an ‘A to B’ behavior on the spot. As the sheep began to comprehend, the children would be asked to stand further and further apart. Sometimes it took the sheep a few moments to understand what was being asked again, but once it did, it responded by going to the correct child for reinforcement.

The Santa Barbara Zoo barnyard also has two Guinea hogs zoo campers were allowed to train. The children learned that a reinforcer does not have to be food. The behavior the campers trained was the injection behavior, though they used a capped needle. The campers were shown that even potentially painful behaviors are trainable, but you just need to make it worthwhile for the animal.

As part this experience the children were given an explanation of training. It requires having something the animal wants, clear communication as to what the animal needs to do to get what it wants, and it must be worth the animal’s effort. If the animal chooses not to participate, that is valuable information, and likely means that one of those three parts is not quite right. Another element was the emphasis on husbandry behaviors. The training we do benefits the animals in many ways. The animals get to choose to participate, but participating gives us valuable information and allows some medical procedures that otherwise can involve physical or chemical restraint and stress. Finally, there is the fact that the campers got to then practice what they learned. The children communicated with an animal and made a connection and the result was an animal responding positively to their actions.

Future Potential

As successful as Summer Zoo Camp 2016 was, there is still a long way to go. Nevertheless, it is an exciting time to be working with the domestic animals in a zoo setting. We have barely tapped the potential of what these animals can do and their educational value. A surprising number of people attend when a ‘Rabbit Keeper Talk’ is instead labelled as a ‘Rabbit Training Session.’ The popularity of such a presentation, with the rabbit merely targeting to a stick in its own exhibit, is inspiring. People want to see and learn how it is done. Explaining the very basics of positive reinforcement, showing it, answering questions about training their pets at home, then choosing a volunteer to enter the exhibit and practice targeting and timing reinforcement can be an amazing take-home lesson for our guests. Not only does conducting such a presentation help guests to better understand how we

provide the best welfare possible for ALL the animals at the zoo, but it also has the potential for them to take these ideas home and practice with their own pets. Training through positive reinforcement is a universal message for our guests demonstrating a direct and constructive impact they can have on animal behavior. It is a training method that is a joint effort between human and animal that promotes communication towards a common goal. Educating, then allowing our guests to practice using this powerful and empowering training tool, leads to the possibility of improving understanding of animal welfare far beyond the grounds of the zoo.

The Top 10 Behaviors of Expert Animal Trainers

Steve Martin

Natural Encounters, Inc.

Think of a trainer you recognize as an expert. Now, think of the characteristics that inspire you to call that person an expert. It is the person's knowledge, skills, charisma, confidence, reputation or ... something else? The presentation will operationalize some of the most important characteristics that animal trainers exhibit who achieve the status of expert field.

Introduction

We all know great trainers in our lives, people we look up to, admire, talk about favorably with others. But, how does a person earn that reputation as a great trainer? And, what separates a great trainer from an average trainer? To answer these questions, we need to start by operationalizing the construct "training skill." What does a trainer do to earn a reputation and label of "Expert?"

"Expert" Operationalized

Curators, managers, supervisors, veterinarians, directors and more would benefit from a description of the observable training skills of their staff. Since everyone's training these days, how does a leader with no experience in training judge the skills of their staff? Because a person has read Don't Shoot the Dog (a great resource by the way), has a whistle around their neck or a clicker in their hand, and uses jargon that confuses non-trainers, does not mean a person is a highly-skilled trainer. When a vet, curator or director watches a training session how are they to know skillful training when they see it? When the trainer tells them the animal is acting up, distracted by their presence, or messing with their minds, how does the director know the real problem isn't the trainer encroaching on the animal's personal space, unclear criteria, low rate of reinforcement, poor antecedent arrangement, or one of many other common training mistakes? For that matter, how does the trainer know?

Good training involves the artful application of scientific principles. As in other art forms, skill is a product of learning combined with practice. Where some people have developed their skill mostly by learning from their mistakes, others have benefitted from the guidance of knowledgeable and skilled mentors. As the training profession advances, there are increased opportunities to learn from mentors and other experts in the field through conferences and direct contact. However, animal training is still a relatively young field in need of more experts and artists to serve as mentors and model training behavior for others to follow.

Here are my top 10 indicators of an expert animal trainer:

1. **Commits to using the most positive, least intrusive training methods.**

Positive reinforcement is now the standard procedure for the majority of training in the zoological world. However, negative reinforcement and punishment are still tools used in animal management today. No one is a purely positive trainer, or "Force-free. There are rare times in animal management and training that negative reinforcement and punishment are the right tools to keep animals safe and healthy, e.g., restraining an animal for important medical procedures and putting a leash on a dog to keep it from running across the road.

One outstanding tool to help tell the difference between an average trainer and an expert trainer is Dr. Susan Friedman's Hierarchy of Behavior Change Procedures (Friedman, 2014) where procedures are organized from least to most intrusive. In describing the hierarchy, Dr. Friedman wrote:

> "Intrusiveness refers to the degree to which the learner has counter control. The goal is to use the procedure that is the least intrusive, effective alternative. The hierarchy is a cautionary tool to reduce both dogmatic rule following and practice by familiarity or convenience. It offers an ethical checkpoint for trainers to carefully

consider the process by which effective outcomes can be most humanely achieved on a case-by-case basis. Rationale like, "It worked with the last case!" is not enough. The evaluation and behavior change program of every animal should be a study of the individual (i.e., individual animal, setting, caregiver, etc.). Changing behavior is best understood as a study of one."

The hierarchy of behavior change procedures is arranged as follows, from least to most intrusive. It is intended as a general guideline, not a map per se:

1. Medical, Nutritional, Physical
2. Antecedent Arrangement
3. Positive Reinforcement
4. Differential Reinforcement of Alternative Behavior
5. Extinction, Negative Reinforcement, Negative Punishment (in no particular order)
6. Positive Punishment

Expert trainers approach each animal with the understanding of, what Friedman calls, a study of one, i.e., that particular animal in the current conditions which include the trainer and all of the other antecedent conditions at that moment in time. Yesterday's behavior and other past experiences are important but they do not perfectly predict what the animal will do in these current conditions.

Expert trainers know they have a long list of behavior-change principles to employ in their animal-training activities. However, they also know to start with the most positive, least intrusive methods as they move through the hierarchy while providing the best welfare for the animals they train.

2. **Empowers animals with control.**

Control is a primary reinforcer for behavior (Friedman, 2014), just like food, water, shelter, etc. An animal does not have to learn that control is a reinforcer; control is inherently a behavior strengthening consequence. As trainers, it is our responsibility then to provide and protect it as a component of animal health and welfare (Friedman, 2016). Trainers and keepers can give animals control in their environment in a wide variety of ways. Opening a door when a rhino moves toward it gives the animal control of the door with its body language and often leads to the animal shifting more reliably in the future. Teaching an animal to lean in and put pressure on the syringe with no needle gives an animal control of the pressure as it learns increasing pressure is criterion for reinforcement. Working an animal in a restraint device with the doors open gives the animal the power to leave whenever it wants. When an animal is closed in a restraint device many animals lose their motivation participate in training. When an animal can leave, it is more likely to stay.

It is too often the case that trainers try to maintain control over an animal, even in protected contact environments. Their loud voice and stern body language is reminiscent of forcing an animal to comply with commands. They might speak in terms like, "Make sure he knows who's boss," "He knows better than that," or "Don't let him get away with that." This trainer-control attitude is common in many training programs but often at the detriment of progress. By giving animals control we form partnerships based on positive reinforcement principles where an animal learns its behavior can produce desirable outcomes provided by the trainer. An expert trainer has calm body language as she offers the cue to signal an opportunity for reinforcement, and then waits patiently for the animal's response through its body language. When the animal does not respond in the desired manner an expert looks for ways she can change her behavior, antecedent conditions, and training strategies rather than blaming the animal and trying to punish poor performance.

3. **Constantly adjusts what they do in response to what the animal does.**

From the moment an expert trainer enters an animal's area, he is evaluating the entire space and the animal's body language for information about how to proceed, or to not proceed at all. Whether the training is happening in a holding area or in a large exhibit, the expert trainer automatically evaluates the antecedent arrangement including such potential learning obstacles as the direction of soft breeze, the other animals in the area, and items that will need to be moved. The animal's tiniest body language can tell the trainer if he should move forward, stay still or leave. An artist will not invade an animal's person space until he is invited in by the animal's body language.

Too often trainers blunder into the training environment with the blind confidence inspired by the training session the day before. Just because an animal was comfortable with the trainer sitting in front of it in a previous session, does not necessarily mean the animal will be comfortable in a current session. An expert trainer enters every training session with the same caution and observation skills utilized in the first session. Additionally, every action an animal makes is an opportunity for a sensitive trainer to make adjustments in his body language. The tiny movement of a trainer's hand can bring an animal's attention back to the trainer, moving back just a few inches can bring comfortable body language to a nervous animal and keep an animal's spit in its mouth instead of on a trainer's face. Adjusting a prompt by just an inch can take an animal's eyes from the target to the trainer's cue, pulling back the hand prompt just

an inch can get an animal's tongue back in its mouth, its foot on the ground or its shoulder against the mesh. Experts realize small adjustments can have a huge impact on clear communication between the animal and the trainer.

4. **Builds a big trust account.**

Every trainer has a trust account at their bank of relationships with each animal they work with. When a trainer does something the animal likes, or provides something the animal will work to gain, the trainer makes a deposit in their trust account. When a trainer does something an animal dislikes or will work to escape or avoid, the trainer takes a withdrawal from the trust account. When a trainer makes more withdrawals than deposits it can bankrupt the account, which behaviorally looks like, for example, the animal no longer approaching the trainer, not participating in training sessions, and showing aggression. When this happens, too many trainers blame the animal instead of searching for tangible causes of the problem behavior in the interaction or the environment, or working to build back lost trust.

Building trust is accomplished through such things as positive reinforcement training strategies, giving animals control in their environment, and adjusting your body language in response to the body language of the animal. When an animal walks through a door to a holding area and the door is closed behind it, there is a chance for a withdrawal from the trust account the animal has with that trainer in that door-closing condition. However, if the trainer delivers a high value reinforcer and then opens the door for the animal to pass back through, there is a likelihood of a deposit into the trust account with that trainer in that door closing/opening condition, and an increase in fluency of the shifting behavior.

No trainer can say he is a pure positive reinforcement trainer. We all find ourselves in positions where we need to use a bit of aversive stimulus, usually to keep an animal safe or healthy. However, we can generally minimize the aversive experiences with an abundance of appetitive experiences. Trainers wonder if they should be in the room when the veterinarian comes to dart their animal to anesthetize it for an examination. The answer to this question usually involves an evaluation of the trust account the trainer has with the animal. With a high trust account, some animals might find comfort in being near a trainer as it goes to sleep after being darted. On the other hand, with a dubious trust account a trainer may need only be heard down the hall when the animal is darted to have their trust account go bankrupt.

Trainers have endless opportunities to make deposits and withdrawals into their trust accounts with animals. Expert trainers search for every opportunity to make deposits, no matter how small, into their trust accounts, and avoid even the slightest withdrawal unless it is absolutely necessary.

5. **Minimizes the use of Time Out.**

Time Out from Positive Reinforcement is a punishment strategy that persists in some training programs but is rarely used by experts. Time Out generally happens in response to an undesirable behavior an animal exhibits, such as charging, loud vocalizations, or spitting in a trainer's face. When the trainer delivers the time out by, for example, picking up the food and walking away, the animal is left to consider the situation on its own, which often leads to confusion, frustration and aggressive behavior. Since punishment is a consequence procedure, the animal can't wind back the clock and undo the behavior to avoid the punishment, and, like with other punishment strategies, the procedure carries no information about what the animal <u>should do instead</u> to earn reinforcement.

Time Out is often associated with unclear communication, lack of sensitivity to an animal's body language, low rates of reinforcement and other poor training strategies. Some trainers blame the animal for unwanted behavior and get a feeling of "justice served" by taking the food away. Expert trainers point the finger at themselves and ask how they missed the precursors for the undesirable behavior, how they contributed to create the problem behavior, and how to avoid putting the animal in that situation in the future through better antecedent arrangement.

Expert trainers avoid using Time Out by using clear, two-way communication, high rates of reinforcement and training strategies that keep the animal engaged in the training dialog. If an animal gets distracted or loses attention, or the trainer notices motivation beginning to decline, an expert trainer will raise the rate, type or quantity of reinforcement and proceed to finish the session while keeping the animal engaged.

6. **Accepts responsibility for their animals' behavior.**

Expert trainers understand the behavior of an animal is a reflection of their ability to train it. Often you can tell an expert trainer from an average trainer by the way he or she responds when a training session goes poorly. Where many trainers are quick to blame the animal for the mistakes, an expert trainer accepts responsibility for their part in problem behavior. Blaming the animal is often manifested with labels such as stubborn, distracted, messing with my mind and more. These labels are meant to justify the blame and relieve the trainer of responsibility, but they do nothing to solve problems or build a path toward more successful training sessions. When a trainer accepts responsibility for the animal's poor behavior he or she is empowered to look inside their training strategies for ways they could have avoided the problems and kept the training moving forward in a productive manner.

7. **Demonstrates flexibility.**

No matter how long it took you to write the training plan and how many weeks it took for supervisors to approve your training plan, when you go into that first training session, you have only half the information. The animal brings the other half of the information. How many trainers have stuck to their training plan when it simply wasn't working? Or worse, stuck to the plan when the animal was offering an alternative that was equally acceptable, like offering the right leg instead of the left leg. Expert trainers understand that training plans are not a recipe, they are an educated guess based on past experience, and when they guess wrong, it is not a sign of failure, it's an opportunity to start again with more information. Changing the plan in response to the information the animal brings is simply good training. For this to work well, a trainer should be in a system that embraces mistakes for the lessons they teach us and responds quickly to requests to make changes to training plans. Training is a dynamic partnership between co-influencers.

8. **Practices two-way communication.**

The best training occurs when there is a clear exchange of information, both from the trainer to the animal and from the animal to the trainer. An expert trainer gives an animal a voice through its body language and behavioral choices. She responds to even the subtlest "tells" that the animal is uncomfortable or confused, and dynamically makes appropriate adjustments in the training.

An expert trainer offers a cue (S^D) at the precise moment the animal looks to the trainer for information then sounds the bridge the instant the animal performs the behavioral criterion. Offering a cue when an animal is eating, looking away, or otherwise distracted reduces the likelihood the animal will respond with the correct behavior. This lowers the overall rate of reinforcement in the training session, weakens the strength of the cue to predict reinforcement (contingent on behavior), and can lead to a pattern of repeated cues. Expert trainers deliver cues when animals are ready to receive them, using a short window of response opportunity to foster quick responding (short latency), which is a strategy called limited hold (Pierce & Cheney, 2013).

An expert trainer knows when and how to use a prompt to add more information when shaping a behavior. A highly skilled trainer moves hand prompts back just an inch or two to increase an animal's focus on the antecedent conditions instead of being focused only on the hand. Moving prompts away from the wire mesh, out of the animal's cross-eyed vision, is a crux move by expert trainers that promotes clear communication and improves learning behavioral criteria for reinforcement. Expert trainers recognize the extensive and often subtle body language prompts they bring to a training environment, both intentionally and unintentionally, and how to use these prompts to promote learning.

An extremely important aspect of using prompts is to know when and how to fade them. Because prompts influence behavior so effectively, it is common for the trainer's use of prompts to be reinforced and continue long past their effectiveness to teach an animal criteria for behavior. Expert trainers fade prompts as soon as the behavior allows, e.g., when an animal performs a behavior without hesitation an expert trainer fades the prompt for that behavior. Experts know overuse of a prompt results in the animal learning to rely on the prompts as a cue for the behavior.

9. **Backs up every use of the bridge with a well-established reinforcer.**

Some people believe they should not follow a bridging stimulus with another reinforcer each time they use the bridge. This is generally not best training practice. In fact, it can be confusing to an animal and lead to frustration and aggression. Some people bridge multiple times without a back-up reinforcer (i.e., primary or well-established secondary reinforcer), and mistakenly call this procedure a variable schedule of reinforcement. However, if the bridge is effective, it is indeed a secondary reinforcer and the trainer is using a continuous reinforcement schedule.

When a trainer does not back up the bridge with a reinforcer he weakens the ability for the bridge to predict a reinforcer is coming, which is actually a respondent extinction trial. Think of Pavlov's experiments with the dog. The metronome sound predicted the meat powder in much the same way a clicker or whistle predicts food, or another well-established reinforcer. Each time food is not provided after the click, the bridging stimulus loses some of its ability to predict food will be available. Fail to back up a bridge too many times and the conditioned stimulus will go back to neutral.

Bridging without backing up with a high value reinforcer is rather like if you made a living painting and selling keychains for $5. If each person that passes by said "Beautiful work" and bought a keychain, the words "Beautiful work" would be associated with the money. But if all of a sudden people started passing by saying "Beautiful work" but did not buy the keychain those words would begin to lose their meaning. After some time, you would probably stop listening to the words and only react when the person reached into their pocket to get the $5. This is the same thing that happens with trainers who do not reliably back up the bridge with another reinforcer. The animal stops listening to the bridge, but to the novice's eye it continues to look like it is responding to the bridge when actually it is responding to the trainer reaching for the food. Reaching for the food becomes the bridge.

Event Markers (bridging stimuli) work because they predict the backup reinforcer. When you don't back up the marker it loses its strength to predict the backup reinforcer. The problem is, many or most trainers fail to track

the effect on behavior when they decide to not back up the bridge and often miss important information like latency in response, below criteria performance, low motivation, aggression, or just giving up. When these things occur, it is often the case that a trainer will blame the animal for poor performance instead of realizing the cause was in the reinforcement strategy.

Experienced trainers understand when there is a need to do multiple behaviors without providing primary reinforcers, such as in water-work with a dolphin, they can use a cue as a secondary reinforcer to back up a bridging stimulus. However, they also know the cue needs to be a super strong predictor of food, contingent on behavior. This level of training can take months, even years for an animal to master.

Another way to accomplish multiple behaviors in a sequence without a primary reinforcer is to cue multiple behaviors and only sound the bridging stimulus after the final behavior in the sequence. In this way, the cue for each behavior is a secondary reinforcer for the previous behavior, and the bridge retains its strength in predicting primary reinforcement.

Clear communication is a cornerstone of good training. When the bridging stimulus is paired with a well-established backup reinforcer the communication is clear and the bridge retains its strength to predict reinforcement. When the bridging stimulus is not paired with a backup reinforcer animals are uncertain if reinforcement is available as a result of their behavior and criteria and contingencies for behavior are unclear.

There is a long list of expert trainers who support backing up each bridging stimulus with another reinforcer. These experts include but are certainly not limited to; Dr. Susan Friedman, Ken Ramirez, Karen Pryor, and Bob Bailey to name a few. They recognize the value of clear communication and how backing up every bridge with some form of reinforcement promotes good training. With this support, and an understanding of the scientific principles of behavior change, especially variable reinforcement schedules, it is a wonder why people would choose to withhold a reinforcer after a bridge. When you have an opportunity to reinforce behavior, why would you not? Give it a try!

10. **Demonstrates a commitment to welfare**

There are countless pressures put on keepers and trainers in the zoological world these days. There are pressures to get animal enclosures cleaned and animals out on exhibit; pressures to get animals to crate, transport and perform for educational programs; and pressures to participate in a wide variety of husbandry and medical procedures. These daunting pressures can compromise a person's good judgement and motivate people to act without considering the welfare of the animals in their care.

Expert trainers keep welfare at the top of their plans when working with animals. They also understand how to accomplish institutional goals while promoting good animal welfare at the same time. Through good training practices and a keen eye for welfare concerns, expert trainers promote the most positive, least intrusive training methods to keep animals safe, healthy and enriched in their environments.

Conclusion

Expert trainers are more than reputation, charisma and purveyors of training equipment and jargon. Expert trainers earn their title through their actions. We all know experts in our field who excel at animal training to a point that we might call them an artist and even describe them as, "The Michael Jordan of Animal Training" or another famous athlete, musician or artist of some kind. Earning the labels "Expert" or "Artist" takes years of practice combined with knowledge, skill, and talent. But, unlike other art forms, the animal training field has yet to establish criteria for these high levels of reputation and performance. However, as the animal training community grows and evolves, and continues to share best practices through conferences of organizations like ABMA, IAATE and AZA, we will see more expert trainers, and better welfare for animals in our care.

Perhaps the most important and impressive characteristic of an expert is their commitment to ongoing learning, even when it means they have to change their mind about a strongly held belief or abandon traditional strategies. Experts are always trolling for better understanding and new procedures because they understand even professions grow and improve. And, when they stop learning and growing is when we should take away their expert card.

Acknowledgement:
The author would like to acknowledge Dr. Susan Friedman for her support and unmeasurable guidance with this paper.

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A Little Bit of Country- Radio Choice for Equine Enrichment

Tara Gifford

Ohio Animal Training

Allowing animals choice in their environment is a prime component of animal welfare. Horses in human care commonly have few choices regarding their environment. What if the horses could choose to have the radio on or off? If a horse has been trained using operant conditioning to turn on a radio set to a country music station, how much time will he choose to have it on? In part A, seven horses were trained to push a panel which would turn on/off a local country music radio station. Each horse was videotaped for 72 hours when the pushpanel activated the radio and 72 hours where the push panel resulted in no radio volume. Six of the 7 horses had the radio playing for 43-64% of the time. In part B of the study, two horses had the choice to activate the push panel to hear a classical music. The horse that listened to country music for 58% of the time, listened to the classical music for 14% of the time. The second horse who did not turn the country music on at all, listened to the classical music for 61% of the time.

This preliminary study indicates that these horses may have individual preferences regarding how much and when they choose to listen to music. The concept of teaching an animal to activate a radio, light, fan, water mister, etc., could have many applications to improve animal welfare by increasing their control over the environment.

Introduction

Some horse barns have a radio playing all day and night. But, what if the horses could choose to have the radio on or off? If a horse has been trained using operant conditioning to turn on a radio set to a country music station, how much of the time will he choose to have it on? This question is the basis of the following preliminary study regarding radio choice for equine enrichment.

Environmental Enrichment is a vital part of any comprehensive animal management program. "Environmental Enrichment is an animal husbandry principle that seeks to enhance the quality of captive animal care by identifying and providing the environmental stimuli necessary for optimal psychological and physiological well-being" (Shepherdson 1998). Enrichment allows for behavioral choices to draw out species-appropriate behaviors and abilities of the animals (AZA Behavior Advisory Group)

Horses *(Equus Caballus)* in human care may have little choice in their lives. The humans decide what they eat, when they eat, when they are in a stall, when they are turned out, on what surfaces and with whom. When horses are ridden, it is how and where the rider chooses. Although enrichment has grown into a daily occurrence for most zoo animals, and devices have been created to give animals choices (Famme 2015), the concept is relatively new to horse owners. With the prevalence of ulcers being diagnosed or suspected in horses, more owners are trying to increase their equines' forage time, but are unfamiliar with providing the other categories of enrichment. In addition to the food category, there are sensory, physical environment, cognitive and social enrichment categories. Horses have little opportunity to control aspects of their environment, including what they listen to while in the barn. Since there is considerable overlap in the hearing ranges of horses and humans, horses can probably hear human music quite well. (Bregman, M. et all, 2012) It has been recommended that the music not be over 21 decibels when played in the barn (Leste-Lasserre 2013). 21 decibels are equal to a whisper or rustling leaves.

Music has been shown to affect the behavior of horses in the following studies. Dr. Houpt and colleagues found that the trends were for country music to increase the time ponies spent eating and jazz to decrease eating time, but there were no significant differences in response to various types of music during a stressful situation (Houpt, Marrow, & Seelinger, 2000). Researchers in France tested earphones designed for horses and found that the horses showed fewer signs of stress during trailering while listening to classical music. In both travel and farrier situations and the horses tended to recover from the stress faster if they listened to classical music through their head-

phones (Leste-Lasserre 2016). One study found that race horses won more prizes after music was played in the barn for 2-3 months (Stachurscka 2015). A research study from Hartpury College in the United Kingdom found that country and classical music was more restful for horses than jazz and rock music (Leste-Lasserre 2013). A study done at the University of Queensland indicated that music clearly had a beneficial consequence on the behavior of young stabled horses (Kentucky Equine Research Staff 2011).

Music has been shown to influence behavior of horses as well as in many other species. This exploratory study was most interested in the choice of the horses to have the radio playing or not.

Materials and Methods

An Amcrest video security system was used to record the horses in their stalls and their interactions with a push panel. Infra-red cameras enabled recording throughout the night hours. Horses had at least two nights to habituate to the night time glow of the cameras. An external hard drive stored the video to be reviewed for data collection. The push panel had several versions, but each one used an outlet foot switch extension cord (Christmas tree switch) to turn the power on/off to the radio. Since audio was not recorded, the flashing of the clock numbers served as a visual indicator that the music was playing. In Part A, the radio was set to a local country music station. Clear radio stations were limited due the rural setting in which the study was conducted, so the options of music genre were limited. For Part B, an iPod Nano was plugged into the radio which activated a classical/new age music playlist.

Each horse was operant conditioned using clicker training to push the panel with its nose. Some horses had prior clicker training experience and others had none, however each horse learned the task within 3 training sessions. The horses were considered complete on its training when they voluntarily activated the panel three times in a row with latency less than 5 seconds. After the horses were pushing the panel fluently, the radio was attached for them to experience the outcome of the push panel. Each push on the panel with the nose that triggered the switch was marked (clicked) with a box clicker and reinforced with a pelleted treat. Once the data collection began the horses did not receive any clicks or treats for interacting with the push panel.

The horses in the study included 2 geldings and 5 mares ranging in age from 12 to 24 years old. All were used for light pleasure riding. Each horse had a box stall of about 12'x12', was provided grain and forage to maintain their body condition and always had access to water. Five of the horses in the study were turned out to pasture on their regular schedules and two of the horses also had free access to a paddock always.

In Part A of the study each horse had 72 hours of the treatment trial portion where the push panel activated a local country music radio station. The control trial portion included 72 hours with the push panel that activated the clock radio but the volume was turned off, therefore no radio was heard. There were 72 hours or more between the treatment and control trials. Four horses began with the treatment portion and 3 horses began with the control portion first. Accidental pushes on the panel were noted. If a horse lifted its head while under the panel, rubbed its neck or head on it, backed into it or chewed on it and activated the push panel, it was considered accidental. The challenge came in determining if a horse used its teeth to push the panel or was it a chew on the panel. Were they trying to activate the music or simply chewing on the device? If there was repeated chewing, those were noted as accidental. One horse, Tigger, would activate the push panel with his shoulder or hip as he walked past the panel. These were counted as pushes and not accidental. A plexi-glass cover and metal edges were added to protect the wood panel, but it did require maintenance several times during the study.

Photo 1 - shows the final version of the panel

Part B of the study included two horses, but the trial time was increased to 120 hours per horse. In this treatment portion the push panel activated a soft classical/new age music playlist. Accidental pushes on the panel were

noted.

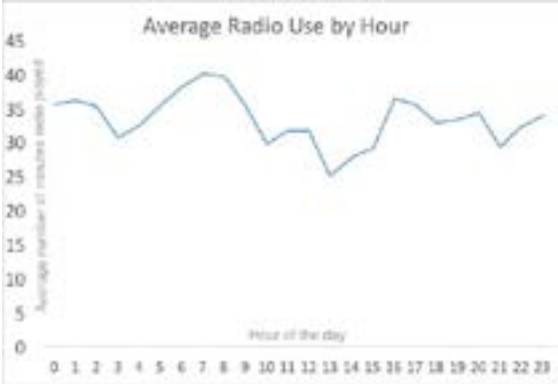
Results

Part A Treatment- Six of the seven horses had the country music radio station playing for a range of 43%-64% of the time. One of the horses did not activate the panel at all during part A of the study, even though she learned the task of pushing the panel for a treat quickly. She began the study with the control portion, so perhaps her not hearing the radio as the consequence for pushing the panel was extinguished by the time the treatment portion began. Beginning with the control portion did not have the same results however for the other two horses in that group. The other two horses interacted with the panel during both the treatment and control trial portions of the study.

Horse	Country Music	Control pushes	Control accidentals	First Trial	Treatment pushes	Treatment accidentals
Barnum	58.84%	0	0	Treatment	35	25
Golly	0%	15	2	Control	0	0
Hannah	55.56%	96	55	Treatment	129	121
Lovey	57.18%	10	1	Treatment	31	5
Princess	50.75%	33	17	Control	2	0
Sabrina	64.00%	79	64	Control	2	1
Tigger	43.23%	114	36	Treatment	152	18

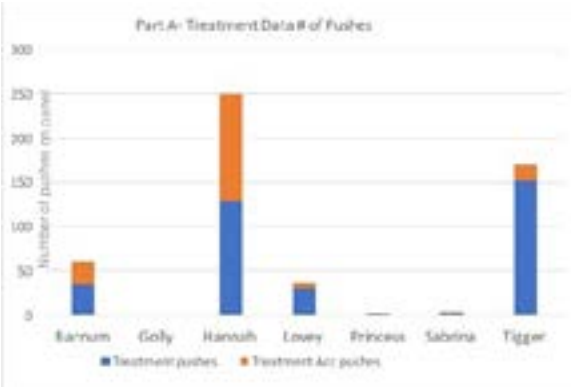
Graph 1- Part A Country Radio % of time played

The time of day that had the highest average radio use was 6:00-7:00 am and 1:00 pm was the lowest average radio use. Graph 2 shows the radio use by the hour of day as averaged between the 6 horses that listened to the country radio.



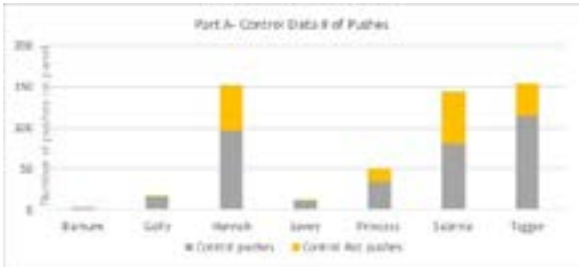
Graph 2- Diurnal Radio Use (Averaged)

In Graph 3 Hannah has about the same number of treatment pushes and accidental pushes on the panel. Hannah's accidental pushes were mostly from chewing on the panel. Following her trial the panel was modified by adding plexi-glass and a metal frame around the edges to protect the wooden panel and discourage chewing.



