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Papers

AMERICAN ASSOCIATION of ZOO KEEPERS

AMERICAN ASSOCIATION OF ZOO KEEPERS
LOS ANGELES CHAPTER

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Using the Hierarchy of Safety Controls to Improve Safety in Your Zoo or Aquarium

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Introduction

Animal keepers are always looking for ways to improve safety when working with dangerous animals. Some tools we can use include creating a positive safety culture and improving our own personal awareness. Another tool at our disposal is called the hierarchy of safety controls. This decision-making tool helps individuals determine how best to manage risks in the workplace. Developed by NIOSH, or the National Institute for Occupational Safety and Health, the tool has commonly been used in aviation, medicine, and construction. We can also use the tool to help us approach situations involving dangerous animals in the zoological field.

The hierarchy of controls includes five different categories of action, listed from most effective to least effective. The first two categories, elimination and substitution, are somewhat difficult to use in zoos and aquariums. The third and fourth categories, engineering controls and administrative controls, are frequently used and will be familiar to almost every keeper, even if they didn't previously know the technical terms. The last category, PPE, tends to be unreasonable when working with dangerous animals except in situations where physical restraint must be used. Understanding how these categories can be and have been applied in the zoological field can help decision makers approach risky situations more easily in the future.

When discussing mitigating risks in zoos, it is important to note that every animal carries an amount of risk and has the capacity to be dangerous. The goal of using a tool like the hierarchy of safety controls is always to reduce risk and danger, not to eliminate danger. Because animals are essential to our facilities' missions and purposes and will always be kept in zoos, we will always face a degree of risk as animal keepers.

Elimination and Substitution

The first two categories in the hierarchy of controls include removing the risk entirely, and in the zoological field these are often not practical options. We cannot eliminate all animals that could be considered dangerous and substituting them for less dangerous animals would often stop our facilities from meeting their missions and goals. However, these options can be utilized when looking at specific situations. For example, if an elephant has a habit of throwing rocks or branches at visitors, these items could be removed from its exhibit. If a gorilla attempts to hit keepers with bamboo, it could be given a different, more flexible type of browse in substitution for bamboo.

We can also eliminate risks by changing our handling method with animals. If we eliminate ourselves from the same space as an animal, we can instantly reduce risk in most situations. For example, working outside of an exhibit that contains orangutans or tigers is likely much safer. However, the increased human safety must always be balanced with other changes to husbandry, care, or maintenance that could occur if keepers do not enter the same area as a specific animal.

Engineering Controls

If we cannot use elimination and substitution as viable courses of action in zoos when dealing with risk, according to the hierarchy of controls we must consider using engineering controls next. Engineering controls attempt to isolate people from a hazard by creating physical barriers. Ideally, these controls are not subject to human error because they are part of the environment.

Two commonly used engineering controls include a "two lock two key" system or a "lock out tag out" system. "Two lock two key" utilizes padlocks that require different keys from the rest of the locks in the area. If the system is set up appropriately, one individual keeper will be unable to enter an enclosure with a dangerous animal on their own. Similarly, "lock out tag out" requires a keeper to use a padlock with a different key when entering a specific yard or enclosure. This system prevents another keeper from unintentionally moving an animal into the same enclosure as a person. When these two examples are correctly implemented, there is a physical barrier that prevents humans from unintentionally occupying the same space as dangerous animals.

Engineering controls can also be used in individual risk situations. For example, our rock-throwing elephant could receive exhibit modifications, like a net, to prevent items from being thrown into a crowd of visitors. The gorilla that hits keepers with sticks could also receive exhibit modifications to prevent further danger for keepers, like a board or mesh with smaller gaps. Any modification that physically isolates or protects the keeper from danger is considered an engineering control.

Administrative Controls

Administrative controls could be considered the bread and butter of zookeeping. These controls exist in the form of protocols, best practices, SOPs, and policies. Essentially, administrative controls are methods that change the way people work to create a safer environment. The biggest challenge with administrative controls is that there will always be a degree of human error, unlike properly implemented engineering controls.

Some common administrative controls when working with dangerous animals include a two-person lock check policy, where a second person must verify that enclosures are secured before an animal is allowed to enter the area. A "head count" protocol requires one or two people to count animals in a group to ensure that an area is free of dangerous animals before a person

enters the enclosure. Some zoos may require communication policies before moving dangerous animals, entering specific enclosures or areas, or training certain animals.

Administrative controls can also include tools and techniques used to increase awareness when working around dangerous animals. These can include different ways to highlight if a door is open or closed, including painting doors a different color, labelling door handles, or highlighting the inside of a door frame. Some techniques may highlight where a dangerous animal is located, including maps with moving icons, labels for doors, and signs around dangerous animal holding locations. Mirrors, bright lighting, and indicators to improve visibility are also considered administrative controls. These are only a few examples of administrative controls; many different techniques exist throughout zoos and aquariums in the country.

PPE (Personal Protective Equipment)

The final category of action within the hierarchy of controls is the use of PPE, or Personal Protective Equipment, to protect employees working in dangerous situations. This category of action should always be considered a last resort when using the hierarchy of controls. When working with dangerous animals, PPE is often not a viable answer. There is no PPE that could protect a keeper that enters the same space as a lion, for example. However, there are some tools we can equip ourselves with when physically handling animals, including long leather catch gloves, long pants and shirts, safety goggles or visors, and steel toed boots. Keepers can also wear bear mace as a last resort when working with large carnivores.

PPE could sometimes be considered useful in independent situations. Theoretically, a hard hat could provide a level of protection against an elephant that likes throwing rocks, and goggles and thick gloves could protect against a gorilla that tries to hit keepers with bamboo. In most cases, there will be many better courses of action to pursue before using PPE.

Applying the Hierarchy of Controls

When applying the hierarchy of safety controls to reduce risk, keepers and supervisors should be creative with possible options and consult each other, other departments, and other zoos. Because complete safety can never be achieved, good reason should always be used. For example, a reasonable decision maker may acknowledge that there will always be a level of risk present when working with large cats and try to balance administrative controls with the keepers' workloads and other concerns.

When applying the hierarchy of controls to a dangerous situation, decision makers should always consider options at the top of the matrix before utilizing options further down. However, because we work with living animals, the earliest possible option may not always be the best option in the zoological field. For example, the ultimate solution for our gorilla, according to the hierarchy of controls, should be to eliminate bamboo or other browse from the gorilla's diet. A reasonable

decision maker may consult with their nutrition department and instead decide to install mesh with smaller openings, an engineering control, and continue offering browse to their department.

Finally, it is always important for an individual keeper to take part in their own safety. Any keeper can play a role in assessing risk within their job- they likely should take an active role as they are the individual facing danger. As a keeper, think about different risks within your job and different options that could make your job safer using the hierarchy of controls. Bring up concerns with your supervisor and talk with others in the field. The hierarchy of controls is just one tool that keepers can use to improve their own safety, with others including affecting the safety culture in your department and improving your personal awareness. Ultimately, each keeper must play an active role in their own safety.

AAZK Safety Committee

The AAZK Safety Committee was created in 2016 with a mission of developing and exchanging resources for AAZK members in the promotion of safety and health. We coordinate continued education through presentations and workshops at the AAZK National Conference, educational articles in Animal Keepers' Forum, and information shared through the AAZK social media accounts. We are always looking for new members who are also interested in sharing safety information with fellow animal care experts. If you are interested in joining the committee or have any questions, please email safety@aazk.org.

Creating Virtual Connections- How AAZK Chapters Can Hold Online Career Events for Students

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Introduction

Zoos and aquariums faced many challenges in 2020 that led animal keepers to use resiliency and innovation to find new solutions for problems. The use of technology for meetings and educational outreach changed dramatically, and as a result more virtual programs were held than ever before. Virtual programs have many benefits, though, and the ability for animal keepers to create virtual outreach events allows them to reach groups beyond local zoo and aquarium visitors.

In 2021, the National Capital AAZK Chapter (NCAAZK) hosted an online career event to reach college students across the nation and discuss zookeeping as a career. Building off a similar event the chapter held in October 2020, the event featured a panel of animal keepers from facilities and AAZK chapters across the country. The panel was conducted on Zoom and had around 300 attendees.

The two keepers that organized the event, Katy Juliano and Hilary Colton, learned about creating and holding a career event for college students. They hope to share information to assist AAZK chapters in holding similar events and improving upon what they learned.

Previous Event

NCAAZK has historically supported education to a variety of audiences, and the chapter won the inaugural Janet McCoy Excellence in Public Education Award in 2019 for its outreach and education efforts. One of its members, Smithsonian's National Zoological Park (NZP) animal keeper Katy Juliano, has a specific interest in increasing career-focused education aimed at college age students. As a result, NCAAZK held a career event for undergraduates in October 2020 that became the foundation for the event held in 2021.

The 2020 career event was designed to expose college students to the variety of potential careers in zoos and aquariums. The panelists held different positions at the Smithsonian's National Zoo,

including veterinary pathologist and education specialist. Advertisement was conducted locally to colleges in the area through alumni connections and emailing. 115 people attended the presentation, which was conducted via Zoom Meetings.

Hilary and Katy gained a lot of knowledge from this event through the experience as well as through a follow-up survey. First, 83% of attendees had heard about the event from their professor or college, which demonstrated that advertising through social media had not been the most effective method in attracting the target audience. 58% of the attendees were college juniors or seniors, meaning that students looking seriously at career opportunities had joined. Finally, Zoom Meetings was useful as an interface but had some challenges, including that the attendees could directly message the panelists during the presentation.

After the event in 2020, Katy and Hilary began planning for a spring event that would focus on zookeeping as a career and highlight the differences that exist in the field. To accomplish this goal, they reached out to AAZK National and then began planning for an event that would be expanded to include animal keepers from across the country.

Planning Spring 2021 Event

Hilary and Katy planned to host a similar event that focused solely on animal keeping as a career. They sought to create a panel that demonstrated the diversity within animal care by highlighting keepers that worked with different species, in various US locations, and in multiple types of facilities. Each keeper would be from a different AAZK chapter to highlight AAZK student membership. They utilized professional partnerships as well as active online presence to determine which chapters might be good representatives for the panel.

After getting approval from the AAZK Board of Directors, Katy and Hilary began selecting chapters. To have speakers that worked with a diversity of taxa, they made sure that at least one keeper worked at an aquarium. They also looked for chapters spread throughout the country and tried to pick a mix of large and small facilities. As a result, they reached out to the Rocky Mountain AAZK chapter first and asked for a speaker who worked at the Denver Aquarium. Following that, they reached out to a variety of chapters spread throughout the country, leaving the suggestion of speaker up to the chapter.

The panelists included Jessica Newell from the Denver Aquarium, John Scott from WCS New York Aquarium, Kristen Craig from the San Diego Zoo, Nicole Darland from the Little Rock Zoo, and Janey Kramlik from the Brandywine Zoo. The speakers had experience with fish and invertebrates, marine mammals, hoof stock, ambassador animals, and more. Opportunistically, the presenters held a variety of roles in animal care; one speaker is a veterinary technician and keeper, while another speaker is an assistant curator. Speakers also had different education levels, backgrounds, and years of experience.

With a panel of speakers confirmed, Hilary and Katy moved forward with arranging the technical details of the event. Building off their experience with the Fall 2020 event, they knew that a Zoom Meeting would not be suitable as it allowed for too much direct interaction with the speakers. Instead, a Zoom Webinar was planned, which would restrict attendees from sharing their screen and messaging others, helping to allay security concerns. Working with the Smithsonian Institution, they were able to get a temporary host license for up to 500 online attendees. AAZK National did not have the capacity to host such a large audience, so we were grateful to our host institution in permitting use of this resource. A Webinar also includes a question and answer feature that allows attendees to ask a question and permits other attendees to see it and vote on if they would like the same question answered. The question and answer feature makes it easier to address questions from a large audience. In setup for the event, they selected for the presentation to be recorded, to collect the email address of attendees, and to record the Q&A submissions.

With panelists confirmed and a Zoom Webinar set up, Katy and Hilary began advertising the event. They created a flyer with the relevant information and shared it with speakers and their AAZK chapters. The AAZK Communications Committee worked to create a series of social media posts that highlighted the speakers and the event. Katy also sent emails to representatives from roughly 125 universities and colleges in the areas around each panelist's facility. To prepare for the event, Hilary and Katy held technical run-throughs to make sure that the settings restricted attendees and allowed panelists to talk. They created a list of potential questions to ask in case the attendees didn't submit many. They also created a survey (Figure 1) to be sent out after the event that would ask attendees about themselves and how they heard about the event.

- How did you learn about this event?
- Are you currently a student? If you are, where are you studying (school and state) and what is your grade level?
- Are you currently a paid employee (permanent, temporary, seasonal) at a zoo/ aquarium? If you are, what zoo/ aquarium and what position?
- Are you currently in an unpaid position (volunteer, intern, other) at a zoo/ aquarium? If you are, what zoo/ aquarium and what position?
- Are you affiliated with an AAZK chapter? Which chapter?
- If none of the above applied, why were you interested in viewing this presentation?
- What was your favorite part of the presentation or what is something new that you learned?
- What is something you would have liked to learn about or know more about during the presentation?
- Do you have any feedback about how this presentation could have been improved?

Figure 1. Survey questions sent to attendees.

Holding the Event

The event was held on March 16 at 8pm EST to allow for participants on the West Coast to attend the event after work. 321 people attended the event and asked a total of 125 questions. The presentation began with a brief introduction about AAZK, the panelists, and the format of the event before beginning immediately with questions. Hilary served as the moderator and asked panelists questions from the audience, while Katy managed the technical settings and typed in answers to questions. Topics discussed included experiences with different species,

upward mobility, education requirements, research and conservation projects, and how to enter the field. In total, the panel presentation lasted 90 minutes and there were still submitted questions that had not been addressed.

Afterwards, the recording of the presentation was shared through social media and email. The results of the post-presentation survey were collected and analyzed. Attendees gave positive feedback, with several noting that they enjoyed the conversation about education and training, especially regarding a graduate degree. Attendees also reported that they appreciated the variety of different perspectives from different roles and facilities and learning about how to get started in the field and.

Around half of the attendees, 127 individuals, answered the survey. Of those that answered the survey, 83% heard about the event from their university and 12% heard through Facebook, demonstrating again that social media wasn't very helpful when advertising the event. 58% of the respondents were seniors and juniors pursuing an undergraduate degree, although 6% were in high school and 2% were pursuing a graduate degree. For respondents that were not working in a zoo or aquarium in a paid or unpaid position, 32% were aspiring exotic animal professionals and 58% were exploring potential careers. Geographically, we found that attendance was mostly based around the panelists' facilities. Approximately 9% of the respondents were paid employees at a zoo or aquarium. There were also 3 international attendees consisting of professionals from Japan, Taiwan and the Philippines.

One of the most successful things that the moderators were able to do occurred after the event. Those attendees who chose to do so provided their email addresses in the log-in process. They were able to follow up with those who submitted questions personally to address their queries. Some of these questions were not posed to the entire panel due to their specialized topics, or were asking for advice based on the individual's own experience for resumes and job applications. Hilary and Katy were able to provide advice to their specific circumstances, give links to possible organizations to work with, and forwarded to subject matter experts who were not represented on the panel itself. Through these interactions, they were able to provide a more curated experience for the attendees, all of which expressed an appreciation for. Some of those who submitted questions have since reached out again to ask for advice or for an updated timeline on internship postings. The virtual format allowed for more impactful takeaways to be gathered by attendees, while an in-person career event would be unlikely to offer the same opportunities.

Question	Name	Response
how do you learn new routines/departments quickly?	Hayley	Answered by HC 3/19 via email
I'm interested in both marine animals and land/wildlife animals. Are there any postions/jobs that work with both? And what advice would you give to figure out which area of interest (marine or wildlife) to choose?	Anonymous Attendee	LIVE CHAT - Hi, it absolutely depends on the zoo. At the Smithsonian's National Zoo, our marine mammal keepers also work with native North American wildlife including bald eagles, wolves, and beavers. In other facilities, marine mammal keepers will only work with marine mammals. I always recommend gaining some kind of direct animal experience- I think that's the only way you can really learn what animals you will like working with.
Have any of you (or keepers you know) pursued falconry for the training experience? If so, has it helped in obtaining jobs?	Bethany	Forwarded to Ashley for bird of prey advice on 3/20
Is it possible to work with insects as a keeper? If so, how is that like?	Jasmin	LIVE CHAT - There are a few zoos that have specific entomology departments where insects and other arthropods are the focus. Also some natural history museums have live insect collections
Do you do any research of your own?	Anonymous Attendee	*unable to respond due to lack of contact information*
How beneficial is graduate school for people that have intern/volunteer experience (for the aquarium industry in particular)? Does graduate school help to set you apart?	Jane	LIVE ANSWERED

Future Advice

There are many lessons to be learned from this career event. Utilizing a webinar format rather than a meeting-style allowed for great control over the visuals of presenters, a more formal question and answer, and the ability to follow up with attendees. It was very beneficial to have a moderator for the conservation and someone who could type in answers as well, especially because all participants could view the typed answers to the questions. Having a post-event survey allowed for the collection of information about the attendees and was extremely helpful to understand what went well in the event.

The panelists represented many different facilities and covered many topics, which was positively commented on in the survey. While information was communicated through social media, it was clear that most students learned from their university or professors. In the future, it

could be better to spend more time communicating with universities and forming those connections with professors than creating a social media plan.

In the future, a similar event could be held to continue exposing college and high school students to careers in zoos and aquariums. An event targeting high school students could be an opportunity to help them consider what choices in major or minor degrees might be useful, given that not all universities offer specific animal science programs. Survey respondents had an opportunity to request topics for other online events, and there was interest in hearing more discussion about the ethics of zoos, a presentation focusing on applying and interviewing for jobs, and a focus on a day in the life of different keepers.

Conclusion

The March 2021 career event reached over 300 attendees and shared with them what it's like to work as a zoo keeper. Thanks to the help of AAZK National and the Rocky Mountain AAZK Chapter, Little Rock AAZK Chapter, Brandywine AAZK Chapter, New York City AAZK Chapter, and San Diego AAZK Chapter, the event was able to reach a larger audience and feature presenters with a diversity of experience. NCAAZK plans to continue to host various career events in the future virtually, as these presentations can reach so many people.

The Association of Minority Zoo & Aquarium Professionals- What We're All About

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Introduction

The Association of Minority Zoo & Aquarium Professionals (AMZAP) is a group of professionals currently working in across all disciplines at accredited zoos, aquariums, and exotic wildlife facilities. The AMZAP mission is to increase minority representation throughout the zoological industry. Our membership consists of professionals working in accredited (AZA, ZAA, GFAS and AMMPA) facilities across the country. Among our current membership, AMZAP is proud to celebrate having people of Asian, Black, Hispanic, Middle Eastern, Native American and Pacific Island heritage as well as White colleagues invested in helping us further our goals. As AMZAP grows, we hope to welcome members representing additional ethnic and racial heritage groups.

While we share the values of Diversity Equity Accessibility and Inclusion committees (DEAI), AMZAP is singularly focused on the racial / ethnic minority demographic. Additionally, AMZAP's goal is not to affect institutional policy change from the top down. Instead, AMZAP is working from the bottom up to encourage minorities seeking career options to consider a profession in the zoo field. As a result of AMZAP's efforts, we anticipate the number of minority applicants will increase, which will help the policy changes initiated by the DEAI committees come to fruition.

To help address the mission, AMZAP is focused on two primary objectives: 1) building a sense of community amongst minorities currently working in the zoo field; and 2) to promote career opportunities within zoos as viable options for minorities, subsequently increasing minority representation throughout the industry. We hope to achieve these objectives by directing our efforts on four core goals.

Core Goals

Networking: We aim to develop, reinforce, and maintain relationships among current zoo professionals, particularly those of ethnic or racial minority backgrounds, from across the country. AMZAP has an independent website and social media accounts (Facebook groups, Facebook public page, Instagram, and LinkedIn) all designed to connect our members across the country. We also host monthly member meetings that include time to socialize and meet others.

Outreach: AMZAP seeks to expose young adults from underrepresented ethnic and racial communities to the idea that working in a zoo or aquarium is a viable option for them if they are at all interested. We do this by introducing them to professionals in a variety of disciplines within the field who look and sound like them. We use our website and social media platforms to share information about the diversity of minority professionals currently working in the field in a variety of positions. AMZAP also hosts online events for college students, high school students, and other groups to discuss the variety of careers that exist in the zoo and aquarium field.

Mentoring: AMZAP hopes to influence and guide any individuals, particularly those of ethnic or racial minority backgrounds, who express an interest in working within the zoological field and seek our help. AMZAP's mentorship program connects aspiring zoo and aquarium professionals with current professionals in the field. Mentees are matched with a professional that may be in the same location as them or have common interests. Mentors then share lived experiences and provide insights and advice about career paths, resumes, cover letters and requisite skills. AMZAP also welcomes mentees to monthly member meetings and hosts online events specifically for mentees and mentors.

Professional Development: Provide guidance to improve knowledge and skills that build AMZP members' confidence and credibility, which will facilitate promotion potential. Additionally, AMZAP utilizes our ever-growing network of zoos and aquariums across the country to collect and post job announcements for our members and followers – allowing them to easily stay aware of career opportunities. Our monthly member meetings feature topics designed to improve our members' skills and knowledge. Topics can include career development, lessons from hiring officials, and current topics in the zoo and aquarium field.

Join AMZAP

Our mission is very specifically to increase racial / ethnic minority representation in the zoo and aquarium field. But our membership is not limited to minorities. AMZAP is always interested in adding members who are invested in helping us achieve our mission regardless of race or ethnicity. We welcome members of any racial and ethnic background, including white people.

While we do have the singular focus of race / ethnicity, we also recognize and appreciate that there are many groups of people who have a desire to be heard. AMZAP has members of racial / ethnic minority background who also happen to be members of other communities, including the LGBTQ+ community and people with disabilities. Our members also hold various positions including animal care, conservation education, human resources, research, information technologies, and more. Becoming an AMZAP member has no monetary cost. AMZAP has two membership categories, professional members and affiliate members.

Professional Members: Prospective professional members must be full-time employees of an accredited zoo, aquarium, or exotic wildlife facilities. Temporary full-time employees (e.g., seasonal or temporary keepers, veterinary residents, post-doctoral fellows, etc.) are included in this criterion. Professional members are invited to join our closed Facebook groups, attend monthly member meetings, participate as mentors in our mentorship program, and learn about other opportunities including grants, scholarships, and sponsored memberships. Professional members are also listed on our website and may be featured on our social media platforms.

Affiliate Members: Prospective affiliate members fill many different categories. They may be students, current or former interns, current or former volunteers, former zoo or aquarium professionals, current employees at an unaccredited zoo or aquarium, or just anyone who may be interested in a career in the zoo or aquarium field. Affiliate members are invited to join our closed Facebook groups, attend monthly member meetings, and participate as mentees in our mentorship program.

To apply to become a member of AMZAP, visit our website at amzap.org and fill out the appropriate application. Membership is free of cost.

Support Organizations

AMZAP also works with support organizations, categorized as supporting zoos and aquariums, academic support organizations, and supporting zoo affiliates such as the American Association of Zoo Keepers (AAZK), the Elephant Managers Association (EMA), Association of Zoos and Aquariums (AZA) and Zoological Association of America (ZAA).

If you are a part of an organization that would like to support AMZAP, please encourage them to visit our website or contact us at email.amzap@gmail.com. There is no monetary cost to become a support organization. We ask that interested partners allow their staff the time to participate in AMZAP and demonstrate their public support by allowing AMZAP to post their logo on our website.

Conclusion

AMZAP is thrilled with the response from the zoo and aquarium community so far- we have over 200 members and more than 40 support organizations. AMZAP has many plans for the

future, but we can't accomplish them without your help. Please consider becoming a member, share our information with colleagues, and follow us on social media for updates. You can visit www.amzap.org, the Association of Minority Zoo and Aquarium Professionals on Facebook and LinkedIn, or amzap_official on Instagram to learn more. If you have any questions, thoughts, ideas, or suggestions, please write to us at email.amzap@gmail.com. We're excited to see what we can accomplish in the future!

Mob Mentality

From an unsuccessful introduction to the successful birth of four Meerkat (Suricata Suricata) pups.

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On October 10th, 2019 we introduced two Meerkat females to our two males, Maral and Tebogo. The females came on a breeding recommendation from the Species Survival Plan (SSP). Flower and Sandy were sisters and had lived together at their former institution. Things were going fairly smoothly for the first week and then the females started fighting. Being matriarchal, we wanted to give them a chance to figure out which female would ultimately rule the mob. Unfortunately, after the second week together both Flower and Tebogo sustained injuries that required medical treatment. Tebogo had a bad puncture wound to his head and he had to have one of his incisors removed. Flower had several wounds and had to have the tip of her tail amputated due to the severity of the injury. While the mob was separated, we started to research how to put the mob back together. I found an old article in a 2015 AAZK Forum that talked about Meerkat aggression and reintroductions. It was from the Lincoln Park Zoo and it was called the Circle of Love (Gossett & Gillespie, 2015).

We tried to mimic what they had done successfully for their mob. Sandy (the main aggressor) was started on a low dose of Haloperidol to see if that would decrease her aggression towards Flower. All four Meerkats were caught up and all were seen by vet staff. The exhibit couldn't be stripped completely but all of the furniture was removed and sanitized. All of the sand was sprayed and deodorized to completely coat it. We sprayed perfume all over the exhibit and applied baby powder to the Meerkats themselves. After their vet checks were completed, all the Meerkats were placed in individual crates and placed in the circle of love for 24 hours. They could see and smell each other but no one had access to one another. After the 24 hours were up, all the furniture was loaded back in and a ton of enrichment was added to the exhibit. We let the Meerkats out and it seemed to be going okay at first but quickly escalated with aggression between the two females. Flower sustained a new injury that required the amputation of one of her back toes. Eventually, the mob had to be separated again. With help from the SSP, we decided to try a desloreloin implant with Sandy to see if it would decrease her hormone levels enough for Flower to take the matriarch position. In the meantime, a howdy was set up in the meerkat exhibit for Sandy. We wanted to make sure they would always have visual access to each other. After the implant, we tried several more times to reintroduce the mob with no success. The decision was made to rehome Sandy. The plan was to keep the howdy set up until she could be rehomed, but, unfortunately, the females proved to be resourceful and kept gaining access to each other. We had to make the difficult choice to manage Sandy as an individual.