Graph 3- Part A- Treatment Accidental Pushes

Part A Control- Hannah, Sabrina and Tigger interacted with the push panel at a greater frequency than the other four horses. Hannah and Sabrina did a lot of chewing on the panel which were counted as accidental, but Tigger had a different style. Tigger was recorded activating the push panel most often with his left shoulder or hip as he moved about his stall. Accidental pushes for Tigger happened when he rubbed his head or neck on the panel and activated it.



Graph 4- Part A Control Trials

Part B- Two horses also experienced a classical music playlist when they activated the push panel. The one that listened to the country music radio station listened less to the classical music playlist. The other horse that never listened to the country radio when it was available, but did listen to the classical music.

Horse	Country Music Station	Classical Playlist
Barnum	58.84%	14.49%
Golly	0	61.23%

Graph 5- Part B- Country Music vs. Classical Music

Discussion

Environmental enrichment has been shown to benefit animals in many areas of their mental and physical well-being. Listening to music is a form of sensory enrichment. Behaviors of horses while listening to classical and country music indicate that music has an enriching effect on the environment of stabled horses (Leste-Lasserre, 2013). Giving the horses the ability to choose if the music is playing is an additional empowering factor. This study found that 6 out of the 7 horses studied listened to the country music radio station a range of 43%-64% of the time and mean of 55% of the time. When classical music was offered instead, the two horses showed differing results. One horse only listened to the classical music and the other one listened to the country music about 4 times as much as the classical music. There could be several explanations for these results. The operant behavior of pushing the panel may have been extinguished due to no primary reinforcement being given following the training phase. The novelty of having the push panel in the stall could have decreased their interest in it. The push panel did have more integrity measures added during the study which could have altered the results. The sample size of horses was relatively small for this study. If the study is repeated, it would be beneficial to increase the sample size and have a better design to activate the music. The push panel appeared to be used as a chewing object by some of the horses. The implementation of giving an animal control to safely turn on a radio, light, water mister or fan etc. can be a challenge, but it would expand their environmental enrichment options.

Acknowledgements

I would like to thank the horse owners Adele and Darrell Dunlap, Debbie and Diana Moskalsky and Lori Swain for allowing me to set up the equipment in their barns and observe the actions of their horses. Technical assistance was generously provided by Tom and Linda Burns, Tim Sullivan, Joe LaNasa and Russ Gifford. Katherine Proudfoot PhD of The Ohio State University graciously provided input on this project.

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Bridging the Gap between Theory & Practice: Current Research on the Relationship between Live-Animal Interactions and Pro-Environmental Behavior Change

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This presentation seeks to contextualize current research in conservation education that targets programs in zoos and aquariums, with an emphasis on pro-environmental behavior change theory. As climate change and other environmental issues become increasingly more critical, the role zoos and aquariums play in educating the public also becomes critical. The majority of zoo and aquarium facilities in the United States dedicate their practice to conservation and conservation education in some capacity. Often these same facilities employ animal ambassadors to forge a connection between audience and animal, intending for this relationship to lead to some level of behavior change that supports conservation practices. The existing literature and research on this link is shaky at best, with little in the way of scientific support for such conclusions. My research is focused on bridging this gap, both theoretically as well as practically, to bring scientific support to education practices which utilize animals to communicate pro-environmental messages to the public. My presentation will summarize current and existing research that attempts to address these issues while providing support for my specific research questions. The review of current and existing research will include behavioral approaches and education theories, as well as studies such as "Why Zoos & Aquariums Matter: Assessing the Impact of a Visit to a Zoo or Aquarium" (Falk, et al., 2007). Additionally, my presentation will seek feedback from industry professionals and researchers to continue to improve my research and ensure its relevancy to the community in which it is intended to serve.

Introduction

Working in the zoo and aquarium industry, I was often educating the public about animals and the environment. I was always surprised by how captivating and exciting the animals were to visitors and I could see that the experience was making a lasting impact in some way. As I continued on in my career, I became interested in the research that supported what I was personally experiencing and wanted to learn how to improve my own education attempts as well as programs within the industry. What I soon discovered, however, was that there was very little empirical research addressing how and why live-animal interactions positively impacted those who experienced them (Falk, Heimlich, & Foutz, 2009). I realized that this was due to a few factors, but namely the relatively recent shift for zoos and aquariums to be environmental educators first and foremost (Churchman, 1987; Wineman, Piper, & Maple, 1996; Ogden & Heimlich, 2009). While I understand that educating the public has been in mission statements and actively pursued for many years within the industry, from a historical perspective that shift has occurred more recently. Even over the past ten years, the zoo and aquarium industry has seen marked shifts and changes as it evolves into much more than its former role as animal collection displays. Prompted by recent animal rights propaganda, zoos and aquariums have become spotlighted and their purpose has been questioned more now than it has ever before. In the age of social media and fake news, having solid support for current practices is imperative in almost, if not all, industries. The zoo and aquarium industry is no different and research which supports the benefits animal ambassadors have on learning and in pro-environmental behavior change is desperately needed (Heimlich & Ardoin, 2008; Falk, Heimlich, & Foutz, 2009). While there is a great deal of research in the fields of informal or free-choice learning (see Bibliography), zoo and aquarium specific research is still relatively limited. Furthermore, gaps between research and practice exist, as is often the case when researchers fail to consider practical implications or are too divorced from the practice to produce relevant studies. Considering all of these factors, my research at Oregon State University (OSU) is aimed at bridging some of those gaps and adding to the existing literature on the relevancy of live-animal interactions on education. This paper serves as an introduction to the research currently available and relevant to practitioners in the field, and addresses the role of pro-environmental behavior change in zoos and aquariums.

Current Research

Free-choice learning describes learning that takes place in settings where people have the ability to choose how and what they attend to (Falk, 2005). This term was pioneered by Dr. John Falk at OSU who has contributed significantly to the zoo and aquarium literature through many of his studies (see Bibliography for additional research). Because learning in free-choice contexts is unbounded, studying the effects of education in these settings is complex. Further complicating this research is the wide and varied audiences found at facilities such as zoos and aquariums. Unpacking these confounding variables has been challenging; however, Dr. Falk and his colleagues Dr. Lynn Dierking and Dr. Martin Storksdieck have successfully identified and evaluated some of the personal dimensions impacting the effects of zoo and aquarium visits. One of Dr. Falk's most notable contributions to the zoo and aquarium industry is the collaborative study entitled "Why Zoos & Aquariums Matter: Assessing the Impact of a Visit to a Zoo or Aquarium" (Falk, et al., 2007). In partnership with Association of Zoos and Aquariums, this study looked at if and how zoos and aquariums successfully promoted conservation. The key findings of this study are outlined in the table below:

"Why Zoos and Aquariums Matter" Key Findings
"Visits to accredited zoos and aquariums prompt individuals to reconsider their role in environmental problems and conservation action, and to see themselves as part of the solution."
"Visitors believe they experience a stronger connection to nature as a result of their visit."
"Visitors arrive at zoos and aquariums with specific identity-related motivations and these motivations directly impact how they conduct their visit and what meaning they derive from the experience."
"Visitors believe zoos and aquariums play an important role in conservation education and animal care."
"Visitors bring with them a higher-than-expected knowledge about basic ecological concepts. Zoos and aquariums support and reinforce the values and attitudes of the visitor." *Falk et al., 2007; p. 3*

Although much of these findings are not surprising to practitioners, this type of data and analysis is important for many reasons, including as baseline information to support and improve the practices within the industry.

Other notable research is being conducted by Dr. Roy Ballantyne and Dr. Jan Packer at the University of Queensland (Australia) who often focus on learning and behavior as a result of experiences with live-animals (see Bibliography for additional research). One of their articles, "Promoting Environmentally Sustainable Attitudes and Behavior Through Free-Choice Learning Experiences: What is the State of the Game?" summarizes the major theories underlying learning in free-choice settings, how experiences in these settings can promote sustainable attitudes and behaviors, suggests areas for future research and recommendations for current practice (Ballantyne & Packer, 2005). This article discusses three factors that other research has determined contributes to pro-environmental attitude and behavior adoption – arousing emotions, challenging beliefs, and enhancing environmental conceptions (p. 290-94). These concepts are important for practitioners to understand as it can assist in program design and facilitates better understanding within the industry. Additionally, the authors mention practical implications from studies suggesting that changes to conservation behavior is short-lived after a visit to an aquarium (Adelman, Falk & James, 2000) by recommending post-visit reinforcement of experiences (Ballantyne & Packer, 2005; p. 13). This implies that the effects of live-animal interactions may be increased and sustained if follow-up materials are available, either via formal education partnerships (e.g. schools) or as part of programming offered directly from the zoo or aquarium.

Finally, research being conducted at OSU's affiliated Hatfield Marine Science Center by Dr. Shawn Rowe and colleagues uses innovative and cutting-edge tools as part of the Free-Choice Learning Lab and CyberLab to understand visitor behavior. Infrastructure with the CyberLab allows actual behavior to be observed and analyzed through video and audio recordings at exhibits within the science center. One such study included touch-tank exhibits where engagement and scientific reasoning were considered (Kisiel, Rowe, Vartabedian, & Kopczak, 2012). Results of this study indicate that hands-on interactions with live-animals play an important role in science learning. Research within formal education regarding best practices for teaching science, technology, engineering, and math (STEM) has been substantial, yet only 3% of our time over the course of our lives is spent in school (Falk & Dierking, 2002). Thus, informal and free-choice learning settings provide vital opportunities for the continued education of the public and should be leveraged to increase science and environmental literacy (Falk, Storksdieck, & Dierking, 2007). If live-animal interactions such as touch-tanks positively impact science learning, it follows that the role zoos and aquariums play in education is important and possibly underutilized. Further research on the effects live-animal interactions play in learning

and behavior change are warranted; a gap my personal research is attempting to bridge.

Pro-Environmental Behavior

One of the implicit goals of environmental education taking place in zoos and aquariums is to positively impact conservation-related behaviors. More broadly, pro-environmental behavior encompasses all behaviors which seek to change the environment in a positive way, and includes conservation-related behavior. Multiple behavioral models have been suggested within the existing literature and each have their own emphasis in regard to the most crucial element that predicts and controls behavior. Most notably and prominent in the current research is the Theory of Planned Behavior, the Value-Belief-Norm Theory, Social Cognitive Theory, and Community-Based Social Marketing (Bandura, 1971; Bandura, 1977; Ajzen, 1991; Stern, 2000; McKenzie-Mohr, 2000; McKenzie-Mohr & Smith, 2011). Although these models are intended to target behavior specifically, many of these models do not correctly consider or incorporate behaviorism principles such as those championed by B.F. Skinner (Skinner, 1938). Since I am coming from the practitioner side which included training animals through operant conditioning, the lack of true behaviorism approaches to behavior modification stood out as a potential area for inquiry. Due to my deep appreciation and understanding of operant conditioning, I will be incorporating these principles into my research in order to fully assess gaps between theoretical models and practice. The intent will be to identify the discrepancies and offer recommendations for improvements in order to better facilitate pro-environmental behavior change that is being targeted in educational programming at zoos and aquariums.

Conclusion

Recognizing the need to bridge the gaps between academic research and practice, I have chosen to utilize the existing expertise among industry professionals as the guiding force behind my master's thesis research. This will be facilitated by interviewing education directors (or similarly positioned staff) at AZA accredited zoos and aquariums as well as directly observing current programs. I am also currently contributing to the National Science Foundation-funded research project titled, *STEM Matters: Investigating the Confluence of Visitor and Institutional Agendas*, a continuation of the larger, AZA-partnered "Why Zoos Matter" research undertaking. This study seeks to identify a wide-variety of factors that may determine the type of impact a visit to a zoo or aquarium may have for guests, including what visitors perceive the role of these facilities as being. A portion of the data we are collecting will be utilized in my thesis research to compare zoo/aquarium mission statements and visitor agendas. Another important goal of my research is to actively bridge the gaps identified between academia and practice, and presenting this information at conferences such as ABMA is an important component to fulfilling that goal. I would like to broaden my reach further by presenting at additional practice-based conferences and other forums for dissemination. Time-constraints imposed on practitioners and other difficulties in accessing academic literature often make this dissemination process prohibitive or challenging. As such, I am also committed to assisting in distribution of literature materials and am available to discuss any of the research with interested parties, either one-on-one or part of a larger group. If you or your facility are interested in becoming involved with my research in any capacity (interviews, observations, funding source, feedback, etc.), please contact me at the address below. Similarly, if you would like copies of any of the literature mentioned in this paper please feel free to contact me. It is my hope to continue to improve our educational practices within the zoo and aquarium industry and to support all of you who are diligently and passionately working with the amazing animals in your care to further conservation worldwide.

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What Can You Do With Your Monkey?

Jenyva Fox

Cheyenne Mountain Zoo

Cheyenne Mountain Zoo's (CMZ) staff is passionate about taking animal training to higher levels to improve the lives of the animals in their care. This includes out-of-the-box thinking when it comes to training basic husbandry behaviors or veterinary care techniques. Furthermore, our unique natural behavior shows inspire guests to become involved in conservation by connecting them to our incredible animals.

One of CMZ's original natural behavior shows features a troop of black and white colobus monkeys leaping through trees, balancing on ropes and even leaping straight towards mesmerized guests! A WOW Factor for sure! This show remains popular with guests each summer and allows zookeepers a great opportunity to weave in important, simple conservation messages, such as purchasing FSC-certified products. Our show continues to evolve as we observe the strengths of our monkeys and train new behaviors such as crossing over a "colobridge". This behavior connects our guests to the challenges these animals face in the wild and how they can help them right at home.
Our training with our colobus monkeys doesn't stop at training natural behaviors for our shows, but continues into our day-to-day care. CMZ staff trained a basic crate behavior in a novel way to allow the monkeys more power during their crating session. The monkeys get to choose when they want the crate door closed, closing it themselves, even picking up their tails and bringing them inside first!

We are proud of how eager our colobus monkeys are to train and engage with us as zookeepers and we firmly believe that this is through the power of positive reinforcement, allowing the animals to make choices, and giving them fun opportunities to show off their strengths.

BACKGROUND

For many years, in order to get a vaccination into our 1.4 Colobus monkeys or to get them in hand for an anesthetic procedure, we had to "herd" or trick them into a squeeze cage to hand inject them. After a few years of using a squeeze cage, our monkeys became wise to what we were doing and their trust in us had broken down. They stopped participating, which forced us to resort to darting them. This became equally stressful for our animals. It was at that time that we decided to shift our focus to positive reinforcement training for husbandry and vet behaviors to improve the care our Colobus were receiving.

The obvious solution was to injection train our Colobus, so we set to work on that. We divided the monkeys up between two primary trainers. However, we quickly found that some of the monkeys were less keen on the idea of being poked with a needle, despite small approximations and lots of time building confidence. We decided to simultaneously crate train them in case this could be an option for sedation in the future. A basic crate behavior is also one of the 10 behaviors that all primates should know, as outlined in our zoo's training program. In addition, we were preparing to send one of our females to another zoo as per a SSP recommendation, so crate training would be beneficial.

THE CRATE TRAINING PROCESS

Our first job, as animal trainers, is to make our target behavior the easiest it can possibly be by arranging their environment in a way that will make them successful. During the crate training process, I tried out many different antecedents just to see what might work best for the Colobus monkeys. I tried to arrange their environment in a way that would invite them to do the behavior, and take small approximations that would make them more comfortable.

I ran through the gamut of ideas during my planning stages and asked myself questions that might help me determine the best antecedents: Would they want to come down to the ground to get into a crate? Should I anchor the crate to a platform? Should I start with the door on or off?

At first, they were very untrusting of the crate, possibly due to their history with a squeeze cage. It took months of building confidence even to get them to come near the crate to get their reinforcers. We made some progress when I decided to leave the crate in one of their dens permanently. I left the door on the crate, at first securing it open to the exhibit mesh, but then removing the carabiner so they could swing it open or closed as they wanted. I hoped that by doing this, they would learn that the crate was not something to be afraid of. We fed them part of their diet both in and on the crate and they started to make great progress after that step!

Once I had them coming towards the crate, I started training them by using a baiting strategy; I used their favorite treats: avocado and white potato. I faded out the bait as soon as possible with each individual, switching to a finger point cue and pairing with a verbal cue of "crate". Some of them would stretch as far as they could to get the reinforcer while still keeping their feet outside the crate. I just waited them out and increased the reinforcer by changing up its value or magnitude when they would commit to stepping into the crate. Each monkey had their own pace; our confident male would go right in but our dominant female became very good at stretching!

PROVIDING CHOICE AND CONTROL

Once each monkey became comfortable with sitting in the crate, I started training them to touch the crate door with the idea that they would eventually close the door to the crate themselves. To make the behavior easier for them, I needed something they could grab onto that they weren't afraid of, and picked a carabineer. I started by having them touch the carabineer on the window mesh of their crate, then moved the carabineer to the door. Once they were touching the carabineer, I bridged and reinforced for every small movement of pulling on the carabineer, which would close the door. We worked on this until they were closing the door completely. It was at this time that I realized that our male's tail wouldn't fit in the crate, so I trained him to pick up his tail and bring it inside the crate, then chained that behavior with shutting the door.

I trained the tail pick up outside of the crate using a laser pointer. At first, bridging and reinforcing him for touching the light dot on his tail then shaping it to a longer touch and eventually picking up his tail. I had to back up a few steps once I started working that behavior in the crate as he just wanted to get into the crate and close the door! Once it was all one smooth behavior- entering into the crate, picking up his tail, closing the door all the way, I was able to start securing the crate door latch.

In order to reach in to secure the crate door without going into the den with the monkeys, we cut a small hole in the mesh large enough for our hands to fit through safely. I approximated my hand to the door to avoid alarming the monkeys at the sight of my hand in their space. Once they were comfortable with the door latching and unlatching, I started moving the crate around slightly with them inside. The next steps will be going into the den once they are crated and gently lifting the crate, heavily reinforcing tiny approximations to avoid losing their confidence in me and the crate.

This crate behavior will provide us with many options, anything from veterinary procedures to separations, to shipments, or even our fire relocation plans. Currently, all four of our monkeys are entering into the crate, which will allow future procedures to be much less stressful.

TREETOP ACROBATS

Natural Encounters, Inc. visited CMZ in 2008 and helped us develop natural behavior shows with many of our animals. In these shows, our animals are trained to demonstrate natural behaviors on cue to help connect them to our zoo guests. Our Colobus monkeys were among the first to begin their training! Our monkeys get to show off what they do best, which is gracefully get around in their treetop home.

We worked with them in a protected contact setting and started training them to target throughout the trees using long extension poles with clips on the end to attach food reinforcers. At first we had to bait them as we showed them the route that we wanted them to take through the trees. Once they got the hang of that, we faded the bait out and targeted them around the trees. A couple of other keepers/ trainers were needed to station the other monkeys who weren't being worked with at that moment to avoid any confusion or stealing of treats! Eventually we were able to fade out the extension poles completely once we got the behavior on a hand cue. We didn't want to use a verbal cue for them as the exhibit is pretty good sized and we didn't want anything that would detract from our message during the show.

Right now, our Colobus are trained to station, jump from various points, walk across ropes, and climb across

their colobridge. These natural behaviors help to show our guests just how awesome monkeys are, and hopefully help them fall in love with our monkeys. Once our guests have that connection to them, we hope that it inspires conservation action.

CONSERVATION MESSAGE

As in any good animal show, we wanted to include a conservation message in a creative way that would hold the audience's attention. The main threat to colobus monkeys today is habitat loss. We decided to illustrate what conservationists are doing to help colobus and other primates in East Africa by building our own "colobridge" and training one of our monkeys to walk across it. It also allows us to show people the FSC logo and what purchasing products with that logo can do for many animals that call the forest home, even those right in our own backyards. That connection to the natural world that our animals are providing is the very thing that will inspire others to want to save them and our planet.

CONCLUSION

The keeper staff at Cheyenne Mountain Zoo have been able to build positive relationships with their Colobus monkeys through their successful positive reinforcement training program. By giving the Colobus monkeys choice and control over their environment, and by reinforcing behaviors we would like to see more of, the monkeys have thrived in their roles as animal ambassadors. They have learned to work with their keepers to create dynamic and engaging shows that demonstrate their amazing natural behaviors.

CMZ's Treetops Acrobats animal behavior show continues to be a big hit with zoo guests even years later. It engages and inspires our guests and our monkeys truly seem to enjoy the interaction with us. And it's great exercise for them! The power that we give our animals during training sessions continues to improve the level of care we can provide as well as proves that anything can be trained to do amazing things. Even a colobus monkey.

By working with the Colobus to train these natural behaviors, keepers saw just how willing and able the monkeys were to learn new things. They focused on creating an environment where the monkeys could be successful in their husbandry training as well, which would create a less stressful environment for both keepers and animals. The keepers took the tools they learned while training natural behaviors and put them to use during crate training. They looked for the best antecedents, high value reinforcers, and lots of control over their environment to establish solid crating behaviors.

We want everyone to know that Colobus monkeys are really willing and able participants in their training programs. By taking the time to work with them and build relationships through positive reinforcement, they sky's the limit for their behavior repertoire.

Wolf Animal-Assisted Therapy

Gaby Dufrense-Cyr

Dogue Shop / Park Safari

The human-dog relationship is well documented. Recent studies have demonstrated C. familiaris has the ability to interpret and understand human emotions (Udell, Dorey & Wynne, 2003 and Guo, Meints, Hall, Hall & Mills, 2009) which confirms humans and animals form attachments. The human-animal bond is documented in Animal-Assisted Therapy (AAT) literature (Fine, 2010) as an inter-species connection which has the potential to promote human physical and psychological health. Anxiety, autism, Alzheimer, and learning disabilities are some of the conditions improved with AAT programs. Furthermore, positive physical results include a reduction in blood pressure, heart rate, and triglyceride levels (Barker and Dawson, 1998). Potential negative outcomes of dog AAT programs are thought repression, cognitive distraction, and reduced empathy; consequently, prolonged dog AAT sessions can be expected. The creation and development of the wolf animal-assisted therapy (WAAT) pilot program serves to establish a positive attachment between participant and wolf in order to reduce the number of intervention sessions, increase communication skills, improve self-esteem, and enhance empathy. During sessions, participant perception of wolves as dangerous predators decreases; conversely, the empathy connection establishes the desire to protect wolves through conservation efforts. As discussed by Guo, Meints, Hall, & Mills (2009), wolf reactivity to humans diminishes with exposure. WAAT is the ultimate management, training, conservation, enrichment, and therapeutic program for both human and animal. This innovative program has the potential to reduce both wolf and human undesirable behaviours, develop effective management and training strategies, promote conservation efforts, and overall enrich each other's lives.

Dogue Shop created the wolf animal-assisted therapy (WAAT) pilot program to improve social skills for at risk teen and promote wolf conservation. Collaboration between Carrefour Jeuness Emploi (CJE), English Montreal School Board (EMSB), Parc Safari Africain zoo (PSA) and Dogue Shop (DS) made the animal-assisted therapy (AAT) curriculum possible. Interviews were conducted to select candidates. Once chosen, participants were handed pre-program evaluation forms to assess knowledge and social skill sets. Post-program evaluation documents and interviews were conducted to gather data on session design and implementation. Program goals were to establish and maintain inter-species attachment between human and wolves through social-cognitive and problem-solving training exercises in order to facilitate human social skill development, provide enrichment to wolves, and promote wolf conservation efforts.

WAAT demonstrated a significant improvement in social-cognitive skills such as communication, confidence, and attachment towards people and wolves. Participants reported their wolf conservation implication nearly doubled after the WAAT program, and continued to impact their daily lives 6 months later. The following paper will discuss animal-assisted therapy, the inter-species attachment model as a social-cognitive learning process, to facilitate enrichment, promote conservation efforts of exotic animals, namely wolves, and to improve human interpersonal communication skills. Finally, I will discuss the successes and short comings of the WAAT program.

Human Animal-Assisted Therapy Program Overview

Disadvantaged adolescents are in dire need for innovate social services and outreach programs. According to the National Crime Prevention Center (2012) 2.2 million people in Canada are aged 15-19-years-old; 8.5% of adolescent populations are high school drop outs without a high school diploma; the highest unemployment rate in Canada involves 15-24-years-olds. 15% of teenagers are unemployed compared to a 7% for the adult population. In Quebec, 423,000 teenagers aged between 15 and 19 years of age (Institut de la Statistique Québec, 2016) share an annual deficit of 2$ million from the Social Services Quebec ministry (Gouvernement du Québec, 2016). Consequently, the adolescent age group is rarely allocated large sums of money to promote social skill development and social reinsertion

programs.

The lack of social programs for adolescents led to the research and development of the WAAT program. Research on animal-assisted therapy programs is well documented and offers promising results. According to Turner et al. (2009), "The results of this study indicate that the dog-assisted group training improves the emotional competences of the participants [adolescents], especially concerning emotion regulation and recognition" (p. 93). Gail Soobrayan Sentoo concluded her master's research by saying "In line with the findings of other studies already mentioned in the literature chapters, this study showed improvement in the self-esteem of the subjects through the implementation of animal-assisted play therapy" (2003). AAT does seem to convey a sense of control to participants through object transference: the leash, treats, and clickers. The perceived sense of control instils a subjective power, which in and of itself, can increase self-esteem.

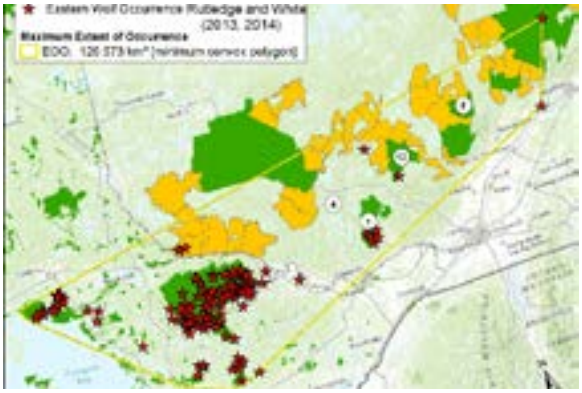
The WAAT program is an 10 week program[1] created to develop social skills for at risk adolescents aged between 15 and 20 years old. Each session built on the previous one through various animal training exercises inspired by Stacy Grover (2010). The program included an introduction session without animals. The final session was an award celebration with mentions and rewards; consequently, participants actively work with animals for 8 consecutive weeks. Sessions were modified on a need-to basis as participants' or animal behaviour improved, stagnated, or regressed. Training exercises were developed and implemented with the help of CJE intervention team members, PSA staff, EMSB high school personnel, and Dogue Shop volunteers. Different sets of abilities were addressed each week: social closeness (attachment), confidence (self-esteem), communication, problem-solving, and emotional management (self-awareness). It was decided the first four sessions would be conducted with dogs to develop participant training skills and assess fear towards canines, if any. Participants were introduced to clicker training and fine-tuned their hand-eye coordination abilities with dogs and rats. The following sessions were conducted with wolves. The second to last session was documented by the French television network TV5.

Wolf Animal- Assisted Therapy Program Overview

Of the 7000 wolves in Quebec, 402 individuals were killed in 2002. The statistic represents approximately 6% of the entire provincial wolf population (Hénault & Jolicoeur, 2003). The form of the killings results from a disguised bounty established in the late 80s. Wolves are mostly killed for the fur industry; consequently, Canada's grey wolf (*Canis lupus*) population is not at risk according to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC, 2015). The only wild canid with a protected status in Canada is Ontario's Eastern wolf (*Canis sp. cf. lycaon*) which is classified as threatened. The Northern grey wolf (*Canis lupus occidentalis*) and the Southern grey wolf (*Canis lupus nubilus*) are not at risk; unfortunately, wolf status could change rapidly because climate change and habitat loss.

Wolves, as animal-assisted therapy partners, offer unique opportunities to implement and maintain lifelong changes for both human and non-human species. In his book *Wild Justice: The Moral Lives of Animals*, Mark Bekoff writes "These neurons [mirror neurons] allow us to understand another individual's behaviour by imagining ourselves into the other individual's shoes." (2009, p. 29). When people attach to wolves, the inter-species relationship creates a remarkable, indescribable, and often unforgettable bond forever imprinted in human consciousness; consequently, people who have experienced a wild or captive wolf encounter are more likely to get involved with conservation and habitat loss (Bekoff & Pierce, 2009).

Figure 1 - COSEWIC Assessment and Status Report on the Eastern Wolf (*Canis sp. cf. lycaon*) in Canada - 2015



Adolescent and wolves are very similar in their perceived behavioural expressions. Some human adults view

1 The program still runs at two Montreal English School Board schools with dogs and rats for at risk teens. Parc Safari wolves are now retired.

wolves as wild unpredictable animals whose sole purpose is to destroy the environment. To a certain extent, adolescent behaviour is equally perceived by certain adults. Furthermore, teenagers believe most adults view them as destructive, wild, and unpredictable humans (Laser & Nicotera, 2011). Consequently, both teenagers themselves and adults have come to accept adolescents and wolves as marginalised creatures of society to be feared, conquered, or eradicated.

The WAAT program goals are to dispel misconceptions attributed to both adolescent and wolf behaviour and to transform marginalised associations into symbiotic relationships. Human objectives were designed to create secure attachments between wolves and teenagers through training exercises, cognitive games, and social imitation (Soobrayan Sentoo, 2003). Wolf objectives were intended to promote conservation and provide enrichment through planned interactions. Because the WAAT program was (is) so innovative, we found little documentation to help plan sessions ahead of time; consequently, some exercises were adjusted as they occurred. Safety remained our primary objective during the entire program. Sessions were video documented and participant files were completed after each day.

Method Overview

We used a pre-post five point bipolar scale evaluation questionnaire to assess teen knowledge and beliefs regarding wolf conservation and interpersonal skills. The pre-evaluation questionnaire was composed of five questions with possible answers ranging from "not at all" to "a lot" and from "very bad" to "very good". The post-evaluation questionnaire was composed of nine questions with only six relating to interpersonal skills and wolf knowledge. The post-evaluation questionnaire offered possible answers varying from "not at all" to "a lot" and from "very bad" to "very good". The three remaining questions were directly related to the program structure and development and offered valuable feedback for future WAAT sessions.

Sessions were video and photo documented. Interactions were analyzed to identify the presence of our goals and objectives. Each week, a table was filled to document each participant's goals and objectives: attachment, communication, self-esteem, problem-solving skills, empathy, and conservation. The following table is a sample from week three documentation. The "x" simply marks if skills were observed during sessions or not. Each week tables were completed by the intervention team which later compiled and corroborated written data with video and photo documentation.

Table 1 - Week 3

Participant/ Goal & Objectives	P1	P2	P3	P4	P5	P6	P7	P8
Attachment	x		x	x		x	x	x
Communication	x	x	x	x	x			x
Confidence		x		x	x			
Conservation		x			x		x	x
Empathy	x		x	x	x			x
Enrichment								
Problem-Solving		x	x		x	x		x

We did not evaluate skill levels each week because of unpredictable environmental variables like weather. Human and animal behaviour variables also affected weekly evaluations. We chose a cumulative approach and decided to compile achievement data at the end of the program. Figure 2 summarises the data we collected from the WAAT program. A decision was made to evaluate personal and group social skills acquisition as a measure of attribute instead of evaluating depth and breadth of skill experience. Lupine knowledge could not be adequately pre-evaluated as participants were highly unlikely to have spent unprotected contact with wolves.

Sample Group Description

None of the participants displayed fear towards rats, dogs or wolves. Sample size was comprised of eight participants: six boys and two girls. Participants were grouped into four categories based on their pre and post evaluation forms (Table 1). One girl was diagnosed with depression, one girl had low self-esteem, two boys were diagnosed with Asperger syndrome, and four boys were involved with social services for abandonment and neglect. One boy with Asperger lived in a group home. The participants came from different high schools within the EMSB and CJE. All participants had insecure attachments toward parental figures. Finally three of our participants had drug related problems. Drug and alcohol consumption was controlled through the honour system; however, intervention personnel closely knew participants and were confident they could identify participants who had consumed drugs or alcohol.

On their pre-program evaluation forms, only two people voiced their concern about wolf conservation on social media while most participants did not express concern over wolf conservation. Only two families signed released

forms allowing participants Michael and Jessie to be filmed by the television crew TV5. The pilot project was documented on 21 July 2011. The day was memorable because the temperature was 35.6° Celsius in the shade. Regardless of the extreme weather, our teens and resident wolves were very cooperative.

Table 2 - Participants

Participant #	Attachment	Confidence	Problem-solving	Save Wolves
1 Asperger	X	X	X	
2 S. Services	X	X	X	
3 S. Services	X	X	X	
4 S. Services	X	X		
5 S. Services	X	X	X	X
6 Asperger + Y. Center	X			
7 Borderline	X	X	X	
8 S. Image	X	X		X

Wolf Socialization and Training

Both Arctic wolves (*Canis lupus arctos*) in the WAAT program were hand reared and socialized towards people on a continuous schedule from birth to 4 months old. The 24 hour schedule included exposure to people, dogs, and other strange situations like television sets and golf tournaments. Socialization towards humans continued throughout daily walks and visits for a strict minimum of 1 hour per day. Wolves Ruby and Akiak were both exposed to visitors and various staff members. Ruby was 3 months old when the program started and Akiak was 5-years-old. Even though both females were intact, neither wolf was part of the reproduction program. Both wolves were kept off exhibit during the day and kept in an enclosure at night time. The cool night air felt during Quebec's summer heat was highly beneficial for Ruby. The nightly exposure also served as enrichment for both female wolves.

The wolves were trained with positive reinforcement for simple behaviours such as walk on leash, come when name is called, pose (stand still next to a person), and sit. The later behaviour was never put on cue. Daily rations of food were used as reinforcement and kept on trainers during sessions. The food was kept in plastic containers attached to trainers' belts. Both clicker and mouth pops were used to bridge stimuli. WAAT did not necessitate highly trained animals because the program required participants to train selected behaviours presented to them during sessions. Participants were expected to problem-solve through training exercises which in turn encouraged social skill development.

Program Successes and Shortcomings

WAAT served to establish a secure attachment between wolves, teenagers, and program leaders. The rate at which teenagers bonded with wolves could potentially be attributed to the program length itself. The limited number of sessions could have contributed to speedy attachment because participants relinquished preconceived beliefs and myths during the first few sessions. However, the participants might have been psychologically predisposed to succeed because of the limited number of weeks available in direct contact. One possible explanation might be teenagers unconsciously feared failure and possible removal from program, thus, were on their best behaviour.

Overall, the program was a success with an increase in social skill sets and conservation. Figure 2 summarises data collected from the WAAT program pre and post evaluation forms. Participants reported an increase in wild wolf conservation efforts; conversely, the concept of training as enrichment remained abstract. Enrichment and problem-solving skills did not increase as expected. Enrichment objects were presented to the animals as games and puzzles which participants had previously made. Only a few teens seemed to have grasped the concept of enrichment. Adolescents understood enrichment in terms of games made and played but not as a wellness outlet. One possible explanation might be because training sessions were tangible activities with direct visible results as opposed to enrichment which only offered indiscernible results. Future program sessions could include human enrichment games such as riddle egg hunts (Grover, 2010) or human superhero chess (Marvel, 2017).

Both individual and group skill averages increased by approximately 50%. Session design exercises are closely correlated with social skill goals. On week 3, training exercises purposefully included a high failure probability in order to reach intended confidence enhancement objective; however, the session concluded with positive outcomes for all participants. The objective for week 5 was to develop empathy. In the fifth session design, participants were asked to draw a human-wolf animal and describe how the picture related to their present life story. Members were encouraged to stay within their human-animal teams throughout the process. Follow-up questions focused on individual perception and description of captive versus wild wolf emotions. Sample questions included "*How do you think wild wolves feel about other wild wolves?*" and "*If you were your wolf, how would you feel about living in captivity?*" Figure 2 summarises individual evaluation forms. In blue, social skill set averages were assessed pre and post WAAT program. Group averages, in red, were compiled pre and post program to give our team an overall understanding of group de-

velopment. To our surprise, individual and group averages increased in conjunction.

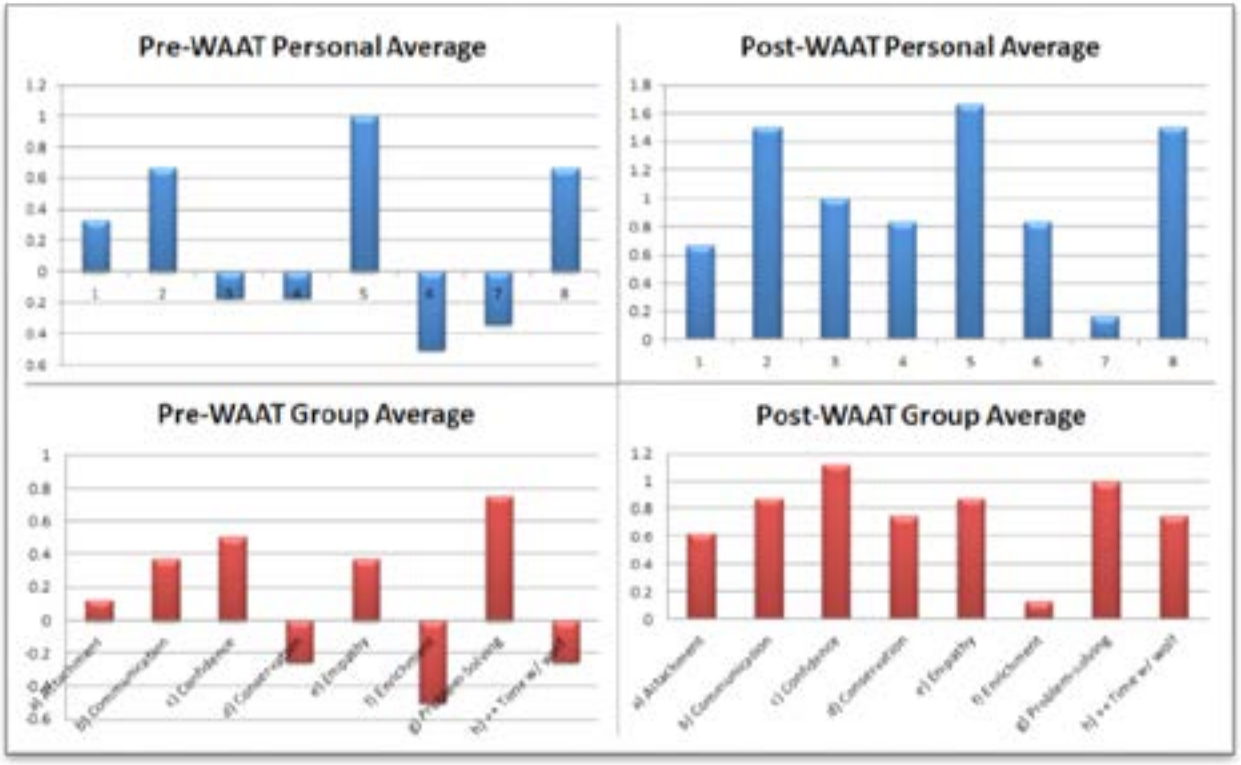


Figure 2

Another shortcoming was the actual conclusion of the program. We did not plan a special end, other than thanking participants for their involvement in the program. Group consultation feared participants might experience attachment loss, or abandonment; consequently, we designed an award ceremony. In the regular dog animal-assisted therapy (DAAT) program, we conduct a farewell presentation to the rest of the school. Each human-animal team introduces their pet-partner and demonstrate the behaviours they have accomplished. We organised the same type of conclusion for our pilot program. Participants receive an extra self-esteem and confidence boost which ended our programs on a positive note rather than on a negative outcome. Future WAAT programs will undoubtedly finish in a similar fashion.

Conclusion

Animal-assisted therapy programs, in general, tend to reduce the number of session required when compared to traditional non-animal related therapy (Dimitrijević, 2009). The WAAT program effectively reduced the number of therapy sessions even further because the attachment to the wolf as an animal-partner broke through emotional barriers much more rapidly. Chandler (2001) best described animal attachment and session expectations when she wrote "Animals actually help a person to focus on a task because of an interest in interacting with the pet." (p. 1).

Other exotic animals like zebras (*Equus grevyi*), Wapiti (*Cervus canadensis*), or foxes (*Vulpes vulpes*) could be considered as effective therapy partners. Giant animal species should not be proscribed; we believe participants could benefit from protected contact exposure and still reach intended goals. Side benefits to exotic AAT programs heighten conservation efforts, enrichment, and environmental preservation.

WAAT achieved, beyond our expectations, the goals and objectives we set out to reach. Participants securely attached to animals, emotionally bonded with adults, improved social skill sets, and developed conservation strategies. Animal-assisted therapy, as an emerging field, offers new and innovative ways to think and approach old problems. Wolf animal-assisted therapy is a *think outside the box* intervention method capable of extracting hidden human emotions and healing psychological disturbances. Permanent implementation of wolf animal-assisted therapy programs in zoological settings is inevitable, for both humans and animals benefit from the symbiotic attachment, read relationship.

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Variances in Behavioral Conditioning of Releasable and Non-Releasable Lake Sturgeon (*Acipenser Fulvescens*)

Zac Reynolds

SEA LIFE Michigan Aquarium

Repopulating the threatened lake sturgeon into their native waters has been a focus of Michigan's Department of Natural Resources and local conservation groups. Through partnerships with the SEA LIFE Michigan aquarium, one juvenile lake sturgeon originating from a state hatchery will be conditioned to be introduced to Michigan's waters. The releasable sturgeon is the recipient of an environmental enrichment plan focused on the introduction of environmental stimuli replicating the changing of seasons while reinforcing foraging behavior.

The goal of this program is to prepare the juvenile lake sturgeon with the physical and mental wellbeing necessary to thrive to a reproductive age in Michigan's waters and ultimately contribute to a diminished population. The releasable fish is housed in an exhibit in the aquarium's classroom. While at SEA LIFE Michigan, the sturgeon is able to be the subject of educational workshops attended by local school groups.

The behavioral conditioning of the releasable sturgeon differs from that of the aquarium's resident (non-releasable) sturgeon. Unlike the releasable juvenile, the non-releasable sturgeon are trained to participate in their husbandry. They respond to a conditioned reinforcer as well as a vibrating target- stimulating their ampullae; one of their most powerful sensory modalities. On the contrary, the enrichment of the releasable sturgeon has an emphasis on the relationship between the animal and its environment.

Data will be collected in regards to physical health. Additionally, observations will be conducted to determine if a change in behavior under varying environmental changes can be noted.

Lake sturgeon (*Acipenser fulvescens*) are an iconic and ecologically important fish to the Great Lakes region. Growing to a length of seven feet and living over one hundred years, they are one of the largest and oldest lived fish in the Midwest. This as well as their natural history, cultural significance, and striking physical features have made their plight a focus of many conservationists. According to US Geological Survey, "by the late 1900s, 80 percent of the lake sturgeon population was removed from Lake Erie". (Bennion & Manny 2011)

The reduction in lake sturgeon populations is through both a combination of the species' unique natural history as well as human intervention. Male lake sturgeon reach sexual maturity between ten and fifteen years and females reach maturity between twenty and twenty-five years. Spawning sturgeon return to the areas of which they were hatched in order to copulate and start the next generation. Interestingly, male sturgeon only reproduce every three years and females only every five years. This slow life cycle and intermittent spawning behavior combined with overfishing and habitat destruction through dredging of river bottoms (removing native spawning grounds) has left the lake sturgeon as a locally threatened species in Michigan. Government agencies like Michigan's Department of Natural Resources (DNR) and US Fish and Wildlife Services have developed a rehabilitation strategy to protect and restore native lake sturgeon populations. (Hayes & Caroffino 2012)

Every summer, Michigan's DNR performs an annual survey on lake sturgeon populations. In addition to monitoring population density, the DNR contributes to it through their hatcheries. In 2016 alone, 7864 juvenile lake sturgeon were introduced to Michigan waters. (B. Champion 2016)

In addition to government agencies, local conservation group: Sturgeon for Tomorrow is dedicated to the revival of the lake sturgeon by promoting conservation through community outreach and education. The St Clair/Detroit river chapter of this group has been a great ally helping SEA LIFE Michigan get involved in local conservation initiatives. One of their projects, the Sturgeon in the Classroom program, has been adapted for SEA LIFE's classroom. In this unique conservation project, juvenile lake sturgeon from the DNR hatcheries are raised in exhibits in the aquar-

ium's classroom, as a grow out and education opportunity, before being released in native waters.

In addition to the releasable juvenile sturgeon, SEA LIFE is home to non-releasable resident lake sturgeon in its Great Lakes exhibit. The behavioral husbandry of these individuals has an emphasis on training that allows the animals to participate in their own husbandry. This has been achieved through the use of a unique form of target training as well as a conditioned reinforcer.

Lake sturgeon lack keen eyesight. But one of the most powerful sensory modalities that they possess is their ampullae. This electrical-sensing organ located at the tip of their rostrum allows these animals to detect the electrical pulses put off by potential prey at the bottom of turbid environments. Considering this led to the implementation of a non-visual target; but rather a vibratory stimulus that the fish are able to hone in on from across the exhibit. The design is a round disc attached to a PVC pole. The target is tapped lightly and rhythmically until the sturgeon approach. The completion of this targeting behavior is marked by a conditioned reinforcer through a clicker attached to the PVC pole. See Figure 1.

This trained behavior was a necessary element of the behavioral husbandry of the resident sturgeon. Because these fish are still in adolescence, it is imperative that they maintain a healthy growth rate. Although broadcast feeding this mixed-species-exhibit allows all the fish to pick and forage for food twice daily, providing the opportunity to the sturgeon to take food from a pole was a simple way to guarantee the type and amount of food they were receiving on a daily basis. This information was used to determine the percentage of body weight in food these fish require to maintain a healthy growth rate and body condition. Aside from the benefits to physical health that target training and pole feeding provide, this interaction has been an effective way to provide daily enrichment for these bottom-dwellers.

Other types of enrichment offered to the resident sturgeon are designed to increase foraging behavior. Frozen blocks of ice filled with frozen meat and fish food pellets and sank to the bottom of the exhibit with a dive weight have been an effective form of food enrichment. Lake sturgeon use their whisker-like appendages called barbels to taste their environment and search for food. The sunken ice block has a layer of food that the sturgeon have a high likelihood of interacting with until the block melts; between five and ten minutes after it is placed in the exhibit.

In October 2016, SEA LIFE Michigan received its first lake sturgeon as part of its releasable sturgeon program. The fish was hatched at the Black Lake fish hatchery in the spring of 2016 and continues to grow at the SEA LIFE Michigan aquarium until its planned release in summer 2017. The goal of this program is to show students the unique characteristics of a prehistoric animal that lives in their backyards. Workshops and games focus on natural history, anatomy, and conservation of this primitive and iconic fish. Apart from the educational outcome of this program, another goal of the care of this fish focuses on the development of physical health and mental wellbeing.

Several differences in the husbandry of releasable and non-releasable lake sturgeon presented challenges that needed to be addressed. An initial challenge was that the DNR requested that the releasable sturgeon not be housed with any fish or water from another system that holds fish to prevent disease transmission. This eliminated any social interaction from other fish. And because this threatened fish was to go back to the wild and contribute to a diminished population, it needed be capable of surviving in Michigan's waters. An environmental enrichment plan was developed to present the sturgeon to changes in scenery and photoperiods as a method of representing seasonal changes. Photoperiods were periodically adjusted to the times of sunrise and sunset in Black Lake, Michigan where the lake sturgeon is to be released. An activity budget was completed to log the releasable lake sturgeon's behavior under different photoperiods. Observations were completed to assess how the animal was spending its time. Because there was no control group, a baseline of activities was taken during times of the day where they would be under light despite what time of year it was; and the same for nighttime with the absence of light. Notably, there was no significant change in behavior despite the time of day- or the presence of light. See Figure 2.

Considering the ecology and age of this animal leads to a simple interpretation of this behavior. Young sturgeon, with limited defenses excluding bony scutes, are vulnerable to predation. Their best strategy for survival is to grow quickly- which is achieved through eating and foraging as much as they can as quickly as possible. The majority of this young, active animal's life is swimming and eating despite photoperiod. And this strategy is successful. In combination with an active behavior, lake sturgeon have physical advantages that contribute to quick growth by limiting the energy necessary to navigate themselves along lake and river bottoms. A light, cartilaginous skeleton, a streamlined shape, and a relatively large caudal fin to propel them are just a few characteristics that are beneficial. From February to April 2017, the releasable sturgeon had a 57.3% increase in body weight and a 28% increase in length.

In the interest of limiting human interaction, it was decided not to train the releasable sturgeon like those residing in SEA LIFE's Great Lakes exhibit. However, there was still a need to provide food enrichment. During the winter months, frozen clams in a block of ice were sunk to the bottom of the exhibit. This variation of the frozen ice block en-

richment used food items that are similar to those that are to be encountered by a wild sturgeon in Michigan waters.

Conclusions and Future Study

The true end of this program will not come for at least a decade, and only if the sturgeon in this program is spotted spawning in the wild. As a result, it is unlikely that there will ever be a definitive conclusion to the success of this program. However, working with SEA LIFE's veterinarian to place a PIT tag on the juvenile sturgeon and enter that number in the DNR's survey database can at least provide a minimal chance of getting data on this sturgeon as it ages closer to sexual maturity.

One of the greatest impacts of this program has been the education to local students that were able to learn about a unique and fascinating animal that is facing considerable environmental pressures. From December 1, 2016 to April 15, 2017: 113 students attended the "Stranger Things: Michigan Lake Sturgeon" program.1691 students were exposed to lake sturgeon messaging through other classroom programs and 488 guests through birthday party programs. In sum, in 4.5 months, lake sturgeon conservation messaging has been shared with 2292 people through this project.

Moving forward, SEA LIFE would like to expand the sturgeon release program to more fish at an earlier age. Having a larger sample size and fish at a different developmental stage will assist in compiling a more complete understanding of the behavioral husbandry of this species through its adolescence. Personally, the most interesting aspect of this project has been the consideration of the behavioral impacts to an animal that is not considered to be necessarily clever. In addition to understanding their natural history, continuing to explore the behaviors of these threatened, primitive fishes may contribute to their perseverance.

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The 10,000 Pound Elephant in the E.R.D. Training an Adult Bull Elephant to Allow Containment in an Elephant Restraint Device.

Eric Duning, Rickey Kinley

Cincinnati Zoo and Botanical Garden

The Cincinnati Zoo and Botanical Garden's bull Asian elephant, Sabu, is one of the most genetically valuable elephants in the country. He has no offspring and collecting semen from him is very important. To safely do this he needs to be secured in the Elephant Restraint Device (E.R.D) and unfortunately Sabu has developed reluctance to being closed inside of the ERD. The elephant staff has developed a multiple step training plan to incorporate tether training, desensitization to the mechanical motorized doors, and re-building Sabu's confidence in the ERD.

The first step has been to train Sabu to allow keepers to attach bracelets/tethers to both of his front legs, then to allow tethering him in place using the bracelets. Secondly, keepers have continued to work with Sabu in the ERD. He is being asked to present various previously trained behaviors while in the ERD. This is to allow Sabu time to become more comfortable in the ERD before the tethering is introduced into this area. The third step is desensitizing Sabu to the sound of the opening and closing of the mechanical doors. This is being done by reinforcing the behavior of stationing near the ERD while operating the doors. When it is all combined in the ERD the goal is that Sabu will willingly allow himself to be tethered in the ERD for semen collection.

Introduction

The landscape of animal care has changed drastically since 1906 when the Cincinnati Zoo and Botanical Garden (CZBG) first opened the Herbivore building which is now called the Elephant House. Elephants have resided there ever since, including both African and Asian elephants. In 2000 the current residents Mai-Thai, Schottzie, and Jati, who had been housed at the zoo's amphitheater, moved in. Sabu arrived later. Two keepers moved with them, joining the current keeper staff at that time. In the past 16 years a lot has changed, however the elephant keeper staff has basically stayed the same. Only two full time keepers have been replaced. The current keeper staff of 5 has a total of 128 years of experience working with elephants, most of that being free contact. The bull elephant Sabu left in 1998 on breeding loan. The elephant house had to be renovated to facilitate his return in 2007. While he was away at the Louisville Zoo and Dickerson Park Zoo he was managed through restricted contact instead of free contact.

When Sabu returned the elephant keeper staff was plunged into a completely different training style than free contact to which they were accustomed. Sabu returned with a solid base of husbandry behaviors, which allowed the CZBG elephant keepers to build their skills and confidence with the new system. This confidence enabled the staff to add new husbandry practices, exercise, and demonstration behaviors to Sabu's regimen. For the next 9 years the elephant program worked with Sabu in restricted contact and the three females were still managed in free contact. The keepers also began to add some restricted contact management to the daily training regimen of the females.

In February 2016, the CZBG in compliance with the AZA mandate switched all elephant department management to restricted contact. The keepers rallied together and welcomed the changes, even though there were concerns that the elephants who had been managed in free contact their entire lives may not adjust well to a new management system. Some institutions have had to completely overhaul the staffing in their elephant departments when the switch from free to restricted contact was decided upon. We are proud to say that the elephant team at the CZBG has readily evolved with the ever changing world of animal care. The zoo's curators were integral to the adjustment to the new changes by offering the keepers the tools needed to facilitate the change into restricted contact. This included consultations with members of the Houston Zoo and Oklahoma City Zoo.

Switching training styles led to a few unexpected behavioral challenges. The first being personality changes in the attitudes of the female elephants. This was seen in the matriarch Schottzie who began exhibiting more aggressive, physically controlling behaviors towards the other two females. Also the youngest female Jati began participating less during training sessions, seemingly testing the boundaries of her new freedom of choice. Some of the behaviors that

she was very proficient with seemed to improve in consistency, while some of the more challenging behaviors seemed to diminish or were offered with a lower willingness to achieve the criteria. As the training moved forward, the team celebrated the successes and worked together to overcome hurdles.

In early 2016, the CZBG established an Operant Conditioning team. The three members of this team is composed of the more skilled employees in operant conditioning techniques at the CZBG. The purpose of this team was to offer operant conditioning assistance to various departments and also to teach and provide consistency with training methods throughout the CZBG. The elephant department chose to have Rickey Kinley, a long-time member of the Aviculture department, to assist our elephant department's operant conditioning program. Rickey had the opportunity to gain the trust of the elephant keepers right away. This occurred when he worked with one of the elephant keepers to train Jati, our youngest cow, to paint on a canvas for our behind-the-scenes tours called Elephant Extravaganzas. She had begun this training in free contact but there was some difficulty exhibiting this behavior in a restricted contact scenario. After a single training session using operant conditioning techniques, Jati was painting consistently. This served as a spring board for all future collaboration between Rickey and the elephant department.

Sabu

- Asian elephant
- Male
- 29 years old
- Wild born
- Arrived at the Cincinnati Zoo from Malaysia - 1991
- Cincinnati Zoo to the Louisville Zoo – 1998
- Louisville Zoo to Dickerson Park Zoo – 2002
- Dickerson Park Zoo back to the Cincinnati Zoo – 2007

One of the previously trained behaviors had regressed with Sabu. He stopped allowing keepers to close both doors in the Elephant Restraint Device (E.R.D.) to secure him inside. When the door motor was turned on or if a keeper walked toward the mechanical box to operate the mechanical doors Sabu would immediately back out of the ERD. This prevented further semen collections from this animal. Since Sabu is a top tier Asian elephant, due to being wild caught and not being genetically represented in the captive population, this was a very important behavior to regain. Many different methods over the past 8 years were attempted to regain this behavior, without success. The elephant department staff, elephant curator, and the training team decided to reevaluate the situation and develop a new more creative training strategy.

The behavioral goal for Sabu was to enter the E.R.D. and stand calmly while keepers close the back gate and apply tethers to all four of his feet. Then the back gate can be opened to allow for semen collection. The new training strategy separates the training goals into three parts. The three behaviors chosen were to be trained independently and brought together at the end. One of the benefits of this concept was that if one of the behaviors were to regress the others could still potentially move forward without a direct negative impact.

First, we worked to have Sabu present his foot at a foot care door located in his stall. The goal being, when the foot is presented keepers would put a bracelet on his leg. This bracelet has a Brummel hook, which is a chain with an open hook on it so that it can be quickly attached to a tether chain forming a complete loop. We wanted to build Sabu's confidence by tethering him in his stall before he is tethered in the ERD. The second component was to desensitize Sabu to the doors and door motor while he is in the ERD. This had to be started in an area called the pre-ERD; which is a smaller area where Sabu can be held before entering the ERD. This was due to Sabu's distrust of the ERD. Finally we wanted to combine all steps in the ERD with all the doors closed, with Sabu exhibiting calm behavior.

Training Plan

<u>Leg tether training</u>

The long term behavioral goal is to be able to tether Sabu while in the ERD. Using a more traditional approach, this would be done after he was acclimated to the ERDT. To speed up the process and to reduce adding any potentially aversive scenarios to the ERD, it was decided to start training this several stalls away from the ERD so that tethering could be done in other areas and then moved to the ERD once proficient. Sabu's overnight stall (Stall 1) was chosen because he already presented his foot there for foot work. The process was started by target training his foot to a pedestal mounted outside the foot presentation door. The expected criteria was for Sabu to hold his foot still on the pedestal for an extended period of time even after the target was phased out. When this was achieved, a bracelet which is small section of chain with Brummel hooks on both ends was held near the pedestal. Over time the bracelet was moved closer to the door until Sabu had to push his foot against it to place his foot on the pedestal. When this was completed, the bracelet was moved around on his leg simulating attaching it to his leg. Up until this point everything moved forward at a good pace. Unfortunately during one session Sabu pulled his foot back unexpectedly this caused

the chain hit the door frame, making a loud noise.

This incident caused a set back with the behavior far more than expected. A decision was made to switch to a cloth fire hose because it would not make any noise and he had no negative experiences with it. This would also be useful because the bracelet could be slid into the firehouse and used for the tethering. The change helped to overcome this hurdle but we decided instead to focus more time and energy on working with desensitizing Sabu to the mechanical doors and the ERD.

Mechanical Door Motor desensitization

As stated earlier, the sound of the mechanical door motor running and doors closing caused Sabu to back out of the ERD. Training for desensitization started in the pre-ERD area. This is an area smaller than his stalls but larger than the ERD and it is located next to the ERD. It contains four hydraulic concrete doors, one hydraulic barred gate, one barred manual gate, and the entry gate into the ERD. This was also one of the places in the elephant barn where Sabu received his regular bath. During his morning bath Sabu would be stationed as doors would be closed. Getting him accustomed to the doors in this area, elephant keepers would station Sabu and turn the mechanical door motor off and on, open doors, and close doors around him. While this was occurring he was continually being provided with high value food items. During the early stages of this training, he would face each door or gate as it opened or closed. It was believed that he did this so that he always knew what was being done around him.

After several weeks of this process Sabu would station and allow any door to open or close around him even the ERD entry gate. This entry gate becomes the back gate when Sabu is in the ERD. At this point Sabu was moved into the ERD and the process of closing doors continued. To enter the ERD from Stall 1 Sabu had to pass through door 17, gate 12, then into the entry gate, therefore emphasis was put on closing the doors behind him in that order. After a few weeks Sabu would stand in the ERD and eat calmly while door 17 and gate 12 would be closed.

Elephant Restraint Device

Sabu is fearful of being enclosed in the ERD. Because of this he would only allow keepers to work with him in the ERD if the back gate was open allowing him the ability to back out. Otherwise immediately upon any occurrence that he was uncomfortable with, he would back out. He was comfortable with allowing the front gate to open so that he could exit the building into his exhibit yard. However he would leave the ERD as soon as the front gate opened and wouldn't remain stationed if the front door to the ERD was open.