Knowing how social Meerkats are and how complex their social structure is we were definitely concerned for Sandy's welfare. After a few weeks, it was clear her demeanor was becoming depressed and she wasn't eating well. A plan was devised that once a week Flower would be crated and removed from the exhibit to give Sandy a chance to interact with the two males. This

seemed to do wonders for her demeanor. It only lasted for a few weeks because we found out Flower was pregnant. We didn't want to risk the stress to Flower by being in a crate while Sandy had her play time. Luckily, other modifications were able to be made to Sandy's home while waiting for her placement from the SSP.

Meanwhile, Flower had 3 pups born on February 13th ,2020. The first few days were a learning curve for us all. We had a nice den box equipped with a camera that we thought Flower would use to give birth. However, she chose to give birth in a corrugated tube and subsequently kept the pups in the tube. All three adults seemed unsettled and kept moving the pups around the exhibit. We were trying to follow the Meerkat AZA husbandry manual, which suggests leaving the mob alone for 48 hours so we hoped they would figure out a place to settle. The next morning, one of the pups had sadly passed away. The group still seemed unsettled and they were moving the remaining two pups all around the exhibit. We became worried for the welfare of the remaining pups and decided to intervene before the 48 hours were up. I had the idea to try to mimic their natural underground borrow system. Since the fix needed to be fairly immediate, all I had on hand was a cardboard box and a cardboard tube. The structure with a blanket was added into the exhibit and, thankfully, Flower moved the pups right into the box. They spent the first several weeks of their lives in that box. Once they had a secure spot, the new mob of 5 settled in nicely. Since female meerkats have a post-parturition estrus cycle, Flower had 2 more healthy pups born on May 6th ,2020! This time we were more prepared and had a larger man-made den box set up for them. Sandy got her own breeding recommendation and went to the Oakland Zoo. She joined a mob of three males and we know she'll make a great matriarch. While our initial plan for our Meerkat mob did not go as planned, we are thrilled that the end result was a good one.

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Counterconditioning in a Time Crunch: Creating Quality Connections with 0.2 Capybara *(Hydrochoerus hydrochaeris)*

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Abstract

Fresno Chaffee Zoo (FCZ) animal care staff successfully implemented a counterconditioning protocol in a highly constrained daily time period with 0.2 capybara. Upon arrival and for their first two years at FCZ, both capybaras maintained a large flight distance from staff and would not eat when staff were present.

Due to previous incidents of intraspecific aggression, the capybaras could only be offered food reinforcers during a forty-five-minute time block each afternoon when they were separated from each other in a small indoor holding space. During this time, staff needed to complete other end of day closing duties. At the beginning of the protocol, any approach would cause them to rapidly retreat to the back wall of the holding space.

We began by implementing a protocol where a trainer would drop one third of their diet into a bowl near the front of each capybara's holding space three times, instead of providing the food all at once. The trainer would then immediately walk away. This allowed us to care for other animals in the section. Due to the lack of flight distance and small number of reinforcement opportunities we did not have high hopes for success.

Surprising us all, it took less than one month for the capybaras to begin accepting food directly from the hands of certain trainers. This allowed us to build a quality connection through daily positive reinforcement training sessions. Each capybara rapidly progressed to touching a target pole with her nose and climbing voluntarily onto a scale.

Introduction

In December of 2017, five-month-old female capybaras Twix and Tootsie arrived at the Fresno Chaffee Zoo (FCZ) in Fresno, California from the Greater Vancouver Zoo in Aldergrove, British Columbia. In congruence with the Fresno Chaffee Zoo's mission of excellent animal welfare, we sought to build a positive human-animal relationship (HAR) to reduce stress during routine care and allow for positive reinforcement training of select medical husbandry behaviors.

Upon arrival, the capybaras would maintain a large flight distance from staff when possible and would not eat when staff were present. Unfortunately, this fearful behavior continued even as the capybaras settled into their new home. This meant that, unlike the other animals in the section, we were unable to provide the capybaras with positive reinforcement training sessions.

In January of 2018, FCZ staff implemented a desensitization protocol in an attempt to improve Twix and Tootsie's HAR. In this protocol, a trainer would sit for one consecutive hour holding out a long piece of leafy browse. This protocol was time consuming and ineffective. It was abandoned after six months with no progress.

In January of 2019, Twix and Tootsie were separated after an overnight incidence of intraspecific aggression. After a lengthy reintroduction process, the capybaras were successfully reunited. However, in order to avoid potential resource guarding, we began to separate them from each other for a 45-minute period each afternoon while they consumed their PM diet.

At the end of 2019, we came up with a plan that would allow us to build a positive human-animal relationship (HAR) within the unusual confines of their situation – a small holding space and very brief time period, during which staff members needed to perform other end of day closing duties.

Methods

At 3:40 p.m. each day, a trainer would open the shift door between the capybara exhibit and a small indoor holding space. Unfortunately, Twix and Tootsie at this time were not trained to shift in from their exhibit voluntarily. In order to bring them inside the trainer would walk onto exhibit and gently "herd" both capybaras into holding. Because Twix and Tootsie maintained a large flight distance from humans whenever possible, the trainer could easily move them by slowly walking toward the shift door.

Once inside, the capybaras would habitually separate into one of two rooms within their holding space. The trainer would then close the shift doors to separate them. Each room measured 9.5 feet in length by 6.5 feet in width and contained a food bowl as well as a bowl of drinking water, a water tub, and a dry tub for a bed. The food bowl was placed near the front mesh of the enclosure, where a trainer could easily drop food items inside.

Capybara Hand Feeding Plan

- 3:45- Separate capybaras. Each animal should have an empty bowl in their room. Drop their vegetables and chow in their bowls. Walk away.
- 4:00- Drop half of their lettuce in their bowls. Walk away.
- 4:15- Drop the other half of their lettuce in their bowls. Walk away.
- 4:30- Pull out all remaining food. Put capybaras back together. Give access to the outside if it's warm enough. Finish closing as normal.

Figure 1. Counterconditioning protocol implemented 11-14-2019.

As shown in Figure 1, the trainer would approach the mesh, drop part of Twix or Tootsie's diet into her food bowl, and then walk away. This was repeated three times. In the time between feeds the trainer would care for other animals in the section. Once Twix and Tootsie had enough time

to finish their food, the trainer would remove their food bowls and give the capybaras access to each other.

Results

When we first implemented the counterconditioning protocol, Twix and Tootsie would rapidly retreat to the back wall of their holding space as their trainer entered the building. However, as shown in Figure 2, they quickly progressed. In just a few days they began to wait at the bowl rather than move away at our approach. In less than one month, both capybaras were choosing to eat from our hands as we pushed the food through the mesh rather than wait for it to fall into the bowl.

Once we were able to directly provide food reinforcers to the capybaras, we began shaping for specific behaviors via differential reinforcement. Twix and Tootsie each rapidly mastered a protected contact "target" behavior – touching their muzzle to a rubber ball at the end of a stick held through the mesh at the front of their holding space. A trainer would then move the target during a session to lead them onto a stainless steel postal scale for a voluntary weight measurement.

Timeline
07-24-2017 – Twix and Tootsie were born at the Greater Vancouver Zoo
12-05-2017 – Twix and Tootsie arrived at the Fresno Chaffee Zoo
11-14-2019 – Counterconditioning-based hand feeding protocol began
12-04-2019 – Twix and Tootsie began hand feeding from certain trainers
12-28-2019 – Trainers began shaping target and scale
01-01-2020 – First voluntary weight measurement

Figure 2. Timeline of events related to capybara HAR.

Twix and Tootsie are now confident, consistent participants in daily husbandry training sessions. Their flight distance has decreased both on exhibit and in holding, allowing us to perform routine animal care tasks without unnecessary stress. They are currently practicing a hand feeding behavior on exhibit that may someday become a part of a behind-the-scenes tour for select zoo guests.

Discussion

A positive human-animal relationship (HAR) has been found to produce measurable benefits for animals housed in zoological facilities. In fact, two separate studies published in *Applied Animal Behaviour Science* revealed impressive results – both using a model that measures the HAR of various animals and using that to successfully predict increased enclosure use in activity budgets and reduced fear behaviors toward humans (Claxton, 2011) (Melfi & Ward, 2013). The use of strategic counter-conditioning to establish a positive HAR with animals that currently display

fear, aggression, or avoidance behaviors toward humans may allow a drastic improvement of the quality of life for many animals housed in human care.

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

In Twix and Tootsie's care, simply dividing one meal into three allowed trainers to rapidly counter-condition a previously aversive stimulus (the presence of humans) by pairing it repeatedly with a reinforcer (food items). In just three weeks, this simple protocol provided a transformative opportunity to permanently shape their relationship with animal care staff. This was accomplished despite a small holding space with minimal opportunity for flight and a highly constrained time period.

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Hand Raising Ambassador Cheetahs in a Running and Outreach Program

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In the zoological field, we have seen a growing emergence in institutions who want to adopt felid ambassadors into their outreach and presentation departments. This comes at a time where we are learning more about the benefits of in-person animal encounters with our zoo visitors. Also seen is an emerging and growing body of best practices for felid care and ambassador handling. There are arising scientific studies to show objective behavioral and neurochemical data that support ambassador animals having optimal and naturalistic lifestyles (Swanson). One of the expanding ambassador programs across zoos is the addition and the bolstering of cheetah (Acinonyx jubatus) ambassador programs, and more specifically, cheetah running programs. Despite the challenges and time commitments to building an ambassador cheetah running program, the value and versatility are paramount. The number of inspired and educated visitors can break records and boundaries previously assumed by the "meet-and-greet" style of ambassador presenting.

The Cincinnati Zoo and Botanical Garden (CZBG) has been one of the pioneers of the cheetah running programs, and still stands to be one of three mentor institutions for new cheetah running programs. The founder of our program, Cathryn Hilker, started the Cincinnati Zoo's Cat Ambassador Program (CAP) in 1980 with the goal of giving the cheetahs more opportunities for naturalistic hunting behaviors while simultaneously allowing for a larger educational reach and a more dynamic presentation of their adaptations. Through the years CAP has successfully hand-raised 15 cheetah ambassadors and has grown a running program to include on-site running encounters in a specially designed yard, as well as two off-site running yards for conditioning and VIP events. Accolades of the program and their cheetahs include the setting of a new land-speed world record, and a state-of-the-art centerfold in *National Geographic.*

As a Senior Trainer for the Cincinnati Zoo's Cat Ambassador Program, I have had the unique opportunity to be a part of the hand-raising of five of our ambassador cheetahs. Utilizing that experience, I have outlined an overview of how CAP manages the physical, developmental, relationship building, training necessities and challenges of our cheetahs. It is my goal in this paper to best show and explain our process.

The decision for a cheetah to become an ambassador is most often made in situations of necessity. To understand this, it is important to note typical instinctual postpartum cheetah behavior. Cheetah dams generally have litters of two to six cubs and there is very heavy maternal involvement for the first 1.5 to 2 years (Marker et al. 121-126). It is hypothesised that because of this large investment of time, from an evolutionary standpoint, the stimulation of one cub, as opposed to multiple, is not enough to continue adequate milk production (344). Without a nursing cub, the dam has a better chance of going into estrus again, thus opening an opportunity for being bred again and producing a litter with more viable cubs. In addition to inadequate milk production and abandonment, there are instances of dams being unable to care for their cubs. Both situations would result in cub fatalities in the wild, but fortunately for cubs born in

zoological management, there are interventions that our animal care team can take to ensure healthy growth and development (344-345).

Like many facilities, at the CZBG we have a number of fantastic resources and expert staff for raising young animals. Our CAP team works closely with the members of the veterinary staff, the neonatal nursery, and the zoo's nutritionist to establish a plan best suited for each individual cheetah. We have a standard rearing protocol, but with the expertise of our team we can adjust for any unique need. During the beginning stages of the cheetah's time in the nursery, CAP's involvement is limited to the basic interactions for establishing relationships and desensitization for tactile stimulation and routine husbandry. The true focus for their time in the nursery, before coming to the CAP program permanently, is reaching physical and developmental milestones. It isn't until the cub is consistently eating solid food and routine vaccinations and quarantine are cleared that they are able to begin branching out to operant learning and ambassador training.

When training an ambassador animal, we generally strive to have an animal that is bold and curious, while also being aware of their surroundings and responding in safe ways to novel or unexpected stimuli. There are key aspects for building such behavior from our ambassadors, which are two prong. The first is constant introduction to novel stimuli under circumstances with controlled variables. This includes approximating situations, both sensory and in settings, and working through the basics of desensitization and habituation. The other is the focus on physical and social development and the importance of play behavior.

There is an integral part of the ambassador cub raising process that helps to facilitate all of the attributes outlined above, and that is a companion dog. CAP sees the cheetah companion dog not as a "security" or a "emotional support", but more as a surrogate sibling that allows the cub to be exploratory, energetic, and outgoing. As the cub expands their physical and developmental world, the companion dog allows the cheetah to engage in predator-play, evolves the cub's social cues, and most importantly, keeps the animal care staff separate from any exploratory carnivore behavior. We explain it to visitors, in almost oversimplified terms, that the dog and the cheetah "speak the same language". With that being said, however, the introduction of the companion dog to the cub is rarely a smooth one. We take very approximated steps to ensure that the pair is comfortable and confident around each other.

Once the cheetah has transitioned from the nursery to the CAP building, we begin our team's take over for all of the milestones and training involved in raising an ambassador cub. Much like the early weeks in the nursery, this time in the cub's life also requires continuous care and regimented scheduling. We try to uphold our commitment to AZA Accreditations Standards for ensuring adequate treatment and conditions for animals in educational programs (AZA,16-18). For our cheetah cubs, this involves 24-hour shifts, which we couple with our normal workday. The overnight care to ensure we are devoting enough time to the training and relationship building with the cub, and because our full-time staff only comprises four trainers, we find that scheduling requires flexibility and dedication. We purposely keep the staff that is responsible for hand raising to a minimum, to maintain consistency and communication through our small team. Each Cub Plan protocol ensures that we have a timeline and a clear plan for how we are training and socializing the cheetah (and dog) and allows us to stay communicative throughout this sometimes chaotic process. We have outlined duties and responsibilities during our evening

time working with the cub. Each of these duties allows for habituation, socialization, desensitization, exercise or facilitating general husbandry or husbandry behaviors.

As ambassadors for their species, and with public notoriety, our Ambassador animals have a heavy emphasis on their socialization and habituation to their environment. A cheetah cub with high play energy, acute awareness of visual and auditory stimuli and carnivore capacity means we emphasize appropriate play as well as routine and introduction of novel variables. The push toward a "bold and safely curious" ambassador cat continues to be a theme, and there is a shift for the emphasis to bolster into programs for the public, and an introduction to our running yard and encounter space. With growing muscles, increased endurance, and coordination acuity (largely attributed to the play interactions with the companion dog), we can also start conditioning training for running on our lure system.

One of the cornerstones of CAP is our running program. It allows our cheetahs to be physically and sensory stimulated, as well as keeping in line with species' appropriate behaviors and a realization and actuation of the cheetah's instincts. There are numerous health, wellness, and cognitive benefits to a running program and we consider ourselves lucky to have it be ingrained in our Ambassador Cheetahs' lives. In the wild, cheetah mothers would spend between 1.5 to 2 years with their cubs, teaching them the intricacies and skill sets to hunting (Caro and Hauser 151-174), so it is something that we, too, take as an intentional and steady learning experience. Similar to a teaser toy, we facilitate agility by using a stick and rope with a wiffleball attached to entice sharp turns and accuracy when running, as well as build motor skills.

Once we have unlocked and exercised the natural instincts of the cheetah and aligned it with how the cat will be expressing those instincts with our resources at CZBG, it is time to begin operant learning that is involved with training our cheetahs to become running ambassadors. This includes release and recall cues for before and after lure coursing with the cats. Because we are often doing runs for public presentations, the habituation and desensitization of any disruptions or variables that are beyond our control is a very important step in training as well (i.e., disruptive audience members, a helicopter flying low, or even sudden changes in weather). As with all of our training, we are cognizant of our approximations and we also try our best to keep true to the animals natural behaviors. Understanding the behavior of a cheetah's hunting style, chase, catch, and prey response is paramount to our ability to be successful as a running program.

Each cheetah in our program has a different running style, speed, and veracity with the lure. There have been previous publications and presentations, made by my colleagues, that explain in greater detail the nuances of the adolescent cheetah run training. Lead TrainerLinda Castaneda spoke on the specifics of strategies and challenges related to our lure system and the way our cheetahs learn to run the lure course (Castaneda, 11–13). Additionally, no one quite explains the first runs of an ambassador cheetah better than our founder, Cathryn Hilker, in a video entitled "Tommy T.'s First Lure-Cincinnati Zoo" on youtube.com (CincinnatiZooTube, 2009).

The cheetahs in the CAP are multifaceted and often excel with both on-grounds and off-grounds programming. In addition to training a cued running behavior that we exhibit to facilitate visitor experiences on-grounds, we also dedicate time to using positive associations and habituation to appearances in off-grounds zoo sanctioned functions and educational venues. Our relationship

building and training leading up to this point in our ambassador's life makes for a smooth transition for these appearances. Having invested heavily in those aspects of training, coupled with our focus on developing a bold and safely curious ambassador cheetah, allows for the animals to focus on the training staff and their own comfort rather than variables and novelties in the environment that may be disruptive.

As recapitulation, the CAP staff strive to have our ambassador cheetahs be intentionally multifaceted; both for their role in representing their species to our zoo visitors, but also for their betterment and welfare. Our success over the years is due to the investment of our team, and also the trust and investment from our management. Our small staff keeps everyone on the same page, and we are all ready and willing for the time and energy that go into the beginnings of this journey. We are also careful to understand each animal as an individual and that there is no "cookie cutter" protocol. In addition, our cheetah companion dogs allow for a great deal of boundaries to be set, as well as allowing for integral play and developmental behavior. We have been able to do amazing things and reach countless people with our ambassador cheetahs, and our hope is to continue to do so well into the future.

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Food preference and nutritional composition in captive Squirrel Monkey (*Saimiri boliviensis*)

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Introduction.

In nature, the Squirrel Monkey (*Saimiri boliviensis*) mainly consumes fruits, insects, small vertebrates, and other items (flowers, seeds). In fruitless conditions, nectar could represent the third part of its diet. (Soini, 1986; Rowe, 1996).

Individuals of the Genus *Saimiri* weight between 1 and 3kg (Defler, 2010). The average weight for males and females *S. boliviensis* is 1,015g and 700g respectively. On average, the weight for this species is 857.5g. (Pastor (1998) adapted from Ford y Davis (1992)).

Research on wildlife has proven difficult when trying to identify the food and quantities that primates consume. In captivity, there are more conditions to control this situation. This reality supports the reason why captive animals are better subjects when conducting nutritional research (Kreigenhofer, 2017). A better understanding of the nutritional needs for squirrel monkey could help other species such as *Callitrichidae* since the genus *Saimiri* is used as a feed model for them (Bairrão *et al*. 2010).

The goal of this project was to determine the nutritional intake in captivity of the squirrel monkey. This value was determined based on the food intake of each ingredient and its nutritional values reported. In addition, determining the food intake makes possible to estimate the ingredients preference and it's in relationship to body weight.

Materials and methodology.

The present research was developed at the Wildlife Rehab Center "Amazon Shelter" in Puerto Maldonado, in the Peruvian forest for five continuous days in April 2021 during the wet season.

Three juvenile squirrel monkeys from the same conditions were evaluated. Their weights were 500g, 380g and 350g, with an average weight of 410g.

Table 1 shows the diet offered to each individual. It was composed of fruits (papaya, mandarin, cucumber fruit, pear, banana, and grape), vegetables (bean, raw carrot, and green beans), greens (chard and lettuce), and others items (dog food and cooked egg).

Table 1. Diet offered to the *Saimiri boliviensis*.

Ingredients	Average per day (g)
Papaya	40.0
Mandarin	50.0
Cucumber fruit	70.0
Chard	15.0
Pear	35.0
Lettuce	15.0
Bean	20.0
Raw carrot	20.0
Banana	20.0
Grape	20.0
Green beans	20.0
Dog Food	10.0
Cooked egg	4.0
TOTAL	**339.0**

Table 2 illustrates the nutritional values of the diet offered to squirrel monkey. It is estimated that the diet offers 12.92% of crude protein, 3.68% of gross fat, 5.99% of crude fiber, 159.93mg of vitamin C, and 566.87kcal among other nutrients.

Table 2. Nutritional values of the offered diet.

Macronutrients		Minerals		Vitamins	
%Crude protein	12.92	Ca(mg)	191.44	A (ug)	566.87
%Gross fat	3.68	P(mg)	166.25	B1 (mg)	0.37
%Crud fiber	5.99	Zn(mg)	0.88	B2 (mg)	0.48
%Ashes	5.41	Fe(mg)	4.42	B3 (mg)	3.00
%Carbohydrates	72.00	Energy (kcal)	566.87	C (mg)	159.93

Diets were prepared twice per day. The first diet was prepared at 0800h, then delivered to the enclosure. The second diet was prepared at 1400h. In both cases, each ingredient was weighed individually.

The leftovers of both diets were colected and weighed at 1600h. Each ingredient was separated individually and then weighed on a scale to determine how much food was not eaten by the three individuals.

The nutritional values of the offered and consumed diets were estimated using the individual nutritional information of each ingredient from the "Peruvian Nutrient Composition Table" (Peruvian Health Ministry, 2009).

Results and discussion.

The food consumption of the three individuals on average was 820.6g per day, having 849.0g and 796.0g as the peaks of the highest and lowest intake days respectively. This is shown in Table 3 where it is possible to identify the consumption of each ingredient individually on average per day.

Table 3. Diet consumed by the *Saimiri boliviensis*.

Ingredients	Average per day (g)
Papaya	107.0
Mandarin	95.2
Cucumber fruit	135.0
Chard	38.0
Pear	105.0
Lettuce	42.6
Bean	56.6
Raw carrot	59.2
Banana	44.2
Grape	55.2
Green beans	40.6
Dog Food	30.0
Cooked egg	12.0
TOTAL	**820.6**

Preferred diet items, which were determined by consumption, were cucumber fruit, papaya, pear, and mandarin, representing the 16.5, 13.0, 12.8, and 11.6% respectively. This indicated that the main part consumed were fruits, which coincide with the natural behavior of the species.

Table 4 shows the nutritional values estimated as result of the ingredients consumed. On average, each individual consumed 14.45 and 4.68% of crude protein and gross fat respectively, which was inside the range recommended by references (NRC, 1978; NRC, 2003; Wolfe Coote, 2005). On the other hand, the consumption of vitamin C

was 138.03mg, which was also inside the range of 110-170mg recommended by NRC (2003). In addition, the ratio Ca:P consumed was 1:1.

Table 4. Nutritional values of the consumed diet.

Macronutrients		Minerals		Vitamins	
%Crude protein	14.45	Ca(mg)	171.94	A (ug)	601.83
%Gross fat	4.68	P(mg)	171.85	B1 (mg)	0.36
%Crud fiber	5.71	Zn(mg)	0.93	B2 (mg)	0.44
%Ashes	5.36	Fe(mg)	4.26	B3 (mg)	2.71
%Carbohydrates	69.81	Energy (kcal)	129.46	C (mg)	138.03

The mean body weight of the juvenile individuals in this research was 410.0g. According to this, Pastor (1998) reported that *Saimiri boliviensis* has an average body weight of 857.5g as an adult.

The individual mean food intake was 273.53g on fresh matter basis (44.45g on dry matter basis). On fresh matter basis, this represented the 66.7% of its body weight (10.8% on dry matter basis). Two explanations arise. First, as they were juveniles and a very active species, they might need to cover greater calories requirements. Second, in this enclosure, they usually were stimulated when there were visitors on the Center.

Conclusions.

Saimiri boliviensis is a primate species that primarily consumes fruits. According to this, in this research, its food consumption was mainly represented by fruits.

The consumed diet under evaluation covers some of the nutritional recommendations for captive *Saimiri boliviensis* as crude protein, gross fat, and vitamin C. Its intake related to the body weight was high, but it could be understood because of the age and activity of these individuals.

This diet could be used as model for other captive primates. Nevertheless, more research is needed for a better understanding of its correct feeding and nutrition in captivity. Also, it would help other species of captive neotropical primates.

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Improving Maned Wolf Health Management through Scat Observation & Scoring

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Front Royal, VA

Introduction

This paper is taken from the author's capstone, *Improving Maned Wolf Health Management through Scat Observation & Scoring,* completed in July of 2019 at Unity College under the direction of Dr. Brent Bibles and in conjunction with former Carnivore Curator Juan Rodriguez at the Smithsonian Conservation Biology Institute.

The Maned Wolf Species Survival Plan (MWSSP) suggested developing a fecal scoring card for Maned wolves (*Chrysocyon brachyurus)*. The MWSSP made this request for several reasons. Future Maned wolf research requires standard benchmarks that work across all facilities housing Maned wolves. Researchers and zookeepers agree Maned wolves in captivity become easily distressed and experience many health complications (Miller & Fowler, 2011; Aitken-Palmer et al., 2016; Hinton et al., 2017: Zdilla et al., 2012). Maned wolf diets vary both in the wild and across zoos and research facilities (Miller & Fowler, 2011), and the lack of standard diets or standard fecal scoring makes assessing care difficult. Maned wolves are the most challenging canid species to care for in captivity due to their sensitivities (Zdilla et al., 2012, p. 23-25). They have many health issues, which usually are stomach and gastrointestinal in nature, along with some urinary issues as well (Zdilla et al., 2012, p. 30-31). Each of these reasons contributed to the request made by the MWSSP.