This training plan started with bringing Sabu into the ERD and turning off the motor that operated the mechanical doors. The mechanical door motor running added to his nervousness. Most likely because the mechanical door motor in operation was a signal that the back ERD door could be closed. The ERD has several smaller manual doors located along the sides. We began training inside of the ERD by opening one of the front side doors and asking Sabu to present his foot into this space. Once he was comfortable with this we began with him presenting various feet into the accompanying side doors at various times. Additionally, Sabu was asked to enter and exit the ERD at random intervals during training sessions.

After Sabu consistently offered these behaviors the same process was repeated with the mechanical door motor running. After a few weeks Sabu was comfortable with working in the ERD with the mechanical door running. The next step was to have Sabu station in the ERD after the front gate was opened until a keeper gave him the release cue. This started with calling Sabu into the ERD with the all the gates open through the ERD leading into his yard. Then he would be asked to station at the front door that allowed him to exit the ERD forward. Also at this time all food items and food enrichment in his yard was placed out of reach or removed. This was so that if he entered his yard before being cued into it, he would not be rewarded.

In the beginning when Sabu was called into the ERD, he ignored the station cue and quickly walked out to his yard. Every time that this happened he was offered the opportunity to continue participating by being called back into the ERD. He was accustomed to there being food enrichment waiting for him in the yard every time he entered. We believe that this supported his desire to continue participating by returning to the ERD for additional training sessions. Finally he held for the 5 seconds that we set as our first criteria to give the cue to enter the yard area. When he did this correctly, his feed barrels were lowered and he received the morning food item enrichment immediately.

Once Sabu was stationing consistently he started coming into the ERD with the front gate set in a half open position. We began training by attempting to have him station while we opened the front ERD gate. Sabu exited as soon as the gate was opened wide enough for him to walk through. We believe that this was because in the past he was always allowed to exit as soon as the front door was opened. Opening the door completely inadvertently became the cue to exit the ERD. We used the previously described process of removing food items from the yard and asking him to continue stationing even when the front door was opened completely. When he would move past the gate before being cued there wasn't food waiting in his yard. He was asked back into the ERD and repeated. Eventually he continued stationing even when the front door was opened and at this time he was given access to his feed item enrichment in the yard plus additional high value food reinforcement.

Combining the desensitization with the ERD

At this stage both door desensitization and ERD training were merged. Sabu was reliably entering the ERD and eating calmly as doors and gates were closed, while remaining in the ERD. Correspondingly he would wait to be cued out of the ERD even when the front gate was opened completely. It was time to begin adding the back gate into his training. It was decided the best way to start was to begin moving the back gate as Sabu exited the building after he was cued forward out of the ERD. This would allow him to realize that the sound of the back gate held no negative consequences. Also as he became relaxed with the closing gate it would start being closed earlier in successive steps after he left the ERD, slowly working towards closing the gate as he left the ERD. At this point the back gate would begin closing as the front gate was opening.

Conclusion

All programs encounter training hurdles. Hurdles may become more difficult, when paired with an older building and a staff that is somewhat inexperienced with restricted contact elephant management. However, the CZBG has used a creative and collaborative training plan to move toward achieving our goals. Using the three independent training plans that eventually merge into one was paramount in that process. Even though the complete goal has not yet been achieved, the progress has been great. Sabu now enters the ERD and stands calmly as all doors and gates are being closed, excluding the back gate. While in the restraint he will offer all four feet to keepers, willingly allow trunk washes, and will station until released, even with the front gate open. As documented earlier, due to Sabu being startled during a tether session he has had some regression with that behavior.

Fortunately his ERD progress has allowed us to decrease the importance of the tethering at this time. That's not to say the tether work will stop, it will simply continue to be done independent of the work in the ERD at this time. The unexpected benefits of the work has been a more unified vision towards restricted contact training. It has also fostered a more team oriented approach to solving behavioral challenges. The successes that have occurred while working through Sabu's training has inspired the application of these same techniques with the female elephants. The expanded options include the use of a variety of operant conditioning with the cows for ultrasounds, enemas, blood draws, trunks washes, and standing sedation. The elephant keepers, CZBG curators, and the training team have all worked well together towards these goals. As a result the elephants have benefited as well as the staff.

Acknowledgements

Cincinnati Zoo and Botanical Garden Elephant Staff
Cecil Jackson Jr
Rick Heithaus
Val Nastold
Ross Garcia
Matt Ruiz

Christina Gorsuch - Curator of Mammals, Cincinnati Zoo and Botanical Garden

Bob Lessnau- Director of Animal Collections, Cincinnati Zoo and Botanical Garden

Nick Newby - Assistant Curator of Large Mammals, Oklahoma City Zoo

Posters

Training a Clouded Leopard to Accept Daily Sub-Cutaneous Fluids

Laura Carpenter

Cincinnati Zoo & Botanical Garden

Early in 2016, the veterinarian came to us and told us that our clouded leopard (Neofelis nebulosa) needed to get sub-cutaneous fluids several times a week in order to help slow the deterioration of her kidneys. He asked if it would be less stressful for her to be netted every time or if we could train her to let us do it without a net. We decided that it would be better to train her to accept fluids without a net. This poster will outline the planning and many steps that were necessary to get our clouded leopard to go into a small box with mesh on the top and allow the vet techs to administer fluids to her four times a week. I will show how we designed the box and how we trained her to go into it, as well as getting her used to new people coming into her enclosure and allowing them to touch her. Also, all the setbacks we incurred. By doing this others who would like to try to use this technique to be able to administer fluids in this way, can learn from our mistakes and our successes. I think that this is a procedure that would be helpful for many animals in many different institutions. I am very happy with the results and would like to share this with others who could benefit from it.

In early 2016, our veterinarian came to us and told us that our clouded leopard (*Neofelis nebulosa)* has kidney disease and would benefit greatly by getting sub-cutaneous fluids on a regular basis. We discussed whether netting her every time would be too stressful for her. It was decided that we would try to train her to accept having this procedure done without this type of restraint.

Our first step was to talk to our training coordinator at that time, Megan Kate Hoover. Megan Kate suggested that we have a box made in which we could train Tevi, our leopard, to go into. It should have mesh top and side and front so she can be fed from the front and the vet techs can administer the fluids through the top.

Next, I talked to one of my colleagues, Mike Land, who is good at wood working and carpentry. He agreed to design and build the box. It would be made from wood, have mesh top, side and front and a removable door on the back. A slot would have to be carved in the door for her tail.

Now it was my turn to do the measuring. Since, Tevi and I already have a good relationship, (she allows me to come into the exhibit and interact with her), I could go in and measure her height and length. From these measurements, Mike would be able to build the box so that it just fit around her and she wouldn't be able to turn around or reach out. The box is made from wood, with chicken wired fencing on the front, top and side. The back of the box is open so that she can get in it from the back. The box dimensions are 32.3" long, 10.5" wide and 18.75" high.

The height of the box turned out to be too tall, as it was measured for her head, not her back. To raise her up, we added a wooden platform to fit inside the box, it is 7.9" high. We still, however, could not reach her back from the top mesh. We added another platform measuring 2.65" tall. This was perfect; however, she couldn't get her back legs in because the angle was too steep. We decided to cut off the end of the second platform so she would have a step to step up on. This worked and she could get all the way in the box and we could touch her back.

Now that the box was constructed, training could begin. First step was to get Tevi used to new people. I first had my coworker, Amanda, go in with me. She knows Amanda but had never been in the exhibit with her. We took in a broom just in case she decided to get aggressive or overly friendly. She was fine with Amanda going in and we gave her treats. Next, we had our trainer, Megan Kate Hoover come in. She also had worked with Tevi on target training, but always with protected contact. Tevi was fine with Megan Kate as well and we just gave her treats and used the clicker as a bridge so she would get used to that. We saved bringing the vet techs in until we had her trained to go into the box.

The next step was getting Tevi desensitized to the box. I simply put it in the exhibit and put treats in it and let her in on her own to explore it on her own. She started going into it almost immediately to get the treats. After a week of that, we started going in with her and just putting the treats in the box. We would say, Tevi box, throw the treat in

and point to the box. When she went in to get the treat, we would click and say "Good Girl".

Once she was going into the box easily with us there, we started to desensitize her to us kneeling next to the box while she was in it. When she was used to that we started to touch her and say touch before we did. She got a click and a treat when she was touched. The training progressed with us getting her to stay in the box for longer periods of time. The vet techs said they would need about two minutes to administer the fluids. We timed each session and progressed towards our goal.

Once we had her staying in the box for us, we started touching her with a blunted needle to get her used to what it would feel like when the techs put the needle in for the fluids. She was fine with the needle so we progressed on to the next step which was to introduce her to the door which would be slid into the back of the box to keep her in while the fluids were being administered.

We started to just bring the door in with us when we did our sessions so she could get desensitized to it. Next, we started touching her butt with it so she would get used to the feel of it. Finally, we tried sliding the door down. She was ok with it for a little while but we would remove it when she wanted to back out. On one of our training sessions, she backed out too quickly and broke the door. We discussed this and decided we would scrap the door idea and just let her back out when she wanted to. The vet techs would angle the needle in such a way as when she backed out the needle would automatically slide out as well.

Now it was time to introduce the vet techs. We introduced one first and then the next. (I would also like to point out that everyone involved in this procedure from beginning to end are females, as most clouded leopards do not like men.) First, we would just have the tech come in with us and stand there, then progress to having them kneel by the box, then touching, then touching with blunted needle. Once she was used to both techs, we were ready to try the fluids.

As with the previous steps, we would simply bring the fluid bag in with us for her to see it and get used to it before we progressed any further. Next, the tech would bring the bag over when they kneeled next to her. Once she got used to that they put the needle in and started fluids. To our surprise, she showed no reaction to the needle. She did back out shortly after the fluids started to go in (I'm sure this felt strange to her), but we did get about 40cc of fluids in her the very first time.

Once she was comfortable with the entire process, it was just a matter of tweaking it to get some ground rules and get everything to run smoothly. To get her to stay in the box longer, we made the treats smaller. Then we ran into the problem that she wasn't hungry enough to come over to the box to participate, so we took away half of her morning diet and saved it for the training session and she would only get the treat in the end if she stayed until we ended the session, not her.

We continue to tweak our process as need be. To date, we only give her ¼ of her food in the morning, and we only let her back out of the box twice before we end the session and she doesn't get a treat. If she stayed in until the food is gone and we end the session, then she gets the treat. We also started adding water or blood to her diet and mixing it in. This satisfies two goals. One, she is getting more fluids this way and two, it makes the meat soupy so it is harder for her to grab a chunk and back out with it. We have found that she stays in the box much longer if she must lick the meat off our fingers.

As of Tevi's last physical, the vets said that Tevi's kidney disease has not progressed at all. The fluid therapy is helping her and she continues to do well.

Footnotes

I would like to thank our vet techs Jenny Kroll and Amy Long for taking time out of their busy schedules every week to administer the fluids. Also, special thanks to the Night Hunters team for their support and working with diet changes and accommodating schedules. Thanks also to Megan-Kate Hoover for giving us guidance to train these behaviors.

Reshaping an Established Behavior in a Geriatric California Sea Lion

Cheyenne Cash

The Aquarium at Moody Gardens

Dino, a 21 year old California sea lion, lived at Moody Gardens in Galveston, TX from May 2010 through October 2016. His established "recall" was to shift into a holding room when he heard two long whistle blasts. However, there were some flaws in this behavior. There were many secondary cues given that would allow him to anticipate the recall instead of the recall being prompted by two long whistle blasts. As a new member of the team, I asked if I could reshape this behavior into a true recall, and eliminate all of the secondary factors that he would cue off of. However, reworking this behavior came with many challenges. Dino was an older male who did well with routine and got excited with any changes. Since he had this behavior established for over 5 years, reshaping this behavior started out with changing small factors as not to overwhelm him. As a large male, I also had to consider and work around his rut and molting periods. Coming in as a new team member and wanting to reshape an established behavior lead to some friction of personalities amongst the team and varying opinions on the matter. However, his primary trainer and I were able to agree on a recall schedule with the appropriate variations for the different stages of reshaping this behavior. Before his passing in October 2016, we had made great progress on modifying this established behavior over time and I believe this progress would have continued.

Dino was born at The Bronx Zoo on June 6, 1995. He was transferred to The Aquarium at Moody Gardens on May 6, 2010 from Omaha's Henry Doorly Zoo. When he arrived, he was quarantined in one of two side holding rooms, holding room 1 (HR1), for 20 days. Shortly after his quarantine, he was shifted and locked into HR1 for dives, where he regressed behaviorally by offering latent behaviors or refusing sessions. He had also presented some aggression issues towards staff during morning maintenance when staff hosed on exhibit with other animals not under behavioral control, and during sessions he became frustrated or did not want the session to end he would block trainers from exiting and on a few occasions push them into walls. Dino's regression and aggression issues, combined with him being too large for staff to safely dive the exhibit with him present, prompted the training of a recall. Holding room three (HR3) was chosen due to the negative issues that developed in HR1. The shaping of his original recall started almost as soon as he was let onto exhibit after quarantine. While it worked for the intent of shifting him for dives, other staff members, myself included, suggested that it should be a true recall where he would shift into HR3 at any time for any reason.

When I arrived at Moody Gardens in January 2015, this behavior had been established for over four years; however, I noticed he was cueing off different actions by the trainers when coming in for his recall. Dino would have his regular training session three times a day, and then he would immediately have a shifting session. The trainers discovered if he knew another session was coming right after his main session, it would decrease his anxiety, and limit the possibility of him blocking his trainer from exiting the exhibit. After his main session, a trainer would then open the HR3 shift door, blow two long whistle blasts, and Dino would shift into HR3. For the most success, a trainer had to be standing visibly at the workroom gate (Figure 1), bucket in hand, whistle in mouth, making direct eye contact. Once the whistles were blown the trainer could start walking toward HR3. While it is good to have a strongly reinforced and successful recall, I felt as though it wasn't a true recall since there were so many factors needed for this behavior to be successful. I wanted to eliminate the need to be seen by him, him cueing off the opening of the shift door, as well as the recall always occurring directly after session.

I approached his primary trainer, as well as another senior staff member, and asked we could slowly start eliminating all of the other factors, so the only cue he needed were two long whistle blasts. I was presented with multiple issues that could arise from making changes to an already established behavior. One, he could regress completely and not show up for any recalls. Two, it has been seen in the past that, due to his anxious temperament, he does not

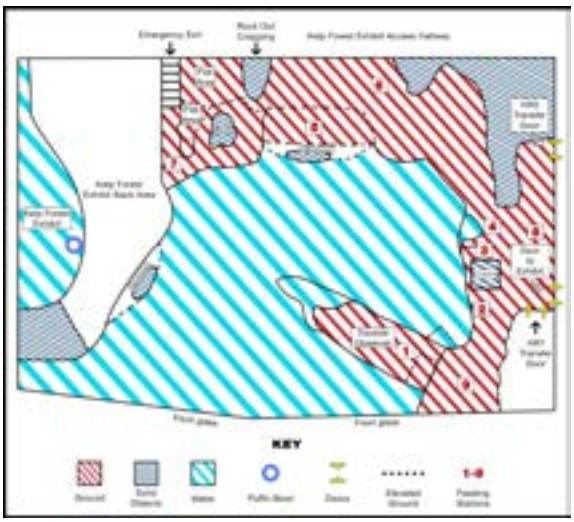


Figure 1

always respond well to changes in his routine. Three, if he refuses the recall before his session, we would then be reinforcing him for not shifting since we still needed to give him his main session so he would not become aggressive during his other sessions, or while we were feeding the other animals. His main session is necessary so he would not become aggressive during his other sessions or while we were feeding the other animals. Lastly, being a large, intact male, we would have to work around his rut and molt schedules - both of these periods directly affect his diet and motivation to show up for his sessions. The main question I was asked was "Why?" Why change his recall if it works for the primary reason of shifting him off exhibit so staff could dive and conduct underwater maintenance? My reasons included: our exhibit is an open top exhibit, and multiple items have fallen into our exhibit, as well as the worst case scenario of a child falling in or having an animal emergency on exhibit when we need all animals off exhibit so we could safely assess the situation as quickly as possible. The aforementioned situations could not be immediately handled if they were to occur due to Dino only shifting after a main session, along with the need of all secondary cues to be present. After a few more conversations and an incredibly detailed shaping plan, I was given the permission to start reshaping his recall.

Since Dino did not respond to changes very well, I started out by removing only one secondary cue at a time. The transition was put onto a schedule so his primary trainer and I were both present for any changes, as well as to make sure the appropriate cues were being taken away at the correct times (Figures 2 and 3). So he would not be overwhelmed by too many changes at once, the first recall schedule only included the elimination of secondary cues, and the change to the time between his main session and recall to accommodate the need to shift him at any time, would change only once all secondary cues were successfully removed (Figures 4 and 5).

When the new recall schedule was implemented, Dino did better than any of us expected. The minute changes were not only for Dino, but also for me, as this was the first behavior I was training with him. His primary trainer and I both wanted to make sure that all changes were recorded, so if he were to regress, we could figure out when, where in the process, and possibly why. We also decided for any large changes, his reinforcement would be a jackpot. Each time he did the same step multiple times, we would reduce the quantity of reinforcement, then back to a jackpot when another secondary cue was removed. When designing the recall schedule, we looked at the past records of his recall. It was noted that he had the most success with recalls at his middle session of the day. So we scheduled any changes to his criteria to occur at his middle session, and varied once that step was successfully completed.

After all the steps were discussed, it was determined eye contact would be the easiest secondary cue to eliminate first. Reshaping the behavior started on February 16, 2016. He completed all new recalls perfectly with no eye contact. The first refusal of a new recall came on February 24, 2016- the day removing the bucket as a secondary cue was scheduled. He refused the recall two times at his middle session after biting our female sea lion twice. In order to not reinforce ignoring the recall and aggressing on another animal, it was decided to not try a third time. I tried the new recall without a bucket at his last feed of the day and he successfully shifted into HR3. On several dates, he refused the new recall the first time, but it was assumed he was too far under the water to hear the recall and it was not counted against his overall progression. June 6, 2016, was the first day that he blatantly refused the new recall. He was at the surface, looking around, and alert. At this point, we had made enough success in the months prior that it was decided he did not need a second opportunity to either progress or refuse the recall again. By July, we had managed to eliminate all secondary cues. One possible cue that was mentioned after the schedule was made was that leaving

the top gate between the workroom and exhibit open could cue Dino that there was a recall coming. He did really well with the top gates being closed directly after session and before his new recall, along with removing the other secondary cues. On July 7, 2016 he refused all recalls, both new and established. One day prior, he refused food and began to lose motivation, most likely due to his impending rut.

In June, Moody Gardens added a 2 year old male California sea lion, Sam, to their pinniped collection. He was quarantined in HR1. Once Sam was ready to make his introduction onto exhibit, Dino was shifted into HR3, where he stayed from July 19 through July 26 to give Sam time to adjust to the exhibit. While he was in HR3, he also went into rut for the year. He remained in rut and unmotivated until August 6, 2016. After August, it was becoming more apparent that his motivation was declining as was his hunger. Unfortunately, he never seemed to recover from his rut, and his old age may have caught up with him. He passed away in October 2016. Although the reshaped recall was never officially completed, Dino only refused his recall completely three times in the five months it was being worked. This leads me to believe that his recall, including removal of secondary cues and change in duration between his main session and shifting session to allow randomness, would have been fully reshaped into a true recall by the end of the year, if not sooner.

It was important to reshape this behavior so any situation that may transpire on exhibit, Dino, who was assumed to be the largest threat due to his size, could easily be shifted off to minimize potential danger. Throughout this process, the staff has had to stop and think how any situation would be handled, and what could be done to make it a safer and quicker process. I believe this has vastly improved our team's communication skills and problem solving abilities. Reshaping an established behavior as my first behavior to train with Dino, has taught me a number of lessons: I learned that you should never underestimate an animal, no matter their age or size. Dino moved quickly through his shaping plan, despite what some of the trainers thought. Dino also taught me a healthy respect for my animals and their temperaments. The reshaping of this behavior had a few flaws; one of which being that I overestimated his hearing. Two of the three times that he refused the new recall, he was too far underwater or I was too far away from the exhibit for my whistle blasts to be heard. Dino and the process of training this behavior also taught me how to objectively look at my shaping plans, the animal's failures and successes, as well as any critiques given by other staff. Even with the flaws mentioned above, I believe the reshaping of his recall was successful and gave me the confidence to train more difficult behaviors on the other animals I train. Most importantly, I learned you can always teach an old (sea)dog new tricks.

Acknowledgments

I would like to thank Greg Whittaker, Diane Olsen, Hector Moral, Margaret Reynolds, Heather Samper, and the rest of the penguin and seal staff of Moody Gardens for their contributions towards this project and paper.

Training 0.2 Ostrich for an Annual Exam

Dan Turoczi

Cincinnati Zoo & Botanical Garden

In June of 2014 the Cincinnati Zoo and Botanical Gardens received two female Ostrich for the brand new African Savanna exhibit. It was decided early on to establish a training program with these birds to make managing them less stressful on all involved. Keepers worked with vet staff to determine what behaviors would be most useful from both an animal management and veterinary stand point, and it was decided to train the birds to voluntarily participate in a full annual exam. The behaviors that were decided upon were blood draw, injection, touch, wing manipulation, tail manipulation, stethoscope, and scale. Our Ostrich each have very different personalities which led us to utilize different strategies for training each bird. Our larger female, "Rose," was very friendly and pushy when she arrived. As a result, we had to teach her how to appropriately interact with keepers during training sessions. Our smaller female, "Pam," was very warry of keepers, so building trust was a top priority with her. Once we found a type of reinforcer and delivery method that worked for both birds we started making steady progress with their training. The Africa team worked with the vet staff and training consultant over a two-year period to successfully train both birds to participate in all of the decided upon behaviors.

Introduction

In June 2014 The Cincinnati Zoo and Botanical Garden acquired two female ostriches to be part of their new African savanna exhibit. The exhibit was to be comprised of three species of hoofstock and seven species of birds. All animals in the exhibit were intended to be worked free contact. With creation of the exhibit, the need to train the ostriches in various behaviors became apparent. The purpose of the training program was to make the birds management both safer and easier. Working with the veterinary staff, it was decided that the first training goal would be to train both birds for voluntary blood draws. Upon completion of this behavior, the birds would be trained for a full annual exam. The training was broken down into several smaller goals, including: injection, touch, wing and tail manipulation, stethoscope, and scale. Our training plan was a success, all aforementioned behaviors have been successfully trained with both birds, and additional behaviors are being added to their repertoire.

The beginning of the ostrich training program proved challenging. Both birds, Pam and Rose, had very different demeanors. The larger female, Rose, was very keeper oriented and seemed to enjoy interacting with staff. The smaller female, Pam, was much more reserved but did not show any signs of aggression.

The first goal in the training program was to find an effective reinforcement method. Initial attempts included: hand feeding produce and using Mazrui ratite pellets from their daily diet. These attempts were only marginally successful, as produce was not a favorite of the birds, and Pam was not motivated by the ratite pellets. Ultimately Mazrui waterfowl pellets was found to be an effective reinforcement for both ostriches. The best delivery method for the food was use of a square Tupperware container.

The initial training routine with each bird centered on building appropriate relationships between the ostriches and keepers. Since Rose was already comfortable with staff, this meant extinguishing undesired behaviors, such as pecking at keepers and stealing food before it was offered to her. With Pam the initial training focus was building trust between her and staff, and encouraging her to consistently approach keepers for food. With a solid routine established and both birds being used to coming in and receiving food when called, more complicated behaviors could be established.

Blood Draw Training

With a solid training routine established with both birds, the focus of the program shifted to performing blood draws. After consulting the zoo's veterinary department, it was decided to attempt to draw blood from the medial metatarsal vein in the bird's lower leg, due to the large size of the vein. Safety was a top priority during these training

sessions, and as a result staff were diligent about keeping sessions positive for both birds. It was determined that the safest way to access the vein was to have the birds stand with the leg closest to the person drawing blood in front of the leg that was to be drawn from. This ensured that staff were not reaching in front of one leg to access the other, thereby minimizing risk as much as possible.

Training with Rose rapidly progressed due to her comfort with keepers, and willingness to be touched. Rose readily accepted the presence of a second trainer. One trainer would be by her head, offering her food, while the second trainer would be interacting with her in another way, described in subsequent paragraphs. She quickly fell into the routine of stepping forward when asked, and did not react to the second trainer bending down and touching the inside of her leg. In preparation for an actual blood draw, Rose was desensitized to the alcohol sterilization pad by having her leg wiped with a damp gauze. Initially, the vein was poked with a blunt needle to simulate an actual venipuncture. Rose showed virtually no reaction to her lower leg being touched with the blunt needle. The most time consuming part of her blood draw training was building up the amount of time she would be required to stand still in the necessary position. The final stage of the blood draw behavior involved integrating the vet techs into the training, whom Rose readily accepted. When the time came to actually draw blood, Rose did not show any adverse reaction to being poked with the needle. The veterinary staff was able to successfully collect blood, without causing Rose any apparent discomfort or distress.

Blood draw training took significantly longer with Pam due to her uneasiness around keepers. Staff had to experiment with different scenarios to ensure a successful outcome. Early training sessions with Pam involved asking her to stand in the center of a stall with only one trainer working on touch desensitization to her upper body. Gradually, over a period of weeks, the trainer would move towards touching her abdomen and finally her legs. Unfortunately, this training method proved unsuccessful after several weeks of training and a new method was devised.

After several weeks of trying different training methods, including adding a second trainer to her stall and changing her standing position within the stall, it was found that she was most successful in training by standing with one side of her facing the stall wall and a trainer on the other side performing desensitization behaviors. When all desensitization training was occurring, another trainer was near her head offering her food.

At this point trainers began to ask Pam to stand in a position that would be needed for an actual blood draw, which she readily provided. Despite being more comfortable during training sessions, Pam was still unwilling to allow trainers to touch her abdomen or wings. However she would allow trainers to touch her leg, although with clear hesitation. Overall, she appeared to tolerate her legs being touched much more than her upper body. With this new insight into Pam's tolerance for interaction, training shifted towards getting her comfortable with staff crouching down next to her, as if to do an actual blood draw. Talking to Pam while squatting straight down yielded the most positive results. The next step was to work on touch desensitization in preparation for blood draws. While Pam did react initially to being touched, she progressed quickly and allowed staff to wipe the area with a damp gauze, and poke her vein with a blunt needle. Building standing duration in the blood draw position took longer than it did with Rose, however she did make steady and consistent progress. The final phase of Pam's training involved integrating the veterinary staff into the blood drawing behavior. This was a major setback for Pam, as she did not accept new people being integrated into her training routine well, but, by having them present for training sessions at least once a week, they were successfully integrated into her routine. On the first attempt to draw blood from Pam she did break away shortly after being poked, however she quickly come back into alignment, and a small amount of blood was collected. A week later veterinary staff was able to collect enough blood to run a full blood panel.

Scale Training

During blood draw training, staff was also working on acquiring weights on both ostriches. Fortunately the barn where the ostriches were held was equipped with an in-ground scale. It was decided to condition the birds to walk over the scale as part of their training routine as opposed to formally training the behavior. When the birds were reluctant to walk across the scale, they were baited and then reinforced when they were on the scale. While not a formally trained behavior, both ostriches are able to be easily weighed on a routine basis.

Body Manipulation Training

Following the successful completion of the blood draw behavior, staff began to work on touching the bird's abdomens and manipulating their wings and tail. The goals for this behavior was to feel along the birds back, manipulate the wings to determine if there were any limitations in motion, feel the sternum to assess body condition, and move the tail to allow for visual cloaca checks.

Since Rose was already comfortable being touched very little actual training was needed for this behavior aside from having her hold still, which she had mastered during blood draw training. Therefore veterinary staff were quickly able to complete this portion of her exam.

Training Pam for the body manipulation portion of the exam proved trying as, as she had shown reservations with being touched throughout the entire training process. During this stage in Pam's training it was crucial to monitor her for signs of stress. When Pam was overwhelmed by a training session, she would walk away and would not come back, prematurely ending the session. Keepers later noticed that when Pam was pushed too hard in a training session, she would stop swallowing her food and briefly freeze before walking away. Keepers were able to use this signal as a visual cue, and would give her a break in training. If she was willing to eat again, the second trainer would briefly engage her before ending the session.

By paying close attention to her body language a majority of her training sessions ended on a positive note, ensuring continued forward progress. Keepers found that Pam responded best to being touched on her back end close to her tail. This was used as a starting point, and trainers gradually moved their hands forward towards her wings. Once Pam was making progress on having her abdomen touched, trainers began manipulating her wings, gently moving them in and out.

Progress was slow but consistent; gradually her trainers were able to reach under her wing and across her chest to check her sternum. The final stage of training was to allow staff to move her tail for cloaca checks. Since Pam was more comfortable with trainers touching the back half of her body, this proved to be an easy behavior to add to her repertoire. Veterinary staff was often present during this part of her training, allowing her to be used to having this behavior performed by various people.

Stethoscope Training

Building upon the touch behavior, we next focused on stethoscope training. The goal of this behavior was to listen to the bird's heart and lungs. This was a fairly easy transition for both birds, as they were both used to being touched, and just needed to become accustomed to the feel of the stethoscope. Rose quickly adapted to the stethoscope being placed on her body. With her willingness to being touched, vet staff was able to locate the best place to listen to heart and lung sounds. This proved beneficial when trying to minimize contact with less willing birds, such as Pam. Vet staff requested that they be able to listen to the birds' heart and lung sounds for approximately thirty seconds.

Not to be unexpected, with Pam we faced a minor hurdle, as she did not initially allow us to touch the same spot for an extended period of time. We worked on gradually increasing the amount of time she was being touched by reinforcing her at variable time intervals. Reinforcing at variable intervals did not seem to be effective, so keepers reevaluated the training plan and switched to reinforcing Pam every five seconds, and her tolerance for being touched for necessary amount of time seemed to improve drastically. As with the touch behavior, vet staff continued to attend training sessions weekly keep her accustomed to their presence.

Injection Training

The final behavior needed to complete the comprehensive exam was thigh injection. The behavior was broken down into several steps, but all were built on the concepts of previously learned behaviors. First, the bird's wings were pulled forward to allow keepers access to their thighs. Next, trainers desensitized the birds to being poked in the thigh. This was done by first poking the birds with a finger, then a capped needle, and finally a blunt needle. Both birds responded well to all of the aforementioned steps, and were soon ready for an actual injection. Before injecting the birds with medication, veterinary staff chose to practice with a saline solution. Neither bird had a notable reaction to the injection. Since the behavior has been completed, both birds have been injected multiple times as part of their parasitology prevention plan with no adverse reaction.

Conclusion and Future Work

Training for the set of behaviors needed for the annual exam took approximately two years. Rose is a fairly tractable bird, and readily accepts almost all parts of the exam on a routine basis. Pam however, does need several practice sessions prior to the exam being conducted, but is becoming significantly more comfortable with the process. Pam's biggest challenge continues to be the length of the session. We have found she is most successful by breaking the exam up into smaller parts and completing it over several weeks.

Moving forward, keepers and veterinary staff have identified several other behaviors to be incorporated into their exam, including standing on a mirror box, accepting eye drops, allowing neck palpitations, and visual checks of eyes, nares, and inside the mouth.

We have shown through a novel training method that ostriches can be trained to allow keepers and vet to staff to perform body checks and accept injections and blood draws on their own accord. Our method uses positive reinforcement to achieve the desired behaviors and eliminates the need to immobilize or sedate the birds. This method helps build trust between the birds and staff, further allowing the birds to be worked in free contact. We have shown

that our training method works not only with passive, keeper-oriented birds, but also with less compliant, more reserved birds. We are currently exploring using this training method with other ratites and related species.

The Importance of 'Training' People to Protect Natural Warm Water Sites for Manatee Health and Conservation

Jennifer Saxby

The Florida manatee (Trichechus manatus latirostris) is a sub-tropical species, with Florida representing the northern limit to its winter range. With a critical lower temperature of 68°F, and no ability to thermo-regulate, during winter months the manatee must seek out warm water habitats. These consist of both natural and artificial sites (discharges from power plants). With the uncertain future of artificial warm water sites, and the better habitat provided by natural sites, the importance of natural springs is increasingly critical to manatee conservation.Cold-stress is one of the leading, non-human, causes of mortality in Florida manatees. Juveniles are particularly at risk, not having the experience to seek out warm water sites. The maintenance of warm water sites is vital for manatee health, particularly in years of extreme cold. The most important natural warm water sites for manatees include the springs at Crystal and Homosassa Rivers and Blue Springs. Manatee use of Blue Springs has increased 8% per year in the last 28 years. Reduction in springs flow has an effect on the ambient temperature of the water, carrying capacity, and suitability of the habitat. The importance of the health of the springs, and its correlation to the health of the ecosystems it supports, should be addressed. We need a multi-agency approach that protects the ecosystem as a whole. Educational tools can be utilized to target people who are passionate about the springs and those passionate about other aspects of the ecosystem such as the beloved manatee.

Introduction

The Florida manatee (*Trichechus manatus latirostris*), a sub-species of the West Indian manatee (*Trichechus manatus*), can be found throughout Florida. It is currently listed as a threatened species, having just been down-listed from endangered in 2017[1]. The manatee is a sub-tropical species, with Florida representing the northern limit to their winter range.[2] Manatee numbers have been increasing in the state of Florida and are currently estimated to be over 6,000.[3] Therefore, the need for suitable habitat is becoming increasingly important.

A manatee's physiology includes a low metabolism, high thermal conductance, low energy food sources and no ability for thermoregulation. When water temperatures reach 68°F or 20°C during winter months, the manatee must seek out warmer water to survive. Without warmer water manatees develop 'cold stress syndrome' which affects their metabolic, nutritional and immunological health. During extreme cold, manatees may not feed for several days at a time. Signs of cold stress include emaciation, skin lesions, depleted fat reserves, and compromised heart tissue.[5] Cold stress can result in death from hypothermia, starvation or other cold-related complications. Although the highest risk factor to manatee mortality is from boat strikes, the greatest long-term threat to their survival is the loss of warm water refuges and death from cold stress syndrome.[6]

Figure 1

Cold stress affects manatees in varying degrees depending on their body size, condition and nutritional state. (Fig. 2) Ultimately cold stress can potentially cause death in all manatees. Juvenile manatees (under 300 kg) are most at risk from mortality due to cold stress. This may be due to their smaller body size, lower capacity to raise their metabolic rate, as well as lacking experience in timely recognition of the onset of cold, and in finding suitable warm water refuges.[7] During

the winter manatees use two types of warm water refuges: warm water discharges (both natural and artificial) and passive thermal basins.[4] It is estimated that 60% of the Florida manatee population use ten artificial warm water discharges from power plants.[4] (Fig. 1)


Figure 2 Cold stress manatee

Natural vs. Artificial Refuges

Natural artesian springs (Fig. 3) – Natural artesian springs provide the best warm water habitat for manatees. Within Florida, manatees routinely use four natural warm water springs. The water temperature is consistent and (currently) continually flowing.

Water-table springs – The other type of springs in Florida, mostly in the Southern part of the state are water-table springs. Depending heavily on seasonal rain and soil saturation, these springs flow rates and temperatures are more variable than artesian springs. Therefore, they may not be as suitable a habitat in the winter for manatees.


Figure 3 Manatees at natural spring

Artificial discharges (Fig. 4) – Within Florida, manatees consistently use ten power plant outfalls as sources of warm water refuge. Generally the temperature of the water is dependable and flows consistently. However, there are times where the flow is interrupted due to routine maintenance and breakdown. Manatees have been seen to stay in an area, even when the warm water is not sustained, causing an increase risk of cold stress related mortality.[4] This was highlighted in the first three months of 2010, a particularly harsh winter for manatees. A record number of manatees died from cold stress that year due to below average temperatures.[8] The below average cold and increasing demand for electricity also placed a strain on many power plants. This resulted in mechanical problems and ultimately lapses in warm water discharge.

Additionally, many power plants are set for decommission within the next century. If this comes to fruition, manatees will need alternative warm water refuges. Since manatees show high levels of site fidelity year after year, human intervention may be needed to facilitate their transition from artificial to natural sites.

Thermal basins – There are four major thermal basins used by manatees in Florida currently. They are small areas that retain heat from the sun or via the decomposition of organic materials[9] Thermal basins lack a sustained flow of warm water, limiting their ability to retain adequate warm temperatures for long periods of time.


Figure 4 Manatees at artificial discharge

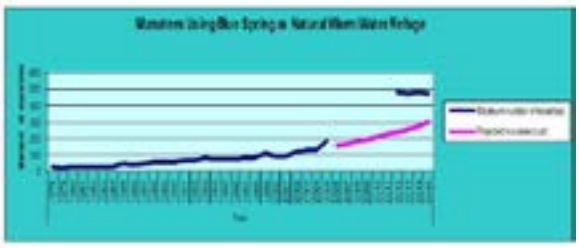
Springs Protection

Natural, artesian springs represent the most suitable and reliable winter habitat for manatees within Florida. Florida has 33 first-order magnitude artesian springs and around 200 second-order magnitude. Natural spring temperatures vary depending on the level of solar radiation, and the aquifer's depth, volume and flow rate.[4] The number of springs in Florida represents a huge potential for suitable manatee habitat. Although not all springs will have access to adequate, nearby food sources.

Due to anthropogenic reasons, many springs do not have accessibility for manatees. Restrictions to manatees accessing these springs include the use of locks, dams, fences and silted in spring runs.[7] One example of this is the Rodman dam on the Ocklawaha River in Florida.[10] Originally part of a canal project, 44 years ago, the dam is now superfluous with the canal project shut down years before it's completion. The removal of the dam would provide hundreds of manatees with access to vital artesian springs. The removal of the dam would benefit many species, not just the manatee. It would provide the Florida Striped Bass (*Morone saxatilis*) access to their spawning grounds. It would provide habitat to many fish species including mullet (*Mugilidae*), American Eel (*Anguilla rostrata)* and the endangered Shortnose Sturgeon (*Acipenser brevirostrum*). These fish feed on algae and would therefore help increase the water quality of the Ocklawaha and springs that feed it.

Other threats to spring flow include ground water pumping for both domestic and agricultural sites that have caused some springs to vanish completely. Reduction in spring flow causes a reduction in warm water output, resulting in insufficient warm water for manatees to survive cold winter temperatures.[11] Reductions in water flow be caused by both seasonal droughts and anthropogenic threats.

Blue Spring is an extremely important winter habitat for manatees and is often used as a safe refuge to release rehabilitated animals. From 1970 to 2015, Blue Spring has seen an increase from 11 to over 400 manatees![12,13] (Table 1) Blue Spring has also suffered from a reduced flow rate in previous decades, putting this essential manatee habitat at risk. The St Johns Water Management District has established minimum flow and level standards for Blue Spring to ensure the protection of this important area.[11]



Manatee Rehabilitation and Training

Every year manatees are rescued and taken to rehabilitation facilities for a number of reasons, including cold stress syndrome. Currently there are four manatee critical care facilities in Florida; Seaworld Orlando, Miami Seaquarium, Tampa's Lowry Park Zoo, and Jacksonville Zoo and Gardens. It is unusual for a rehabilitated, healthy manatee not to be re-released. Even orphaned calves have been seen to adapt well to being released once at a healthy weight and appropriate age. There are some exceptions to this and these animals may be given a home at one of the critical care facilities. In addition, the South Florida Aquarium, Mote Marine Laboratory, Homossassa State Park, Cincinnati zoo and Columbus Zoo house resident manatees.

While some long-term resident manatees have been taught husbandry and behavior training, this would be unjustified for releasable manatees and may cause more harm than good long term. Some conditional training can be seen however from human interactions with wild manatees. Although illegal, some people still feed and 'water' manatees in the wild. This conditioning can cause manatees to become reliant on more anthropogenic sources of basic needs (food and fresh water). This can cause conflicts with manatees seeing humans as a food or fresh water source, bringing them closer to anthropogenic dangers such as boats. This can also cause a reliance on a routine that may not always be there (for example if the person moves away). Education is always a key component to ensure people interact with manatees, and other wildlife, appropriately.

Educational Opportunities

Figure 5 Lowry manatee hospital

With a number of manatees being rehabilitated in zoos and aquariums each year there is a tremendous opportunity to educate and inform the public on how to help this species. Many facilities have begun to open up their rehabilitation areas to allow the public to see less critical animals and teach conservation issues. (Fig. 5 and 6) With boat strike injuries; there are often obvious signs of injury. It is easy to associate injuries with the dangers of boats to manatees. This can also be the case for cold stress, with visible evidence of how cold stress effects manatees including bleaching of the skin and lesions. Many members of the public may be well informed about the risk of manatees being killed and injured by boats but not about the risk of cold stress. Through education we can provide constructive ideas for people on how to help conserve and protect the manatee. Informing people of the importance of artisan springs and springs flow and providing ideas on how to reduce waterway pollution benefits not only the manatee but the ecosystem as a whole. Ecosystems that all rely upon natural springs and clean water.

Conclusion

Since cold stress is a natural threat to manatees, people may believe there is little they can do to help protect them. In reality there are several opportunities for people to help protect manatees. One of which is to conserve the natural, artesian springs since these are the best, long-term habitat for the Florida manatee. There is a strong correlation between the health of the springs and the health and survival of the species. With the uncertain future of artificial warm water refuges, springs are becomingly increasingly important habitats. Future conservation efforts should include:

- investigating lesser known spring sites to see if they are being used by manatees
- looking at the potential of spring sites as suitable manatee habitat
- implementing minimum flow rates for all springs
- preventing and reducing pollution of the springs
- educating the public to the importance of the springs

Figure 6 Seaworld manatee rehab

Educational programs have the opportunity to target a large number of people with different interests towards the same goal. For example, the importance of maintaining spring flow rates can be important to those wishing to protect the manatee, those wishing to protect other flora and fauna that reply upon the springs, those that wish to protect eco-tourism and those who enjoy the springs natural beauty. By working together, with multiple agencies, it will be possible to better protect the manatee, natural springs and the large eco system that relies so heavily on these important natural resources.

Use of Cagefront Verandas by Cynomolgus Macaques

Sue Rubino

Pfizer, Inc.

Typical nonhuman primate quad caging consists of a mobile unit of four cages stacked two over two. As an option to improve animal welfare, several manufacturers offer small, box style devices that can be added to the front of the individual cages. They are referred to as verandas, porches, or viewing boxes. Verandas are enrichment devices with a primary purpose of increasing an animal's visual access within the room. This creates additional opportunities for social interactions with conspecifics and may improve access to visual enrichment in the room. They also increases floor space, caging complexity, and provide an opportunity for greater light penetration for animals housed in bottom-tier cages. Verandas have been in use for several years in the animal facility at Pfizer. The aim of this study is to evaluate what percentage of an animal's activity budget is spent in the veranda. Twelve mature male cynomolgus macaques were monitored 24 hours / day for 4 days via a remote camera system. The results and discussion will focus on the pattern and duration of use by the observed animals and how that impacts management decisions for veranda use in an enrichment program.

Materials & Methods

- Twelve mature male cynomolgus macaques were selected. Selected animals had access to a veranda on a rotating basis for over one year. Animals were housed in standard two over two quad caging. Six animals were housed in upper units and six animals were housed in lower units.
- Verandas were added to the front of each cage one day prior to study start and remained in place for the duration of the evaluation. Animals were monitored via a remote camera system.
- Staff entry and exit was documented on a log sheet prior to entering the ante-room.
- Veranda catch pans were evaluated daily to determine if biscuits were consumed in the veranda.
- The video was reviewed and animals were documented as either in or out of the veranda at 10-minute time points between 6:00am and 6:00pm. (Lights are on/off at 6:00 am/pm daily.)
- The observation spanned two work days and two weekend days (Fri – Mon) to evaluate the impact of staff presence on use of verandas.

Results

Average Use

- 59% of times observed, animals were noted in the verandas.

Cage Location

- Animals in the lower cages were noted in the veranda 26% more often than animals in the upper cages.

Staff Presence

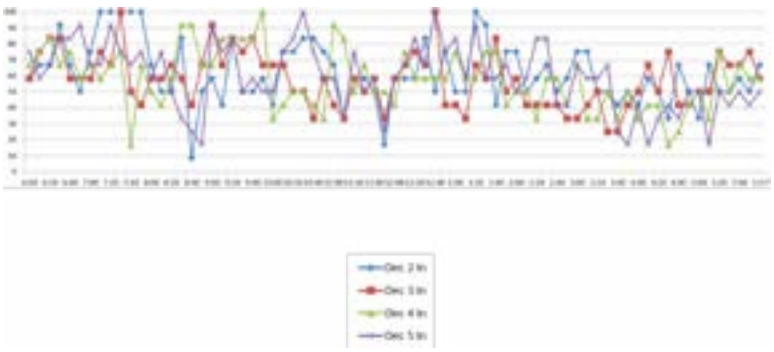
- Animals were noted in the veranda 50% more often when staff was present.

Time of Day

- Time of day trends could not be evaluated because staff presence significantly impacted use. Staff entry varied by time and duration each day of the study.

Age/Social Housing

- There was a trend that younger animals were more likely to use verandas; however, this was not statistically



significant (p = 0.06)

- Younger animals were also pair housed so trends based on paired/single housed could not be evaluated.

Discussion

Although the use of verandas as enrichment devices is becoming popular, there are few references that quantify how often animals use them. The addition of a veranda to the cage front gives us a unique opportunity to evaluate the choices that animals make. This study demonstrated that the veranda was the preferred cage location 59% of the times observed. Biscuit crumbs were noted in all veranda pans daily, indicating that all animals chose to eat at least some of their daily biscuit ration in the verandas. The higher use of verandas by animals in the lower cages suggests that these animals may benefit more from the opportunity to access a veranda if resources are limited. Although a trend in use based on time of day could not be interpreted, the significantly higher use of verandas when staff is in the room indicates that animals take advantage of the improved visual access that the verandas provide. Based on these findings, verandas should be considered as a beneficial element in a comprehensive environmental enrichment program.

"Behavioral observations were conducted in accordance with regulations and established guidelines under a protocol approved by Pfizer's Institutional Animal Care and Use Committee."

Forgiving What Cannot Be Forgotten

Nora Bierne

Central Park Zoo

The basis of any successful relationship is trust. In zookeeping, this concept revolutionized the industry. However, while practices of positive reinforcement replace antiquated techniques, the negative memories of past experiences are difficult for some species to forget. So while our tactics are changing, we must ask the question: can animals learn to forgive what they cannot forget? At Central Park Zoo, our task was to initiate a training program for 1.5 Japanese macaques with the eventual goal of a voluntary injection behavior. However, because these individuals associated keepers with negativity, isolation with being forced into a squeeze cage, and syringes with fear, rebuilding trust was our first hurdle. Initial steps required identifying suitable pairs for buddy training to eliminate separation distress with minimal con-specific aggression. Daily five-minute cooperative feeding sessions had all monkeys participating in 2 weeks. Once pairs were approaching keepers, simple targeting behaviors were used to build their confidence. After a month, injection training began through approximations: first capturing a hip present, then pairing it with progressive tactiles — a touch with a finger, then a syringe, next a paperclip syringe, and lastly a needle. In 10 months' time, we were able to administer annual vaccinations to a troupe of previously fearful macaques voluntarily, thus eliminating unnecessary stress and continued negative associations with keepers. Additionally, all individuals now actively seek out training opportunities, are easily separated, and display less aggression. This exceeded our initial goals, but demonstrates how far one can progress when trust issues are addressed.

History

Central Park Zoo has exhibited Japanese macaques (*Macaca fuscata*) for nearly 30 years. The current 1.5 troop consists of an elderly male and female, brought to the facility in 1988 and 1999 respectively, and 4 offspring born on site in 2002 and 2003. Central Park Zoo's acquisition of this species predates many of the revolutionary positive reinforcement training practices of current zookeeping methodology. Consequently, annual vaccinations previously required each individual to be separated from the troop, coaxed or forced into a squeeze cage, and restrained for inoculations. Over many years, this less than ideal situation instilled a distrust of keepers and a strong fear of being isolated from the rest of the troop. Being intelligent animals with long memories, these prejudices endured through staff turnover and the shift towards positive reinforcement training. So while keepers expressed the desire to change from stressful, forced vaccinations to calm, voluntary ones, there were many challenges in implementing a program. Despite these obstacles, after a taxing round of vaccinations in fall 2014, the decision was made to initiate a new protocol in earnest. Keepers were certain that a positive reinforcement training plan focused on trust building could achieve the ultimate goal of a voluntary injection behavior, thus improving management practices and reducing stress to both monkeys and staff.

Preparation

There were three major challenges with implementing this new plan: the holding's design and accessibility, the monkeys' social structure, and the zoo's staffing requirements. Due to the layout of the enclosure, keeper access to the monkeys on exhibit was extremely limited. Thus, all training had to be done in holding, prior to zoo opening. This was exactly when keepers were most pressed for time. Further complicating the training project was the social aspect of Japanese macaques' natural history. This primate species has a strict social hierarchy where a dominant male oversees females of different matrilines. These matrilineal groups also have their own dominance hierarchy. This social structure combined with Central Park Zoo's small staff made full troop training sessions impossible. Without enough staff to have a trainer per monkey, only dominant animals would approach for rewards, leaving subordinate

animals without the opportunity to build a rapport with keepers. However, isolating the monkeys for individual attention resulted in them hiding in corners, for fear of being pushed into the squeeze cage. The posed solution was to split the troop into pairs and have two trainers manage the sessions—one per monkey. However, the Japanese macaque section was normally manned by a single keeper. The second trainer would need to come from another section, but these keepers were busy with their own tasks that needed to be completed prior to zoo opening. As a solution, Collection's Manager Mary Iorizzo volunteered to act as the second trainer. The final challenge was to designate which monkeys would be coupled together. Determining the pairs was done through trial and error, and largely decided by the monkeys. In the end, the pairs separated into the elderly male and female (Flash and Isabelle), the two boldest offspring (Enez and Hana), and the two shyest offspring (Yuki and Iris).

Training

The first step was to establish stations for each individual. Enez trained in Holding 1 next to Hana in Holding 2, Yuki and Iris trained in Holding 3, and Flash and Isabelle trained in Holding 4 (fig. 1). Each pair was separated from the others by closed shift doors. While the goal was to establish a voluntary injection behavior and eliminate the use of the squeeze cage for annual vaccinations, it was decided that the troop should still be comfortable shifting through the squeeze, should it be necessary in emergency situations. Thus, all sessions began by cuing the troop to shift from Holdings 1 and 2, through the squeeze, and into Holdings and 4. Enez and Hana normally waited in Holding 3 while the other four moved into Holding 4. Enez and Hana were rewarded for shifting away from their stations before being moved back into Holdings 1 and 2. Initially, trainers had to toss these rewards through the caging and walk away, since the monkeys would not approach with a keeper present. Then Yuki and Iris were cued to move from Holding 4 to Holding 3. Isabelle and Flash simply remained in Holding 4 while the others moved around them. Establishing this shifting behavior took patience. The monkeys tended to move into a holding only if they were comfortable with the other occupants, which also helped to designate the pairs, initially. For instance, both Hana and Yuki would readily move into a holding with Enez, whereas Iris actively avoided a holding that Enez occupied. And though Iris would allow herself to be paired with either Yuki and Hana, her body language indicated a higher level of comfortably with Yuki. After a couple of weeks practicing these pair groups, the monkeys separated easily. What proved more difficult was overcoming their distrust of keepers. Being intelligent primates, the staff knew that the macaques were capable of learning an injection behavior, but only if they were able to overcome their negative memories and associated fear of keepers. If they did not even trust taking rewards from the trainers, then the monkeys would never tolerate being stuck with a needle. The decision to add a second trainer was pivotal in working through this longstanding distrust.

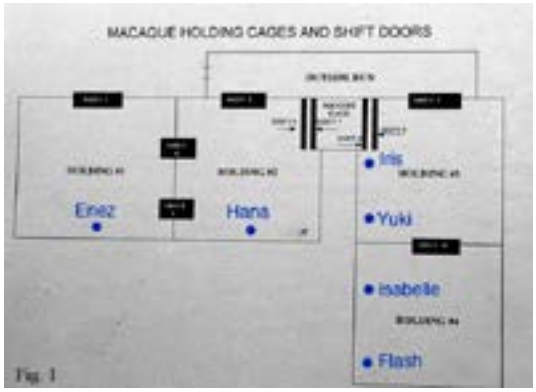


Figure 1

Initially, the presence of two staff members in holding was a setback. As mentioned, the Japanese macaque section is normally manned by one keeper and the additional personnel usually indicated a veterinary procedure to the monkeys. However, since each macaque had a training companion in the holding with them, they quickly grew less suspicious. The presence of another monkey gave both individuals security and confidence. Instead of hiding in the back of holding, they expressed curiosity and interest in the rewards. Sessions lasted approximately 5 minutes, and any movement towards keepers was bridged with a verbal "good" and a tossed reward. Some monkeys responded more rapidly than others, but after 2 weeks, every individual was readily coming over to the keeper to take treats. Due to the strict social hierarchy, trainers were careful to follow the practices of cooperative feeding. The dominant animals in the pairs were more heavily rewarded for allowing the subordinate ones to participate and take food reinforcers. This trained the dominant animal to associate the presence of the subordinate with rewards, and improved their tolerance of the other animal. In turn, the subordinate animal learned confidence around more dominant individuals and was not as stressed in their presence [Laule 1995]. Trainers always finished sessions with the dominant animal so that the hierarchy was enforced rather than undermined.

Once individuals were reliably stationing in front of their trainers, a target stick was introduced to establish a basic targeting behavior. All individuals easily mastered the behavior, and it enabled trainers to teach the monkeys that they must perform a desired task in order to receive a reward. This was followed by the training of several other simple behaviors (stand up, sit, stay) so as to bolster their confidence and make sessions more engaging. After a

month, the first stages of injection training were introduced. While training the previous behaviors, it was noticed that a majority of the monkeys were inclined to rest upon a crossbar midway up the cage front. From this resting position, trainers began shaping a hip present. Monkeys were bridged and rewarded for sitting sideways on the crossbar. This behavior was then paired with the verbal cue "hip" and the visual S^D of pointing at the corresponding leg. Through approximations, the eventual criteria required the monkey to press firmly enough against the mesh that their fur stuck out and to hold that position until bridged (fig 2). While some individuals progressed faster than others, this approach saw Enez, Hana, and Iris all performing the behavior in under 2 months. Yuki, the most skittish of the group, required the same method at a slower pace, which took 5 months. Flash was too large to sit comfortably on the crossbar, and instead of teaching "hip," a "line up" behavior was introduced. This required him to place both his left arm and leg on the crossbar and lean into the cage-front, while keeping his right leg firmly on a shelf for balance (fig. 3). The same criteria established for the "hip" behavior was expected for his "line up". However, this adaptation proved impossible for Isabelle. At 33 years old, arthritis made clinging to the mesh for extended periods of time uncomfortable for her. Instead, she was trained to station on the floor. The trainer attempted to capture her sitting sideways, but she was reluctant to press against the mesh. So, after 6 months of troubleshooting and little progress, it was decided to train her to accept a pole syringe to close the distance instead of asking her to move in herself (fig 4.).

Figure 2

FIgure 3

Figure 4

The next step was to introduce a touch to the location on the monkey where an injection would eventually be administered. Since they were familiar with keepers' hands, tactiles were first attempted with a gentle touch of an index finger, paired with the verbal cue, "poke." The initial reaction was as expected: surprise and fear. The new sensation made them extremely wary, and had to be followed by simple stationing and targeting in order to reinforce continued participation in the session. This process took a considerable amount of patience to keep the sessions positive for both monkeys and keepers. Slowly the group became comfortable with tactiles and the monkeys held position long enough to be touched and receive a jackpot. After 6 weeks, all individuals were performing the behavior consistently. Incrementally, trainers began pressing more firmly and increasing the duration.

Once the behavior was solid, keepers started holding an empty syringe. The sight of the tool sparked a similar

reaction to being touched with the trainer's finger. Previous injections had instilled a deep fear of the instrument. So, trainers worked very slowly to reinforce the monkeys for tolerating the sight of the syringe and for it being passed from hand to hand. By this time, the troop had formed a more positive relationship with the keepers. Therefore, they overcame their fear of the syringe more quickly than they had of being touched by the keeper. They transitioned rapidly from a finger touch to a poke with the syringe. Enez, Hana, Iris, Yuki, and Flash all accepted the syringe in under 1 month. Meanwhile, Isabelle tolerated a pole touching her hip after 2 months.

The last preparation phase involved adding a paperclip to the syringe to simulate a needle. Though this elicited a reaction from all the monkeys, it was not as drastic as the first 2 stages. Most of the monkeys abruptly pulled away, and a few rifled through their fur to check for a mark. Yet, the regression was slight. As the monkeys began trusting keepers, each stage of the training became increasingly easier than the last. The following 2 months were used to perfect and solidify the injection behavior. When annual rabies vaccinations were due, 5 of the 6 monkeys were inoculated with a voluntary injection behavior. Due to Isabelle's advanced age, the veterinarians opted not to administer her a dose, despite her training. Furthermore, only a week later, 4 of the 6 monkeys were inoculated for tetanus with the voluntary injection behavior. For this second vaccination, the veterinarians chose to exempt Flash due to his age, as with Isabelle.

Results

It took under a year's time to successfully vaccinate 5 of 6 Japanese macaques for rabies through voluntary injection. Though faced with many challenges, patience and persistence of the keepers were able to overcome years of ingrained fear and distrust. Though, the initial goal of the project was to minimize the stress of yearly vaccinations, additional positive results exceeded all expectations. Monkeys that once hid from keepers or fled at their approach began actively seeking out training opportunities, and the entire troop learned to shift readily each morning. Even Yuki, the shyest individual, developed a zealous desire to participate. They have become so interested in daily sessions that some of the smarter monkeys (Enez and Iris) have begun to innovate behaviors by presenting different areas of their body not yet trained (back and chest). This has allowed keepers to perform more thorough daily checks of each individual's body condition.

The level of trust has developed to such a degree that a second trainer has now become obsolete. It became increasingly difficult for Mary to spare time from her managerial duties on a daily basis, and so the keepers slowly began working on separating the pairs for individual sessions. In the second year of the program, the monkeys have become comfortable enough with certain keepers that they allow themselves to be singled out from the group for individual training sets. This was monumental, considering how terrified they had been when isolated before the project. Presently, every single monkey now allows themselves to be separated from the group for training on a daily basis, enabling the program to continue without burdening other keepers (or managers) for assistance.

A final unexpected outcome was an overall decrease in troop aggression. Prior to the cooperative feeding sets, con-specific aggression was a common occurrence. Iris, as the lowest monkey in the hierarchy, bore the brunt of the negative behavior. She was also an outlier in the troop, usually keeping to herself or occasionally grooming her sister, Hana. However, since training beside Yuki, she has become bolder around other members of the group, and the others now tolerate her presence more. She has even been observed grooming Yuki on multiple occasions. Thus, in addition to reducing stress in human-to-monkey relationships, the training plan has had the added effect of reducing con-specific stress between the monkeys.

Conclusion

Central Park Zoo's Japanese macaque troop was able to surmount years of negative experiences and associations through 1 year of trust building and training. As voluntary injections are now part of their routine, stressful squeeze cage vaccinations no longer disrupt the relationship between monkeys and keepers. This once distrustful and unapproachable group is currently engaged and sociable when keepers are present. This change in attitude has drastically improved the overall management of the macaques on a daily basis, facilitating routine visual exams, innovating thinking, and calm shifting between holdings. Hui and Feldman [2013] reported similar positive results in lowering aggression and avoidance when they initiated a trust-focused training program for a North American badger. This suggests that the benefits of such methods span varying taxa, and emphasizes the importance of persevering with positive reinforcement regardless of an animal's species or its past experiences. Forgiveness is indeed possible, so long as keepers are willing to invest the time and effort to train their animals to trust.