Value of Observational Health Assessments

Experts prefer observational and less invasive procedures like fecal scoring to assess wolf health because the species is temperamental (Miller & Fowler, 2011). Maned wolves are anesthetized, but drug dispensing methods may cause damage to the animal (Miller & Fowler, 2011). Maned wolf long bones can be broken with darts, and darts can also cause bruising, so many facilities prefer using oral relaxants followed by hand-injection for tranquilization (Miller & Fowler, 2011). However, wolves might become violent toward humans attempting sedation by hand, which can also cause issues administering anesthesia when avoiding darts (Miller & Fowler, 2011). These complications often require keepers and veterinarians to choose other methods for health assessment, such as scat scoring and behavioral observation (Miller & Fowler, 2011). For example, squeeze cages and Y poles can hold the animals, but stressful capture methods may also create issues (Miller & Fowler, 2011). Complex care requirements illustrate clear reasons the MWSSP desires a standardized fecal scoring sheet.

In domesticated canids, fecal scoring is a standard of care. About 90% of dogs seen by health providers have vomiting and diarrhea symptoms (Rychlik, 2012). These symptoms are also

found in Maned wolves without any other clinical symptoms. Domestic dogs with chronic bowel inflammation, and no other health issues, participated in a study determining whether a correlation existed between the activity index, histopathic grades, and health (Mccann, 2007). In that study, fecal scoring played a key role (Mccann, 2007). Veterinarians use fecal scoring systems to analyze domestic canid fecal samples, as depicted in Figure 1. The MWSSP requested creating a similar system to promote further research and a better understanding of Maned wolf health management.

Maned wolves have varied fecal types ranging from cowpat-types to normal looking dog-like stools, and different scat types can signal illness. Domestic dogs are distantly related to Maned wolves (Tiffany, 2016). Veterinarians use fecal scoring methodologies on domestic dogs, and the same methods can work for Maned wolves in human care as well (Greco, n. d.). In 2004, a group of domestic animal veterinarians founded an international group to study why inflammatory bowel disease is so prevalent in pets (Washabau et al, 2010).

Figure 1. This is an example of a fecal scoring system from the *Quick Resource Guide* for Diagnosis and Dietary Management of Gastrointestinal Disease produced in conjunction with Purina Veterinary Diets (Greco, n. d.).

The World Small Animal Veterinary Association (WSAVA) formulated standard tests performed to see if animals have Inflammatory Bowel Disease (IBD) or other diseases and deficiencies (Washabau et al, 2010). Changing diets of domestic dogs improved their inflammatory bowel disease (Cerquetella, 2010). One researcher studied dogs with no health issues to gain a deeper

understanding of why those dogs did not have any intestinal issues while others did (Mccann, 2007). Many canine scat scoring systems are standard in veterinary care (Waltham, n. d.; Greco, n. d.). Examples of these scoring systems are attached in Appendices D and E. Zoos and other facilities holding Maned wolves can easily carry over fecal scoring cards with minor adjustments since the animals are similar.

Need for Documentation

Before this project, no one had created a cross-facility standard regarding Maned wolf fecal scoring cards. Scientists want to perform more research on Maned wolf dietary needs, so providing the fecal scoring card assists zoos and research institutions keeping Maned wolves. Because of this, the MWSSP asked experts at the Smithsonian Conservation Biology Institute (SCBI) to create a standard fecal scoring card. The use of a standard would not require many changes for animal caregivers, who are already using some form of assessment. Many facilities use different, non-standard scales, so there is a lot of information, but the values do not match. If the wolf has issues ranging from constipation to diarrhea, and according to the scores, diet changes and treatments can be administered. Unfortunately, these different scales do not match up from one facility to another, so there is no recognized standard of Maned wolf fecal health.

The Smithsonian Conservation Biology Institute (SCBI) is a research facility in Front Royal, Virginia in conjunction with the National Zoo in Washington DC. SCBI was interested in helping with the fecal data sheet requested by the MWSSP, but SCBI did not have the manpower to do so. SCBI has the largest number of Maned wolves in human care, totaling 12 animals, and this may have contributed to the MWSSP asking for SCBI to create the scoring card.

History & Background of Maned Wolf Species

Maned wolves are a species of omnivore weighing 40-60 pounds and have approximately a 15-year lifespan (Zdilla et al., 2012, p. 6). Even though they are called wolves, they are a member of their own unique genus and species, *Chrysocyon brachyrus* (Smithsonian National, 2019). In the wild, Maned wolves travel long distances to find food and mates (Zdilla et al., 2012, p. 6). They are also known as the “fox on stilts” because they are the tallest canid species. Maned wolves can grow up to 36 inches tall (Zdilla et al., 2012, p. 6). Maned wolves are solitary except for breeding seasons or a mom with pups. Please see Appendix C for pictures of Maned wolves (Smithsonian National Zoo, 2019).

Wolves in the wild and in human care likely suffer from some pollutants introduced into their foods. For instance, a study by Kelly & Gobas (2001) found that, like persistent organic pollutants in water-based food chains, persistent organic pollutants can also be found in terrestrial-based food chains. In terrestrial-based food chains, these pollutants are taken in by plants and magnify exponentially up the food chain to accumulate most in the predators (Kelly & Gobas, 2001). This is documented in caribou and wolf species located in parts of Canada and the Arctic areas (Kelly & Gobas, 2001). It is possible that the findings of Kelly & Gobas (2001) may be extrapolated to other wolf species, such as Maned wolves. If this is the case with other omnivores, persistent organic pollutants such as pesticides or other chemicals may end up in the Maned wolf food chain, especially if they have access to live prey in their range who may have

been exposed to such chemicals. Pollutants may then magnify in intestinal systems, contributing to Maned wolf intestinal issues, but this possibility has not been tested.

Out of all the canids, humans have the best chance of successfully interceding on behalf of Maned wolves to keep them from becoming Vulnerable, Endangered, or Critically Endangered (Vie, Hilton-Taylor, & Stuart, 2009). Maned wolves still have a large enough population that human intervention now could slow or reverse their Near Threatened designation, which is not as severe as Vulnerable, Endangered, or Critically Endangered. The species designation infrastructure created by the International Union for the Conservation of Nature (IUCN) can be seen in Figure 2. It is much more difficult for humans to intercede once a species moves from Near Threatened to Threatened categories (Vie, Hilton-Taylor & Stuart, 2009).

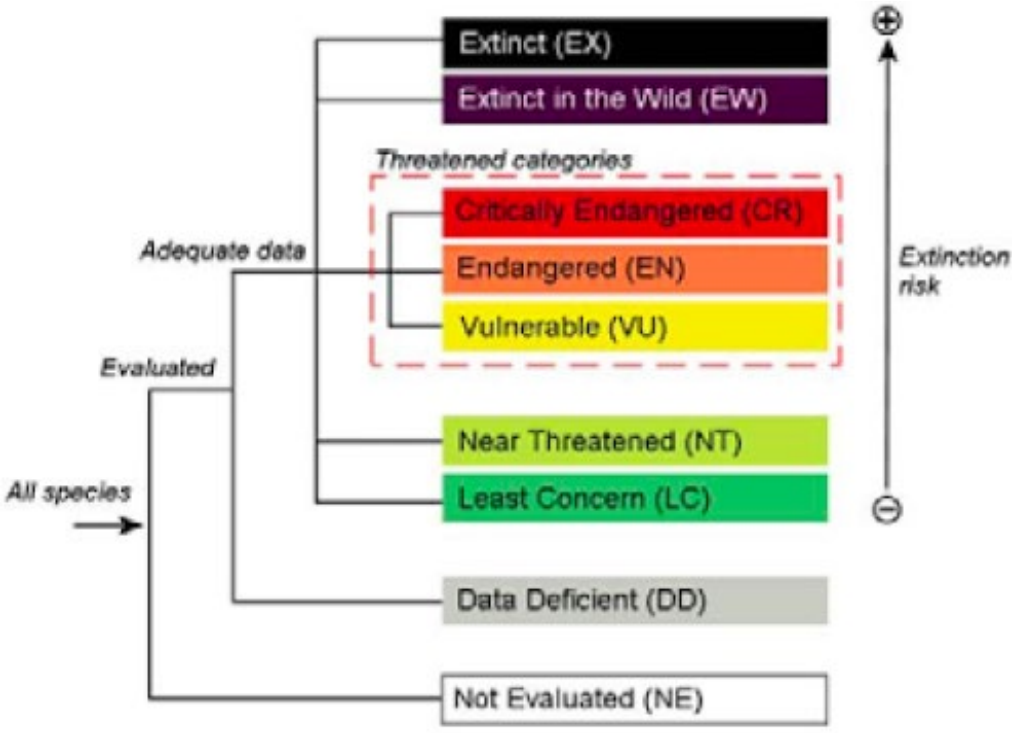

Figure 2. Near Threatened (NT) species status is shown in comparison to other designations from the IUCN. Structure of the Red List Categories (Vie, Hilton-Taylor, & Stuart, 2009).

Maned wolves are Near Threatened (NT) in the wild. NT status signals animal habitat destruction, so the species is threatened with extinction in the near future if habitat destruction continues (IUCN Red List of Threatened Species, 2019). Some criteria defining the Red List Categories are depicted in Figure 3. Due to Maned wolf NT status, humans have a better chance to save these animals and maintain wild population levels than with other branches of the canid species that have progressed to Red List status.

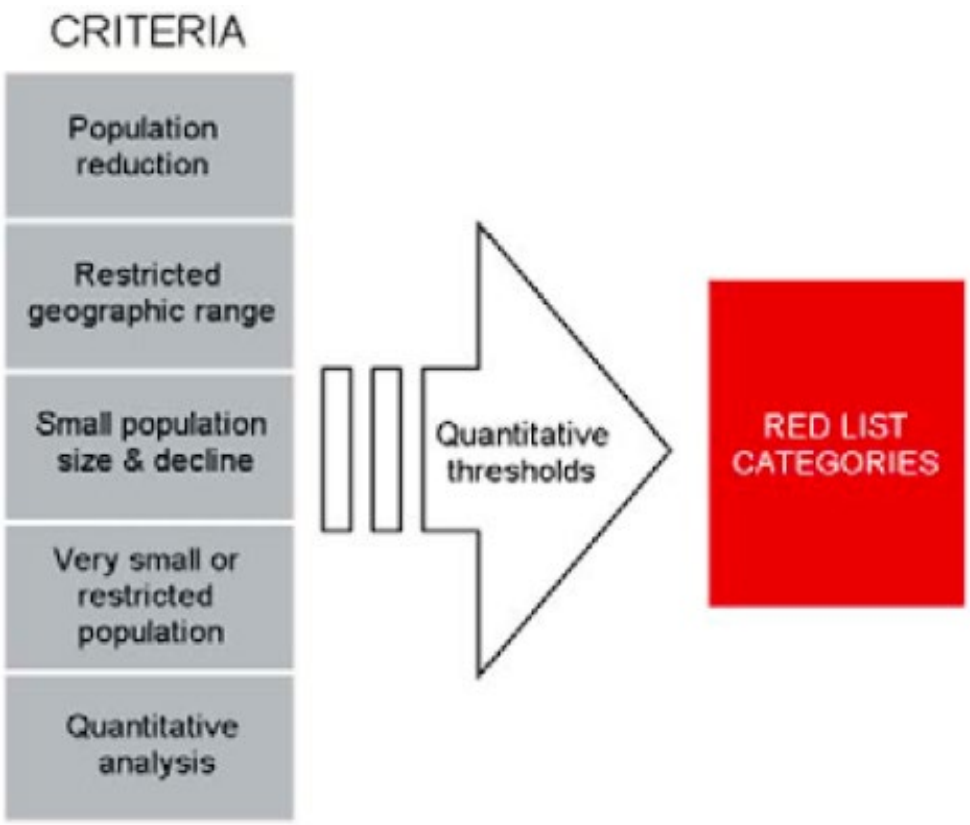

Figure 3. The Red List categories, or Threatened categories, define the events that designate animals as Threatened. Many of these have occurred for Maned wolves, but the quantitative analytical research is lacking (Vie, Hilton-Taylor, & Stuart, 2009).

The best way to save Maned wolves involves learning more about their needs and behaviors. To plan for healthy species continuation, Maned wolves in captivity are monitored and studied. The MWSSP is a committee of experts connected to the Association of Zoos and Aquariums (AZA). This group of experts who work together to maintain a healthy population in captivity, to enhance the lives of Maned wolves in captivity, to educate people about the study, and to study the Maned wolves through fieldwork and supporting fieldwork (Songsasen & Rodden, 2010). In many instances, species survival plans enable those managing the species to make the best genetic matches for breeding purposes, and to monitor diets, (Species Survival Plan Programs, n. d.). Each species has their own group of species-specific experts assigned to the SSP (Species Survival Plan Programs, n. d.). When the SSP meets, experts join and talk about different issues with their Maned wolves (Songsasen & Rodden, 2010). For years, the MWSSP has been trying to create a sheet guiding fecal scoring, but prior to the project, no standard fecal scoring guide was completed (Maned Wolf Species Survival Plan, 2019). Facilities housing Maned wolves were using their in-house scales, and these can vary depending on keeper and institution preference.

Presently, SCBI is considered a leader in Maned wolf care. SCBI houses so many Maned wolves, this gives a great database and resource for researchers to experiment with new medical procedures and diets. Maned wolves are the only canid species that are not obligate carnivores

(Zdilla et al., 2012, p. 28-30). They are omnivores eating a varied diet of small prey, such as birds, fish, reptiles, and rodents in addition to fruit and vegetables (Zdilla et al., 2012, p. 25-30). Since Maned wolves have a varied diet, their fecal changes with what they eat (Zdilla et al., 2012, p. 24-30). Most facilities give Maned wolves a mix of food types, so this can make Maned wolf feces change daily (Silva & Talamoni, 2003). Maned wolves also produce grass stools, which are being tracked in different studies to identify a trend or link to explain why they may or may not eat grass (Maned wolf Species Survival Plan, 2019). For instance, as with domestic dogs, Maned wolves may eat grass due to stomach concerns or to rid themselves of parasites (Maned Wolf Species Survival Plan, 2019). Creating the scoring sheet is one step towards improving both research and care for Maned wolves.

This project assists Maned wolf keepers to objectively rate Maned wolf stool and capture data for researcher use. This tool aids in animal overall healthcare assessment. Since so many facilities use such a variety of ways to score and have their own opinion of how Maned wolf stools should be scored, the lack of clear standards for fecal rating makes it challenging to figure out if the fecal sample in question is healthy or not. Providing this scoring sheet allows standards to be implemented directly from the Maned Wolf Species Survival Plan.

Project Objectives:

The objectives of this project were to:

1. Create a reference sheet guide, or scoring card, for scoring Maned wolf feces to establish a standard rating system across facilities similar to industry standards for domesticated canines.

2. Include pictures and descriptions to minimize scoring subjectivity.

3. Make identifying health concerns easier so that staff can objectively score a Maned wolf fecal using the proposed grading scale.

Since so many facilities may use a variety of different scoring systems that are not in the scope of this project report, the different scales are not readily available to be discussed. At this point, many facilities simply guess or use a scale one of their employees has created. For example, the Smithsonian National Zoo produced a fecal scoring card for Maned wolves in 2005, which is not currently in use at SCBI. However, this scoring card from 2005 does not meet the specifications required by the MWSSP. The MWSSP wants a 1-9 scale. The new rating scale is similar to standards used in canine fecal scoring. Examples of industry standard scoring cards for dogs are included in Appendix D. Please reference the Smithsonian National Zoo 2005 Maned wolf fecal scoring card in Appendix E. The lack of clear standards for fecal rating makes it harder to figure out if the fecal in question is healthy or not healthy in comparison to other facilities' populations of Maned wolves.

Methods

Phase 1 - Generation

Project perimeters were defined according to MWSSP and SCBI recommendations and guidelines. The guidelines given by the MWSSP and SCBI were that the fecal scoring card needed to be a standardized scale, originally 0-100 and later changed to 1-9, with accompanying identifying pictures. Neither the MWSSP nor SCBI gave detailed specifications and guidelines. After reviewing pertinent literature and examples, a standardized scale with examples was used to create a scoring card in alignment with the specifications of the MWSSP and SCBI.

Phase 2 - Planning

Discussions around expectations occurred with the SCBI Carnivore Team regarding final outcomes of the project. A project plan based on the expectations was created, which was to create a 1-9 fecal scoring card with pictures.

Phase 3 - Research, Data Gathering & Data Processing

The processes for the research and fieldwork were as follows: Photographs were taken of 400 different stool examples with of each sample. After attending the annual meeting with the MWSSP, the feedback confirmed the rating scale as 1-9, which had changed from the original project parameters.

After the 400 pictures were taken, the photos were sorted, the best approximations for the 1-9 scale were chosen. This scale aligns more with the continuum in canine veterinary care. Number one on the scale represents constipation dry stool, number five is healthy-formed cowpat, and number nine is liquid diarrhea. The scale is discussed more in depth in the results section.

Phase 4 - Production

In this phase, the fecal scoring sheet was taken from the original Google Sheet and exported to a pdf with the right sizing that can be used for printing purposes. As well, the original scoring sheet was translated to a Google Form linked to a Google Sheet. This Google Form can be accessed from most smartphones and devices. It can be duplicated if facilities want to gather all their own data. However, if each facility uses the same form every time they process a fecal score, all the data will go from the Google Form into a linked Google spreadsheet, which creates a universal Maned wolf fecal scoring database for researchers and zookeepers to use.

Results

To produce a more standardized method of assessing Maned wolf fecal samples in the field, a Maned wolf fecal scoring card was created. Four-hundred photographs were taken of Maned wolf fecal samples. Those photographs were sorted into 9 fecal categories, and the most representative and clear photo was chosen for each category. The following Figures 4 through 12 identify and illustrate the 9 categories of Maned wolf fecal samples.

Figure 4. This is an example of the first grade for the fecal scoring card. Animals producing these kinds of feces may be straining to defecate, and these animals may have issues needing further investigation assessing appropriate mitigation measures (J. Rodriguez, personal communication, 2019).

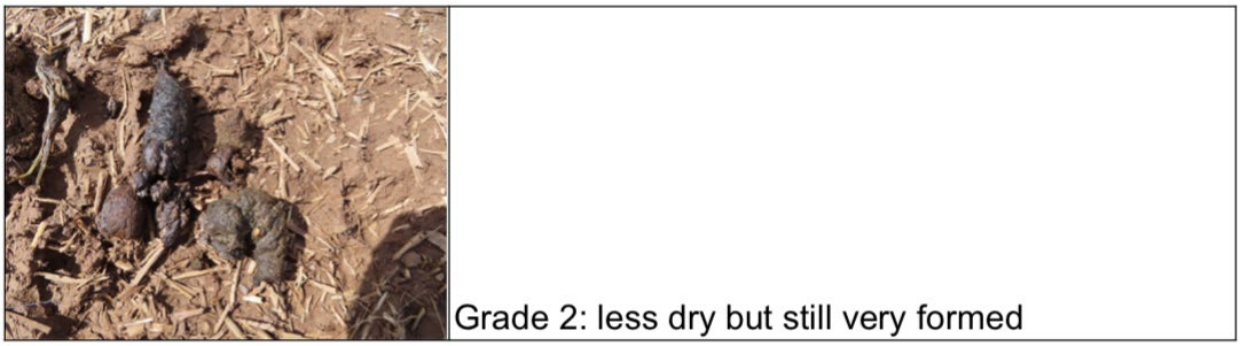

Figure 5. This is an example of the second grade for the fecal scoring card. Further investigation would be needed to determine illness or other causes (J. Rodriguez, personal communication, 2019).

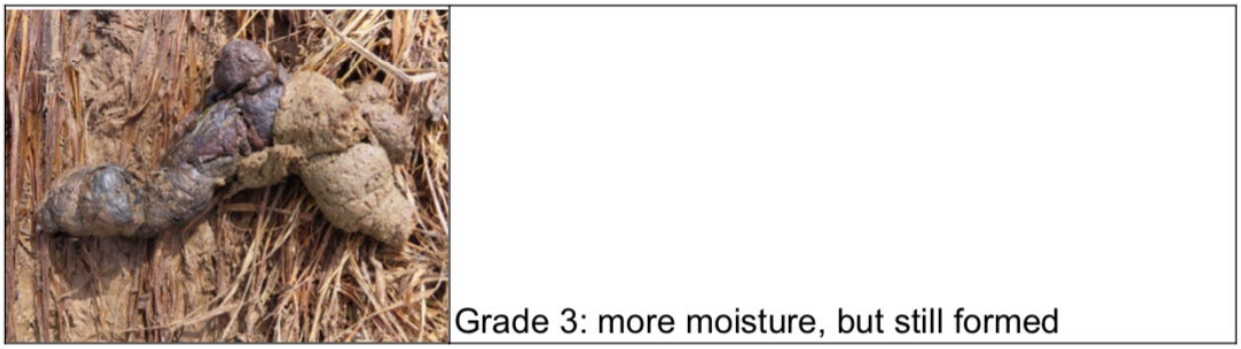

Figure 6. This is an example of the third grade for the fecal scoring card. This category marks a closer approximation to a standard fecal, and although there may be some digestion issues, they may not be as severe as Grade 1 and Grade 2 feces (J. Rodriguez, personal communication, 2019).

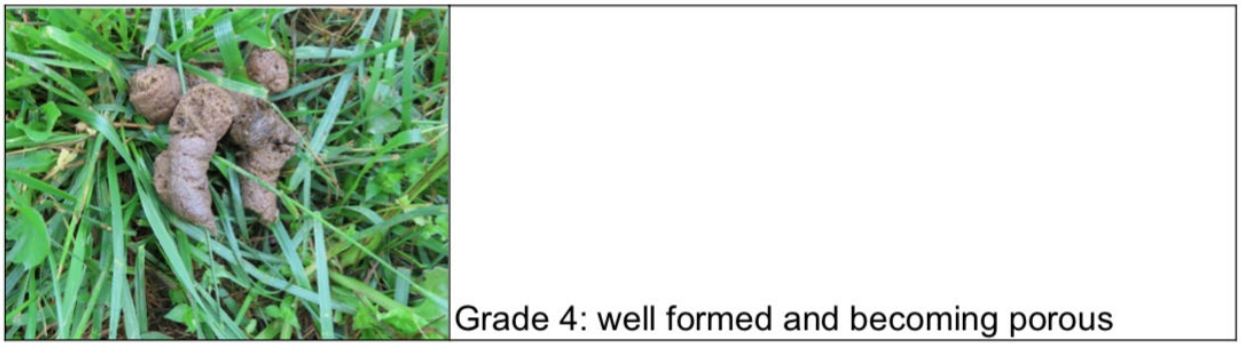

Figure 7. This is an example of the fourth grade for the fecal scoring card. This fecal is considered standard (J. Rodriguez, personal communication, 2019).

Figure 8. This is an example of the fifth grade of fecal for the fecal scoring card. This fecal is considered slightly less standard than grade 4 (J. Rodriguez, personal communication, 2019).

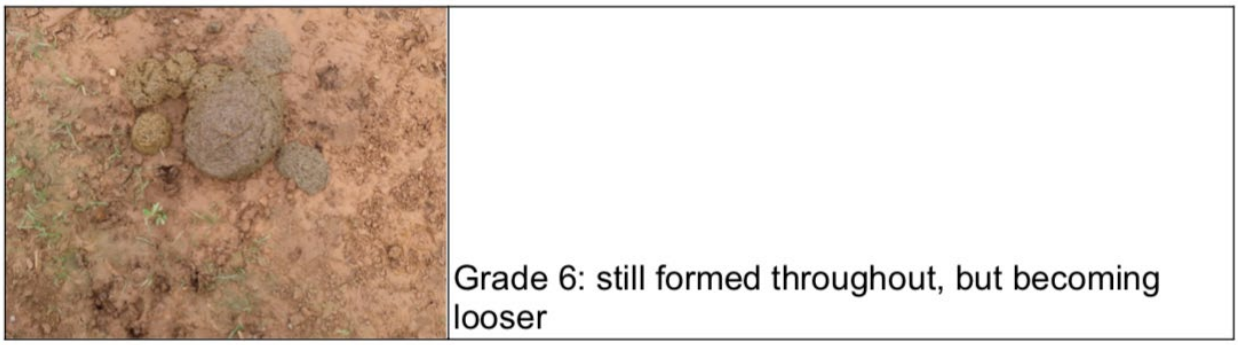

Figure 9. This is an example of the sixth grade for the fecal scoring card. (J. Rodriguez, personal communication, 2019).

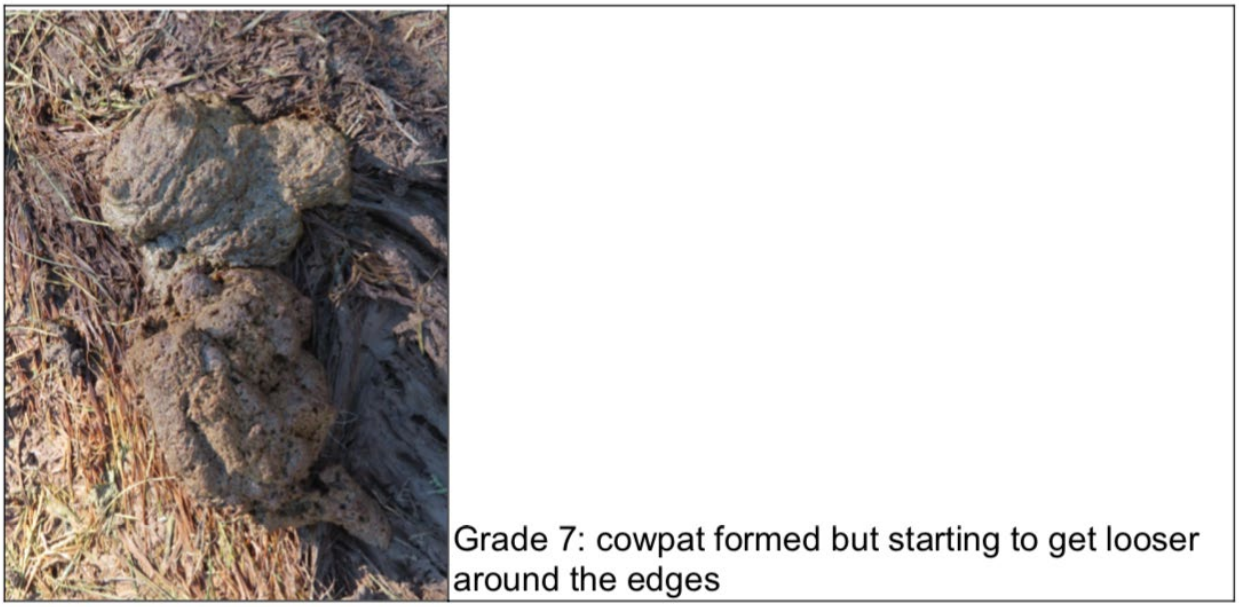

Figure 10. This is an example of the seventh grade for the fecal scoring card. This fecal can point toward possible health issues (J. Rodriguez, personal communication, 2019). Taking samples for analysis when seeing this kind of fecal could be a useful standard practice.

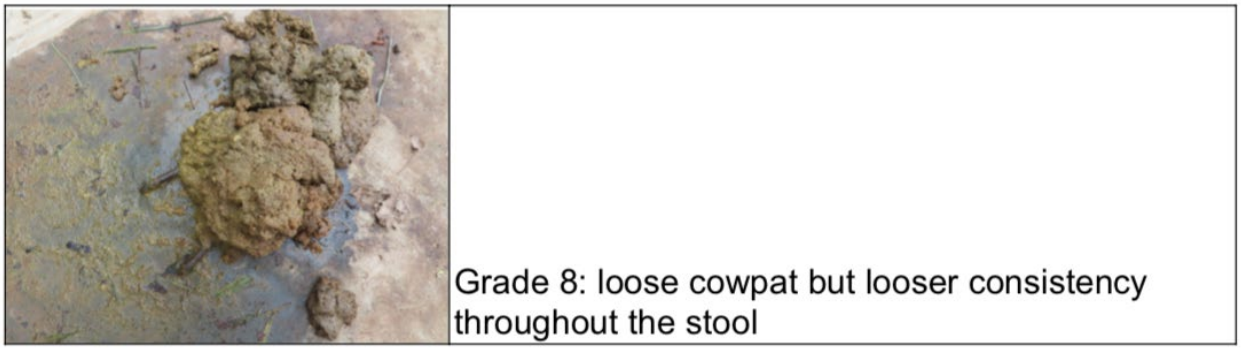

Figure 11. This is an example of the eighth grade for the fecal scoring card. Underlying causes for such loose stools should be investigated and monitored (J. Rodriguez, personal communication, 2019).

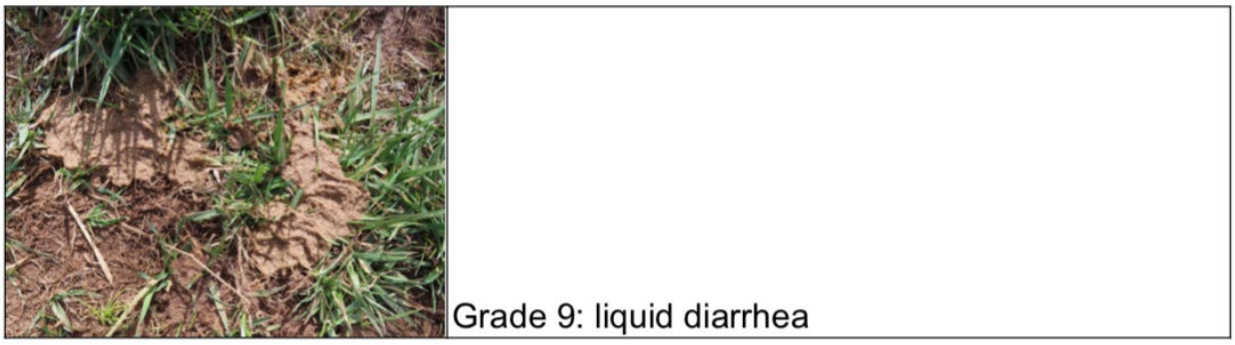

Figure 12. This is an example of the ninth grade for the fecal scoring card. Causes for this type of stool should be investigated, monitored, and mitigated if possible (J. Rodriguez, personal communication, 2019).

In addition to the fecal scoring card, further questions for useful data collection were added to the fecal scoring card. These questions include information about individual Maned wolf diets, medications, etcetera, in case those caring for and observing the wolves want to document additional reasons possibly contributing to the state of each fecal scored. Each of these questions can contribute to the quality of data collected from each fecal scoring. These sheets can be saved and collected for researchers to assess trends in diet and fecal scores over time. The additional questions include identification of the person taking the fecal score, the date and time of the fecal score, the animal designation (if available) for the Maned wolf having the fecal scored, the facility or location of the Maned wolf, the details about the diet one day previous and the day of the fecal score, and any pertinent medication details. See completed fecal scoring card in Appendix A.

In addition to creating the printable sheet, the Google Form with the same information as the printable sheet was created. The Google Form can be accessed from anywhere on most mobile devices, tablets, or computers and filled out. The information from the Google Form is automatically populated into a spreadsheet.

Discussion

The Maned wolf fecal scoring card gives zookeepers caring for and studying Maned wolves a chance to pool data-gathering resources using a standardized system. The results of the scoring card's initial creation are that experts have a direct and clear method to score fecal samples, and this directly affects the level of care Maned wolves receive. Research on these elusive creatures is sparse at best, and these tools provide a means to gather and access data. Data is a key component for keepers and researchers to better examine Maned wolf health care. They can measure diet effects on health over the long term as well as examining medical treatments and their effects on gastrointestinal health.

The Maned wolf fecal scoring card and Google Form-linked spreadsheet can greatly ease research data-gathering efforts. In future research, the data gathered from fecal scoring can be made available for analysis. The project can be monitored and updated periodically as directed by the MWSSP. These tools are flexible, editable, and easily reproducible. The fecal scoring card can be printed, or the person doing the fecal scoring can use the Google Form, and either method will allow zookeepers to generate standardized data every time they take a fecal score. The only required field in this Google Form is the fecal score, so if the keepers are assessing the fecal in a limited amount of time, they can just enter the score and go back and update the other information when they have more time. The data generated from the forms can allow researchers and scientists to go in and assess the data with different methods to test hypotheses about Maned wolf fecal scores and their connection to diet and medication changes.

Conclusion

Research facilities and zoos needed a fecal scoring sheet to assess the health of their Maned wolves. No standard benchmark scoring sheet existed before this project, and standards needed to be established according to the directives of the MWSSP. This project required building a fecal scoring card to help veterinarians and zookeepers determine the health of their Maned wolves in a more streamlined fashion. Because of Maned wolves' distant relation to domestic dogs, assessing their scat similarly to current veterinary standards may help unlock some of the issues currently observed in Maned wolves. Assessment through fecal scoring may allow professionals to alter Maned wolf diets and medical treatments accordingly. Since fecal scoring sheets made for other animal species were beneficial, the Maned Wolf Species Survival Plan, staff at the Smithsonian Conservation Biology Institute, and researchers in the field believe that a standard fecal scoring card for Maned wolves can also be successful. The outcomes and completion of this project was reported to the Carnivore Curator at SCBI. The use of the fecal scoring card in combination with the Google Form and Spreadsheet will allow observational data to be paired with medical tests to assess health and treat Maned wolves. Providing standard documentation tools establishes an important step to managing Maned wolf care across all facilities housing Maned wolves.

Carnivores of Asia and South America team: Ginger Eye, Tom Eyring, Marissa Gonzalez, Jessica Kordell, Chris Lemons, and Juan Rodriguez. The Management team at SCBI: Dr. Nucharin Songsasen (Head of the Center for Species Survival at SCBI/Maned Wolf SSP Coordinator, Paul Marinari Senior Curator at SCBI, Juan Rodriguez (former) Curator of Carnivores of Asia and South America

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Appendix A

Printable Maned wolf Fecal Scoring Card (front and back should be printed on landscape orientation)

Link to original google sheet document used to create the printable fecal scoring card in drive:

https://docs.google.com/spreadsheets/d/1RjWC3IpFxuIPyT8KUA4cakFK3IHmPUa0Qd46XabuCvU/edit?usp=sharing

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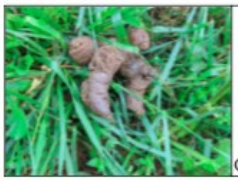
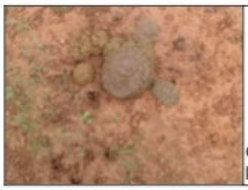
Front of Scoring Card

Maned Wolf Fecal Scoring Card - Printable Version

This scoring card should be used as a reference for keepers to score fecals of maned wolves.

Please enter your name or designation (not required):	
Please enter date and time of fecal score:	
What is the name or designation for the animal who's fecal score you're taking?	
What facility houses this wolf?	
Please enter details about the foods given on the day before scoring:	
Please enter details about the foods given the day the score was taken:	
Enter details about medications this animal has taken recently along with dosage and frequency information:	
Additional comments:	

Back of Scoring Card

Fecal Score	
Enter fecal score here and refer to pictures below.	
	Grade 1: very dry and formed easily picked up
	Grade 2: less dry but still very formed
	Grade 3: more moisture, but still formed
	Grade 4: well formed and becoming porous
	Grade 5: majorly formed with more moisture consistency
	Grade 6: still formed throughout, but becoming looser
	Grade 7: cowpat formed but starting to get looser around the edges
	Grade 8: loose cowpat but looser consistency throughout the stool
	Grade 9: liquid diarrhea

Link to printable document on Drive: https://docs.google.com/document/d/1aroNLlKnzo-kuSUHHu31X6ijwFKldnM-FWuKFR1VKok/edit?usp=sharing

Appendix B

Google Form

Link to form: https://docs.google.com/forms/d/e/1FAIpQLSfqdQbWhfKIIVZ-YrvfrBr9-joHqVT2iwjMtNgv0Yk0eCCE0w/viewform?usp=pp_url

Linked Google Spreadsheet

Link to Spreadsheet: https://docs.google.com/spreadsheets/d/12BPXOG2LK3PY2jkPBPCsDJgr-NWGBsH3GDXmLtQj3lc/edit?usp=sharing

Google form created for easy scoring on smartphone in the field.

Maned Wolf Fecal Scoring & Diet Monitor

This form has been created to capture data on maned wolf fecal scoring across facilities. This information will be used to provide better care for the animals and collect a body of data for analysis.

* Required

Email *

Your email

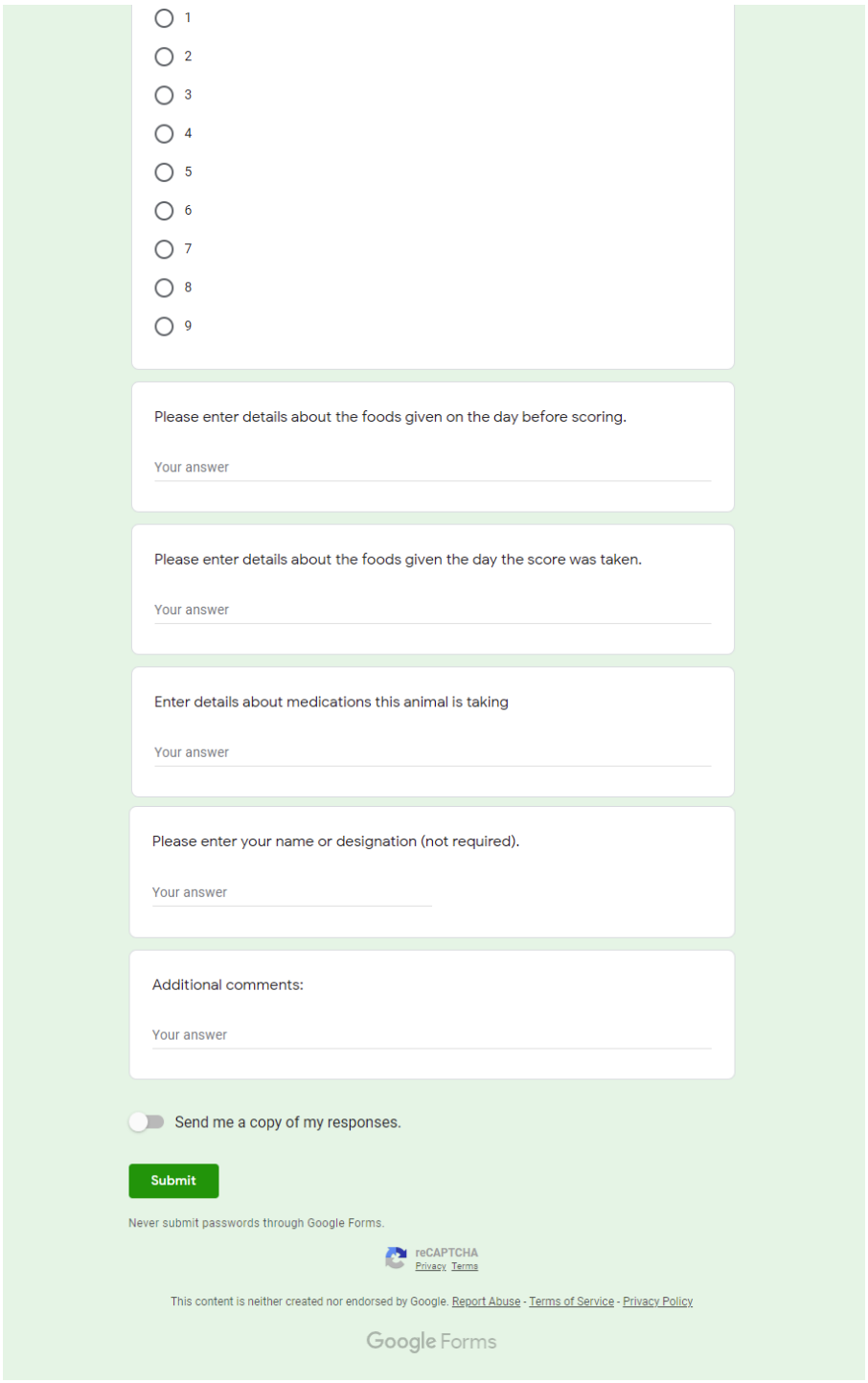
What is the name or designation for the animal who's fecal score you're taking?

Your answer

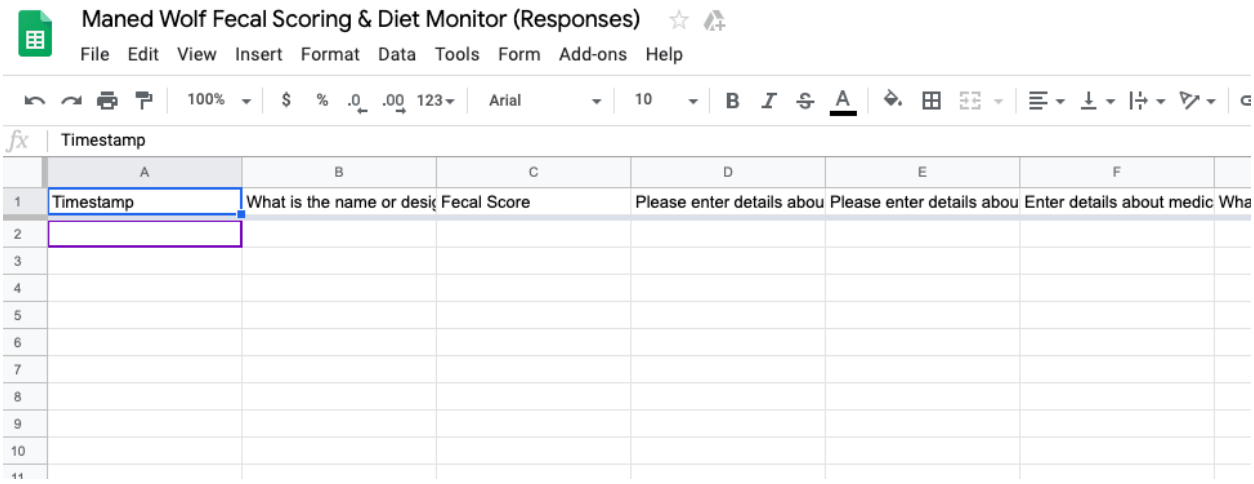
What facility houses this wolf?

Your answer

Fecal Score *

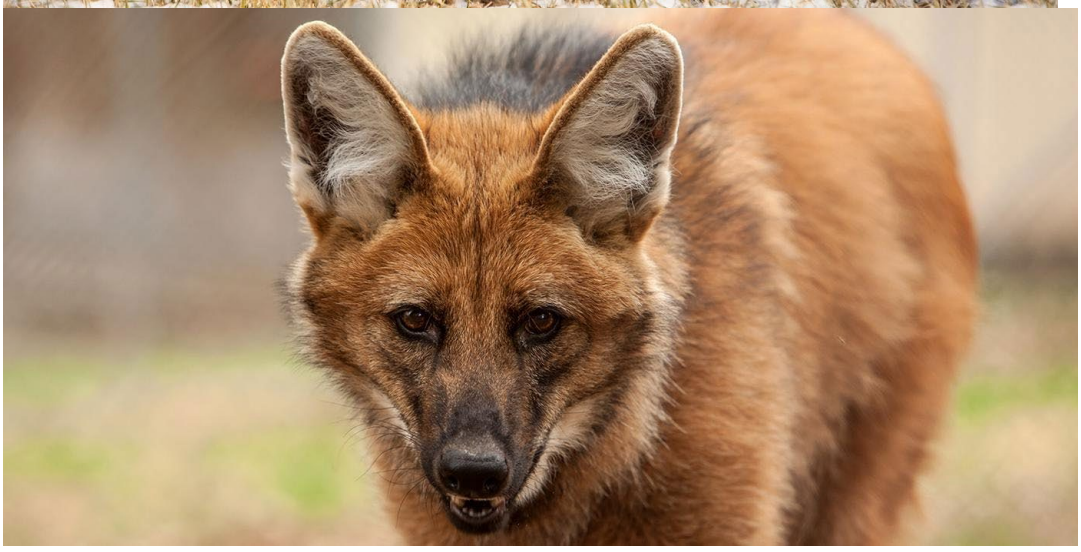

1
2
3
4
5
6
7
8
9
Please enter details about the foods given on the day before scoring.
Your answer
Please enter details about the foods given the day the score was taken.
Your answer
Enter details about medications this animal is taking
Your answer
Please enter your name or designation (not required).
Your answer
Additional comments:
Your answer
Send me a copy of my responses.
Submit
Never submit passwords through Google Forms.
reCAPTCHA
Privacy Terms
This content is neither created nor endorsed by Google. Report Abuse - Terms of Service - Privacy Policy
Google Forms

Google Form Reports to Spreadsheet:



Appendix C

Photos of Maned wolves



These photos came from the Smithsonian National Zoo website at https://nationalzoo.si.edu/animals/maned-wolf

Piacentino, S. (2021). Picture of Maned wolf (Chrysocyon brachyurus). Accessed in personal communication at http://www.facebook.com

Johnson, J. (2021). Picture of Maned wolf (Chrysocyon brachyurus). Accessed in personal communication at http://www.facebook.com

Whittington, B. (2021). Photo of Maned wolf in snow. Retrieved from personal communication on http://www.facebook.com.

Frace, A. (2021). Picture of Maned wolf sitting (Chrysocyon brachyurus). Accessed in personal communication at http://www.facebook.com

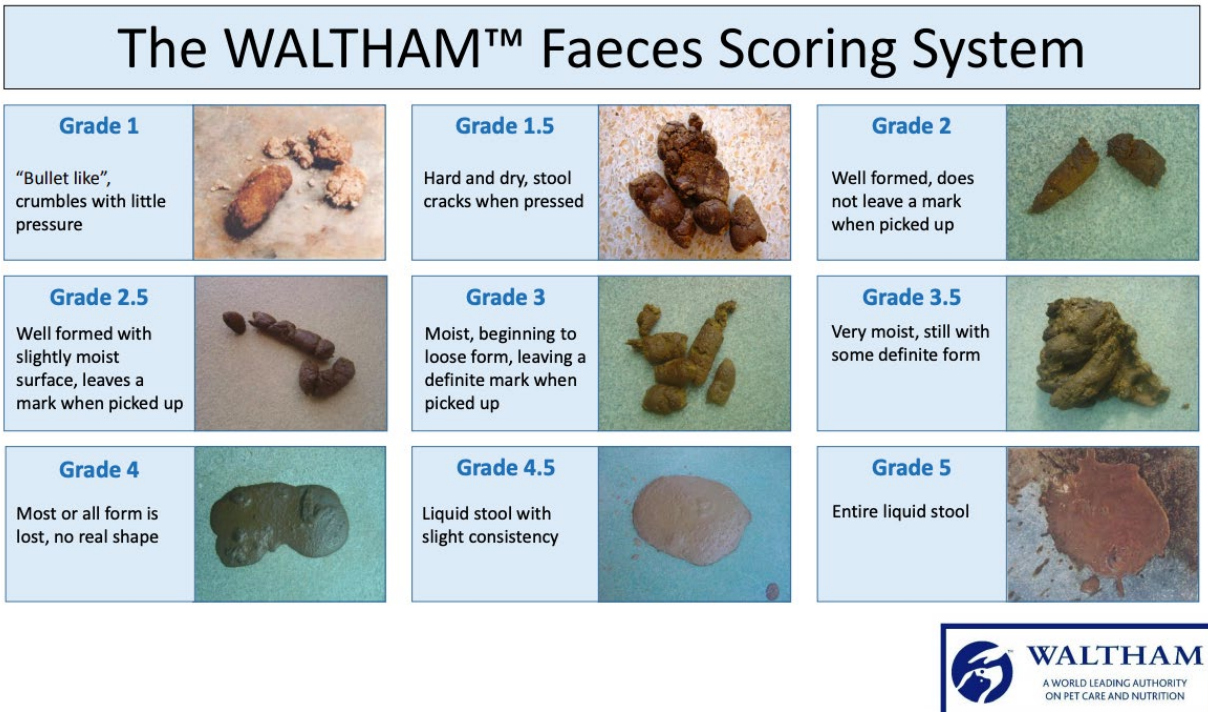
Frace, A. (2021). Picture of Maned wolf sitting (Chrysocyon brachyurus). Accessed in personal communication atwww.facebook.com

Appendix D

Veterinary Dog Fecal Scoring Card Examples

Purina ProPlan® Veterinary Diets RX Scoring Card:

The Waltham Feces Scoring System



Link to the Waltham System: https://www.waltham.com/dyn/_assets/_pdfs/other-resources/waltham-scoring.pdf

Appendix E

2005 Fecal Scoring Card for Maned wolves

Link to 2005 Fecal Scoring Card: https://nagonline.net/wp-content/uploads/2018/04/20061010_MWolfFecalConsistencyGuideline.pdf

Proyecto Paujil: A Keeper Initiated Research Project in Northern Colombia

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Introduction

The Blue-billed Curassow (*Crax alberti*) is a large, ground-dwelling bird species endemic to lowland tropical forests in Colombia. Known locally as 'El Paujil de pico azul', it is among the most threatened birds in all the Americas, with an estimated 2, 500 birds remaining in the wild. (BirdLife International 2016) Categorized as 'Critically Endangered' by the International Union for the Conservation of Nature (IUCN) (Figure 1), the species is primarily threatened by deforestation for mining, logging, agricultural expansion, and rapid urbanization but also faces hunting pressure from indigenous populations. (BirdLife International 2016, Carrillo 2016, CITES 2017, Delacour 1973, Fundación Pro Sierra Nevada de Santa Marta 1994, Quevedo 2004, Urueña 2006). Estimates have shown that Blue-billed Curassows have lost nearly 95% of their original habitat and, due to this tremendous loss, their current range is limited to several remnant forest patches in northern Colombia. (Carrillo 2016, Mello-Vásquez 2008) Not only does this species play an important part in the regeneration of tropical forests due to their role as seed dispersers but are also key biological indicators of overall environmental health due to their susceptibility to anthropogenic disturbances. (Delacour 1973, Fundación Pro Sierra Nevada de Santa Marta 1994, Jiménez 2003) A combination of continued habitat loss, population decline, and limited range have revealed the need to employ accurate, systematic surveying methods for this critically endangered species. As a zookeeper, conservation has always been close to my heart and a fascination for birds encouraged me to find a more hands-on way to contribute more to avian conservation efforts. Working closely with a pair of Blue-billed Curassows at the Phoenix Zoo nurtured a particular passion for the species and led to me pursuing this *in-situ* research project.