Acknowledgements

A huge thank you to Mary Iorizzo, as this project would not have been possible without her support, time, and encouragement. Additional thanks to Judy Wolfe, for lending her photography skills, and to Nichole Shelmidine, for her guidance through the writing and submission process.

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Stimulating Natural Behavior and Promoting Conservation of the Pygmy Loris at the Columbus Zoo and Aquarium

Fred Nicklaus

Columbus Zoo & Aquarium

Over the years, the many benefits of a solid operant conditioning program has been well documented. Active and consistent training can dramatically reduce the amount of time an animal needs to be sedated for a medical procedure. Animal welfare of animals in a zoo setting can be improved through keeper interactions and training (Hosey and Melfi, 2014). At the Columbus Zoo and Aquarium, target training is used to assess health, weigh animals, get them to station to a specific area, and check the estrogen cycle of Pygmy Loris females to determine when they are ready to mate with the male. Once new Loris' become accustomed to training, they scurry down to the lower level of the exhibit when a keeper enters the enclosure. Positive reinforcement through training and unpredictable feeding schedules will reduce agitation and pacing in animals (Hosey, 2004). After training is complete, the Loris' activity level increases. They utilize the exhibit more and they exhibit more naturalistic behavior. Training not only benefits the animals medically, but it stimulates their brains, and zoo guests are able to see them in their natural state. The breeding of the Pygmy Loris is vital to the conservation of the species. When training is used with Loris's, they become more familiar and relaxed with their keepers. When Loris's are more relaxed, breeding activity is more likely to occur. When guests see the Loris's active, they are more likely to participate or donate to the conservation of the species. Training stimulated our lorises at the Columbus Zoo and Aquarium to utilize their exhibit. The animals were easier to manage in a zoo setting and it aided in the conservation of the species.

Introduction

Pygmy Lorises (*Nycticebus pygmaeus*) are Prosimians and they are active at night time. *Nycticebus pygmaeus* live for up to 20 years. Pygmy Loris and other Prosimians have been studied under red lights in the wild. They have blood vessels in their hands and feet which allow them to hold tightly to branches. They leave their sleeping nests at night to eat and they return at dawn to sleep. Sleeping nests location sites for an individual are changed due to heavy rains or sudden changes in temperature. Pygmy Lorises are slow climbers and do not leap like some other Prosimians. Pygmy Lorises have a low metabolism and consume a high energy diet of gum, fruit, and live insects. *Nycticebus pygmaeus* defend themselves by producing venom through their brachial glands and biting their attacker (Bearder, S.K., 1987). Small members of the Prosimian family are solitary. They hide in vegetation which can make them difficult to find in their wild habitats (Radhakrishna, S., Kumara, H., 2010).

It is important for animals to have control of their environment in zoos. Negative effects will often lead to stress. One negative effect is if an animal cannot escape a scary situation. Sometimes primates will not breed if they are stressed by visitors. Animals need to explore and they crave stimulation. Enrichment is important to stimulate animals and take away stress. Training can further stimulate animals (Carlstead, K., 1996).

Since Lorises are slow moving, they are lunar phobic. One reason Lorises are more active on dark nights is they are being cryptic and hiding from predators. Pygmy Lorises do not seem to be frightened by the presence of humans. They are most active on the ground and in the lower canopy. The Pygmy Lorises seem to have a preference for very dark nights due to a high number of insects and a lower chance of being seen by a predator (Rode-Margono, E.J., Nekaris, K.A.I., 2014).

The purpose of this study was to determine if training increased activity in four Pygmy Lorises at the Columbus Zoo and Aquarium. Activity levels were compared. A period of time with no training was compared to activity levels when animals participated in training sessions. The Lorises were permitted to choose whether or not they wanted to train and they participated each time. The animals were able to have some control over their environment.

Materials and Methods

The study was conducted at the Columbus Zoo and Aquarium inside the Australia/Islands Nocturnal building. The observations were recorded in November 2016 in a 2p.m. and 3p.m. time window, which is typically the time of day the Pygmy Loris are the most active. The lights are on timers set to turn off at 10a.m. and come on at 6p.m. The data included nine days without training followed by nine days with training.

A chart was designed for each Loris to record nine days with no training session. Sections on the chart included day, enrichment offered, time of day, and the duration of activity during the designated time slot. Another chart was designed for each Loris to document the level of activity on days following a training session. The data gathered on the chart included day, enrichment offered, time of the training session, duration of the session, and duration of activity following the training session. The entire study spanned over an eighteen day period. Activity included foraging, climbing, eating, and investigating. Once the data was gathered, four graphs were designed. Each graph represented each animal and showed a comparison of activity level with training and activity level without training.

Results

Data was collected on four Pygmy Lorises of various ages. Loris A and B were approximately five years old. Loris C and D were approximately eight months old at the beginning of the study in November 2016. The exhibit was 5 meters long x 2.4 meters wide x 6 meters high. The lights in the building came on at 10a.m. and turn off at 6p.m.The following data was collected on each Loris:

Loris A (Fig. 13) averaged 24.78 minutes of activity after training (Fig. 1). Day 1: 30 minutes, Day 2: 22 minutes, Day 3: 15 minutes, Day 4: 26 minutes, Day 5: 32 minutes, Day 6: 12 minutes, Day 7: 35 Minutes, Day 8: 28 minutes, and Day 9: 23 minutes. Loris A averaged 12.56 minutes of activity on days there was no training (Fig. 2). Day 1: 16 minutes, Day 2: 8 minutes, Day 3: 7 minutes, Day 4: 12 minutes, Day 5: 14 minutes, Day 6: 10 minutes, Day 7: 18 minutes, Day 8: 15 minutes, and Day 9: 13 minutes. The graph (Fig. 9) illustrates the amount of Loris activity after training sessions compared to minutes of activity when no training took place.

Loris B (Fig. 14) averaged 19.56 minutes of activity after training (Fig. 3). Day 1: 28 minutes, Day 2: 16 minutes, Day 3: 12 minutes, Day 4: 20 minutes, Day 5: 18 minutes, Day 6: 15 minutes, Day 7: 20 Minutes, Day 8: 25 minutes, and Day 9: 22 minutes. Loris B averaged 12.56 minutes of activity on days there was no training (Fig. 4). Day 1: 17 minutes, Day 2: 15 minutes, Day 3: 10 minutes, Day 4: 8 minutes, Day 5: 15 minutes, Day 6: 10 minutes, Day 7: 16 minutes, Day 8: 10 minutes, and Day 9: 12 minutes. The graph (Fig. 10) illustrates the amount of Loris activity after training sessions compared to minutes of activity when no training took place.

Loris C (Fig. 15) averaged 28.33 minutes of activity after training (Fig. 5). Day 1: 35 minutes, Day 2: 30 minutes, Day 3: 17 minutes, Day 4: 23 minutes, Day 5: 35 minutes, Day 6: 15 minutes, Day 7: 40 Minutes, Day 8: 30 minutes, and Day 9: 30 minutes. Loris C averaged 13.88 minutes of activity on days there was no training (Fig. 6). Day 1: 12 minutes, Day 2: 15 minutes, Day 3: 14 minutes, Day 4: 18 minutes, Day 5: 20 minutes, Day 6: 9 minutes, Day 7: 15 minutes, Day 8: 12 minutes, and Day 9: 10 minutes. The graph (Fig. 11) illustrates the amount of Loris activity after training sessions compared to minutes of activity when no training took place.

Loris D (Fig. 16) averaged 27.33 minutes of activity after training (Fig. 7). Day 1: 33 minutes, Day 2: 30 minutes, Day 3: 20 minutes, Day 4: 25 minutes, Day 5: 40 minutes, Day 6: 17 minutes, Day 7: 30 Minutes, Day 8: 25 minutes, and Day 9: 26 minutes. Loris D averaged 15.33 minutes of activity on days there was no training (Fig. 8). Day 1: 14 minutes, Day 2: 12 minutes, Day 3: 15 minutes, Day 4: 16 minutes, Day 5: 18 minutes, Day 6: 12 minutes, Day 7: 16 minutes, Day 8: 20 minutes, and Day 9: 15 minutes. The graph (Fig. 12) illustrates the amount of Loris activity after training sessions compared to minutes of activity when no training took place.

All 4 animals in this study were more active on the days in which training was present. Day 3 and Day 6 (Fig. 1, Fig. 3, Fig. 5, and Fig. 7) with training indicated a lower level of activity for all Lorises than the other days. Enrichment provided did not make a difference in activity levels. The animals were not disturbed by the presence of trainers in the exhibit, and they even seemed energized to participate in the training sessions.

Discussion

Prosimians learn by tactile, olfactory, and visual senses. The juveniles learned training from the adults (Fedurek, P., Slocombe, K., 2011). They responded very well to the targets and the clicker that was used. Non human primates use body language more than humans to express themselves. Non human primate communication can be as expressive as human language (Burling, R., 1993). Many examples exist that demonstrate the brain complexity of Prosimians.

Gursky reported that Spectral Tarsiers were observing mobbing and killing snakes in the wild. It was usually the male that started the mobbing. There is only one male per Tarsier group, so the local male would recruit other

males to join him (2005). More research needs to be done on growth and development of the cerebellum in Prosimians (Lewis, K.P., Barton, R., 2004). Lemurs have been studied more than other Prosimians because they are mostly diurnal. The Prosimians outside of Madagascar are hard to study, because they are nocturnal and great at hiding (Fedigan, L.M., 1982).

Activity included play, foraging, climbing, or investigating exhibit. The reward for the training was live mealworms. The animals were habituated to have trainers in their exhibit. They were comfortable enough by the presence of humans to interact and breed. Lorises and Tarsiers have been studied with red lights in the wild. They became comfortable in the presence of researchers. They were able to follow them closely and gather data (Bearder, S.K., 1987). DeWaal stated we can relate our own actions to animals, because they want relationships and harmony as well (2014). Prosimians have amazing perception. When they are studied by observers, they will change their behavior if they feel uncomfortable (Mahanjan, N., Barnes, J.L., Edwards, L.A., Santos, 2006). Orangutans occasionally eat Lorises in Sumatra. As a result, Lorises do not occupy the same area as Orangutans in the region. However, Lorises are not afraid of Orangutans in Borneo (Morrough-Bernard, H.C., Stitt, J.M., Yeen, Z., Nakaris, A.I., Cheyne, S.M., 2014).

Trainers can learn a great deal about the animals by gaining experience with the animals (Kruse, C.K., Card, J., 2004). Many studies of Lorises in the wild are done in shrubs around farm fields at night time (Padmanaba, M., Sheil, D., Basuki, I., Leiswanti, N., 2013). At the Columbus Zoo and Aquarium, the Pygmy Lorises trusted the keepers, and play activity increased after the training. When humans work in close proximity with animals, they start to trust the keepers (Vonk, J., Vedder, C.E., 2013). Animals need to explore and control their environment. When animals are stimulated mentally and physically, they are more active. The animals and humans benefit from a stimulating environment that encourages natural animal behavior (Thorn, J.S., Nijman, V., Smith, D., Nakaris, A.I., 2009). Animals that are not fearful of humans will reproduce (Estep, D.Q., Dewsbury, D.A., 1996).

The training is dependent on animals forming relationships with their trainers as well as the trainers trusting their animals to learn what is being asked of them. The animals needed motivation that was strong enough to overpower to the outside forces such as visitor noise and commotion (Zeligs, J., 2014). It might be tempting to state the Lorises wanted human contact, but the true motivating factor was eating mealworms. The result was rewarding for the animals and the humans. The animals got the food they desired and the humans received the desired animal response to the training. Activity increased with the stimuli.

Most primates learn from watching the experiences from family and they adjust their behaviors as needed. The animals then store the information for future use (Poirer, F.E., Hussey, K.L., 1982). Play helps animals socialize. If the goal is not easy to reach, the animal will lose interest in the training session. Zoo primates have no interactions with visitors, but they may enjoy the relationships with visitors (Jerolmack, C., 2009). In this study, sessions were limited to 10 minutes in order to keep the Lorises engaged in the training.

Primates have roles. Roles are a predictable pattern and more than just a certain behavior. An individual role can be considered social conduct but most of the terms used for primate behavior have been used to frame human behavior. Some Scientists dispute whether animals know that they are performing a role. They are influenced by nature and their society (Fedigan, L., 1982). There are four views that can be used to ensure animal welfare needs are being met: wellness of the animal's mind, behavior is similar to wild animals of same species, animals appear to thrive, and we can meet the needs of animals by comparing their needs to our needs (Hosey, G., Melfi, V., Pankhurst, S., 2009).

The experiment showed the Lorises became more active and playful after a training session. The session triggered their instincts and they displayed more naturalistic behavior. All four Lorises were more active after the training sessions in a 9 day span. In addition, all four Lorises were less active in a 9 day span without training. Training Lorises on a regular basis can improve their lives. They are relaxed to breed and we can always educate the visitors better when they see active animals.

Conclusion

Activity levels increased significantly for four Lorises. The increase of activity could be attributed to the stimulation from eating live foods, the time of day, or the presence of familiar trainers in their enclosure. It is clear the Lorises did not seem frightened of agitated by the presence of keepers. Due to habituation to trainers, and scheduled training sessions, the Lorises became more relaxed. Once the Lorises became comfortable with their trainers, they engaged in play activity and breeding. Both of these activities aid in the conservation of the species. When the Lorises were stimulated by the training, they displayed natural play and foraging behaviors. If visitors are drawn by the activities, they will sponsor conservation projects. When the Lorises are comfortable, they breed, and produce

offspring.

It is not anthropomorphic to say boredom damages an animal's mental health. It is impossible to know what an animal thinks. Human thought and needs are used to understand animal behavior and meet their needs (Wemelsfelder, F., 1984). The energy and behavior of the Lorises increased after training sessions, and that suggests an increase in their mental health status. Past studies show that zoo visitors have an increased awareness of conservation when they observe primates exhibiting natural behavior (Waller, B.W., Peirce, K., Mitchell, H., Michelletta, J., 2012). Zoos will continue to evaluate how visitors learn and improve zoo education (Pearson, E.L., Dorrian, J., Litchfield, C.A., 2012).

Future studies on how training effects Loris behavior should include a larger sample size. A larger sample size with various family groups would provide a better understanding of the impact of training on behavior. The time of the day the training is included can be expanded. A new study can span over a longer period of time. In this study, it can be concluded the animals were more active when they were trained. They were less active on days there was no training.

Nocturnal primates are less active than diurnal primates, because they need to avoid predators. They also forage alone to avoid predators (Terborgh, J., Janson, C.H., 1986). The window of activity for Prosimians is much smaller than larger diurnal primates. In the cool season, Pygmy Lorises do not come out when the forest is less dense in the cool season. Pygmy Lorises use the darkness more than other nocturnal animals, so deforestation is a big problem for them (Starr, C., Nekaris, K.A.I., 2012).

Conservation is very important for Pygmy Lorises. They are threatened due to habitat loss and the wildlife trade. They are taken as pets and killed for medicine. They were once unknown, but the Internet pictures have led to people wanting to keep them in their homes as pets. Since Lorises can inject venom that can cause anaphylactic shock, their fangs are removed before they go to the market. This is unnatural and often leads to health problems down the road. Pygmy Lorises are difficult to reintroduce to the wild. We need to support researchers to continue to gather more data on Pygmy Lorises (Nekaris, K.A.I., Starr, C.R., 2015).

Nycticebus pygmaeus are fascinating animals that respond well to training in zoos. They are easy to display and observe in a zoo setting. Through this study at the Columbus Zoo and Aquarium, it became obvious that the Lorises were not disturbed by training. They became motivated and stimulated by the training. The mental stimulation of training itself and the reward of food seemed to trigger a natural response. Training allows us to have a connection with the animals in our care and visually inspect them. It is more entertaining for visitors to see active animals utilizing their exhibit to the fullest extent. We are able to teach the conservation message when our guests are engaged. A special thank you goes out to the Australia/Islands staff and my supervisor for showing great support and encouragement for this study. This study showed the positive impact training had on the psyche of our four Pygmy Lorises and we expect continued breeding success with this wonderful species.

Loris A	Enrichment Offered	Time of Day for Training	Duration of Session	Min. Activity post training
Day 1	Produce Skewers Juice Cubes	2PM	10 MIN	30 MIN
Day 2	Ferret Log Snake Shed	2PM	10 MIN	22 MIN
Day 3	Honey in Pinecone Leaf Pile	3PM	10 MIN	15 MIN
Day 4	Phonebook Herbivore Hair	3PM	10 MIN	26 MIN
Day 5	Kong Wobbler Perfume	2PM	10 MIN	32 MIN
Day 6	Shavings Pile Perfume	3PM	10 MIN	12 MIN
Day 7	Crickets in Feeder Cardboard Tube	2PM	10 MIN	35 MIN
Day 8	Cardboard Box Flowers	3PM	10 MIN	28 MIN
Day 9	Smeared Grape Mulch Pile	3PM	10 MIN	23 MIN

FIG. 1

Loris A	Enrichment Offered	Time Of Day	Activity @ Training Time
Day 1	Produce Skewers Juice Cubes	2PM	16 MIN
Day 2	Ferret Log Snake Shed	2PM	8 MIN
Day 3	Honey in Pinecone Leaf Pile	3PM	7 MIN
Day 4	Phonebook Herbivore Hair	3PM	12 MIN
Day 5	Kong Wobbler Perfume	2PM	14 MIN
Day 6	Shavings Pile Perfume	3PM	10 MIN
Day 7	Crickets in Feeder Cardboard Tube	2PM	18 MIN
Day 8	Cardboard Box Flowers	3PM	15 MIN
Day 9	Smeared Grape Mulch Pile	3PM	13 MIN

FIG. 2

Loris B	Enrichment Offered	Time of Day for Training	Duration of Session	Min. Activity post training
Day 1	Produce Skewers Juice Cubes	2PM	10 MIN	28 MIN
Day 2	Ferret Log Snake Shed	2PM	10 MIN	16 MIN
Day 3	Honey in Pinecone Leaf Pile	3PM	10 MIN	12 MIN
Day 4	Phonebook Herbivore Hair	3PM	10 MIN	20 MIN
Day 5	Kong Wobbler Perfume	2PM	10 MIN	18 MIN
Day 6	Shavings Pile Perfume	3PM	10 MIN	15 MIN
Day 7	Crickets in Feeder Cardboard Tube	2PM	10 MIN	20 MIN
Day 8	Cardboard Box Flowers	3PM	10 MIN	25 MIN
Day 9	Smeared Grape Mulch Pile	3PM	10 MIN	22 MIN

FIG. 3

Loris B	Enrichment Offered	Time Of Day	Activity @ Training Time
Day 1	Produce Skewers Juice Cubes	2PM	17 MIN
Day 2	Ferret Log Snake Shed	2PM	15 MIN
Day 3	Honey in Pinecone Leaf Pile	3PM	10 MIN
Day 4	Phonebook Herbivore Hair	3PM	8 MIN
Day 5	Kong Wobbler Perfume	2PM	15 MIN
Day 6	Shavings Pile Perfume	3PM	10 MIN
Day 7	Crickets in Feeder Cardboard Tube	2PM	16 MIN
Day 8	Cardboard Box Flowers	3PM	10 MIN
Day 9	Smeared Grape Mulch Pile	3PM	12 MIN

FIG. 4

Loris C	Enrichment Offered	Time of Day for Training	Duration of Session	Min. Activity post training
Day 1	Produce Skewers Juice Cubes	2PM	10 MIN	35 MIN
Day 2	Ferret Log Snake Shed	2PM	10 MIN	30 MIN
Day 3	Honey in Pinecone Leaf Pile	3PM	10 MIN	17 MIN
Day 4	Phonebook Herbivore Hair	3PM	10 MIN	23 MIN
Day 5	Kong Wobbler Perfume	2PM	10 MIN	35 MIN
Day 6	Shavings Pile Perfume	3PM	10 MIN	15 MIN
Day 7	Crickets in Feeder Cardboard Tube	2PM	10 MIN	40 MIN
Day 8	Cardboard Box Flowers	3PM	10 MIN	30 MIN
Day 9	Smeared Grape Mulch Pile	3PM	10 MIN	30 MIN

FIG. 5

Loris C	Enrichment Offered	Time Of Day	Activity @ Training Time
Day 1	Produce Skewers Juice Cubes	2PM	12 MIN
Day 2	Ferret Log Snake Shed	2PM	15 MIN
Day 3	Honey in Pinecone Leaf Pile	3PM	14 MIN
Day 4	Phonebook Herbivore Hair	3PM	18 MIN
Day 5	Kong Wobbler Perfume	2PM	20 MIN
Day 6	Shavings Pile Perfume	3PM	9 MIN
Day 7	Crickets in Feeder Cardboard Tube	2PM	15 MIN
Day 8	Cardboard Box Flowers	3PM	12 MIN
Day 9	Smeared Grape Mulch Pile	3PM	10 MIN

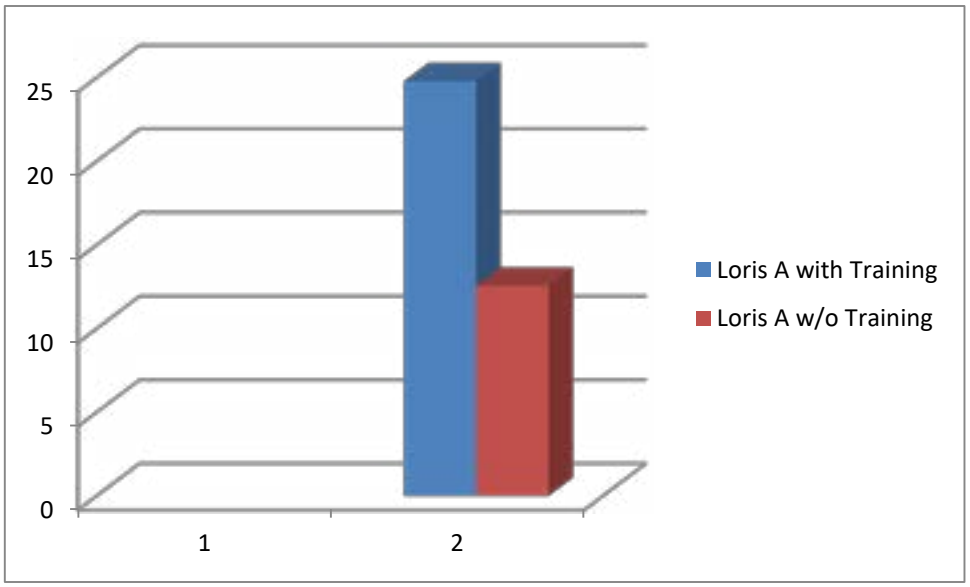
FIG. 6

Loris D	Enrichment Offered	Time of Day for Training	Duration of Session	Min. Activity post training
Day 1	Produce Skewers Juice Cubes	2PM	10 MIN	33 MIN
Day 2	Ferret Log Snake Shed	2PM	10 MIN	30 MIN
Day 3	Honey in Pinecone Leaf Pile	3PM	10 MIN	20 MIN
Day 4	Phonebook Herbivore Hair	3PM	10 MIN	25 MIN
Day 5	Kong Wobbler Perfume	2PM	10 MIN	40 MIN
Day 6	Shavings Pile Perfume	3PM	10 MIN	17 MIN
Day 7	Crickets in Feeder Cardboard Tube	2PM	10 MIN	30 MIN
Day 8	Cardboard Box Flowers	3PM	10 MIN	25 MIN
Day 9	Smeared Grape Mulch Pile	3PM	10 MIN	26 MIN

FIG. 7

Loris D	Enrichment Offered	Time Of Day	Activity @ Training Time
Day 1	Produce Skewers Juice Cubes	2PM	14 MIN
Day 2	Ferret Log Snake Shed	2PM	12 MIN
Day 3	Honey in Pinecone Leaf Pile	3PM	15 MIN
Day 4	Phonebook Herbivore Hair	3PM	16 MIN
Day 5	Kong Wobbler Perfume	2PM	18 MIN
Day 6	Shavings Pile Perfume	3PM	12 MIN
Day 7	Crickets in Feeder Cardboard Tube	2PM	16 MIN
Day 8	Cardboard Box Flowers	3PM	20 MIN
Day 9	Smeared Grape Mulch Pile	3PM	15 MIN

FIG. 8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15
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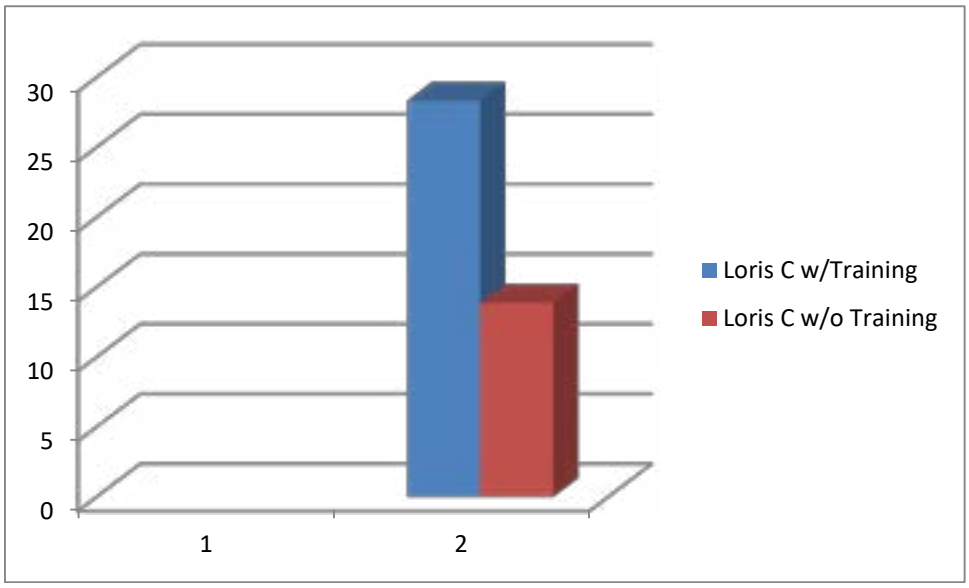
5
0
1
2
Loris A with Training
Loris A w/o Training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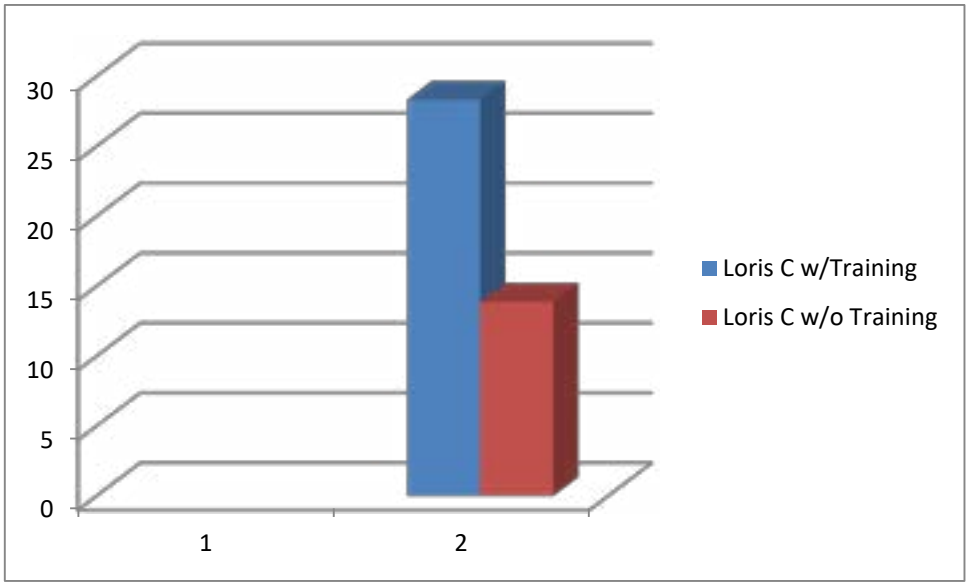
1
2
Loris C w/Training
Loris C w/o Training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Loris C w/Training
Loris C w/o Training

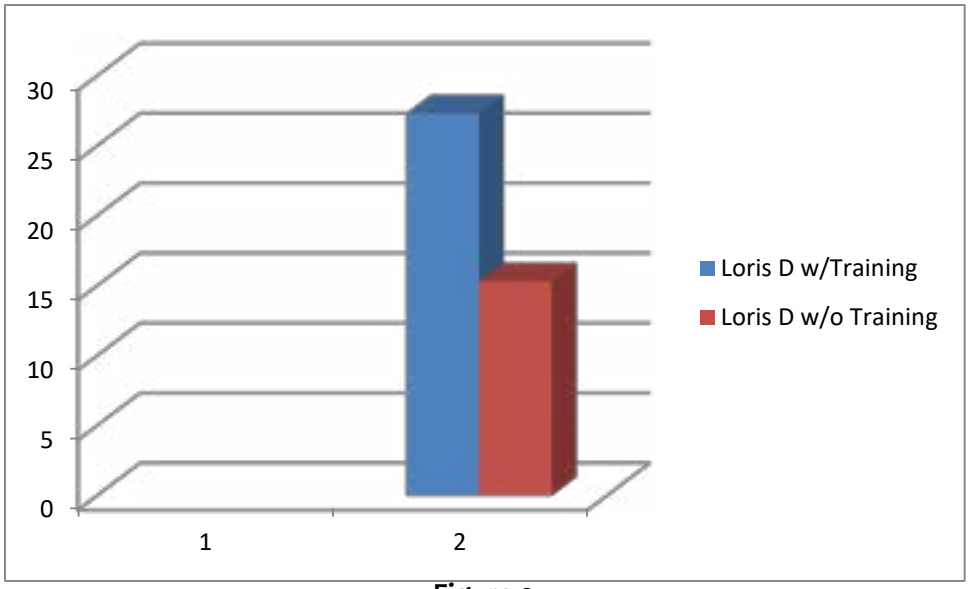

Figure 9
Figure 10
Figure 11
Figure 12

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A Tale of Two Binturongs: Separate Hand Rearing and Use of Palawan Binturong Littermates as Ambassador Animals

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Nashville Zoo, Columbus Zoo & Aquarium

Ambassador animals in zoological institutions have become vital elements of conservation messaging and important partners for interpretation. It has been shown that animals presented in educational settings by handlers prompt 69% more cognitive responses from visitors than animals in a traditional setting (Povey and Rios, 2002). The Nashville Zoo had the first birth of Palawan binturongs (Arctictis binturong whitei) in the United States in November of 2015. The two offspring were separately hand-reared by experienced ambassador animal keepers at the Nashville Zoo and the Columbus Zoo and Aquarium. Though there were differences in hand-rearing protocols, training regimens, handling policies, and numbers of staff interacting with the individuals, both have proven to be effective ambassador animals for the institutions. Extensive communication between the institutions allowed knowledge to be shared and helped establish best practices in hand-rearing for this little-known species. We hope for this paper and presentation to be a resource for institutions looking to add this species to their collection. Smaller in size than their cousins (Arctictis binturong), Palawan binturongs are easier to physically handle and easier to house for facilities with less space. Endemic to tropical rainforests in the Philippines (MacDonald 2009), this species provides opportunities to educate zoo guests about conservation issues including deforestation, climate change, and unsustainable harvesting of palm oil, through personal interactions. The shared experience of raising "Templeton" and "Wilbur" has affirmed a promising future for these two animals as effective ambassadors.