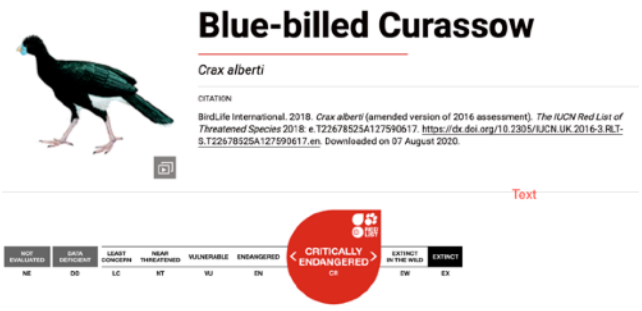

Figure 1: IUCN status of the Blue-billed Curassow

Background

The Sierra Nevada de Santa Marta is a mountainous range in the Caribbean region of northern Colombia (Figure 2). Independent from the Andean chain, it is the highest coastal mountain

range in the world, rising over 5, 500 m only 46 km from the Caribbean coastline and covering an area of approximately 17, 000 km^2. (Fundación Pro Sierra Nevada de Santa Marta 1994, Strewe 2004, Tribin 1999) A remarkable combination of ecological factors, along with its tropical location, have given rise to this biodiversity hotspot; over 3, 000 species of plants, 500 species of birds, 130 species of amphibians and reptiles, and 120 species of mammals have been documented within the mountains. With its unique blending of biological richness and isolation from other nearby mountain ranges, a very high level of endemism occurs; approximately 60% of all reptile and amphibian, 3% of all bird, and 2% of all mammal species that occur in the mountains are endemic. (Tribin 1999) This coastal range and surrounding lowland forests contain numerous undisturbed forest patches that are thought to support some of the largest remaining populations of Blue-billed Curassows in the wild.

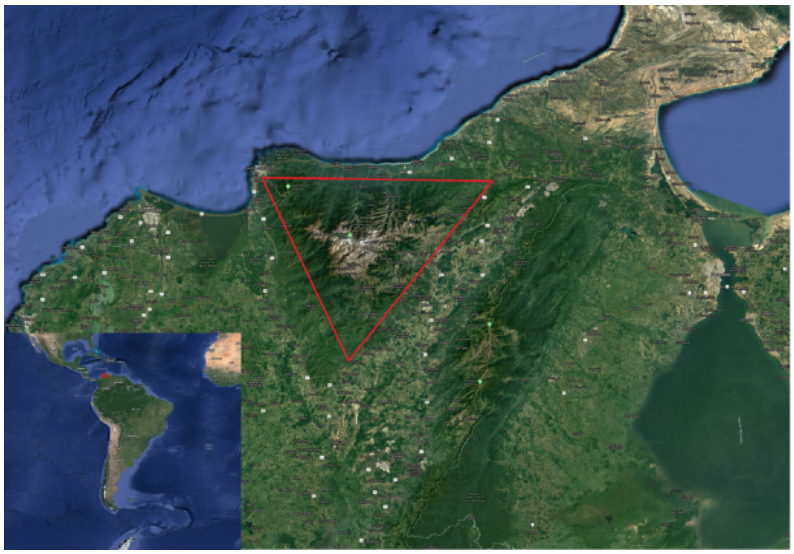

Figure 2: Location of Sierra Nevada de Santa Marta in northern Colombia

Curassow species have commonly been surveyed using line-transect counts, where ecologists survey along a pre-established transect and only include individuals if they are observed within a specified distance from the line. (Alves 2017, Jiménez 2003, Pardo 2017, Strewe 2010) However, sex-biased results can arise when utilizing this method to survey ground-dwelling avian species. (Alves 2017, Jiménez 2003, Strewe 2010) Many of these species, Blue-billed Curassows included, are known to be extremely cryptic. Due to this, surveys are mainly conducted during the breeding season when males are much easier to detect due to their loud, conspicuous courtship displays. (Jiménez 2003, Strewe 2010) This method increases detectability of individuals, but it also skews the results with a male-biased count and does not provide an accurate representation of the population in its entirety. (Jiménez 2003, Strewe 2010)

In recent decades, camera trapping has become an increasingly popular method for surveying cryptic, ground-dwelling avian species due to it being a highly effective, non-invasive approach. (Ancrenaz 2012, Lasso 2017, Maya 1999, O'Brien 2008, O'Connell 2010) Utilizing a non-invasive surveying approach is crucial to the effective monitoring of Blue-billed Curassows and is an ideal method due to the cameras' ability to work independently of researchers, observing large areas both day and night for extended periods, resulting in relatively low study costs. (Ancrenaz 2012, Lasso 2017, O'Brien 2008) Training of field assistants is also facilitated

through the ease of operation, maintenance and data collection from individual camera units. (Ancrenaz 2012)

In 2018, with financial support through grants from the Phoenix Zoo and a AAZK, I initiated a pilot study aimed at utilizing trail cameras to find, then monitor and study the ecology of remnant populations of this species within the Sierra Nevada de Santa Marta. Unfortunately, no Blue-billed Curassows were documented during our 2018 efforts. Building upon what my team and I learned from our 2018 study, we initiated year-long, systematic survey for the species in July 2019 by installing 33 trail cameras (Figure 3) throughout several promising river valleys located on the western slopes of the Sierra Nevada de Santa Marta. In February 2020 we confirmed the persistence of a viable population of Blue-billed Curassows within one of the three surveyed river valleys.

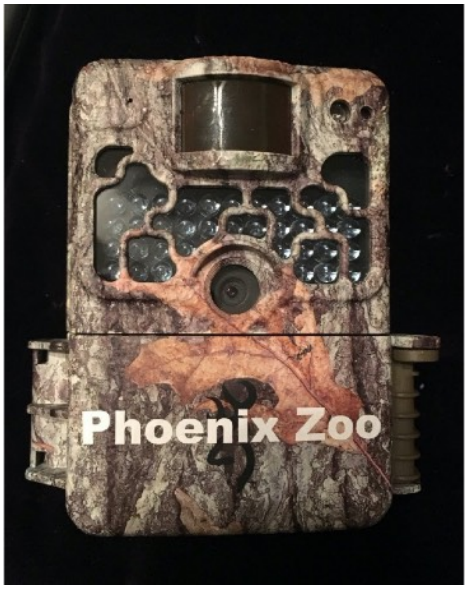

Figure 3: Typical trail camera used for the study

Research Summary

In July 2019, I travelled to Santa Marta, Colombia to initiate a year-long study effort with my primary objective being to implement an accurate, comprehensive surveying method in order to evaluate and monitor the current population dynamics of Blue-billed Curassows that inhabit the Sierra Nevada de Santa Marta. Local field assistants and myself targeted specific locations to survey for Blue-billed Curassows based on three main factors: a) the location has confirmed current/historical records of Blue-billed Curassows, b) the location currently contains suitable habitat to sustain a viable population of Blue-billed Curassows, which was defined as a minimum patch of 3 km^2 of primary forest (Mello-Vásquez 2008) and c) the location must be in an area containing privately owned land, as permits have not been approved to conduct research on land owned by Parques Nacionales Naturales, the national park service of Colombia.

Following the above criteria, we decided to focus our surveying efforts on 3 river valleys located on the western slopes of the Sierra Nevada de Santa Marta:

1. The Río Frio valley, located near the town of San Pedro de La Sierra where we installed 18 trail cameras (Figure 4)
2. The Río Cordoba valley, located near the village of La Tagua, where we installed 7 trail cameras (Figure 5)
3. Río Guachaca valley, also located near the village of La Tagua, where we installed 8 trail cameras (Figure 5)

Individual sampling sites were chosen based on a variety of criteria, including (a) close proximity to a game trail, as the target species is known to utilize them, (b) close proximity to a water source (streams, rivers, water tanks, etc.), (c) elevation below 1, 200 m as this is

considered to be the upper elevational limit of the species, and (d) must be located within a suitable forest patch capable of sustaining a viable population

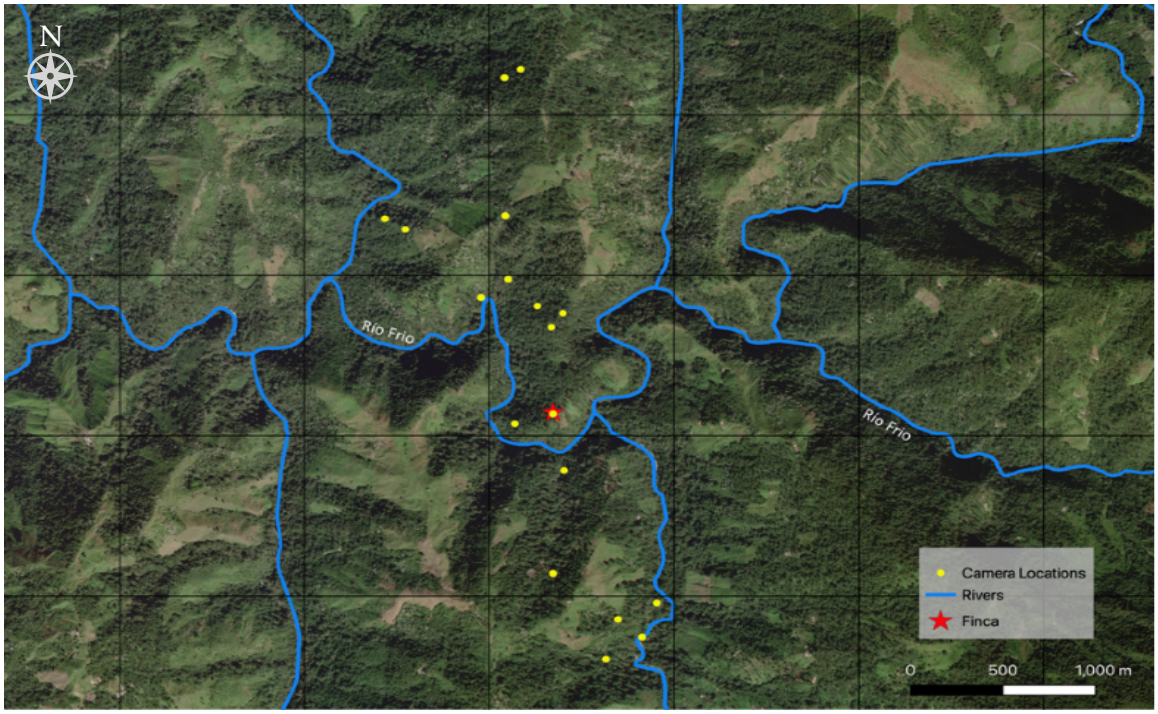

Figure 4: Distribution of trail cameras in the Río Frio valley

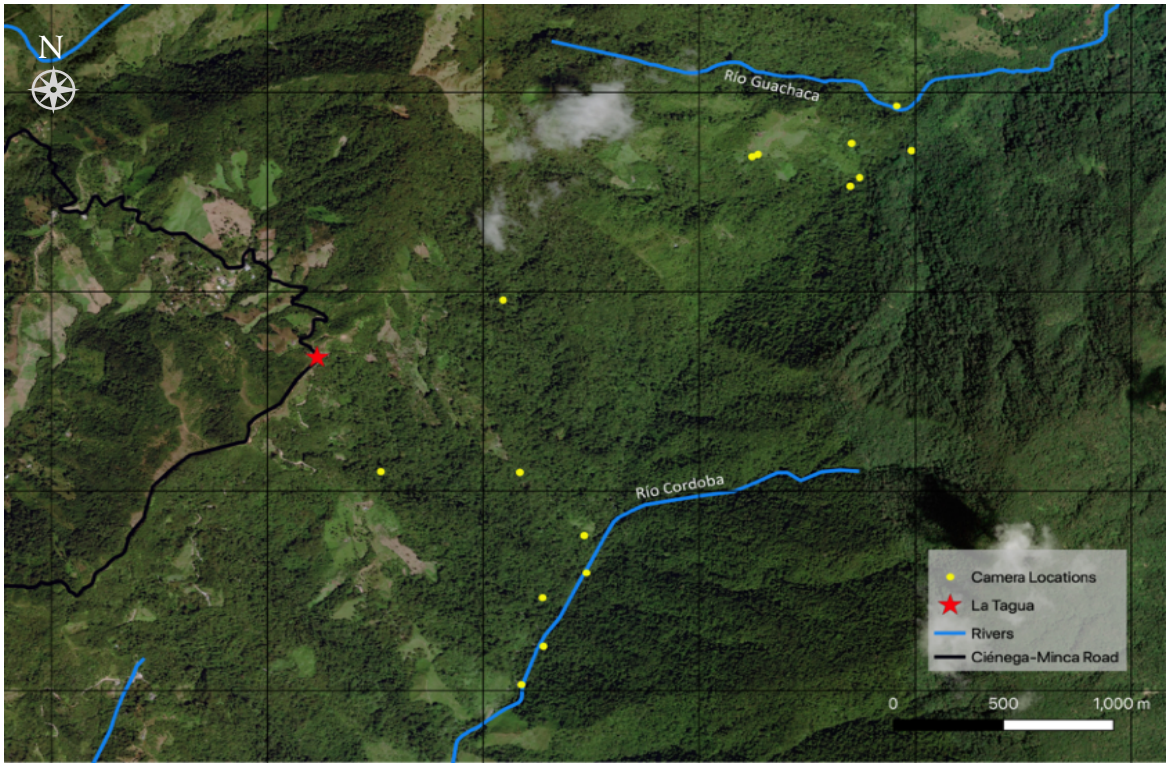

Figure 5: Distribution of trail cameras in the Río Cordoba and Río Guachaca valleys

Research Findings

Our 33 cameras surveyed over a 421 day period for a total of 6, 509 trap days that resulted in 31, 191 images captured. To date, we have documented at least 61 species within the sampling sites and have positively identified 22 mammal species (Table 1) and 18 bird species (Table 2). Unfortunately, due to both technological limitations and COVID-19 related travel restrictions in Colombia, our entire data set has not been uploaded. I am currently working hard with colleagues in Colombia to acquire and collate the rest of our data sets for a complete analysis.

Scientific Name	Common Name
Dasyprocta punctata	Central American Agouti
Dasypus novemcinctus	Nine-banded Armadillo
Puma concolor	Puma
Leopardus pardalis	Ocelot
Leopardus wiedii	Margay
Panthera onca	Jaguar
Herpailurus yagouaroundi	Jaguarundi
Tayassu pecari	White-lipped Peccary
Sciurus granatensis	Red-tailed Squirrel
Cuniculus paca	Spotted Paca
Eira barbara	Tayra
Mazama americana	Red Brocket Deer
Didelphis marsupialis	Common Opossom
Marmosa robinsoni	Robinson's Mouse Opossom
Coendou prehensilis	Brazilian Porcupine
Procyn cancrivorus	Crab-eating Raccoon
Cerdocyon thous	Crab-eating Fox
Galictis vittata	Greater Grison
Tamandua mexicana	Northern Tamandua
Cebus malitiosus	Santa Marta White-fronted Capuchin
Alouatta seniculus	Red Howler Monkey
Conepatus semistriatus	Striped Hog-nosed Skunk

Table 1: Mammal species recorded (species of conservation interest are highlighted)

Scientific Name	Common Name
Chamaepetes goudotii	Sickle-winged Guan
Leptotila verreauxi	White-tipped Dove
Tinamus tao	Gray Tinamou
Tinamus major	Great Tinamou
Momotus subrufescens	Whoping Motmot
Aulacorhynchus albivitta	Southern Emerald-toucanet
Ramphastos sulfuratus	Keel-billed Toucan
Patagioenas fasciata	Band-tailed Pigeon
Coragyps atratus	Black Vulture
Cathartes aura	Turkey Vulture
Buteo nitidus	Grey-lined Hawk
Buteogallus anthracites	Common Black Hawk
Crax alberti	Blue-billed Curassow
Icterus icterus	Venezuelan Troupial
Butorides striata	Striated Heron
Aburria aburri	Wattled Guan
Cyanocorax affinis	Black-chested Jay
Turdus flavipes	Yellow-legged Thrush

Table 2: Bird species recorded (species of conservation interest are highlighted)

Our primary research goals were to determine:

- Presence or absence of Blue-billed Curassows at each camera trap sampling location

  The presence of Blue-billed Curassows was documented at 6 out of 33 sampling sites (Figure 6), including documentation of several juveniles, confirming a successfully reproductive population. All sampling sites where we confirmed the presence of Blue-billed Curassows were in the Río Frio valley. No individuals were detected in the Río Cordoba or Río Guachaca valleys.

A

B

C

Figure 6: Trail camera footage documenting Blue-billed Curassows in the Río Frio valley. (A) Adult male, (B) Adult female feeding juvenile male, (C) Family group with one adult male, two adult females and a juvenile male

- Occupancy of Blue-billed Curassows at each sampling site

  Due to several missing data sets, full statistical analysis of occupancy is pending analysis until they can be uploaded and added to the complete data set. Using a detection, non-detection method, this analysis will provide valuable estimates of the probability that the species occupies specific sampling sites.

- Distribution of Blue-billed Curassows throughout the study area

  Due to several missing data sets, full statistical analysis of distribution of the species throughout the study area is pending until they can be uploaded and added to the complete data set. Distance between cameras with confirmed documentation of the species in the Río Frio valley was maximized at 3.7 km, supporting our hypothesis that the species continues to persist throughout this valley where suitable habitat remains.

- Species richness of all species observed in each sampling area

  Due to several missing data sets, full analysis of species richness at each sampling site is pending analysis until they can be uploaded and added to the full data set.

Additionally, we collected preliminary data on the ecology of this understudied population to better understand habitat use, diet, and reproductive behavior. Through a combination of personal observations, data collected from camera traps and conversations with local guides, we were able to collect novel ecological information on the species. This included documentation of two plant species whose fruits are utilized as a common food source for Blue-billed Curassows that had not been documented in previous reports: Florida Strangler Fig (Ficus aurea) and Wild Cashew (Anacardium excelsum). Both species were observed in abundance throughout the Río Frio valley where the presence of Blue-billed Curassows was confirmed. More data will need to be collected to determine whether there is a positive correlation between the occurrence of either of these species and Blue-billed Curassows.

We also documented the presence of several additional species of conservation interest: the endemic Santa Marta White-fronted Capuchin (Cebus malitiosus) which is listed as endangered, White-lipped Peccary (Tayassu peccary) and Gray Tinamou (Tinamus tao) which are both listed as vulnerable, and Wattled Guan (Aburria aburri) and Jaguar (Panthera onca) which are both listed as near threatened by the IUCN.

Training and Outreach

During my time in Colombia several education and training initiatives were undertaken with the aim of inspiring members of the local community to help protect this endemic species, as well as providing them with the resources and skills to continue this monitoring project into the future.

Our primary training focus was on the capacity building of field assistants, which consisted of local guides and students. Directly involving the local community in all aspects of the project has instilled a sense of personal pride and personal commitment to the research. Field assistants were provided with on-site training in basic trail camera techniques such as site selection, set up, deployment, data collection and recovery of cameras (Figure 8). In conjunction with on-site training in camera trapping techniques, field assistants were also introduced to identification and collation of data by utilizing a novel camera trapping analytical service called Wildlife Insights™ (Figure 7). Wildlife Insights™ is a collaboration of leading international conservation organizations and is backed by Google. As a cloud-based platform, it melds citizen science and artificial intelligence for wildlife monitoring through camera trap data analysis and species conservation. Incorporating this project into Wildlife Insights™ allows local community members to become even more involved and active in the conservation of this species.

Figure 7: Wildlife Insights™ logo

Figure 8: Capacity Building: (A) Demonstration of testing trail camera before installation (B) Field team with installed trail camera in Río Frio valley (C) Data collection and documenting the project's first Blue-billed Curassow

Parallel to the field training, our project engaged in several initiatives in order to educate and raise awareness about the plight of this emblematic species within the local community. Strong relationships with local ecotourism companies were built in order to better access and effectively reach out to local community members. Through these relationships, we have been able to organize several important community-based education events. This included an appearance on the Colombian-based news station called *Caracol Radio* to discuss the project, the degree of endemicity and current threats facing Blue-billed Currasows, as well as the positive impact ecotourism can have on protecting local biodiversity. Additionally, a collaborative meeting between various stakeholders in the protection of Blue-billed Curassows was held at a local university, Universidad del Magdalena (Figure 9). This meeting, entitled *Foro Paujil de Pico Azul: Estado actual y propuestas de conservacíon* (Blue-billed Curassow Meeting: Current status

A

B

C

Figure 9: Foro Paujil de Pico Azul**:** (A) Poster/social media advertisement (B) Author/Principle Investigator presenting at the meeting (C) Group photo of attendees

and conservation proposals), included a diverse group of attendees that included local coffee farmers, members of the indigenous community, representatives from Parques Nacionales Naturales, as well as professors from Universidad del Magdalena. Representatives from two ACOPAZOA (Colombian Association of Zoos and Aquariums) facilities, Aviario Nacional de Colombia and Zoologico de Barranquilla, who are heavily involved in the captive breeding program for Blue-billed Curassows in Colombia also presented at the meeting. Numerous topics were covered, conveying important aspects associated with this species to the attendees including an overview of life history, ecology, current threats, conservation research, ex-situ conservation efforts, as well as future re-introduction plans. We received great feedback from attendees of the meeting, with many curious to know what they can do to help protect this species and preserve the biodiversity of the habitats in which it, and many other species, live.

Future Plans

Our plan is to focus future efforts on increasing our knowledge of the distribution and population dynamics of Blue-billed Curassows inhabiting the Río Frio valley. Expansion of this project by incorporating larger camera arrays and increased involvement of local community members will help us reach this goal by helping lay the foundation of a long-term monitoring project. Our primary goal is to eventually collect enough data to accurately estimate the remaining population located within the Río Frio valley and then utilize this data to pursue the development of protected areas. Much work still needs to be done to determine the status of this population but we are confident our future efforts will provide much needed data that will be able to garner support for further protection of this enigmatic species and the habitats it calls home.

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Evaluating agonistic interactions of an all-male Nile Crocodile group to optimize care and welfare at Disney's Animal Kingdom®

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Disney's Animal Kingdom
Orlando, FL

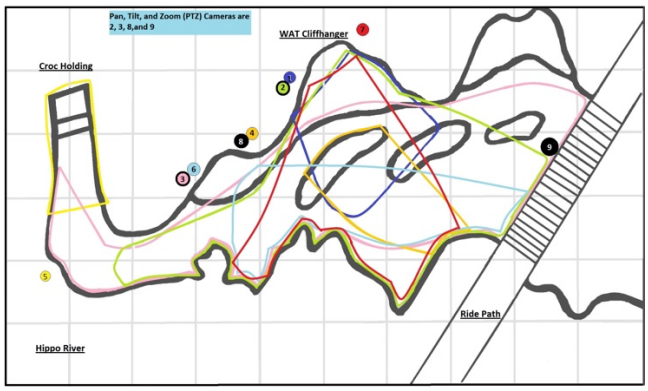
Abstract: When we began this study, Disney's Animal Kingdom® (DAK) was home to 21 male Nile crocodiles, the largest group in any AZA institution. In 2014, a behavioral research project was initiated to further understand their behavior, husbandry, and welfare. Project focuses have been seasonal patterns of behavior, space use and territoriality, and how husbandry routines, including feeding and training, affect behavior. In 2018, video cameras were installed throughout the exhibit, increasing our ability to monitor the crocodiles throughout the day and overnight. This project has been particularly informative and successful due to key partnerships between DAK's husbandry and science teams. For the past seven years, the project has continued to reveal important information about the social dynamics, and ultimately welfare, of this unique group of crocodiles. This talk will cover the journey of this partnership as well as highlight unique findings from the behavioral study that have been used to inform and evaluate management strategies. We hope sharing our experience will inspire others to create similar data-driven approaches to animal husbandry.

Introduction: Disney's Animal Kingdom® is a unique facility in regards to the size of the social group of Nile crocodiles that is housed as well as the management practices. The management practices are a combination of group husbandry regarding group shifts and group feeds and individual husbandry when dealing with medical records and behavioral husbandry. The entire group is shifted into an off-show holding area in the spring and fall for medical exams, training, and exhibit maintenance. During this time the animals will be crate trained individually where they are visually examined for injuries, weighed, and body condition scored as well as recording length and transponder confirmations. These animals are then tagged or painted with a grease cattle marker and then shifted back onto exhibit after their crate session. Between these periods smaller groups of 1-5 are brought into the holding pools for weekly sessions that focus on target and crate training. These smaller groups are generally the individual animals that are most responsive to training and therefore training time is not necessarily evenly distributed.

Project History and Overview: In winter of 2013 concerns were expressed regarding training sessions and their impact on group dynamics as several animals were being removed from and reintroduced to the group frequently. The croc training team, consisting of two keepers, reached out to the Science team to begin a behavioral research project. Our goal was to better understand the effect of behavioral husbandry on group dynamics. In the spring of 2014 the project officially began. We originally called it the "croc aggression research" project, but due to different interpretations of what constitutes an aggressive behavior, we replaced the word "aggressive" with "agonistic". These words will be used interchangeably in the presentation and in this manuscript.

There were several key actions that gave this project momentum. The most important one being that we included our Science team from the start. They were able to help us form the project and keep it consistent over the years, which has protected the integrity of the data. A year into the

project more keepers of the Ituri team were trained to be a part of the research team. This increased the amount of data we could get and over more time windows as the project had thus far only consisted of the two croc trainers. In 2017 we added 9 cameras surrounding the exhibit so that the group could be monitored around the clock. Video monitoring by the Science team began in November 2018 and has continued since. One of the last key components was making it easier to identify a large group of crocs as individuals. To do this we started adding cattle ear tags to their scutes as well as painting their backs with colored grease markers. The identification methods have been useful in identifying individuals both in person and from camera video.



Nile Crocodile Exhibit- Camera Surveilance Diagram

Figure 1 shows a bird's eye view of the exhibit, the placement of the cameras, and the range that each camera covers.

This project continues to be a partnership between the Ituri and Science teams. Currently Ituri's role is conducting live observations where we focus on individual behavior. The Science team conducts observations from camera video, and they are focused on data regarding the group as a whole. The Science team also manages data entry and data reports. The data being gathered have become a cornerstone in our croc management, and it guides decisions regarding their health and wellbeing.

Data: What are we learning? First and foremost we've learned that training does have an impact, but on a small scale relative to the other factors that influence their social interactions. Feeding, more than any other husbandry-related activity, impacts behavior of the group the most. We observe more aggressive interactions on feed days than on non-feed days. The group is fed once per week.

We know that there are environmental factors that influence social behaviors and historically observed more aggression and injuries in the spring, but the research has shown us that the peak season for aggression actually spans wider than we previously thought. Aggressive behaviors are highest in winter through spring (December- May) and level off in the summer. Summer is the season where we see the least injuries and the animals lying in contact with each other less.

We can see how the group uses their exhibit and have even established individual preference for space use. Most of the crocs have a clearly defined range for where they like to be in the exhibit. Some crocs do show a preference for being mostly on land, mostly in water, or a proportion of both. We are also able to see where most of the aggressive interactions take place and what those interactions consist of. For example "bites" are the most commonly seen aggressive behavior.

Figure 2 shows a heat map of 1.0 Nile crocodile “Ben Ali”’s exhibit space usage

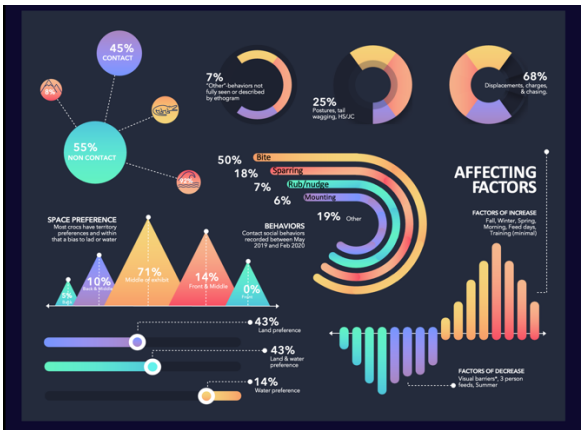
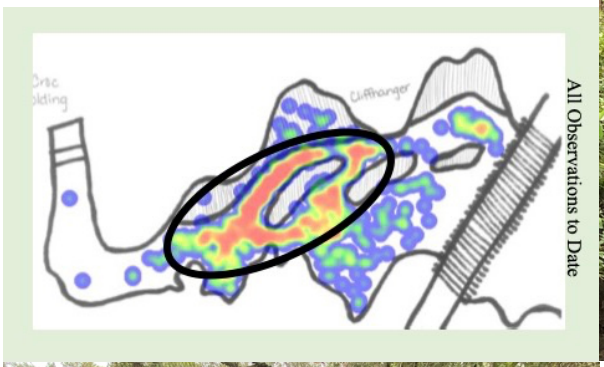


Figure 3 provides a visual aid to give a general idea of the types of data that we are compiling

How the Data are Being Used: Reducing aggression surrounding feeds has become our priority as well as reducing seasonal aggression. For feed days we have increased the number of keepers feeding to a minimum of 3. This allows us to feed from both sides of the exhibit to make sure every animal is able to eat their allotted amount without the stress of competing with the more dominant animals of the group. We also do this to spread out the group to minimize competition in general. Additional action items are currently being brainstormed, but one topic of interest is food item type and whether that has an impact. For example, on the weeks that we feed chicken and Mazuri croc chow we feed the chicken first and the chow last as the crocs seem to be busy “grazing” on all the floating pieces of chow versus fighting, but there isn’t any data on that theory yet other than anecdotal observations.

We’ve added visual barriers in the form of concrete Jersey barriers that are completely submerged and floating logs that eventually sank. Evidence suggests crocodilian visual barriers are most effective at the surface of the water, so in the fall of 2020 we placed large cedar logs in the exhibit and rested them on the Jersey barriers (See Fig. 5). We used the agonistic behaviors heat map (Fig. 4) to guide us on log placement, placing logs in areas with the highest frequencies of behaviors. Short term data told us that the addition of the visual barriers reduced aggression significantly, but long term data collection has shown that the visual barriers have had no impact. Using visual barriers is something that we will continue to work with and gather data on.

An interesting visual barrier technique that we tried was dyeing the exhibit water black with pond dye to mimic tannins in river water, but unfortunately the filtration system worked too well and the dye only lasted for a few days.



Figures 4 and 5 (top row) is the heat map we used to strategically place the visual barriers in areas of high aggressive interactions and the installation of the logs that we used. Figure 6 (bottom row) is a photo of the exhibit after the addition of the pond dye. The exhibit next to it is the undyed hippo river for comparison. You can also see a croc in the water that has been colored with teal and orange cattle marker.

Conclusion: The welfare of our bachelor group has turned into a department wide priority, and this research has been integral in providing data to steer ideas and decisions. We currently have a welfare committee that has focused monthly meetings in which we discuss ideas and action items to mitigate the agonistic behaviors the animals are exhibiting and experiencing. We aim to lower stress, create a more even body condition across the group, and reduce aggression and wounding.

Chevrotaining the Masses

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Abstract

In December of 2017 the Milwaukee County Zoo Aviary acquired 0.2 Greater Malayan chevrotains (*Tragulus napu*). This was our first ever mammal-bird mixed species exhibit (with an additional pair being added in June of 2019). Prior to this the aviary had only exhibited birds in our naturalistic free-flighted exhibits. These small mouse deer, only 7 pounds, are known being flighty and secretive. Some of the challenges we overcame were dealing with zoo visitors just feet from their piano-wire fronted exhibit, finding the diet and presentation that works for the mixed exhibit as well as integrating the group into our public interaction tour. This presentation will detail the obstacles and the successes we have encountered throughout this process. The exhibit has become one of our most popular exhibits in the building and the chevrotains readily come up to guests during tours for their diet. They are excelling at training and have taught us just how big of a personality something this tiny can have.

What are Chevrotains

Chevrotains are small even toed ungulates that are also sometimes referred to as mouse deer. The range in size from 1.5 lbs to 18 lbs and are the smallest hoofed animals. There are ten living species of chevrotains with most living in south and southeast Asia, one species lives in Africa. Although called deer, they are more closely related to hogs and camels than cervids. They are considered a primitive species as they are unchanged for over 30 million years. They are also considered the evolutionary link between non-ruminants and ruminating ungulates.

Greater Malayan Chevrotain

Milwaukee County Zoo currently houses 0.3 greater Malayan chevrotains (*Tragulus napu).* This particular species of mouse deer is between 5 to 10 pounds. Our females are all around 7 to 8 pounds. Males of many chevrotain species including the greater Malayan chevrotain have elongated upper canines that appear to look like tusks and tend to be smaller than females. The are found in Southeast Asia in Malaysia, Borneo, Indonesia and surrounding areas. The live in heavy undergrowth forests and are not endangered though their numbers are declining dur to poaching and habitat loss like many species in the area. Being prey species, they are shy. Generally, they are nocturnal and solitary. They have a 5-month gestation with usually one calf

born that matures quickly and can reproduce at as little as 5 months old. Female chevrotains can also become pregnant within hours of giving birth. Under human care, this species of chevrotain does well in pairs or small groups.

SSP Population

The current population of greater Malayan chevrotains in the AZA SSP is very low. According to the most recent breeding and transfer plan (as of July 2021) there are only 10.17 in the population at 10 AZA facilities. This puts the population at a red SSP and more space is greatly needed to grow and sustain the population. This species does very well in many types of settings including nocturnal and diurnal light cycles. They work well in small mammal exhibits, can mix with larger mammals and thrive in aviary exhibits with a wide range of bird species. Longevity has been up to 17 years under human care though that is not the average. Currently the oldest in the SSP population is only 7 years old. This population is going through a rebuilding period.

Chevrotains at Milwaukee County Zoo

Although Milwaukee County Zoo has housed greater Malayan chevrotains in the past, they were housed in our small mammal building in a nocturnal exhibit in the 1990's and early 2000's. When discussing adding chevrotains to the collection plan again, we were interested in trying them in our aviary building as part of a diurnal mixed species exhibit after hearing that they do well in that particular set up. We currently house 0.3 chevrotains ("Rain", "Opal" and "Ruby") in and approximately 15' x 15" exhibit that is open to the roof of the building (approximately 30' high). We received the first pair who are half sisters in late 2017 from the Bronx Zoo. They proved to do well in the set up so we received another female pair from Los Angeles Zoo in mid-2019. Unfortunately, one passed not long after arriving at our Zoo. Introductions of the of the unrelated females were uneventful as were introductions to the birds in the exhibit.

The chevrotains are currently living with 5 species of small breeding birds. Bleeding heart doves, fruit doves, shama thrush, Bali mynah and Pekin robins all share a home with the chevrotains in a natural dirt/bark chip substrate. We have added sand spots for latrines for the chevrotains and there are live trees and plants as well as artificial plants in the enclosure. Natural lighting is provided by skylights and we have five hiding spots/nest boxes for the 3 chevrotains though its is not uncommon for them to squeeze in to a box with another.

Diet

At the Milwaukee County Zoo, we follow a diet recommended by the SSP. We offer free choice Mazuri ADF-25 pellets and free choice grass hay. We find that they do not eat the grass hay often. We also feed a mixture of greens three times a day (usually romaine, kale, and endive). Twice a day they receive produce scattered on exhibit. This is generally limited to yam, carrot and banana peel. When available, browse if given but only 2-3 times a week. For training, we use Mazuri high fiber primate sticks or their produce. The sticks are given in small amounts for

mainly shaping new behaviors. Rarely we will feed fruits (watermelon, pear and mango seem to be preferred) but only for an occasional treat or for a jackpot for training. We keep the fruit at a minimum. We have found that at times, the chevrotains will eat live crickets when given to the birds in the exhibit.

Challenges

There were a number of challenges and considerations to be taken into account when adding these small ungulates to the aviary. The chevrotains are the first mammals to be exhibited in the aviary building at the Milwaukee County Zoo. Keepers made sure to do their research and learn how to care for an animal that was new to them. In addition, the exhibit has a piano-wire front. Besides the concerns of the chevrotains getting hooves and legs stuck, there were concerns that guest may try to reach in. A clear plastic panel was added and has since been removed after we were confident there would be no negative issues. Crowds in the aviary (pre-COVID) could be large and with chevrotains being prey species and naturally shy and nocturnal, we were concerned about their stress levels and if they would even be seen during opening hours. Live plants were also a concern. Horticulture staff was consulted to ensure any plants were not toxic to the chevrotains and we had plants that could hold up to potential destruction by small ungulates. We were also concerned about cleaning and potential smell as the exhibit floor is a bio floor. Sand latrines were added to aid in clean up of feces. In addition, we have a number of established breeding pair of birds in that exhibit so we did not want the new addition to negatively impact those successes. And finally, we were concerned with the chevrotain possibly ingesting food meant for the birds that could negatively impact their diet.

Successes

Since the chevrotains have arrived, we have seen that the successes greatly outweigh and challenges or concerns. They have quickly become a visitor favorite! They are active many times during the day and do not appear stressed or bothered by crowds. Initially one individual did seem to get nervous especially during cleaning but keepers have adapted the cleaning routine to make sure she is comfortable in the nest box while moving around the exhibit with the hose. The chevrotains tend to be very calm and even rest right next to the front of the exhibit or in the nestbox closest to the front. Our breeding success has continued (the bleeding-heart doves and fruit doves have had many chicks since the new addition). The chevrotains leave the tiny, newly fledged chicks alone and we haven't seen any egg predation. We did find one chevrotain trying to chew on a discarded dummy egg once however. There has been minimal plant loss, some plants have been chewed on but they tend to leave the plants alone. They regularly use latrines so cleaning has proved to be quite simple. And most importantly, they are friendly with keepers and guests during encounters. This allows keepers to get a good look at them daily and monitor them for any health issues.

Training

Almost immediately, keepers began working with the chevrotains to get them used to movement in the exhibit and comfortable around us. Most training started with desensitization to new items and basic conditioning. Eventually, the chevrotains began approaching the keeper door so more structured training could being. A verbal bridge is mostly used as we felt like a clicker was too loud for the birds and would disturb them. They are also conditioned to a whistle as a bridge. Most behaviors have been baited to establish them. While keeping in mind the hesitant nature of the chevrotains, we want to reward them for behaviors outside their comfort zone. Patience and persistence have paid off and the chevrotains are quickly learning new behaviors. We have trained a basic target (to a target pole and fingertip), all three now will step on to a scale (we did have to cover the scale in non-slip tape), they will all hand feed and feed off of a feed stick. We have also been able to start hoof work with them. Initially hoof work began with simply getting them to step on a white painter's canvas to get pictures of their hooves. "Ruby" has historically had over grown hooves so we want to monitor when it is time for her to get a trim. Currently we do have to anesthetize her for that but are work towards more options with voluntary trimming. As we continue hoof training, we are asking the chevrotains to step into our hand to get them comfortable touching hooves and legs and will hopefully move to filing or trimming as needed. Other future behaviors planned are side presentation, tactilies, open mouth, crate and recall. We are able to get them calmly into an induction chamber so we do not have to hand catch them but we would like them to enter a crate for potential exhibit maintenance also.

Encounters

In June of 2019, Milwaukee County Zoo began a program called "Wild Connections" to provide animal connections, encounters and behind-the-scenes tours with keepers and animals. We chose animals currently in the collection that we thought would benefit and thrive from these encounters while being able to provide an experience to connect guests with animals while educating them. As part of our general overall aviary tour, we included the chevrotains. Initially, we were not sure if they would be interested in interacting with new people but as we had multiple tours, we found that not only were they interested, they seemed to enjoy the interaction. After a slight pause in encounters due to COVID restrictions, we have been able to resume some encounters and the chevrotains now have their own encounter which had proven to be very popular with both guests and the animals. We use their normal portion of produce and three days a week at their afternoon feed, guests are able to see the chevrotains up close while feeding from a food stick. Not only has this been beneficial for the guests but it has also introduced the chevrotains to many new people, smells and sounds. Many times, we find the chevrotains waiting at the door for the encounter. Guests do not enter their exhibit space but feed from our keeper closet so the animals can choose to interact or leave at any time.

Future

As we look to the future of the chevrotains at Milwaukee County Zoo, we have many potential plans. We would like to increase their enrichment program. We have focused on training more

due in part to the challenges of ensuring items offered are safe for all animals in the exhibit. The chevrotains have proven to be very interested in new items so expanding our approved enrichment list and focusing on natural behaviors is a goal. We would like to continue to grow our training program also with a potential goal of incorporating training into our encounter program. Potentially becoming a breeding facility might be a possibility though we would need to identify more space to hold offspring and separate individuals. We would also like to continue to promote awareness and raise interest in chevrotains in the zoo community and with guests. As already stated, the greater Malayan chevrotain SSP needs more institutions to become involved. And chevrotains are a great conversation starter to engage guests in conservation issues for many of the endangered species they share a habitat with in the wild.

In conclusion, chevrotains not only thrive in a variety of enclosures under human care but can be a great addition in places one might not think to find them. Even with their shy nature and small size, they are a charismatic species that can add excitement to an exhibit and engage guest to take action after connecting with them.

References

2021 Greater Malayan Chevrotain SSP Breeding and Transfer Plan, aza.org.

Utilizing Volunteer Help with Animal Observations to Improve Animal Welfare

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The Houston Zoo has a very large volunteer program. On any given day, we can have Zoo Crew Junior Zookeepers (high school students), Interns (college students), and Keeper Aides (anyone over 18 who is not in college or fresh out). They work alongside keepers to clean yards and barns, do dishes and diets, educate guests, and learn about the animals we have in our care. We are always looking for opportunities to involve our interns and volunteers more fully in ways that are both educational and helpful to the department, but we oftentimes struggle to find projects for them that are both helpful to animal welfare and do not require direct supervision from keeper staff. This led to the creation of an ethogram project designed to utilize our volunteers as animal observers.

When the project began, it was centered around the Houston Zoo's 1.1 Giant anteaters (*Myrmecophaga tridactyla*) "Pablo" and "Olive" and was meant to evaluate their behavioral habits. Keepers had seen the anteaters pacing in the yard from time to time, but we did not know how frequently it occurred. Keepers had also anecdotally noticed that the anteaters stuck to specific sections of their yard and did not seem to be fully using the space available to them. We began using volunteers and interns to observe the anteaters in shifts for as much of the day as possible. Volunteers would stand in front of the anteaters' yard for one hour shifts and record the behaviors they saw at two-minute intervals. They also documented where in the yard the animal was. With a small amount of training they were sufficiently able to distinguish our two anteaters apart from each other. We also taught them how to identify pacing behavior and what distinguishes it from other movement patterns, like foraging for food or simply walking around.

After a month of observations, we compiled the data. We learned that our anteaters displayed a much wider variety of behaviors in the mornings compared to the afternoons, that the male and the female utilized their yard in very different ways, and we also learned that they did not pace as much as we had anticipated! With that knowledge, we began to make small changes to the anteater's routine to further diversify their behaviors and we chose to continue our volunteer observation project to evaluate the effectiveness of those changes.

Several months into the project, we expanded it considerably. Our anteaters were moved to a brand-new yard along with several other South American species in our collection, so we added five new species to the observations. We also began to utilize ZooMonitor, an online app developed by the Lincoln Park Zoo designed to help record and visualize animal behavior data. Shifts were extended to two hour long sessions, one shift in the morning and one in the afternoon.

To date, this project has benefitted everyone involved. Volunteers like it, it gives them a chance to watch the animals and provides an opportunity to engage with guests. This project is a way for them to directly impact an animal's welfare for the better, and they love doing it. We offer 10

different observation shifts to our volunteers each week and they always fill up immediately. Keepers benefit by having a go-to activity that volunteers can participate in unsupervised, and we are able to gather more data than would ever have been possible if we had tried to do it alone. Zoo guests benefit from having someone in front of the yard identifying and locating animals for them and answering questions. Even the animals benefit from the changes that keepers can make based on observations of their behavior!

This project is something that is easily adaptable across teams and institutions. It is simple, straightforward and has a clear positive impact on animal welfare. It could be used to monitor introductions, observe reproductive behavior, determine exhibit usage, address stereotypic behavior, and more. We, at the Houston Zoo, plan to continue to expand this project as much as we can.

An Easy Guide to Implementing Collection-Wide Welfare Assessments

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Abstract

In 2019, the California Science Center used Tracks® to create a comprehensive animal welfare assessment program in order to track the welfare of the terrestrial and aquatic collection on a quarterly basis. Four assessment types were created for a well-rounded and proactive program aimed at tracking individual and group welfare over time. The four assessments are broken down into two groups, quarterly scheduled assessments (for groups or individuals) and as needed assessments (chronic condition and quality of life). The program, both assessments and the implementation process, needed to be adaptable to preferences in order to ensure success when working with one turkey vulture (*Cathartes aura*) or hundreds of Madagascar hissing cockroaches (*Gromphadorhina portentosa*). Encouraging success of this program included not only assessment creation, but also revitalization of our Animal Welfare Committee goals to include this new process. Finally, we will discuss our problems we have encountered and goals for furthering the growth of our assessment program.

Development

Starting Guidelines

For anyone wanting to begin developing a personalized welfare assessment program, there are a few main starting points to determine in order to guide the way the program functions: frequency of assessments, scoring method, and content of assessments. Determining frequency is a balancing act between how much time keepers feel that they can dedicate versus the time required for the ideal welfare assessment program you want to create. When we got started, the idea of doing quarterly assessments on all of our animals was daunting. We decided to value welfare enough to prioritize creating the time needed for the assessment expectations for the thorough program we were developing. There are various scoring options to choose from depending on how specifically you want to be able to rank the categories and address any "gray areas." Content of assessments refers to both the inputs you choose to track as well as how you group your assessments. Lists of inputs are readily available online. You can pick the options that work best for your animals based on how you group your assessments.

Our terrestrial husbandry team groups assessment by taxa while leaving room for the flexibility to create individually tailored assessments for specific animals. Our aquatic husbandry team groups assessments by enclosures instead. Do what works best for you! The most important thing with all these questions is finding what will make your team the most comfortable while keeping the welfare science accurate. Like us, perhaps different teams within your institution will have individualized preferences for welfare assessment methods that best meet the needs of their keepers and animals. Keeper comfort is key to the success of generating a long-term, reliable, valuable program.

Our Assessment Program Breakdown

Assessments of all animals at the California Science Center use the welfare module of Tracks® software where assessment protocols are available for use. For all assessments performed, scoring is on a 1-5 scale, with one being the lowest available score and five being the highest. Descriptions are provided for scores one, three, and five to promote consistency in ratings. All husbandry staff are trained to perform a welfare assessment. Training consists of a description of welfare basics, how to enter an assessment into Tracks®, as well as performance of practice assessments to ensure inter-observer reliability.

These assessments are done by husbandry staff on a quarterly basis which allows us to track individual and group welfare. Evaluations are based on animal outputs and some important inputs. Scoring animal outputs on a quarterly schedule allows us to understand trends in welfare over time accounting for seasonal differences in behavior. These quarterly assessments require training that should be performed with pairs of keepers/aquarists or in husbandry/management pairs in order to increase inter-observer reliability. Once training is completed, assessments will be performed individually. Staff is highly recommended to check in with fellow husbandry staff if there are any questions regarding scoring.

For each species/individual animals, keepers/aquarists and husbandry managers choose from a larger list of indicators which would be relevant for the groups or individual they are assessing. This list of indicators was created based on Greg Vicino and Lance Miller's work outlining the Five Opportunities to Thrive (Vicino et al., 2015) and the five domain model of animal welfare by Mellor and Beausoleil (Mellor et al., 2015). Keepers/aquarists can also request to change the indicators in use by discussing with the husbandry manager or animal welfare specialist/registrar why they would like to add or remove an indicator based on any noted changes in the animal. There are two options for assessments that can be used for an animal or group. Scoring schemes and descriptions are chosen for each assessment to provide opportunities for improvement or for general tracking of welfare:

1. Specimen Holistic: A specimen holistic assessment is an evaluation of an individual animal's welfare for the last quarter. These ask how an animal is performing compared to species-specific requirements. An example for two specimen holistic indicators can be found in Figure 1.
    a) Instead of quantitative population assessments, this assessment type uses qualitative language that is more general (e.g., appropriate, infrequent inappropriate, inappropriate).
2. Outlier: An Outlier assessment is an evaluation of a group of animals (that can be the same or different species). Scores are based on the percentage of the population that performs in an ideal way according to the species-specific requirements. An example for two outlier indicators can be found in Figure 2.
    a) These use the same kind of questions as seen in a specimen holistic assessment but are made in the framework of a group setting using quantitative methods of evaluation (e.g., 90% of the population or more have optimal feeding behaviors).

A welfare assessment schedule for both the aquatics and terrestrial teams ensures every animal gets assessed within the quarter. The terrestrial schedule is based on animal taxa and is arranged

to have a new animal group assessed each week (Figure 3). The aquatics schedule is based on enclosures and is arranged to have assessments for a few enclosures each week (Figure 4). Schedules can be changed if needed but any changes must ensure that each animal continues to be assessed every three months.

Any individual or group will have a minimum of one assessment per quarter. However, there are ways for there to be more than one assessment in one quarter. There are two potential ad hoc assessments available for use depending on the situation. These assessments are not required quarterly or annually but are available for use in the event of a chronic condition or for any new event that a quality of life assessment is recommended. The use of these is at the discretion of the husbandry manager.

- Chronic Condition: shorter assessment that attempts to track a chronic condition or behavior of concern. This assessment is not a routine assessment but can be used to track a chronic condition of concern. Not all chronic conditions may warrant the use of this assessment. The director of husbandry, husbandry managers, or the veterinarian can request that a chronic condition assessment be implemented and can determine if the assessment is no longer required. A chronic condition assessment might also be initiated due to a low score in a specimen holistic or outlier assessment.
    - A single question makes up the chronic condition assessment: “What is the status of the condition of concern: better, same, or worse?”
    - Frequency of assessments are dependent on the animal and the condition. The frequency is decided by the husbandry manager with input from keepers or aquarists.
- Quality of Life: for individuals/groups that experience an event that warrants a quality of life assessment. These events could include but are not limited to large events that could disrupt the animal, animal move, population disruption, low scores in outlier/specimen holistic assessments. An example quality of life assessment can be found in Figure 5.
    - If an individual animal (aquatic or terrestrial) has been separated from a group due to medical reasons, it will receive a quality of life assessment a week after it is moved. If an animal is due to receive a routine quarterly assessment, the individual receives a quality of life assessment instead. Once it is returned to the group, it will go back to being included in the outlier assessment of that group.
- Random "other" assessments: This refers to extra assessments that have been created for very specific situations. These assessments might be for a short time, to answer a specific question, or more.
    - For example, one of our keepers thought that the enclosure for a snake did not have the appropriate heat zones and wanted to use a welfare assessment to compare behavioral indicators as well as some inputs in the current enclosure and then after a move. This meant we looked at evidence of pacing, time spent in different heat zones, temperatures within the enclosure, and a few more.
- ZooMonitor®: We have a subscription to ZooMonitor® that we use as an extra behavior monitoring tool. This includes assessing activity budgets and space use for any animals we decide. Currently we are using this for our turkey vulture and our giant sea bass.

Finally, we have a few future goals that we are working on creating as we move forward. We are interested in creating onboarding training for all staff here at the California Science Center. This

would mean anyone that works here, regardless of the department will understand animal welfare science. Next, we are interested in updating our list of indicators descriptions to have species specific options. This is an incredible undertaking but having research to back up what we should be seeing behaviorally written out for staff would be an ideal addition. Finally, our last big goal is to create yearly enclosure assessments. This would be to ensure that our systems are still safe and following all required guidelines. While we use inputs for our routine assessments, this one would ideally be more thorough for the different types of enclosures we have here.

Assessment Results

While using assessments is an important step of tracking our welfare impact, we also strive to track welfare trends in order to use results for constant improvement. On a daily basis husbandry managers and staff use the results of input and output assessments to understand what is happening with the animal and make adjustments to their care accordingly. Living Collections Husbandry staff have weekly meetings to discuss any existing or potential welfare matters based on staff observations and recent assessment scores.

Additionally, every two weeks the animal welfare specialist/registrar compiles a report of all assessments performed within the last two weeks. This report is sent to husbandry managers so they can keep track of the welfare assessment process and all scores that are submitted.
If an assessment produces a low score, there are three available actions; one of the three must occur. The first two are to complete either a chronic condition or quality of life assessment. If the low score does not seem to be the result of a chronic condition and is not significant enough to warrant a quality of life evaluation, the third option is that the husbandry manager requests weekly animal journal updates on the category of concern. These journal entries are logged in the animal journal section of the animal or group in Tracks® under the welfare category and include descriptions of the problem as well as new assessment scores for that category. The husbandry manager may continue to request these journal entries until the score has improved or until the next assessment report is performed.