Introduction

Ambassador animals are those in a zoological collection that are utilized for educational programming on- and off-site, including: shows, outreach visits to classrooms or assemblies, on-grounds presentations for groups, and more. Typically, they are tractable, presented without barriers, or at least in closer proximity to the public than an exhibit animal, and are trained to remain calm in a variety of settings and demonstrate natural behaviors. Like exhibit animals, ambassador animals are trained for husbandry behaviors, serve to educate zoo patrons, and have their health and welfare take precedent over all other factors. However, ambassador animals generally encounter more stimuli than exhibit animals. The Palawan binturongs (*Arctictis binturong whitei*) living at the Columbus Zoo and the Nashville Zoo are ambassadors; frequently leaving their enclosures at all times of day to perform in shows, travel for programs, or to help provide interpretation to guests on zoo grounds. This is not to say that exhibit animals and ambassador animals are not equally well-cared for, but to note that there are many factors that influence what makes an ambassador animal the right candidate for the task.

History of "Templeton" and "Wilbur"

When zoos look for suitable ambassadors, many factors are considered, including: how large the animal is at adult size; the typical lifespan of the species in human care; the tractability of the species, while acknowledging that every individual can be different; and the level of training competency of the staff working with the ambassador animals. Binturongs have a history of being included in ambassador animal collections, but anecdotally, are not always the best choice for every team. This is due to their size, temperament, and the skill level of the staff training and caring for the animals. Both of the authors have worked with binturongs in other institutions with mixed success. The key factor that may influence the success of the Palawan subspecies is the size of the animals, which rarely exceed 18 kilograms.

The first of the subspecies that the authors could find record of were imported into the United States by the Nashville Zoo in 2015. Three males and two females were brought in from the Rare Species Conservation Center

(RSCC) in the United Kingdom. Since then, one male has been moved to a facility in Florida to be used as an exhibit animal, and the remaining pairs have been at the Nashville Zoo as exhibit and breeding animals. The offspring of these pairs are first cousins to one another, so breeding is not recommended. The first litter born in the United States at the Nashville Zoo was born to 4988 and 4986 and was a litter of two males, named Wilbur and Templeton. Based on the recommendation of the RSCC and keeper and veterinary staff observations of the pair, it was elected to pull the kits. Veterinary staff at the Nashville Zoo began the hand-rearing process immediately. Templeton was moved to the Columbus Zoo and Aquarium at ten days of age, at which point the Animal Programs staff took over hand-rearing.

Hand-rearing and Neonatal Care

Wilbur had several complications in his first two weeks of life. Fortunately, the veterinary staff at the Nashville Zoo have extensive neonate experience and were able to bring him back to full health. Around thirty days of age, he was moved to the Behavioral Husbandry Department's care, and those staff members took over his hand-rearing. The Behavioral Husbandry Department (BHD) at the Nashville Zoo and the Animal Programs Department (APD) at the Columbus Zoo have collectively hand-reared many neonates to adulthood, most with the intent of becoming ambassador animals. The two institutions raise neonates similarly in that they prefer to have just one or two staff members raising animals for the critical first stage of life, then add more members to the care team as the animals age. Wilbur had a total of eight BHD keepers rolled into his care team starting at thirty days of age, and those same keepers are the same still caring for him to this date. Templeton was raised by two APD keepers at the Columbus Zoo when he arrived there at ten days of age, and his care team was supplemented by six keepers at 32 days old. Collaboration between animal care staff at both institutions played an important role in the success of this species as an ambassador animal.

From text messages to video calls, a variety of communication methods were utilized to share information about the binturongs' growth and development. Animal care staff sent feeding advice on optimal milk consistency, size and types of chopped produce offered, behavioral changes, and more back and forth to one another to help learn best practices. Both institutions kept extensive logs of their animal's first four months of life—all defecation, urination, feeding, weight change, and behavior was recorded. This is the same process each institution undergoes for all neonates they raise and proved to be an effective and helpful practice for Templeton and Wilbur. For example, Columbus's APD cross-referenced Templeton's behavior with past binturong (*Arctictis binturong*) records and found that Templeton began independently locomoting roughly 21 days before his mainland cousins, possibly suggesting an accelerated ontogeny in Palawan binturongs. The binturongs were traveling home with keepers each evening and returning to the zoo in the morning. While this practice may be unconventional for some institutions, it is done with the blessing of both zoos' veterinary teams and done in the safest of ways, all in order to enhance animal welfare and optimize future success for the ambassador animals. Early exposure to changing environments and vehicle travel lays vital framework for the animals' future as traveling ambassadors.

Growth and Development

As the binturongs aged, they began staying at the zoo overnight. Housing these young arboreal mammals requires careful thought and frequent alterations. Both Wilbur and Templeton learned how to use their tails right around 30 days of age, and from that point on, could not be stopped from climbing any mesh, branches, or objects in their enclosures. Various perching, including ropes of assorted sizes, branches, and platforms, should be placed throughout the enclosure for the binturongs to use as much vertical space as possible. Perching, especially when changed regularly, not only encourages natural behaviors for arboreal animals but also provides the binturongs more choice in their environments.

Neither binturong was recommended for breeding due to their close genetic relation to other individuals in the current United States population. Resultantly, both binturongs were neutered in-house at their respective zoos to prevent breeding with potential conspecifics. Wilbur was neutered at 126 days and Templeton was neutered at 145 days, both successfully.

The Nashville Zoo's other breeding pair of binturongs produced two offspring four months after the birth of Wilbur and Templeton, and the same hand-rearing process was repeated by both facilities after the mother cared her offspring for a brief period. Both teams of keepers desired that the new kits be paired with the current kits to provide companionship and a positive outlet for excess energy. The introductions were straightforward—once the new kits were fully vaccinated and old enough to operate on their environments, they were held near their older cousins and allowed to physically encounter them. The older kits showed minimal interest on the first several introductions, but as they all grew a bit closer in size, the two sets of kits began to be able to spend more supervised time with one another and positive behaviors like wrestling, play-fighting, and chasing occurred.

At present, both animals have reached their adult size. Templeton weighs in at 18.2 kilograms and Wilbur at 14.4 kilograms, and each are similar in size to their parents.

Diet and Nutrition

Omnivorous in nature, Palawan binturongs in the wild show great plasticity in their diet but prefer sugar-rich fruits supplemented with protein (MacDonald, 2009). With that in mind, Palawan binturongs are not picky eaters. Despite this, collaboration between both institutions was key to successfully feeding and nourishing both binturongs. As infants, both were fed Esbilac formula mixed at a 3:1 water to powder ratio. Wilbur was weaned off formula at 63 days old and Templeton at 64 days. Wilbur self-weaned—he was being offered several bottles a day, along with solid produce and protein, then one day stopped drinking milk. Before solids were added to their diets, fruit-flavored baby food was mixed into their formula starting around 30 days old. Soon after, solid fruits were introduced into their diets—around 35 days of age. Protein was introduced to Wilbur at 37days and to Templeton at 104 days.

As adults, both binturongs receive a variety of fruits and vegetables as part of their daily diet. Wilbur is offered three cups of mixed produce and 180 grams of Mazuri omnivore biscuits daily. Templeton gets four cups of produce daily along with constant access to Mazuri leaf-eater biscuits and Iams cat food. The Columbus Zoo's Animal Nutrition Department and the Nashville Zoo Commissary deliver different produce daily, allowing for a variable daily diet, mimicking the changing availability of foods Palawan binturongs would encounter in the wild. Three times weekly Templeton and Wilbur get ½ cup of protein in the form of cooked chicken, hard-boiled egg, insects, or Nebraska brand feline diet.

Training and Enrichment

Environmental enrichment has become the norm for AZA-accredited zoos and aquariums, as well as affiliate and forward-thinking organizations. Both institutions introduced their respective binturongs to environmental enrichment at an early age, at roughly 50 days. Exposure to environmental enrichment at an early age has been shown to improve spatial abilities and problem solving in adult mammals (Leggio et. al, 2005). In addition to deliberately placing approved stuffed toys, sticks, cardboard, scents, and textures in their immediate environment, there is inherent enriching value in ambassador work. New sights, smells, sounds, environments, and audiences can all be enriching to the animal at any age as long as the handler is closely monitoring for, and mitigating, signs of acute stress. Anecdotally, Palawan binturongs seems to respond most actively to novel scents, pools of water, and interactive/movable climbing devices and structures.

R+ training was, and continues to be, an important part of Templeton and Wilbur's care. In the APD at Columbus Zoo, Templeton is handled by the entire staff (14 full time, 2 part-time, 6 seasonals) but has two primary trainers for husbandry and novel behaviors. A formal training plan must be submitted and approved by the Director of Animal Programs Training before sessions can begin. At present, Templeton has been trained for voluntary nail trims, voluntary injections, recalling into his enclosure, crating, and is working on a tail-hang behavior for public demonstrations. Banana and grapes taken from his diet are used as primary reinforcement to great effect. Wilbur, similarly, prefers sweet produce as reinforcement, and is trained to crate, station, participate in voluntary nail trims, and target. He is handled by the entire BHD staff at the Nashville Zoo (10 full-time staff) and has primary trainers for novel behaviors. Training plans are submitted to the supervisor and curator of the Behavioral Husbandry Department.

Associated Messaging

Ambassador animals are on the front lines of guest interaction in zoos. As such, they have the potential to open the widest doors for inspiring and educating guests. Typically, ambassador animals are accompanied by a keeper or interpreter who can use the animals and their behavior to provide context and focal points for conservation issues relevant to that species. Palawan binturongs have several direct connections to current conservation issues. Being arboreal, they are directly affected by deforestation in their home territory and are a great discussion starter for the dangers of slash-and-burn farming and the importance of providing alternative income to native people. Binturongs can be found in areas where palm oil is unsustainably harvested and therefore form a bridge to conversations and messaging about buying sustainable palm oil products. Even climate change can be related back to Palawan binturongs; increased levels of atmospheric carbon dioxide increasing global temperatures is changing the humidity and precipitation levels in the Philippines, directly affecting the animals found there.

Conclusion

Relatively unknown in the ambassador animal world until recently, Palawan binturongs have the potential to be effective ambassador animals. Smaller than their mainland cousins, they require less space to thrive when given frequent access to new environments and larger areas and are able to be handled for longer. With a dynamic care team, early exposure to new people and environments, and bond-building training with handlers, Templeton and Wilbur have grown into confident animal ambassadors for the Nashville Zoo and Columbus Zoo. Frequent communica-

tion between the care teams at both institutions was key to the successful hand-rearing of both individuals. Constant comparison of sizes, feeding strategies, and behavior records, all under the umbrella of detailed record keeping, has laid the groundwork for helping other institutions which may want to add Palawan binturongs to their ambassador collections. The success of each individual binturong and institution was directly related to the success of the other, and we know that Wilbur and Templeton will catalyze conversations about conservation and inspire thousands of guests throughout their time as ambassador animals.

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Encouraging Gentoo Penguins to Pair Bond for Successful Breeding

Deanna DeRosa

Kansas City Zoo

The Kansas City Zoo's Gentoo colony includes 2.8 Pygocelis Papua Papua with a few pairings that are recommended for breeding. From 2004-2016 the Gentoo Penguin was considered a near threatened species by the IUCN Redlist. Although, no action for reintroduction is necessary for the species currently, the zoo finds importance in increasing our captive population for research and educational purposes. In 2014, we attempted to encourage our two males to bond with suggested females by moving them off exhibit, each pair in one holding. After 4 weeks, the penguins went back on exhibit but both males found different mates.

In July 2016, we pulled a highly-recommended pair, Kevin and Fiona, off exhibit to encourage pair bonding. This pair stayed off exhibit for just over 2 full months until the beginning of nesting season and the addition of adequate nesting material. At the same time, we removed the penguins that Kevin and Fiona were pair bonded to the previous year. Courtship behavior was observed between Kevin and Fiona, proving bonding success.
On December 20, Kevin and Fiona's first egg was externally pipped. By the next morning, the chick was completely hatched. The previous year's mates were being nuisances to the nest site and parents. Those penguins were removed from exhibit because they were preventing the chick to grow properly. Following the removal of those nuisance females, the chick gained 50g overnight. Currently, the chick is bright, alert, and gaining weight rapidly as it should be at this early age.

Encouraging Gentoo Penguins to Pair Bond for Successful Breeding

The Kansas City Zoo opened the Helzberg Penguin Plaza in October 2013 with 4 penguin species, including King, Gentoo, Rockhopper, and Humboldt Penguins. The Gentoo population is a mixture of both subspecies *Pygoscelis papua papua* and *Pygoscelis papua ellsworthi*. Each subspecies is managed separately to prevent hybridizing gentoos. In 2014, our only highly recommended pairs of penguins were *papua*. There were only 2.9 *Pygoscelis papua papua* living in our sub Antarctic colony at the time. Based on the studbook MateRX, each male had multiple females that they could breed with to help genetic diversity in the population. In hopes of being able to have chicks hatch out to the recommended pairs, both males were taken off exhibit with preferred females. We chose one highly recommended female for each male to spend time with in our off exhibit holding areas.

On October 11, 2014, both male *papua papua* were put in holding with the recommended female *papua papua.* The pairs were off exhibit only for four weeks before going back with the rest of the colony for nesting season on November 7, 2014. Once back on exhibit, each male found a different female than the one paired by the keepers. One male, Gunter, re-paired himself with a female who was recommended a 2 on the breeding MateRX. The other male, Kevin, re-paired himself with a female who was a recommended 4 on the MateRX. Since Gunter had found himself with a suitable mate, we planned to allow the pair to keep eggs for incubation. Kevin, however was not allowed to incubate eggs with his mate.

For the 2015 nesting season, our team didn't think our efforts from the year before would work again so we allowed the birds to choose mates on their own. Gunter chose the mate from the previous year again and they successfully raised a chick of their own. Kevin chose the same female and went another breeding season incubating a dummy egg.

It was decided that we would try again to get Kevin to pair bond with a different female to successfully produce offspring. To make the most educated decision, my supervisor reached out to other facilities to see if anyone had successfully encouraged pair bonding in Gentoos. Most responses we received did not involve Gentoos but gave us insight on what may be best for pair bonding. Moving forward we planned to put our ideal pair together and

reduce visual and audio access to the rest of the colony. On July 26, 2016 we pulled the male, Kevin, and a female, Fiona, off exhibit. There are a few females that could have bred with Kevin and all are recommended the same priority to breed. We chose Fiona out of those choices because she was a recommended 2 with Kevin.

While in holding, we noted any courtship behavior that was observed between Kevin and Fiona during their time together. We also provided the pair with a manmade nest site and river rocks. Gentoo penguins show interest in a mate by bowing and bringing rocks to each other to begin building a nest. Towards the end of the ten weeks that Kevin and Fiona were together, we started seeing bowing to each other during feed times and then throughout the day.

The timeline we set for releasing the penguins back on exhibit was based on previous breeding seasons. Our earliest egg laid during the 2015 breeding season was on October 26. We decided to provide the entire colony with river rocks for nesting by October 1, 2016. Once the nesting material was provided, we would allow Kevin and Fiona back on exhibit to be able to begin nesting along with the rest of the colony.

On the same day, we removed multiple females who were bonded with each penguin the season before. Kevin had shared his nest site the year before with two females and Fiona had paired with another female, so those females were taken off exhibit. In the days following, we noticed an *ellsworthi* penguin was trying to bond with Kevin and was intruding on successful courtship between him and Fiona. This interrupting was enough to decide that she was to also be pulled off exhibit.

On November 12, 2016 Fiona laid her first egg, which was candled approximately ten days after the second egg was laid. When candled on November 27, it was determined that the first egg was developing nicely and the second egg was no longer developing. Our candling protocol is that after ten days of incubation, we candle to see if there is development and then twice a week until the embryo is close to internally pipping. We may candle daily to catch an internal pip to ensure preparedness for a chick.

When we went out to candle the egg on December 19th, the chick had externally pipped. By December 21st, the chick was completely out of his shell and dry without any help from keeper staff. Chick protocol is to get daily weights on our chicks from the time they are dry after hatching until they are holding weight which is usually about 35 days, from our previous experience.

After seeing that a strong bond had grown between Kevin and Fiona, we believed that the old mates wouldn't ruin that bond. The females were put back on exhibit with the colony. Quickly after being back on exhibit, we observed that Kevin's previous interests had started to spend time around his nest. Kevin and Fiona were keeping the chick safe so we did not think this would be an issue.

The chick's weight on days 1-3 showed no change, even though the parents were observed feeding. Based on experience with a Humboldt penguin chick that had trouble gaining weight and had benefitted from supplemental feeding, we decided that would be the best option. In addition to the supplemental feeds for the chick, those females were pulled off exhibit again to allow the parents to focus on feeding their chick instead of defending the nest site constantly.

The chick's weight had increased the day after the females were removed from the exhibit again. Daily weights showed significant weight gains and that the chick did not require further supplemental feedings. To prevent any more disruption of the weight gain we were now seeing, the team decided to keep the females in holding until the chick was old and strong enough to fend for itself if there were any quarrels.

Using some remaining fluids from the shell, we could find out that our big and healthy chick was a male. Kevin and Fiona did a very good job for first time parents. Daily weights continued up to his 35th day then every third day. The success of this pair bond will allow team Water's Edge to replicate this process in the future if deemed necessary to increase our population. Before putting the two penguins together, we didn't know if it would work or if the time spent together would be enough. We learned a valuable lesson that it is worth trying something new and using pieces of information from other institutions to put together a plan.

Acknowledgements:
Andrea O'Daniels, Water's Edge Assistant Animal Manager, Kansas City Zoo
Tim Steinmetz, Senior Animal Curator, Kansas City Zoo
Bridget Cronin, Shows Team Keeper, Kansas City Zoo
Water's Edge Team

Giraffe Blood Draw Training

Samantha Frohlich & Sheri Smith

Columbus Zoo & Aquarium

Giraffe Training is a very important focus for our keepers at the Columbus Zoo and Aquarium. Through the talent and dedication of our Keepers we are able to perform many behaviors, from presenting their hooves for hoof trims to collecting radiographs. One of our main focuses had been on blood collection. Through many trial and errors we have been able to come up with a method of collection that is less invasive and more reliable, leading to improved animal welfare. Keepers will highlight their methods and the road that lead them to success.

The Columbus Zoo and Aquarium houses 10.2 giraffe (*Giraffa camelopardalis*) in the Heart of Africa department which opened in 2014. Prior to 2014 the zoo had not housed giraffe since 2005**.** In the winter of 2013 the giraffe barn construction was completed. The barn is equipped with a 58 foot long mezzanine 8 feet above ground level and a 76 foot long chute system with a tamer. In addition several 4 foot wide shift ways are utilized for training the giraffe by putting a pair of fire hose straps across the doorframes enabling safe, close, unobstructed access. Most of the giraffe arrived by the end of 2013, were under the age of five, and had had little to no previous training. As we started our training program we decided to focus our efforts on hoof presentation and blood draws.

For 7 months out of the year, the herd is also housed in an extensive exhibit space with vast amounts of grass in a mixed species environment which has created a trifecta for harboring parasites. Due to the parasite load our vets have deemed it necessary to collect fecal and blood samples on our herd every month. Blood samples ensure that they are not showing any signs of anemia or low protein, secondary to GI parasitism. These parameters help us to decide how aggressive to be with treatment of parasitism, since low protein or anemia may warrant more aggressive treatment (dietary interventions etc). We also evaluate for markers of inflammation, infection and general metabolic disease (liver and renal values) every other month. (Pers Comm Bapodra)

After consulting with other facilities we started training our herd for blood collection from the jugular vein. We quickly learned that the giraffe would engage and commit to a session more willingly when the vet staff was not present and because of this it was decided that the giraffe care team would collect blood without assistance from the vet team. Using these methods we were able to obtain a blood sample from every member of our herd. However, we found that once we collected blood, most of our giraffe regressed to the point where we would need to essentially retrain the behavior.

We continued to collect blood from the jugulars of our herd with inconsistent results. As we continued to press our herd for successful collections we found that some individuals were becoming intolerant to the training; giraffe that used to engage in sessions would no longer even approach. We realized that we needed to start taking an individualistic approach for each member of our herd. Some of the giraffe that were uncomfortable with us poking their necks were perfectly comfortable with us manipulating their feet and legs which we accomplish at the straps or in the tamer. This led us to question our methods and brainstorm about other options.

In the spring of 2016 we acquired 2.0 giraffe that were under the age of two and were slated to be castrated at our facility. During the castration procedure vet staff attempted to find a reliable site to draw blood from the leg. They found that the palmer digital vein that runs the length of the leg was perfect for blood collection. Vet staff successfully collected from a giraffe under anesthesia and keeper staff was excited to see if this collection method could translate into a trainable behavior.

Keepers started training for blood collection from the leg following the same plan used when collecting from the jugular. The first individual we attempted collection on with this new method was done in our tamer and was successful. The individual also had no regression when blood collection was attempted from the same spot just a few weeks later. Through this experience we learned that not only could we collect blood from different areas of the

giraffe but we could also utilize different areas of our barn. We are able to obtain blood at the mezzanine and at the straps from the giraffe that participate in jugular collection. We can now also acquire blood at the straps and in the tamer from the giraffe that participate in fetlock collection.

We train at the animal's pace, taking it slow when we see any signs of frustration or hesitation. Little things like an ear twitch or a slight shift in weight help us to determine the rate at which we progress. This helps us to avoid the larger more obvious signs like a head swing or even refusal to engage. Filming as many training sessions from beginning to end has also proven helpful for us to succeed in catching these occurrences, by reviewing the video we can see these little gestures and can adjust from that. Another important factor during this training for such an invasive procedure is finding the appropriate reinforcer. While a simple behavior may only require a low level reward; when we are asking for voluntary participation for a blood draw, a higher value reward can be beneficial.

In addition we learned that some of our giraffe prefer the company of other herd members while others prefer no distractions at all and we are more successful when they are alone. Our larger bull giraffe will tolerate a stick and draw when he is in our community room with other giraffe present and next to him trying to get that special treat. With him that competition is actually beneficial. For other members of our herd we clear out the community room and work them one on one which provides a better environment for those giraffe to focus and for us to be successful.

We pride ourselves in using our creativity and passion to find the most appropriate way possible for collecting our blood samples. The most effective tool that we have when collecting blood is the availability of options. Our barn is equipped with several areas for blood collection that we have found, and maybe even some we haven't. Our giraffe are also given options in the sessions, in every blood draw scenario they are all given the choice to participate. Our motto is "set yourself up for success" and fortunately we have a supportive management staff that allows us to have the ability and capability to achieve our goals. At this time we are able to reliably draw from 60% of our herd and we have our sights set on achieving collection from 100% by the end of this year.

The Differences between Lion and Tiger Cubs and Their Management Strategies

Heather Sinn & Christy Nuss

Columbus Zoo & Aquarium

Over the past 2 years we have had multiple litters of lions and tigers born at the Columbus Zoo. All have been mother-reared, but our management with the cubs has evolved. Through early exposure to training sessions and hands on keeper interactions we have developed an increase in tractability and reduced stress levels with the individuals. Through these practices we have also increased the safety and their overall health. Keepers will showcase the process and development of these programs.

Lion Cub Training

In August 2015, The Columbus Zoo and Aquarium welcomed 3.3 lion cubs. The cubs were born to half-sisters, Kazi and Asali, and were sired by our male, Tomo. Asali gave birth to 1.3 cubs on August 16 and Kazi to 2.0 on August 20.

Day 1- 30 (August/September)

During the first week, the main goal was to separate the mothers from their cubs by feeding them in adjacent pens. We did this to start keeper/cub interactions and to begin the adult howdies/introductions. The time ranged from 10-15 seconds and was gradually increased depending on the mothers' comfort level.

During the second and third weeks, keepers started interacting with the cubs. Keepers began by sitting a few feet away from the den and as time progressed, would inch themselves closer to the entrance. Once the cubs started leaving the den, keepers would sit in the general vicinity which allowed the cubs to approach keepers on their own and over time, the cubs began to enjoy and anticipate time spent with the keepers. These particular cubs were very adventurous and explored several areas with their mothers. Within less than a month, they were walking between pens and into the chute system with our squeeze. This curiosity made training invasive procedures in the squeeze that much easier.

Day 31-61 (September/October)

Once the cubs began enjoying and expecting interactions with keepers, the cubs were desensitized to tactile, which included the rubbing of their ears, paws, etc. Originally, only two primary keepers were allowed in the lion building, so we started introducing and desensitizing the cubs to new people when their comfort levels/confidence dictated it was okay to do so, demonstrated by soliciting play/exploration with their primaries. The keeper/cub interactions gave them a general understanding and expectation that when a keeper entered the pen, they were going to get touched. In return, they would receive their favorite toys as reinforcement. Kongs seemed to be a favorite of theirs and this was used as reinforcement in training before they began eating meat. Behaviors trained in this manner included target, sit, and laydown.

Around this time, the cubs were also being trained to run through our chute system into their new yard. At first, the cubs only had access to the upstairs portion which included our squeeze, but now they were given access to the bottom portion, which included our built-in scale. The cubs were trained to go into their new exhibit with assistance of their keepers. They were shown how to leave and enter the building through the chute, the boundaries of the exhibit and what their new territory had to offer. Within a few days they understood their new surroundings and were coming onto and off exhibit without assistance.

In the beginning of October, we introduced the sets of cubs to one another without incident. All the cubs got along well and acted as if they had always known each other. Once all six cubs were a single unit and they began to learning how to eat meat. Initially, none of the cubs wanted anything to do with it. The female cubs started investigating the meat by pawing and mouthing at it, though the male cubs were very timid. It took two days for the males

to get over their fear and 3-4 days for all cubs to realize they enjoyed the taste. It wasn't until three weeks later that the cubs started becoming actually motivated by meat and then keepers started incorporating it into their training.

Day 62-92 (October/November)

During this time, we started injection training, which was done in our squeeze. Keepers began by having the cubs enter the squeeze with the front door closed and having them lie down. From there, we began closing the space in the squeeze. To incorporate tactile, we started touching them with the palm of our hands, then progressed to poking them with our finger, poking them with a blunted needle, and then sticking with an actual needle (25 gauge). The first few times the cubs were poked, they backed up and displayed grimacing facial expressions. However, because the main portion of their diets were only given in the squeeze during training sessions, they learned quickly in order to receive it, they needed to participate in the session. Because of this, they were trained for injection at 3 months of age and keepers were given all vaccinations without vet assistance.

Day 93-123 (November/December)

At this stage in their training, keepers stopped going inside the pens with them. This was done primarily because six 3.5-month-old lion cubs were becoming overwhelming, as they were excited all the time. Due to their bonds with keepers and being with them at a very early age, they saw us as playmates and members of the pride. For safety reasons we started training and retraining all behaviors behind a mesh wall. The cubs were confused at first and didn't always want to participate, but as time went on and their motivation for meat was peaking at an all -time high, they got over it quickly.

We then started incorporating paws, stand, open, and stationing into their daily behaviors, along with target, sit, and laydown. The behaviors that proved most difficult for them to understand and do on a continual basis was paws and open. The males mastered open and struggled with paws and our females mastered paws, but struggled with open. Training them to station also took some time because they couldn't sit still for long periods of time. Teaching them patience was the hardest part in this entire process. The day they understood that calm behavior got them reinforcement was one of my best days. It was the most time consuming and challenging parts, but it was the most rewarding.

In the beginning of December, we started blood draw training. We found this month to be our most prolific during the training process, as we started and completed the largest number of behaviors in this 30-day time span. We found this age to be their training sweet spot. They retained a lot of information and their endurance through the new behaviors was much longer and they didn't get agitated as quickly.

The same approach was taken with blood draw training as their injection training. It was done in the squeeze and we used the same process for working them up into being stuck with a needle, though a major difference was the location of where they were being stuck, their tail. Being stuck with a needle in the tail seemed less annoying than being stuck in the hip for an injection. Again, due to a hands-on approach and strong relationship, they soared through their blood draw training. The only problem we were met with was because their tails were so small and so too were their veins, drawing blood was a struggle. No matter the amount of alcohol swabbed or hot water used, their veins refused to show themselves. Because of this, they were also trained for small patches of fur at the base of their tail to be shaved, as well as constant readjusting of the needle.

Day 213-243 (March/April)

By seven-months-old, the cubs were trained for blood pressure readings from their tail. The same approach was taken with blood pressure as was taken with the blood draw and was started by simply holding onto their tail. When they could lie still for a minute and not flick their tail, it progressed into seeing and feeling a blood pressure cuff. When they got used to that, keepers would loosely fit it to their tail. Again, when they would sit still for a specified amount of time, keepers progressed into tightening the blood pressure cuff. When they were comfortable with that, keepers would tightly fit the cuff and then squeeze their tail to replicate the cuff being blown up. Keepers then started using a real cuff and blood pressure machine. Within the first session, keepers were able to get accurate readings for all six cubs.