Implementation

Staff Input

Now that we have described the broad planning process for our entire husbandry department, this paper will describe more in detail how the terrestrial team has tailored our welfare program. Many of the decisions described above were researched, thought through and finally made by the welfare specialist and managers, with occasional input from the keeper team. However, once the bones of the program were established, it was important to bring everything to the staff and have them share their thoughts and test out the process. Keepers were invited to a workshop where they chose the categories for routine assessments based on taxa. For example, out of 'x' assessment categories, the keepers would choose which could and should be used for birds and which for invertebrates. We tried to keep all routine assessments at roughly 9-12 categories.

Note that this process could only run smoothly because clear definitions were written for each assessment category (see Figures 1 and 2). While these were written by the welfare specialist, even these definitions were decided upon with keeper and aquarist input. It was important that they be clear enough for all staff to understand but loose enough that they could be applied to a variety of species. Things that didn't make sense or were confusing for staff could be adapted to

the needs of the staff. This meant being open to change and adaptation of the language or basic workings of the program to ensure it would work for their day-to-day process. The key to a long-lasting program is to thoughtfully incorporate the needs of the staff as they begin to work on assessments and encouraging comments.

Developing Consistency

While management staff gave the husbandry staff relative freedom in deciding on the logistics of the assessments, we also knew it was key that, once those parameters were decided, the team do the work in a consistent manner. This meant we had to train together on how to assess and score. For the majority of the staff, this was a new process and it was important to get people on the same page about the meaning of the category descriptions and feeling comfortable with this slightly more attuned way of observing our animals.

We facilitated discussions in which everyone's thoughts were heard (even, and especially, when it differed from those of others in the team). We recognized and celebrated the fact that we were influenced by our personal experiences with the animals. We wanted to learn the individual's style of interpretations so that we could come to a common understanding and agreement of what categories/scores meant and how to analyze welfare for our various animals. In short, these meetings taught us how to think through assessments in a standardized, consistent way. Soon, we had fewer and fewer discussions as all our scores came out consistently and we knew we could move on to doing assessments alone.

An interesting facet of how we run our terrestrial husbandry at the California Science Center is that our keepers rotate through all our collection on a quarterly basis (switching routines monthly) which means that it was even more important for keepers to know that they could trust the perspectives of their fellow keepers. On the flip side, this meant that fresh eyes were regularly laid on each animal's welfare *and* keepers had to remain comfortable with getting a second opinion from their teammates. This created greater trust in our data knowing that there were regular checks on our consistency.

Of course, no matter how strong our system was, there were still moments where the wording of a category's description could be unclear in a specific circumstance. For example, the category “space utilization” asks if the animal is using all areas of its enclosure in a species appropriate way. For a desert blond tarantula *(Aphonopelma chalcodes),* this definition could be understood in two ways. The tarantula spends most of its time in its den and so is almost never seen in the other parts of its enclosure suggesting low space utilization. On the other hand, this behavior is species appropriate and giving this category a low score would prompt us to try to fix a problem that doesn’t exist. In order to maintain consistency in scoring, we had to simply agree what the category meant for this circumstance.

Finally, it is also important to remember that this emphasis on consistency is not just for consistency between keepers. We also wanted to make sure that we could accurately compare data over time in order to track improvements or declines in welfare. The time it took to plan and thoroughly test in the beginning of this process allowed us to make sure most of the categories stayed consistent quarter to quarter. For example, it would be difficult and unscientific to compare an animal's “keeper interactions" year to year if initially assessors scored high because

they only included training time but later decided this category should include all interactions including vet procedures and cleaning.

Embracing Adaptability

While consistency in assessment style and structure was essential, it was very important that we kept a certain amount of adaptability. The last thing we needed was a system that seemed wonderful in theory but was clunky or failed to capture what we were trying to capture. So as the months passed, we did a decent amount of tweaking:

- We started with taxa-specific assessments and learned that, for some animals, we needed individualized assessments to effectively encompass their personal circumstances. For example, we found that our birds, turkey vulture and military macaw (*Ara militaris*), were significantly different from one another and forcing them to stay with the same list of assessment categories was doing them a disservice.
- For some taxa/individuals, we found certain categories that were included initially to be irrelevant or impossible to quantify. For example, keepers couldn't say with accuracy whether termites were showing positive keeper interactions since we know too little about termite behavior and what constitutes "positive" interactions with keepers.
- For other taxa/individuals, we found that we needed to add more categories to their assessments in order to get an accurate, full picture of their welfare. For example, the category for environmental parameters included temperature and humidity. While this is adequate for most animals, we knew that reptile health and welfare is closely tied to whether they have adequate access to UV. We did not want to lump this with the other parameters as UV has distinct impacts on health so we created a new category.
- We wanted our staff to feel ready to assess new species added to our collection. This meant that we had to be comfortable with discussing what categories we felt were relevant rather than blindly applying the protocol from our other animals from that taxon.

This troubleshooting/adjustment process gave keepers a sense of ownership for our welfare program. Keepers were very open to try doing the assessments knowing that anything could be discussed and adjustment to be more relevant and valuable. Eventually, the team felt the assessments were able to capture a full picture of their animals and were able to see firsthand the benefits of the assessment process.

Creating Time in Keeper Schedules

When we did our first welfare assessment training, we met in our office area. Despite detailed prep work and having our welfare specialist present to facilitate the training and answer our many questions, we quickly realized that implementing our welfare assessment program was going to take time – lots of time. And we determined we needed to make it fun and relaxed so that it was something that the keepers could look forward to. We didn't want this to feel like a chore or a cumbersome meeting. We needed to avoid viewing this as a task that took keepers away from their work, but rather as a task that elevated our work in caring for our animals – something extremely worth the time.

We decided to commit to having a group break at our favorite spot, the Coffee Bean across the street, every week at the same time. We would bring all of our welfare documents, and after break we would stay in the outdoor food court and discuss welfare assessments. We invested this time as a team. Everyone was invited to these discussions from our volunteers to our team

manager, and, of course, our welfare specialist was always there too. And everyone came every week. We successfully held this meeting for nine months (until COVID-19 entered the scene and we were required to split into two physically and temporally separated teams).

Prioritizing The Time

We were only able to reliably make this commitment as a group because we all chose to prioritize the time and support each other. Each keeper was dedicated to helping others on different routines accomplish their tasks of the day and week in order to help everyone have the time to attend our welfare meeting. Rather than simply being informed by higher-ups that we needed to figure out time to do our welfare assessments, the keepers took ownership of the program and approached the time required as a team. We worked together to come up with the best way to make our welfare goals a reality. Department higher-ups supported us committing the time we needed to develop a robust program. Our time investment paid off! It gave us needed direction, clarity, familiarity, and confidence. Now assessments can be completed in only a few minutes which allows us to sustainably complete quarterly welfare assessments on every animal in our entire collection.

Continuing Assessments During the Pandemic

Time devoted pre-pandemic set a firm foundation for keepers in split shifts since consistency and efficiency were established. There was also an openness to reach out to each other for second opinions virtually. The animal welfare specialist/registrar also attempted to remain the constant between teams and provided clear communication of deadlines and any changes.

Having weekly meetings to do group welfare assessments with all of the keepers really made assessments cohesive and prepared us for the pandemic when we adopted a split shift/no contact schedule and were encouraged to stay away from people working the same shift. We could no longer do group welfare assessment meetings as we had been. A year of discussing each score in such detail enabled us to continue to score similarly when keepers suddenly had to change to completing assessments on their own. Of course, the team was still available virtually for questions. But, for the most part, each keeper had enough experience because of our previous group meetings that few questions arose. Most questions were checking in to see if staff on the opposite shift were noticing similar indicators from the same animals.

Maintaining consistent scoring among all of the keepers would have been very difficult (or impossible) without the time we invested together as a whole group when we initially rolled them out. The keepers are really good about reaching out to others for their input when multiple keepers worked with the same animal throughout the assessment period, but we have rarely seen a need to make adjustments to the original keeper's scores since we're usually on the same page.

Benefits to Humans and Animals

Team Building

Welfare training led to the unexpected benefit of team building. Our team approach improved our welfare program, and it also improved our relationships with each other and our overall team dynamic. Those conversations were safe spaces that encouraged our less outspoken team members to find their voices. And we were all able to practice resolving differing opinions to find common-ground solutions. The welfare assessments allowed us to highlight individual's

strengths and to help support each other in areas that we could see needed improvement. Reviewing assessments together helped solidify our culture of non-judgment. We do not shame keepers for low scores. Rather, those scores are viewed as opportunities to learn and develop our husbandry practices, and we are grateful for the information that allows us to improve our animals' lives. Determining the assessment scores allowed us to easily see and celebrate our successes. The entire process gave us a sense of pride and group accomplishment knowing that we were engaging in the important work of improving animal welfare. The meetings were also a lot of fun, and this promoted our camaraderie with each other.

A Few Examples of Benefits to Animals

- Reticulated Gila monster (*Heloderma suspectum suspectum*): Scoring stress and keeper interaction responses led us to re-evaluate our handling protocols to improve his welfare while maintaining safety.
- Giant sea bass (*Stereolepis gigas*): Using ZooMonitor®, aquarists were able to track behavior of our giant sea bass before and after abnormal events around the kelp tank. This helped us see if there were any instances of spending time in areas of the tank they normally don't visit, pacing, increased aggression, or any other potential indicators. We wanted to see if these abnormal events, such as construction, weddings, parties, other events near the kelp tank at odd hours would have an impact on these animals.
- Chilean rose tarantula (*Grammostola rosea*): Regular assessments of the environmental parameters in the tarantula's enclosure prompted us to question why we misted this enclosure when their humidity requirements were so low. It is easy to fall into patterns of "we've always done it that way" and clearly this was one such circumstance. Welfare discussions provided the perfect opportunity to change protocols without judgement.
- Turkey vulture: Our turkey vulture receives an individually tailored quarterly assessment, a daily chronic condition assessment, twice daily 10+ minute ZooMonitor® observations, and quality of life assessments when he has joint flare ups and when he encounters new situations that could be stressful (like changing locations or hearing construction work). All of these assessments help us understand and improve care for a permanently disabled rehab animal with a difficult history.
- Western pond turtle (*Actinemys marmorata*): We created a monthly chronic condition assessment to track potential plastron changes on a turtle with a history of shell rot. This helps us effectively communicate updates to veterinary staff without having to catch this turtle up more often than her monthly weights in an effort to reduce unnecessary stress.
- Western hognose snake (*Heterodon nasicus*): Keepers had noticed some evidence of pacing but there was no concrete data and management was reluctant to take this individual off exhibit. With help from the welfare specialist a daily behavior assessment was created to monitor for pacing. The hognose was then moved into a larger and more complex enclosure and assessments were continued to see if there was a significant difference in his behavior. A significant difference was observed and this provided the needed justification to move him permanently.

Conclusion

Developing a welfare program that is both consistent in scoring and adaptable to meet the needs of staff and animals is critical to gaining valuable data from the assessments that can be compared over time. Investing time up front to develop and implement the program and

involving keepers in the entire process can greatly impact how useful and effective the program is. Support from higher-ups and colleagues is essential to make the time needed to prioritize welfare. While the Association of Zoos and Aquariums only requires yearly assessments, we see great value in more regular assessments as well as incorporating a variety of offshoot assessments beyond the scheduled, routine ones. A robust welfare program has the potential to not only be highly successful in analyzing welfare but also to improve the lives of the animals being assessed and to improve team dynamics as peers collaborate in this effort.

Contact Information

Don't hesitate to contact us! We are happy to share our experiences and our documents.

- Jennifer Heinsius (Registrar/Animal Welfare Specialist), jheinsius@californiasciencecenter.org
- Erin Hoff (Senior Keeper), ehoff@californiasciencecenter.org
- Louise Leborgne (Senior Keeper), lleborgne@californiasciencecenter.org

Special Thanks

We'd like the thank the entire husbandry team in the Living Collections department at the California Science Center. We are especially grateful for our director, Misha Body, and our previous manager, Josh Hestermann, for allowing us to spend the time required to develop and implement our welfare program. And we are proud to work alongside a team of fantastic keepers who eagerly and enthusiastically participated in this process. We appreciate the time they spend observing our animals every day and completing regular, meaningful assessments. We admire their commitment to excellent husbandry standards and peer relationships as well as their dedication to continuous improvement.

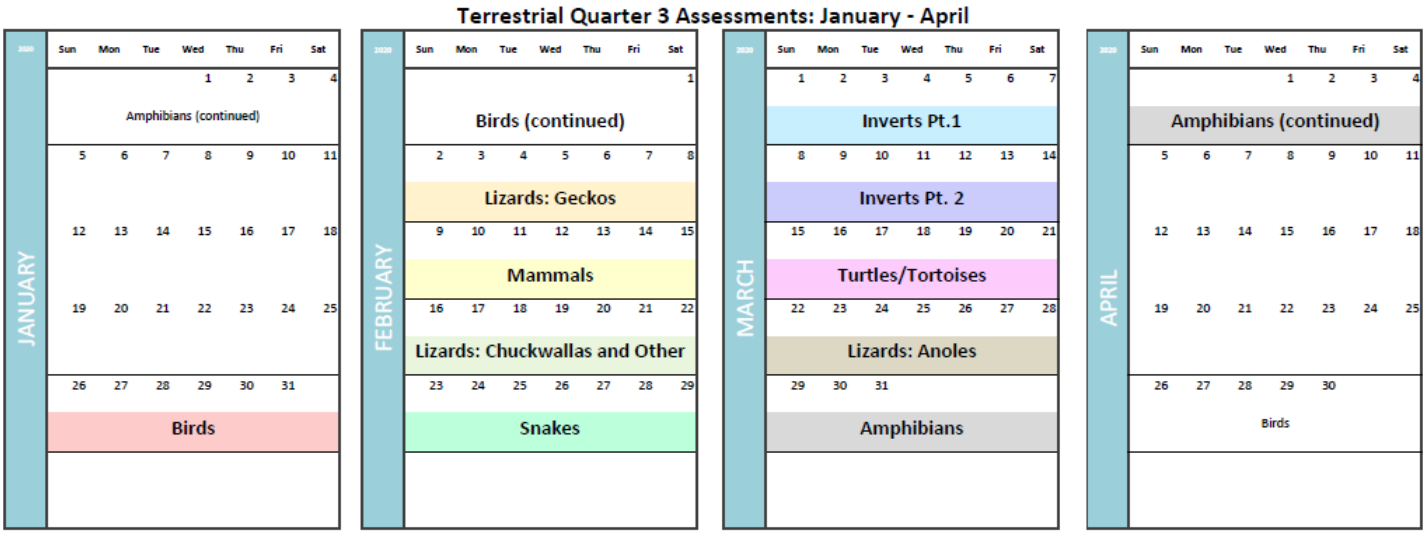
Tables/graphs/illustrations

SPECIMEN HOLISTIC			
Category	**Description**	**Score**	**Scoring Description**
Social			
Aggression	Looking at attack behavior (nip chase charge), display behavior (lateral display and operculum flare), and submit behavior for signs of species appropriate timing, amount, and type of behavior.	1	The focal animal initiates aggression beyond or below what is species appropriate. This might mean fighting/aggressing without resources (food, shelter, feeding sites, mates, spawning sites) present or in an amount exceeding species appropriate levels (leading to excessive injury and death).
		3	The focal animal is often aggressing and/or submissing appropriately but is not consistent. Focal animal might show some instances of inappropriate aggression or submission behavior.
		5	Aggression and submission behavior are consistently seen in species appropriate amounts, types, and times.
Animal-caretaker interactions	This looks at the animal-caretaker relationship for signs of consistent and interactive positive interactions. Positive relationships show a distinct lack of fear or discomfort when being trained, fed, or handled.	1	The animal shows consistent discomfort when caretakers enter their space. This could include moving away, hiding, or species-specific fear displays. Focal animal does not participate in training, feeding from hand, or eating in presence of caretaker and attempts to escape any handling.
		3	The focal animal sometimes has negative interactions with caretakers. They show some signs of fear or discomfort.
		5	The focal animal shows consistent signs of positive responses to caretaker presence as well as active participation in training, feeding, or handling sessions where applicable. The animal never shows signs of fear or discomfort during the presence of any caretaker.

Figure 1: An example of two indicators from our specimen holistic (individual animal) list. There is a definition for the indicator itself, and descriptions for scores 1,3, and 5.

OUTLIER			
Category	**Description**	**Score**	**Scoring Description**
Social			
Aggression	Looking at the groups display of species appropriate attack behavior (nip, chase, charge) and display behavior (lateral display, operculum flare, etc.). Must look at the amount of behaviors observed, types of behaviors, and at what time/context they are being performed. Looking for species appropriate reactions given context.	1	50% or less of the population shows signs of species appropriate aggression.
		3	70% of the population shows signs of appropriate species appropriate aggression.
		5	90% or more of the population shows signs of appropriate species appropriate aggression.
Animal-caretaker interactions	This looks at the animal-caretaker relationship for signs of consistent and interactive positive interactions. Positive relationships show a distinct lack of fear or discomfort when being trained, fed, or handled.	1	50% or less of the population shows a positive relationship with the caretaker.
		3	70% of the population shows a positive relationship with the caretaker.
		5	90% or more of the population shows a positive relationship with the caretaker.

Figure 2: An example of two indicators from our outlier (group of animals) list. There is a definition for the indicator itself, and descriptions for scores 1,3, and 5.



Birds	RR: Military Macaw D: Turkey Vulture
Lizards: Geckos	WOL: Crested Gecko, Henkel's Leaf-Tailed Gecko, Giant Leaf-Tailed Gecko, Mossy Leaf-Tailed Gecko, Satanic Leaf-Tailed Gecko
Mammals	RR: Norway Rat, House Mouse WOL: House Mouse, Mongolian Gerbil, Tenrec
Lizards: Chuckwallas and Other	RR: Cuckwalla WOL: Prehensile-tailed Skink, European Legless Lizard, Inland Bearded Dragon D: Chuckwalla, Desert Spiny Lizard, Gila Monster
Snakes	WOL: Boa Constrictor, Ball Python, Western Hognose Snake, Corn Snake, Sand Boa D: Rosy Boa

Inverts Part 1	RR: Bess Bug. Sow Bug, Dermestid Beetle WOL: Arizona Stripetailed Scorpion, Desert Hairy Scorpion, Emperor Scoprion, Chilean Rose Tarantula, Cactus Longhorn Beetle D: Blue Death Feigning Beetle, Cactus Longhorn Beetle, Desert Hairy Scorpion, Desert Blond Tarantula, Vinegaroon
Inverts Part 2	RR: House Fly, Caribbean Giant Cockroach, Madagascar Hissing Cockroach, American Cockroach WOL: Caribbean Giant Cockroach, Millipede, Madagascar Hissing Cockroach, Giant Mealworm, Eastern Subterranean Termite, Regal Jumping Spider, Velvet Ant D: Montane Honey Ant, Carribean Giant Cockroach, Long Legged Ant, Sonoran Desert Millipede, Velvet Ant
Turtles/Tortoises	RR:Pacific Pond Turtle WOL: Ornate Box Turtle, African Pancake Tortoise D:Desert Tortoise
Lizards: Anoles	WOL: Guantanamo Anole, Cuban Green Anole
Amphibians	WOL: Red-Spotted Toad

Figure 3: An example of the terrestrial schedule for one quarter. This has every taxonomic group and species listed for the week. Some weeks have only two animals while others have significantly more. At the bottom you can see species separated by routine.

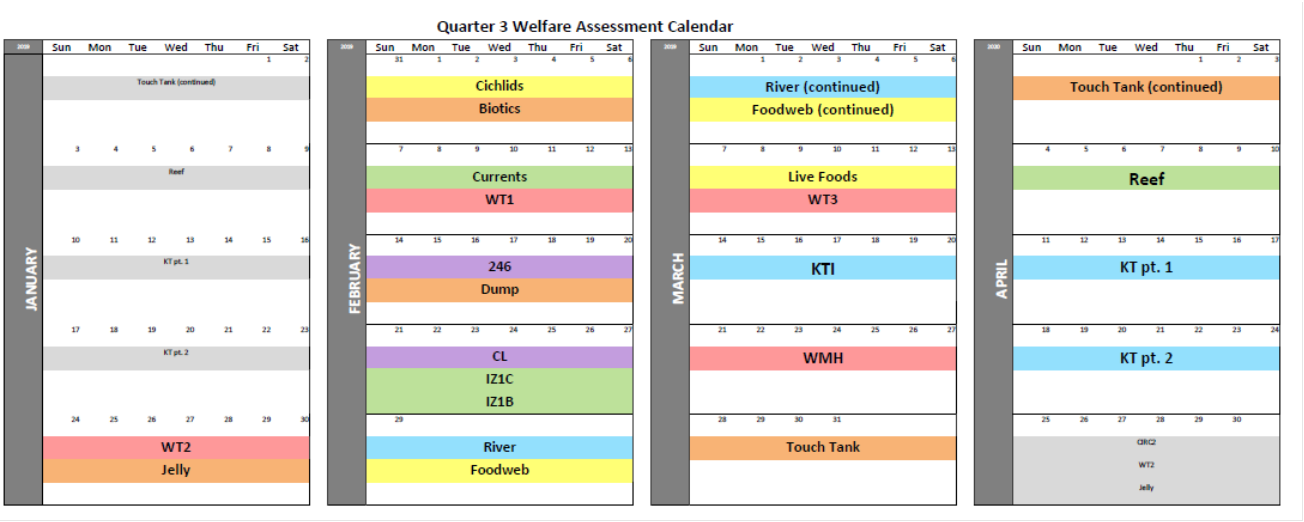


Figure 4: This shows an example of the aquatics assessment schedule for one quarter. This is separated by enclosure, with each color indicating a different person responsible. When creating this, the aim was to ensure that each primary aquarist had some time between assessments. Each week only a few people will have assessments due when their enclosure comes up. This was done so that staff could receive help from other staff members if they needed extra time to complete assessments.

Edit Quality of Life - Terrestrial (Individual) Assessment

Assessment | Action Plans

Entity B00231

Assessment Time 6/2/2021 11:48 am

Observation Type	Weight	5/27/2021	Assessment	Comment
Activity Budget	1.00	5 5	5 5	
Adequate Space	1.00	5 5	5 5	
Animal-Caretaker Interaction	1.00	5 5	5 5	
Attention Level/Attitude	1.00	5 5	5 5	
BCS/Weight	1.00	5 5	5 5	
Consumed Diet	1.00	5 5	5 5	
Environmental Safety	1.00	5 5	5 5	
Fear Display	1.00	4 4	4 4	Flinching due to unexpected sounds appears to be subsiding.
Health Status	1.00	5 5	5 5	
Hydration Level	1.00	5 5	5 5	
Posture and Mobility	1.00	5 5	5 5	
Signs of Stress	1.00	4 4	5 5	No obvious signs of feather loss or stereotypic behaviors. Feathers will likely remain in poor condition until replaced. No new
Space Utilization	1.00	5 5	5 5	
Urination/Feces	1.00	5 5	5 5	

Created by Jennifer Heinsius

Score: 4.93

Figure 5: This is a recent example of a quality of life assessment for our military macaw. He was moved to a new outdoor enclosure near our turkey vulture and we wanted to track how this move was impacting their welfare. We started with weekly quality of life assessments and have since moved to monthly assessments. This shows and example of what our quality of life assessments

look like. They are a longer list of indicators that cover a wider range of their life that the routine assessments might not look at due to lack of concern in those areas.

References

- Mellor, D.J. and Beausoleil, N.J. (2015). Extending the 'Five Domains' model for animal welfare assessment to incorporate positive welfare states. *Animal Welfare*, *24*(3), 241-253.
- Vicino, G. and Miller, L.J. (2015). From prevention of cruelty to optimizing welfare: opportunities to thrive. International Ethological Conference, Cairns, Australia.

Products Mentioned

- ZooMonitor®: Lincoln Park Zoo
  - Email: zoomonior@lpzoo.org
  - Website: https://zoomonitor.org/
- Tracks® Software: Tracks Software by Zier Niemann Consulting
  - Contact: Tony Niemann
  - Email: support@trackssoftware.com
  - Address: 501 W 5th Street, Salida, CO 81201
  - Office: 719-207-4217

Growing Up Jaguar

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Abstract

The Houston Zoo Carnivore department has cultivated a training program that relies on strong, positive keeper-animal relationships and focuses on setting the animal up for success both within our zoo and at future zoos. Working with a breeding pair of jaguars, *Panthera onca,* and their offspring, trainers focused on behaviors that would become essential in the care and transfer of these individuals. Training plans were designed and implemented for voluntary radiograph, socialization, separation, injection, blood collection, emergency recall, and crating behaviors. Through the voluntary radiograph, separation, and socialization behaviors, keepers were able to monitor the dam and allow her to choose to participate in sessions while also creating healthy, well-adjusted cubs that had positive experiences away from the dam. Using voluntary injection, blood draw, and emergency recall behaviors, trainers set the cubs up for success for future medical or emergency situations as they aged. Finally, trainers used the voluntary crate behaviors to create in-house transfers and prepare them for successful moves to different AZA zoos.