Along with blood pressure training, all cubs started on recall training. During this process the adult lions were also involved, primarily because they were all in the same building and would be hearing the recall noise, which they already knew. The beginning stages of this behavior frightened the cubs, as our recall noise is a siren. When they first heard it, it gave them quite a scare, but they received was a horse shank and the fear was very short lived. The beginning stages were simply just pairing the siren with food. When they were no longer fearful, but excited, we moved onto shifting them from one pen to another. We then progressed to doing recall on exhibit with their parents. By June they were reliably recalling off exhibit in 30 seconds or less and by August they were recalling off exhibit in less than 15 seconds.

Tiger Cub Training

Tiger moms oftentimes show a level of sensitivity in terms of outside stress influencing maternal behavior, often struggling to raise a first litter of cubs and sometimes rejecting a first litter. Even when raising a second litter, tiger mothers can be influenced by stress and extra care is often taken to limit disturbance. In March 2013, our tiger, Mara, gave birth to 0.4 tiger cubs. This was Mara's second litter (two cubs from her first litter were pulled for hand raising), and she was very dedicated from the moment all four were born. For the first 8-9 weeks, Mara and her cubs were disturbed very little. There was no interaction between the keepers and her cubs, unless initiated by the cubs, which was rare. Once Mara and her cubs were introduced to a very large tiger yard, the cubs were overwhelmed by the new environment and they huddled in the bushes and would not follow their mom inside. They displayed few signs of confidence or comfort. Because they were still unfamiliar with their keepers, it was not helpful for the cubs to have the keepers in the yard trying to help them inside. They were stressed and very fearful. This made developing a relationship difficult and time consuming. Even when they became more comfortable, they were still very fearful of strangers and anything new in their environment. As adult tigers, they remained cautious and fearful, making management and husbandry sometimes difficult.

In 2016, our other female tiger, Irisa, gave birth to 1.2 tiger cubs on March 16, sired by our male Jupiter. This was Irisa's second litter, her first being born the previous April and being hand raised. The goal for this litter was to be more interactive with the cubs by taking cues from Irisa and her comfort level when being separated from them.

For the first 8 days, we allowed Irisa to bond with her cubs, monitored nursing and maternal behavior, creating very little disturbance to their environment. During this time, we were feeding Irisa on the other side of a doorway from the den, so we could get eventually shut a door between her and her cubs. On day 9, we shut this door between her and the cubs for the first time, for just a couple of seconds, then reopened it. We did this for the next three days. On day 13, we shut the door for two minutes. On day 14 it stayed shut for 4 minutes. By day 20, we were keeping the door shut for 10 minutes. Irisa seemed relaxed and continued to eat while the keeper feeding her stayed near her and in her sight. On day 22, we did our first cub exam where they were weighed and checked over by the vet staff. Irisa was separated from her cubs approximately six minutes during this time. For the next two weeks, the cubs were weighed every few days, taking only between 5-8 minutes each time. In between cub interactions, the door between Irisa and the cubs was shut regularly, even if we were not interacting with the cubs, so Irisa would continue to become more comfortable with that door being closed and see it as routine. The keeper feeding Irisa always stayed near her whenever other keepers were interacting with the cubs and we kept this consistent for the first few weeks. The hope was that Irisa would feel comforted seeing the keeper feeding her and not be suspicious about her cubs being handled. However, no matter how quiet we were when in the den, Irisa always heard something and stopped eating until we gave her access back to her cubs, but her stress level was low and we were confident that it would not impact her interacting with her cubs. After the first couple weeks of this routine, Irisa would often quickly nose each cub, and then go back to her food. There were a few times when she would be reluctant to leave the den on days when we planned to weigh them. On these days, we left it up to Irisa to leave when she felt comfortable. As Irisa proved her maternal behavior was unshaken, our routine with cub interactions became more flexible. By May, all three cubs were becoming much more mobile, utilizing both pens adjacent to the den, drinking from water bowls, and playing.

A unique feature of the Columbus Zoo's tiger habitat is that the holding area is downstairs from the yard itself and all tigers have to traverse a staircase in order to enter the yard. In addition, the den is on the other side of an aisle way from the stairs that enter the yard, which is accessed through a chute. On May 5, we carried the cubs from the den across the aisle to the pen connected to the chute, and the pen they would be using to enter the yard. This pen also has modified benches and a modified staircase for short cub legs to make access easier. The cubs were introduced to the chute and the floor of the whole pen and allowed to explore, with keepers present. Eventually the cubs began exploring the platforms that lead up to the staircase, the staircase itself, as well as, the chute. This introduction was done daily, and the cubs learned how to navigate the structures in their new environment and how to get back home through the chute where they would be reunited with Irisa. For the next fifteen days, the cubs were carried from the den, weighed, and placed in the staircase with access to the pen leading to the staircase and the chute. They were also introduced to antlers as enrichment, which they really enjoyed. During this time, we began feeding tiny meatballs with tongs. All the cubs enjoyed the meat from the start, although taking it off the tongs was a challenge at first. We decided to use tongs from the beginning as a way to eliminate a step in the future once they were older. These sessions lasted about ten minutes. As the cubs got more comfortable, they stayed longer in the staircase. Playing with each other and the antlers enabled the sessions to last longer. Irisa was always able to see her cubs across the aisle during this time. Never a fan of these interactions, she tolerated them, and when they were reunited through the chute, there was always lots of head rubbing and chuffing.

On May 23, the cubs were carried out and placed in the tiger yard for the first time. The tiger habitat is ap-

proximately three-quarters of an acre. It has two large pools, a small pool, and two connecting streams, large rocks surrounding the pools, multiple trees, a viewing window, cave, and a large moat. It's a large area for a two-month old tiger cub, and a very easy place to get lost. Our goal was to help the cubs find their way back to the staircase and the holding area. If anything scary or stressful happened, such as an encounter with hot wire or hot grass, they would remember how to get to the 'safe zone'. The first day they were taken out, they were pretty terrified and didn't linger in the yard very long. They were taken just outside the doors to the stairs, and two of the three cubs made their way to the stairs very quickly. One cub got a little sidetracked by one of the pools and had to be carried back inside. The next day, they were taken to just outside the doors and again they we were able to guide them to the staircase. Each day, the cubs were taken a little further out into the yard and allowed to explore. Their comfort level continued to increase, and at times they had to be coaxed and guided to the door to inside. On May 31, they were taken to the far end of the yard, and allowed to walk all around and eventually inside. This was repeated multiple times.

During the afternoons, Irisa would be locked away from the cubs and we would take this opportunity to spend time with them, feed meat with tongs, continue to introduce toys, and desensitize them to being touched. For the first several days of these interactions, they were fearful. The meat was helpful and seemed to accelerate the transition from the keepers being "scary "to "something that gives us food". About eight days later, all three cubs were comfortable with the keepers, and allowed us to touch their tails, hips, and ears. Other toys were also introduced, a small boomer ball and kongs. Unlike the lion cubs, however, the tigers were terrified of the kongs, and seemed to dislike the smell.

Once we felt the cubs were comfortable in the yard and had knew how to find their way to the door inside, they were let outside with Irisa. On June 2, Irisa was put out into the yard first, and the cubs were encouraged up the platforms and into the stairs. Once there, we would leave and shut the cubs in by themselves and open the door to the yard. This became the routine every day and enabled us to have good interactions and training sessions with the cubs while Irisa got to have some alone time, where she would spend time smelling, scent marking, and eventually lie down. This time out in the yard alone also allowed her to be more comfortable and inspect it for any "traps" that may be harmful to her cubs. It helped us to continue to teach them where to go and how to get there. The intent was to keep the cubs out for a few hours a day, but since cats often do what they please, they often stayed out much longer. As the days got hotter, they tended to fall asleep and not want to move. The process of letting the cubs explore and learn how to get back increased their confidence and comfort and exceeded our expectations as they knew how to come home, even though they chose not to. Sometimes, once Irisa was inside, the cubs often stayed out in the yard and either played, napped or continued to explore the yard and we would have to go in the yard and get them. At this point, carrying the cubs was not ideal, and we wanted them to walk to the door on their own. Keepers avoided carrying the cubs for safety reasons and because it was not a positive interaction They were encouraged with meat, toys, or sometimes even a stick, whatever got them excited and moving. As the cubs got more used to this routine, they were becoming more interested in meat, possibly because Irisa was not nursing them as often while in the yard together. This helped spur the process of getting the family inside in a timelier manner. The cubs began to come in on their own, motivated by hunger, and looked forward to being fed once inside. We also utilized a training door on the side of the yard, one used for training demonstrations, by offering meat to the cubs to help remind them it was time to come inside. When this door is opened, visitors gather pretty quickly and large groups had intimidated the past cubs, but these three were unfazed by strangers and found the door opening and the people intriguing. Opening that door proved to be a good motivator in times when Irisa and cubs were unresponsive out in the yard.

On June 23, we started preparing the cubs for their next set of vaccinations. They had been desensitized well to being touched all over, especially hip and tail areas and the hope was that they could be hand injected with vaccines by the keepers without the stress of being restrained. We introduced bite gloves on one hand, which would be worn as a precaution "shield". Paper clips were used to get them used to the feeling of something sharp poking them. The cubs did great during this training process, and all were successfully hand injected for their second set of vaccines. By this time, the cubs were nearing four months old. They were becoming rambunctious and a harder to manage hands-on. It became too difficult to get them to focus on training while being in with them because they wanted to wrestle and play with keepers. We decided to continue their injection and other training through the mesh.

The tiger holding area does not have a training chute with a squeeze. In the past, our method has been to line up a log alongside the mesh, and position the tigers in between the log and mesh so that they are up against the mesh and close enough to be touched and eventually injected. Since all three were already desensitized to being touched, the main challenge was getting them to calmly lie or stand in between a log and the mesh. In the beginning, they would straddle the log, but over time they begin to stand in the space, and eventually lie down. Once in position, they get reinforced. Once a tiger understands the concept, it often becomes their most consistent behavior, because all they only need to lie down in the correct position and they get fed. All three of our cubs caught on fairly quickly, and on both females received their boosters successfully.

Early in the fall, our male cub sustained an injury and was limping for several days. After pain meds failed to help, he needed to be immobilized for radiographs and then a few weeks later he needed to be immobilized again for an MRI. Both times, he was successfully hand injected with anesthesia, and was examined multiple times by our vet staff without incident. There are many benefits to socializing and building trust with cubs, and one of the most valued benefits is the relationship they have with our vet staff. Giving the vets the ability to closely examine our animals at close range benefits all participants, especially the animal. At less than a year old, all tigers were hand injectable and trained to allow general husbandry. With minor renovations to the tiger area, we hope that with our next set of tigers to have them blood draw trained, as well.

Our most recent tiger cubs have been exposed to daily interactions and training from an early age. All the cubs have learned to navigate new environments, been desensitized to touch and intense training methods, and have learned that people, both keepers and strangers, are not to be feared and can sometimes act as a source of entertainment. As these cats continue to grow and eventually move on to other institutions, they will maintain these behaviors and adjust to new situations easier with less fear, less stress, and in much less time. The benefits of this process far exceeded our expectations. The cubs quickly adapted to changes in the environment, are extremely confident and comfortable in new situations, which increased the enjoyment of our visitors because of their confidence on exhibit.

Tactile Training with Aardwolves: Building Trust through Positive Reinforcement

Ronda Planck & Danielle Holste

Cincinnati Zoo and Botanical Gardens

A time commitment to positive reinforcement accomplished goals not only for training, but the animal welfare of our aardwolves (Proteles cristatus). A husbandry need arose due to food aggression between our male and female aardwolf. Behavior modification through operant conditioning was the path to remedy this situation and improve the quality of life for these animals. This was a challenging project because of the skittish and guarded nature of the species. Crate training is an essential part of husbandry as well as beneficial for medical purposes and was a logical place to start. Positive training showed benefits on many different levels from the start and we began to see changes in their behavior and a level of trust that previously didn't exist. A medical need put our training to the test. Bite wounds, inflicted by the female, started to appear on the male. Anesthetizing the animals repeatedly to evaluate these wounds was not the right option. During a routine examination, veterinary staff were able to determine that the bite wounds were superficial, but needed to be monitored for the possibility of infection. The positive foundation and months of training lead to the aardwolves allowing and trusting us to do body inspections including any areas of concern in a way that is safe for keepers and animals. Tactile training is an essential part of their ongoing care now as well as our ability to take high quality photos and videos to share with our vets and curators to monitor the situation.

Introduction

The aardwolf is a maned striped nocturnal mammal of southern and eastern Africa. *Proteles cristatus* have large pointed ears and a long erectile mane extending from behind the head down to the middle of the back. Under stressful situations, the aardwolf lifts its mane which normally lays flat on their back. They may also give a surprisingly loud and explosive roar when highly stressed, but could do so when startled or frightened. Aardwolves are distinguished by thick dark vertical lines on either side of their body. They have long slender legs and their bodies appear to be sloped due their front legs being a little longer than their back legs. Their body coat consists of dense, soft yellow/white underfur interspersed with coarser guard hairs. Aardwolves are solitary, territorial animals who scent mark their territory with a yellowish-orange secretion from the anal gland called pastings (Richardson, 1985). The diet of the aardwolf is exclusively termites, eating about 300,000 termites during a single night (Cooper & Skinner, 1979). They use both their keen auditory and olfactory senses to locate their food source. The aardwolf feeds on foraging termites, tolerant of the noxious secretions of the soldier termites, by licking them off of the soil surface, not digging (Krunk & Sands, 1972).

Proteles cristatus is classified in a family of its own, but is closely related to the *Hyaenidae*. Despite previous references to the contrary (Roberts, 1951); the aardwolf has a disproportionately strong jaw and skull with well-developed masseter muscles giving them powerful jaw action. Features possibly retained to help defend territories and breeding dens. Although hyenas are their closest relative, molecular data estimates suggest that the origin of the aardwolf is possibly derived from a bone and meat eating lineage of hyaenidae that were present in the Late Miocene (Koepfli, Jenks, Eizirik, Zahirpour, Van Valkenburgh, & Wayne, 2006).

History

Our two aardwolves arrived at the Cincinnati Zoo and Botanical Garden in 2011. Chipo, the female, and Changa, the male, were wild-caught in Tanzania in 2010. They were determined to be six to twelve months of age and unrelated. The pair are exclusively housed together in a nocturnal exhibit in the Night Hunters building. In early 2015, signs of escalating aggression were observed when the pair was fed together on exhibit, which was a normal practice. At the

end of 2015, Chipo was diagnosed with pyometra and subsequently spayed. She was the aggressor between the two, which is also a common behavioral characteristic of the species and their closest relatives, hyenas. Bite wounds were visible on Changa, around his neck and along the side of his body. The start of the aggression could be related to her hormonal imbalance, while the continued aggression could be due to the fact that they are solitary foragers in the wild but are constantly together in their captive environment (Koehler & Richardson, 1990). A training program based on positive reinforcement was put into place to address the concern for the animals' welfare. From the start this was a challenging project because of their skittish and guarded nature.

Training

Behavior modification through operant conditioning was the path to remedy the aggression and improve the quality of life of our aardwolves. It was important to have a commitment to making the necessary changes in developing relevant training to ensure the welfare of the animals. Additional benefits to training include enhanced keeper/animal relationships, providing mental stimulus and decreasing stress.

Crate training encouraged a foundation where the aardwolves could develop a trusting relationship with keepers, which was essential. An assessment of the animal's natural and individual history was conducted before any training was started, to try and eliminate any problems before they occurred.

Crate training proved to be a slow process. The crate had not been a positive influence in the past and that was the first thing we needed to overcome. Training sessions were held once a day, five days a week. The primary reinforcer used was their diet, Mazuri brand Insectivore. Multiple attempts to introduce a variety of insects as the reinforcer were unsuccessful. Within about 3 months of crate conditioning, the aardwolves came to understand that their interactions with keepers would result in good outcomes. The criteria was to use specific crates only for the aardwolves and to minimally clean the crates to keep them smelling of the aardwolves' scent. In six months, the aardwolves were totally crate trained. Positive reinforcement showed benefits on many different levels from the start and we began to see changes in their behavior beyond our initial goals. We began to see a potential with these animals that we never thought was possible. The aardwolves were approaching us, seeking more positive experiences, therefore creating more learning opportunities for the animals and keepers. The outcomes were encouraging and led to a natural progression to move forward with other training based on the aardwolves continued acceptance. We began to see their true personalities without fear and realized the greater impact the training was having on their lives. Also, through observations of the aardwolves' body language we began to recognize what was working and what wasn't.

Target training seemed like a natural progression. It helped to focus the aardwolves on following commands but they clearly enjoyed the interaction. We moved on to defined cues, hand signals and stationing. The positive foundation led to the ability to start tactile training, allowing us to do body inspection for medical purposes, always keeping animal and keeper safety in the forefront. From animals who in the beginning would try to nip at the back of our legs, we were surprised at how well the aardwolves accepted touch/tactile interactions. Currently tactile training is an essential part of their ongoing care.

A muddled mixture of targeting and stationing were the first attempts at tactile training but safety was a great concern. The process evolved on an individual basis for each aardwolf. Both were highly motivated and engaged in training, but in different ways. Changa's inquisitive nature made it necessary to go in a completely different direction with him. Trial and error took a play behavior and modified it to incorporate an effective station behavior that was comfortable to Changa but limited his motion while providing a safe environment without using any kind of restraints. Allowing Changa to have control means providing opportunities for free choice. Ideally the exhibit or holding areas would have had areas to accommodate training, but instead stationing on an existing artificial rock in the exhibit became the goal. The rock allowed for a position that enabled Changa to extend his front legs up on the rock and tuck them under his torso. This gave Changa the stability he needed while allowing keepers to access bite wounds, medicate, and perform body inspections. Also, by using an existing element of the exhibit there was no acclimation needed.

Although the female rarely had bite wounds, we continued to train and inspect her for signs of reciprocated aggression. Chipo, who is more reserved, allowed for shaping the behavior in a controlled way. After almost a year, it was now possible for us to sit on the floor of the exhibit with her, allowing her to choose to come to us. This gave Chipo the control to progress the training forward while continuing to further strengthen the bond of trust. Even though she approached us face first, which is typical with most mammals, a side tactile inspection was shaped almost right away. Chipo took longer to trust, but she has such an elevated level of trust now that she willingly participates in a variety of training options.

The crate training was also taken a step further to help with medical procedures. Crates were introduced in

the off exhibit holding where the aardwolves are separated and fed every morning. Their crates (crates that smelled like them and were only used for them) quickly became the go to place for both aardwolves in their holding area. This extra step allows any of the keepers to retreat the aardwolves and crate them, without stressing the animals. This method has been used successfully several times when necessary.

Challenges/Outcomes

A tremendous amount of time, planning, constant assessment of progress, and the animals' response produced success. Immediately it was apparent that each of the aardwolves required different strategies to excel at training. It is important to remember that no two animals are alike in the way they learn. With each new training behavior introduced, we had to assess how to best train Chipo and Changa in their own way. Clear, honest communication with positive reinforcement was the foundation for a trusting relationship and kept the aardwolves motivated. Also, the care the animals required dictated the direction for what was needed in their training. Keepers diligent monitoring and documenting of the aardwolves, as well as their training, kept progress on track and ensured positive outcomes.

Not only were we able to accomplish the necessary goals, but the training also includes care recommended by the veterinary staff. Ear cleanings are now something both animals allow us to voluntarily do as needed. And if a bite wound occurs or any other issue of concern, pictures and videos can be taken without issue so our veterinary staff can monitor the situation.

We also discovered that making changes in their enclosure and training schedule would have an added benefit to their quality of life and our training. Adding permanent substrate to their enclosure has allowed them to demonstrate natural behaviors such as digging. Rotating what we do with them daily not only helps keep their learned skills intact but keeps it a fun and rewarding experience.

Conclusion

When food aggression became physical, a need arose to redirect the behavior of our aardwolf pair. Operant conditioning was the logical path to take and crate training is how it all started. Progress was slow due to the aardwolves' skittish nature. However, after several weeks with a commitment to consistency, there was an apparent level of trust that wasn't previously there. Personalities of each aardwolf began to shine through. While the reason for increased aggression is still unclear, keepers had to devise a better way then repeated anesthetized examinations to monitor the wounds for infection. Months of standard training had gained the level of trust needed to introduce tactile training. Keepers can now inspect wounds, provide visual documentation, and apply medication. While we've had incredible success, the project continues with the hope to achieve more ways to make the aardwolves lives less stressful and address aggression using different methods. Future goals include training the pair together in hope of lessening aggression and allowing unlimited access to their off exhibit holding, giving the aardwolves' choice and control over their environment.

Acknowledgments

We would like to thank the Cincinnati Zoo and Botanical Garden for the ongoing support and time needed to successfully complete this training project. We thank Mike Dulaney, Curator of Mammals, for comments that greatly improved our paper. We would also like to thank, to whom without this project would not have been possible, our aardwolves, Changa and Chipo.

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Events

Full Day Workshop

Shape of Enrichment

Mark Kingston Jones, Chris Hales, and Valerie J. Hare

At The Shape of Enrichment we have been running workshops for keepers, animal care staff, and university students since 2000. These are designed around a core of practical and theoretical units, to assist animal caretakers in creating and assessing effective enrichment plans within their institutions. Over 100 workshops have been conducted to date, both as in-house staff training and as publicly available courses.

In addition to the material we are delivering during the 2017 ABMA Conference, our pre-conference workshop is designed to give animal caretakers the chance to put their practical skills to the test, and maybe develop some new ones, as we construct long-term-use enrichment devices. We will be working with various taxonomic groups at Cincinnati Zoo and participants will be building pre-designed items, installing them in the animal enclosures, and observing how the animals respond. This will be a physically active session, with hand and power tools -- and rest assured there won't be a cardboard box or flour and water in sight!

WE HAVE A NEW WEBSITE: www.teambuildingwithbite.co.uk
Please contact us if you have any questions.

Professional Development Workshop

Get your job inquiry questions ready...What do you wear to an interview? Are internships resume worthy? What is the best way to follow up after applying? What type of end of interview questions are appropriate? A panel of industry professionals answered anything delegates were ready to ask. Afterward there was time set up for resume reviews and mock interviews. There is something for everyone, whether you're just getting into the field or are interested in moving onward or upward, this workshop is for YOU!

Honors and Awards

Travel Scholarship Winner:
This scholarship is awarded to an ABMA member whose institution is unable to give them financial support. The Travel Scholarship will help the award recipient by giving them the ability to present their work and it will help the organization by giving ABMA members the opportunity to hear presentations that the membership otherwise would not have the opportunity to hear and as such, the Travel Scholarship supports the ABMA Core Value of "Sharing the Knowledge".

Improve Animal Welfare in Alouatta Caraya From Illegal Traffic
Maria Florencia Presa, Temaikèn Foundation

Behavioral Management Achievement Award:
Recognizes an outstanding achievement in the application of behavior management techniques.

Thinking Outside the Shell For Conservation:
Inspiring Zoo Guests By Training Behaviors In Tortoises For Public Encounters
Lauren Etzkorn, Columbus Zoo

Behavioral Management Innovation Award:
Recognizes outstanding application of novel, unusual or original behavior management technique.

Polar Bear Conservation Training at the Oregon Zoo
Sara Morgan, Amy Cutting, Nicole Nicassio, Amy Hash, Robert Draughon, Jen DeGroot; Oregon Zoo

Animal Welfare Advancement Award:
Recognizes achievements that enhance animal welfare through specific environmental enrichment/conditioning techniques or programs.

Let's Get Physical: Physical Therapy Training For Two Otters with Metabolic Bone Disease
Christine Montgomery, Downtown Aquarium Denver

Sharing the Knowledge Award:
Recognizes achievements in behavior management education to enhance the knowledge of professionals and/or the public to the benefit of animals in human care.

Building Expertise: Something to Aspire To
Steve Martin, Natural Encounters, Inc.

Poster Presentation Award:
Recognizes the best poster that represents an achievement in any of the above categories in this format.

Training 0.2 Ostrich for an Annual Exam
Dan Turoczi, Cincinnati Zoo & Botanical Garden

Engage Award:
The best article submitted for the year from the quarterly Animal Behavior Management Alliance magazine ENGAGE.

Breeding or Education: Why not both?
Cathy Schlott, National Aviary

Impact award:
This award is chosen by all delegates at the end of the last formal presentation. Delegates may cast a vote for any paper, poster, or activity that they feel deserves special recognition.

Dr. Megan Parker, Working Dogs for Conservation

Member's Business Meeting

Animal Behavior Management Alliance

Annual Member Business Meeting Minutes

April 25, 2017

Cincinnati, Ohio

I. Call to order at 12:04 PM EST by Cathy Schlott, President.

II. Minutes recorded by Christa Gaus.

III. Opening comments by Cathy Schlott, President:. The reason for the business meeting is because we have a member based organization. We do the work based on what you want to see. If you are interested in seeing something new, as long as it aligns with our bylaws, contact us to give us feedback.

IV. Acceptance of the minutes from the 2016 member business meeting.

MOTION made by Cathy Schlott to accept the 2016 member business meeting minutes, having been reviewed in advance. Second made by Cindy Wilson. **Motion passed by unanimous consent.**

V. Board reports

A. President report: Cathy Schlott

B. CFO report: Susie Ekard

i. 2016 Financial report (see below)

MOTION *made by Susie Ekard to approve the 2016 financial report. Second made by Genevieve Warner.*

C. Past President Nicki Boyd

i. Election results **(INCLUDE NAMES and POSTIONS**)

1. We have elections every year and are always looking for new board members. There is a simple nominations process. If you are interested, see Cathy Schlott.

2. Incoming board members as a result of the 2017-2018 election-slate passed by 96%. Susie Ekard will return as CFO, Christina Burgess will be Secretary Elect and Scott Trauger will be President Elect. Traci Schneekloth,Julie Grove, Wouter Stellaard will be directors at Large, and Christine Burgess as Secretary Elect.

D. Secretary: Christa Gaus

i. Membership update: We have 492 members in 31 countries.

ii. Conference Registrants: 184 delegates that purchased weekly registration and 15 purchased daily registration and delegates from 6 different countries have attended.

E. President Elect Tricia Dees:

i. Program Council Chair introductions/updates Committee meetings are from 5:10 to 5:30 April 26th.

1. Behavior Management Fund: Cinnamon Williams and Genevieve Warner-We help to raise money for the grants and scholarship winners.

2. Conference: Christina Burgess/Angie Llanas-Planning for 2018 in San Antonio.

3. Conference Content Advisory: Christine McKnight-

4. Conference Proceedings: Jen Hickman

5. Education: Missy Lamar-

6. Government Affairs: Justin Garner

7. Honors and Awards Jen Hennessey/Ashley Friedman

8. Membership: Jessica Robinson

9. Merchandise: Susie Ekard-Don't have committee members, but would love to hear ideas of what people would like to have us sell.

10. Nominations and Elections: Cathy Schlott

11. Public Affairs: Margaret Rousser

12. Publications: Cathy Schlott

13. Research and Evaluation: Clint Lusardi

14. Site Selection: Kelly Elkins-We are headed to Oregon in 2019!! Just a heads up for 2020 you might need a passport.

15. Sponsorship: Alicia Sampson

16. Website: Heather Samper-Last year we asked for a lot of feedback on the website. Some changes were then made to include a conference tab and a member's tab with all the member benefits listed. We also created direct links to Collabornation and did some renaming of the menus and sub-menu items. All members will be receiving a website survey in the near future. Please give specific information to help us continue to make the website better.

VI. New Business

A. Acknowledgement of outgoing board members Cathy Schlott- The outgoing board members are Scott Trauger, Susie Ekard, Jay Tacey, and Nicki Boyd.

B. Acknowledgement of 2016-2017 (*current*) board member positions: Cathy Schlott:

President- Cathy Schlott	Director- Justin Garner
President Elect- Tricia Dees	Director- Scott Trauger
Past President- Nicki Boyd	Director-Alicia Sampson
Secretary- Christa Gaus	Director-Jay Tacey
CFO- Susie Ekard	
1st Vice President- Kelly Elkins	
2nd Vice President- Missy Lamar	

C. Priorities from Members (C. Schlott)-We are very serious about having member feedback to continue to grow the organization. We are going to try to get the conference survey out very quickly this year so, it will be available Friday. If you fill it out immediately and show us you did at the banquet, you will receive a free gift. This survey allows us to evaluate and improve for future conferences. Later in the month, we will send out a survey to get feedback on the website, Engage, and Collabornation. Please fill these out. If we don't get feedback, we can't improve.

D. Term List (Missy Lamar)- We have looked to update our terms list. The one that is on the website currently is very comprehensive. Moving forward we want to make sure we are all using the same language. AZA and AAZK have an approved terms list that they have put out and we are looking to use it as well. We are looking into how best to put it out. If you want to know more, see Missy Lamar. As soon as we have more information on it, we will let you all know.

E. Partnerships with IMATA, Twycross, IATCB and AAZK (N. Boyd)- We have been working hard to get together with like-minded organizations. We have reciprocal memberships with AAZK and IMATA. We get a member rate to go to their conferences. Our goal would be to do a ABMA/IMATA joint conference. For now, we are doing a best of ABMA presentation at IMATA and they are doing one here. Twycross partners with ABMA to do a few workshops at their annual conference in England. This is an international conference. Part of the reason this relationship began is because Collabornation gives us a professional development tool that provides over 3500 classes and has an international reach. There is a reciprocating membership with IATCB. This allows us to take their certification test at a discounted rate. We are looking to move to an all- encompassing animal certification test in the future to continue to improve professionalism.

F. Outgoing president comments: Cathy Schlott If you want to get involved, everyone is very outgoing and friendly, just let us know.

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Acknowledgments

I would like to thank the Proceedings Committee members for all of their hard work on putting this together! With the multitude of papers that are submitted each year, it takes all of us to go through and proof read and edit them. We value the time and energy that they put into making sure these papers are ready for the proceedings!

Jen Hickman

2017 Proceedings Committee members:
Christina Lavallee
Jane Anne Franklin
Peggy Hoppe
Dr. Susan Friedman
Jason Jones