Introduction to housing

The Houston Zoo Carnivore department currently consists of nine keepers and a supervisor that manage nine species dispersed into three sections: Africa, America, and Tiger Building. Africa includes lions, painted dogs and cheetahs, America is the Hamill Foundation Black Bear Exhibit and the new Pantanal jaguar habitat. The Tiger Building houses a diverse population including 1.1 Malayan tiger, 1.1 cougars, 1.1 clouded leopards, 1.0 ocelot, 1.1 fossa, and the 2.2 jaguars. This section requires 1-2 keepers to manage it daily. The Tiger Building consists of 41 individual bedrooms broken into three parts: 1-23, 24-36, and 37-41. Stalls 1-23 are connected via shift doors and have access to shift hallways that are connected to five exhibits (A-F) known as Small Cat Row. At first there was only one transfer guillotine that a crate could be secured to for Small Cat Row holdings and it was located in stall 23. A secondary transfer guillotine was installed in the shift hallway between stalls 5 and 6 to facilitate jaguar crate training. Stalls 24-41 are located opposite of the Small Cat Row holding stalls but are usually divided into three sections: exhibit G with holding stalls 24-31, exhibit H with holding stalls 32-36, and exhibit I with holding stalls 37-41. Stall 27 is the only stall in this group that has a transfer guillotine for crate training, however keepers have the ability to connect stalls 24-36 via a solid mesh transfer tunnel between stalls 31 and 32. This tunnel can be left in place for training or enrichment at the trainer or section keeper's discretion.

The Houston Zoo has the ability to house jaguars in multiple fully mesh enclosed habitats in the Tiger Building (TB). The main habitat used to house jaguars is TB exhibit G and contains accessible rock structures, natural foliage, a waterfall and pool, and relative seclusion from other exhibits. The holding area consists of eight stalls that vary in size and shape with multiple table heights and

water sources with two exhibit shift access points. Another exhibit that has been utilized is exhibit A which contains a water feature, accessible rocks, elevated platforms, and propping with one exhibit access point to four holding stalls.

Introduction to 2.2 jaguars

The Houston Zoo received 1.0 Tesoro and 0.1 Maya as part of a SSP breeding recommendation. Maya came from Turtle Back Zoo in January 2016 and she was transitioned to TB exhibit G quickly after quarantining at the zoo's vet clinic. Maya quickly settled into the carnivore department and the designated primary trainer began to work with her on the behaviors that she knew from her previous facility. Even though she settled into the department, she was an animal that proved difficult to work with as she did not seem to find reinforcement in working with most keepers. Primary and secondary trainers worked together to build a positive relationship with her utilizing the reinforcement she viewed as the highest value, which was fish and meat flavored baby food. Two keepers worked with her daily and were able to successfully transition previously learned behaviors of line-up and injection to the departmental cues. Once these behaviors were completed and transferred to other keepers in the department, primary trainers focused on radiograph and separation training for o prepare for breeding and voluntary crate behavior for departmental transfers.

Tesoro arrived from The Living Desert Zoo in April 2016 and was initially housed in TB exhibit A before moving him to TB exhibit G. Tesoro took much longer to settle into a routine within the department, so keepers focused on monitoring his behavior and creating positive experiences in his new habitat. Tesoro began to appear more comfortable in his new routine in July 2016, so the primary trainer began to transition his known behaviors of line-up and injection to the departmental cues before opening them up for the rest of the department. Tesoro's behavior continued to improve as the department waited to get the official recommendation to breed.

Maya and Tesoro rotated on TB exhibit G until visual and howdy introductions started in January 2017. Physical introductions were completed in holding starting April 1, 2017 and successful breeding occurred April 2-8. Maya continued to rotate on exhibit with Tesoro until July 4, 2017 when cubs were confirmed via voluntary radiograph. Three cubs were born on July 20, 2017 and 1.1 cubs (1.0 Fitz and 0.1 Emma) survived. Maya was very attentive and raised Fitz and Emma until she began to display estrus and aggressive behaviors that deemed it was necessary to separate. Fitz was fully separated June 5, 2018 and after observing aggressive behaviors such as growling, lunging, and door banging the decision was made to transfer him to TB exhibit A on August 23, 2018. Soon after Emma was fully separated due to aggression from Maya on September 10, 2018 and she was transferred to TB exhibit A to rotate with Fitz on January 15, 2019. After both moves, keepers observed a short transitional period where Fitz and Emma adjusted to the new area but otherwise the interactions with keeper staff stayed very positive. Trainers continued to work essential behaviors such as line-up, injection, tail blood collection, emergency recall, and crate behaviors in this new area until we received the recommendation to transfer to a new institution. Both young jaguars were voluntarily crated and loaded into the transport vehicle within 10 minutes

of starting the session. Emma moved to Zoo Miami on July 29, 2019 and Fitz to Woodland Park Zoo on December 12, 2019.

Introduction to training

In the carnivore department every keeper works with each animal as they rotate through each section, however each keeper is a primary trainer for specific individuals. Primary trainers are responsible for monitoring weights, suggesting diet changes, ensuring their primary animal is trained at least three times a week, and monitoring behavior criteria for maintenance behaviors. Any keeper can train an animal a behavior as long as it does not interfere with a current behavior being worked on (ie. A trainer can't work on a tongue present if an open mouth behavior is currently being worked on). Once a behavior is completed, it is opened for all carnivore keepers to ask during training sessions to maintain the criteria and build stronger relationships. Keepers are encouraged to record or watch training sessions to help each other be more successful and monthly training meetings are a resource for troubleshooting roadblocks that trainers might encounter.

When an animal first arrives within the carnivore department, keepers focus on acclimating the animal to the new enclosure, observing the nuisances of the animal's individual behaviors, and deciphering the highest value reinforcer for the individual. Once the animal is acclimated to the space and the keepers, the appointed primary trainer works on transitioning previously known behaviors to the departmental cues. This allows for the animal and trainer to begin to learn how to best communicate with each other and create a rapport between them. After all known behaviors are transitioned, they are passed off to all other keepers in the department and then any keeper may begin to submit training plans to train new behaviors with the animal.

Radiograph training

Trainers decided to use the mesh transfer tunnel, located between stalls 31 and 32, as the ideal location to train a voluntary radiograph behavior with Maya. The tunnel is 8 feet long, 3 feet high, and 3 feet wide with a guillotine shift door on either side. Trainers had all keepers feed Maya in the transfer tunnel to acclimate her to the new space and she was left with access to it overnight when possible. In the meantime, a platform was built, using 2x4s and ½" plywood, for the tunnel that would protect the radiograph plate while also supporting Maya's body weight. Once completed, trainers slowly began to introduce Maya to the various objects and sounds that would be used for the radiograph. The objects included a cardboard box painted yellow to simulate a radiograph machine, the platform, the trigger button, a flashlight, and lead vests that the trainers wore during sessions. The sound of a radiograph being taken was also recorded and introduced which included the click of the trigger, the beep of the machine, and clicks from the machine as it registered the radiograph. Maya was very confident during sessions and did not appear to react to any of the extra sounds or objects as they were introduced. The main focus became the positioning and stillness of Maya's body while she was on the platform. It was determined that the best position for her was to be laying in a sternal posture with the machine shooting down from the top of the tunnel mesh. After three sessions, trainers introduced the veterinary technicians and since Maya did not react to their presence a radiograph was attempted the next week. The veterinary staff were able to see two possible areas on the radiograph but they could not confirm the pregnancy. Trainers continued to

work on Maya's posture as the potential pregnancy progressed, and another radiograph attempt was made a month later. Veterinary staff were able to distinguish two distinct cubs on the radiograph and both appeared to be developing at the expected rate. With this news, trainers began to develop and get approval for behaviors that would allow for early and positive cub management and training: socialization and separation.

Separation and Socialization Training

The separation and socialization training sessions were tightly linked because keepers were focused on making sure Maya was not kept away from her cubs if she wanted to return to them. Due to the links between these two behaviors, progression on socialization was dependent on Maya having a highly reinforcing session in an adjoining stall. A list of positive and negative behaviors were compiled for keepers to watch for during the separation and socialization sessions. These behaviors were focused only on Maya and if she displayed any of these behaviors the session was ended and she was given the remainder of her diet and reinforcement. Positive behaviors included responding to the trainer calling her name, participating in training, resting, and staying focused on the trainer while food was presented. Negative behaviors that trainers looked for included agitation (presents as fast pacing, not responding to name or food presentation, and door banging) and aggression (appears as vocalizing, lunging at mesh, and mesh biting). A trainer stayed with Maya for the whole separation/socialization training session and offered reinforcement consistently. Once the session ended Maya was given access back to the cubs and then reinforced with a high value reward. While a trainer stayed focused on Maya for the sessions, multiple keepers were allowed to enter a stall that adjoined with the cubs for socialization sessions.

The carnivore department has experience with cub socialization dealing with clouded leopards, *Neofelis nebulosa,* and cheetahs, *Acinonyx jubatus*, so these protocols were modified for the jaguar breeding program. The goal of socializing with the jaguar cubs was for keepers to become a positive or neutral presence in their life, not to encourage cuddling. The other goal of the socialization sessions was to help the cubs transition to eating meat which would allow for the training process to begin and allow keepers to build relationships. Keepers had a list of desirable behaviors to look for including: playing with toys, playing with other jaguar cub, sitting calmly on lap, licking arms or legs of the keeper, and participation in training sessions. There was also a list of undesirable behaviors that keepers had to constantly look for. These behaviors included jumping on keepers, biting/scratching clothing, stalking/lunging, swatting, hissing/growling, or sucking/suckling on toys. The goal was to either prevent these behaviors from occurring or, if the behavior occurs, to redirect the behavior with a toy. Should the unwanted behaviors continue a firm "no" was applied, but the cubs had to be taught what no meant by accompanying it with a firm tap or flick on the nose, preferably before keepers saw the behavior happening or quickly after. The key for trainers to catch the behaviors before they occurred is by learning to predict the negative behavior by watching the cats body language such as tail flicking, vocalizations, and stalking/pouncing posture and respond by either giving the cub space or leaving the session altogether.

Separation training started two weeks after parturition by simply calling Maya into an adjoining stall and reinforcing with her normal diet. The primary trainer began to incorporate a second

keeper to make noise and move the shift weights to prepare Maya for the doors opening/closing between her and the cubs. Maya did well with this training until the first socialization session, which occurred a week after separation training started. As soon as keepers entered an adjoining stall with the cubs, Maya's attention and focus split from the trainer and the decision was made to end the session early. Maya's willingness to leave the cubs declined after that session and keepers were forced to take a few steps back to help increase Maya's comfort level. These additional steps included: regaining Maya's comfort in moving into an adjoining stall and having the shift doors open/close, increase the amount of neutral keeper presence around the jaguars, and resuming normal operations within the building. A month after these changes were put in place, keepers were able to resume socialization sessions. The cubs had minimal interactions with keepers socializing and mostly chose to stay in the holding opposite from keepers, while Maya became more comfortable being separated and was even observed resting in the stall during sessions. After two weeks of consistent socialization sessions, the male cub finally began to approach keepers and even took goat milk reinforcement. The next week both cubs began to take meat mixed with goat milk from keepers during socialization sessions and soon after socialization sessions were discontinued due to the size and development of the cubs at three months of age.

After we ended socialization sessions, keepers continued separation training with the goal shifted to building the jaguars confidence by having positive experiences away from the dam. This assisted with the introduction of training to include base behaviors such as bridge, target, station, sit, stand, down, open mouth, and tongue present. Every time keepers needed to train or feed the cubs they were separated to prevent food aggression from occurring and to promote positive interactions with keepers. As the jaguars became more comfortable with these short instances of separation, keepers began to increase duration based on behavior. For example, there were instances where either Maya or the cubs would not shift on or off exhibit together. In these instances they were kept separated while keepers monitored their behavior and were given another opportunity to shift together later in the day. Maya and the cubs were never kept separated for more than five hours when this occurred, and keepers only observed positive/calm behaviors from them by basing the separation on their behavioral cues. The department continued these practices until Maya began to display estrus behaviors about one year after parturition and aggressed on Fitz. Due to the recurrence of the estrus behaviors in Maya, the decision was made to no longer house Fitz with Maya. With Fitz's permanent separation from Maya, new separation protocols were developed to allow Emma to rotate time between Fitz and Maya. Fitz, Maya, and Emma maintained visual access at all times to allow for a smooth transition when shifting Emma between the two groups. Keepers maintained the fission/fusion groups by keeping a close eye on each jaguar's behavior as they were separated and then reintroduced. After three months, the rotations were ended and all jaguars were managed separately due to aggression from Maya toward Emma.

Line-Up and Injection Training

As the separation between Maya, Emma, and Fitz increased, keepers were able to begin working on more management based behaviors with Fitz and Emma. These behaviors relied on positive relationships and sustained duration and included line-up, injection, and tail blood draw. Keepers started by setting up a line-up with either a bar or cinder block that would help position Fitz and

Emma. The cubs were then targeted into position and reinforced for staying in the line-up. Emma quickly took to this training while Fitz was more reserved and struggled to stay in position unless food was present. Once the cubs were comfortable sitting in the line-up for extended durations without receiving constant reinforcement, trainers began to integrate a touch behavior at the hip. Neither jaguar fully accepted the touch to the hip, so keepers transitioned to touch acceptance throughout the body using constant reinforcement. As Fitz and Emma became more comfortable with the touch behavior along their entire body, their comfort with a touch to their hip increased. The keepers were able to phase out the constant reinforcement and transition to only reinforcing after the behavior was bridged. Keepers then tested the strength of the behavior by incorporating other keepers, veterinary technicians, and moving the position of the line-up to various stalls and the exhibit before successful injections were achieved.

Tail Blood Draw Training

While moving the line-up and injection behaviors to various stalls, trainers also took advantage of when Fitz or Emma would move their tail under the mesh or door. If they completed this behavior voluntarily, trainers would bridge and reinforce with a high value reinforcer (such as chunk meat, fish, or baby food) before continuing the session. This allowed trainers to quickly and easily transition into a tail blood draw behavior. As the cubs became more comfortable with moving their tail under the mesh, trainers began to incorporate the touch behavior to their tail and with the previous body touch training both cats quickly accepted the behavior. After touch was accepted, the next steps included introducing tail manipulation, alcohol application, and a practice syringe for needle insertion training. Each new variable was introduced with no negative reactions and keepers were soon ready to incorporate veterinary technicians and attempt to collect blood. It soon became apparent that communication between the technician and the trainer was paramount for this training as un-cued movement by the technicians began to set training back. For example, during one of the first sessions, the technician reached for Fitz's tail before the touch cue was given. Fitz immediately pulled his tail back under the door and left the line-up area. Fitz was hesitant about re-entering the line-up but due to the relationship between Fitz and the trainer the session ended with Fitz moving his tail back under the mesh. Trainers continued to build communication between the trainer and technician while also building the confidence of both young jaguars until successful voluntary blood collection was achieved with both Emma and Fitz.

Emergency Recall Training

All animals within the carnivore department are shifted into holding by presenting an open door and calling their name. In emergency situations keepers tend to resort to baiting with high value items to shift animals into holding. To avoid having to bait an animal with the risk of them not moving into holding, trainers planned to train an emergency recall behavior with Fitz and Emma. Emergency recall is an important behavior to have for dangerous animals. The hardest part of training the behavior is selecting an appropriate sound cue and the right high value reinforcers for the behavior. Since keepers had worked with Fitz and Emma since birth they were already familiar with the preferred reinforcers for each cat. The reinforcement that each individual deemed to be the most reinforcing was fish for Emma, and raw eggs for Fitz. Keepers rotated through high value reinforcers when training the behavior to provide unpredictability of the reinforcement. Keepers

began training the behavior with both jaguars secured in holding and sounding the recall cue while feeding their diet and/or high value reinforcers. Trainers then transitioned to sounding the recall cue and following with reinforcement. Next, the cue was sounded and the cats were shifted for reinforcement while still in holding. Finally, trainers began sounding the recall cue and calling the animal's names from inside the holding while the jaguars were out on exhibit and reinforcing once they shifted inside. If a jaguar was already in holding they were shifted to their reinforcement in an adjoining stall and towards the sound of the recall. When consistency was achieved, trainers phased out calling the jaguars' names, then reducing time allowed to respond and finally adding distractions. Emma was transferred before the training was completed, but Fitz completed the behavior and would respond to the emergency recall within two minutes with toy and keeper distractions in place.

Crate Training

The final behavior that trainers focused on with the jaguars was a voluntary crate behavior. This behavior ended up being vital for internal and external transfers of all of the jaguars. After Fitz was fully separated from Maya, trainers worked on crate training by feeding all jaguars in a crate placed in stall 32. Keepers were asked to place their diet (with a focus on the juvenile jaguars) in the crate, if no training was to take place and a jaguar was adjacent to the stall that the crate was stored in. As each jaguar became comfortable entering and eating their diet in the crate, trainers introduced the crate doors and the verbal cue "crate" for the behavior. Trainers then moved the crate to the transfer guillotine attached to stall 27 to be able to work on opening and closing the crate doors. Once at the transfer guillotine, trainers focused on the animals' comfort entering the crate on cue while trainers moved around the crate. The next step was to incorporate moving the doors on the crate, which included the verbal cue "door" before opening or closing any door. For a cat that appeared more nervous (like Tesoro), trainers worked on comfort with the doors movement before the cat entered the crate, while with the more confident cats (such as Maya) it was a step that occurred in conjunction with entering/exiting the crate. As trainers slowly closed the crate door with the cat in the crate, the focus was geared on making sure the cats had control over the session. If a jaguar turned around or moved to exit the crate, the door was re-opened to allow for the cat to exit. If they chose to stay in the crate or they re-entered the crate after exiting they were reinforced. Eventually trainers began to see each jaguar choose to stay in the crate even if they turned around. This transitioned to each jaguar eventually allowing the door to close completely without turning around or acknowledging the sound of the door. As each jaguar became accustomed to being in the crate with the door closed, trainers began to increase the duration they stayed in the crate while receiving reinforcement intermittently until management decisions were made to transfer the jaguar.

The first transfer was an internal transfer of Fitz to TB exhibit A. He voluntarily crated and moved allowing keepers to monitor his behavior as he transitioned away from familiar conspecifics and space. Several months later, Emma voluntarily crated and moved to TB exhibit A to rotate on exhibit with Fitz. While Fitz welcomed the familiar face, Emma's stereotypical behavior of chasing and pouncing appeared to be triggered by the increased volume of people and visual stimulus that passed the exhibit. Keepers were able to work her through these stereotypies to help Emma

develop more predictable behaviors that would help her and benefit future keepers. Soon after her move to TB exhibit A, Emma received the recommendation to be transferred to Zoo Miami.

Trainers continued to focus on all of her current medical and safety behaviors until she was crated within three minutes and moved into the van that drove her to Miami. Six months later, Fitz received a recommendation to transfer to Woodland Park Zoo. Due to this impending transfer, the team decided to move Maya to TB exhibit A where she would have the opportunity to go onto exhibit every day vs rotating on TB exhibit G with Tesoro. Maya voluntarily crated and moved into the new exhibit within 10 minutes. While moving the crate, Maya was observed looking out as the crate was moving down the hallway to the new location. Maya had a similar transition to Emma with the higher volume of traffic around the exhibit, but she eventually settled into her new space. Fitz voluntarily crated and transferred via plane to the Woodland Park Zoo where he had a small transitional period before settling into his new space and thriving with the new keepers. The final transfer of the jaguars occurred in the Fall 2020 when Maya and Tesoro were voluntarily crated and moved to a new exhibit at the Houston Zoo. Due to the preparations for and lessons learned from previous transfers, this final transition was flawlessly completed with the assistance of other zoo staff to smoothly and effectively transfer Maya and Tesoro the same day.

Conclusion

The Houston Zoo carnivore department faced many challenges to achieve the noted training success with 2.2 jaguars, the first being staffing. From 2016 to 2020, the department faced a turnover rate of 90% and newly hired keepers became the training team for the jaguars. The trainers focused on building a strong positive relationship with all jaguars while assisting fellow keepers on strengthening their relationship through relationship training sessions. Keepers within the department worked effectively to create time to build these strong positive relationships while also creating time for the trainers to focus on the new and integral management behaviors. As the primary jaguar trainers strengthened their relationship and moved onto training new behaviors, the trainers were inexperienced training things such as blood draw, emergency recall, and crate behaviors. The jaguar training team was able to overcome this by working together to create and execute shaping plans for each of these behaviors. The department and training team was always supportive with each other and feedback was readily accepted and applied to continuously see improvement.

Another challenge with training these behaviors was the consistency of the training area. Trainers were constantly adjusting line-up and crate training areas due to management moves of the jaguars. Trainers were able to use this to their advantage by being consistent in training cues and the rate of reinforcement. The responses between the trainer and the cat rarely changed allowing for more flexibility when moving the behavior to a new area. Trainers were able to keep this consistency by relying on each other. Multiple training sessions were performed with another keeper or jaguar trainer around to discuss how the session progressed and what the expectations were for the next session. Trainers also started to discuss sessions before the start to make sure that whoever was involved knew how each person would react allowing for more predictable responses for the cats.

The final obstacle that keepers experienced was the varying personalities of each jaguar, and the best example of this was during crate training of Maya and Tesoro. Maya was the calmest of the jaguars and quickly progressed through the shaping plan. She appeared comfortable in the crate a week after crate training started and trainers began duration training in the crate after 10 days of working the behavior. On the opposite end of the spectrum, Tesoro was a more nervous jaguar and the crate appeared to be a highly aversive stimulus for him. When keepers were moving the crate within the building, Tesoro would begin to develop frantic behaviors that appeared as pacing and panting. Trainers had to focus on setting Tesoro up for success by working the behavior with a quiet building and creating several positive associations with the crate before even attempting to feed him in the crate. With consistent effort and constant communication, trainers were able to completely flip Tesoro's aversive association with the crate to a positive one where he would run into it and paw with what appeared to be anticipation.

Charlie Shaw

Telling Tails: Monitoring *Panthera Leo* Health Through Tail Training

The main purpose of our project is to obtain blood pressure data and blood samples from our 3.3 lions. This is because blood pressure data and blood tests can be very reflective of an animal's health. With the information obtained, we can get additional aid in monitoring our 3 geriatric cats for potential renal issues as well as allowing us to offer more preemptive and accurate care.

In addition to being able to improve geriatric care, the training will allow us to establish a record of "average" blood pressure rates in African Lions. There is very minimal data collected on conscious cats as most has been collected on cats under anesthesia, and it isn't entirely known how much being under influences their blood pressure. Therefore, we can have a more accurate idea of what their blood pressure is like in a day-to-day setting as well as creating less stress for the cats as we would not have to go through the knock-down process to collect blood pressure data. It would be beneficial to eventually add onto our data pool from other institutions to allow a wider range of data and in turn help to detect potential problems in cats earlier on.

The process of collecting blood samples and blood pressure data start out very similar regarding training. Cats already have an established behavior of "line-up" (the cat sits parallel to and has hip touching mesh) and "touch" (keeper touches cat, typically on hip, at verbal cue) giving us a very strong basis. From there, we start exposing the cats to the use of a snake hook to retrieve their tail on "tail" cue. As sessions progress, we can extend the amount of time that the cat allows their tail to be manipulated, including holding their tail outside the enclosure for longer periods, squeezing, and poking with fingers and blunt objects.

With blood pressure, after the initial training, we are then able to practice placing the cuff on the cat's tail without running the machine and slowly extending that time. Eventually we can run the machine and obtain the actual data. When we initially started, we were only able to perform one reading per session. After many sessions, we have now been able to progress to five readings per session.

With blood collection, we continue the tactile manipulation with their tails, leading up to test pokes with blunted objects. Eventually, veterinarian technicians can attempt to draw blood. As sessions have progressed, cats have allowed for needle redirects and reinjections during single sessions.

With our work, we were able to find out that our geriatric lion "Luke" has increasing kidney values. With this information, we can now monitor him more closely for signs of renal issues as well as perform routine blood work checks to see how he is progressing.

For the future of our project, we are hoping to collect at least two years' worth of blood pressure data to establish a conscious blood pressure average. Eventually, we would like to introduce data from other institutions to expand upon the average as our current collection of lions are all related. Additionally, it gives us the ability to offer training opportunities to other vet techs and keeper staff both in our zoo at other institutions.

Medical Training and general management training of Giant Panda (*Ailuropoda melanoleuca*), at Chapultepec Zoo "Alfonso L. Herrera", Mexico.

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INTRODUCTION

Zoos are responsible for animal welfare of individuals kept for exhibition, conservation and reproductive programs in animal collections.

In order to provide the most suitable conditions for each species, promote natural behaviors and provide proper care, zoos keep animals under human care. Conditioning techniques are one of the tools that can facilitate animal management, kind interactions and respecting animals helps having safer keeper-animal interactions.

Positive reinforcement operant conditioning is a non-invasive technique that helps reducing distress in management and husbandry or in clinical procedures. These techniques have a positive effect in animal health. In the other hand, training techniques helps to detect any abnormalities animals may have, even to manipulate wounds, evaluate gestation stages, administer medical treatments and transport animals and other uses (Savastano, *et al*, 2003).

Generally speaking, training is to teach an animal to perform in a given movement to hold a given position, or tolerate a particular stimulus. The following considerations are crucial for training animals: empathy (a cognitive ability to perceive "the other" and sympathize), cooperation, patience and flexibility. Many authors emphasize the need to strengthen relationships between animals and humans that care for them. Training is a means to enrich relationships and is mutually beneficial (Bayne, 2002).

Training doesn´t mean taming wild animals instead, is seeking animal cooperation to perform concrete tasks for routine or medical procedures (Xuefeng y Yanqing, 2008). It is necessary to have a to have a willing participant (motivated) and not a passive receptor of actions out of their control.

A fundamental principle of operant conditioning is to evaluate actions by their consequences, given that in a positive reinforcement operant conditioning animals are rewarded with a treat that they enjoy for responding appropriately to signals given by the trainer (Prescott y Buchanan-Smith, 2003).

Giant Pandas (*Ailuropoda melanoleuca*) are Carnivore mammals. Listed as endangered by IUCN red list of threatened species, and listed by CITES in appendix I. In 2004-2005 there were 1600 Pandas, in the bamboo forests and 188 under human care. Panda is the symbol of World Wildlife Fund (WWF) since 1961 (Bram, 1986).

Behavior. In their natural habitat, Giant Pandas are terrestrial animals that spend their lives roaming and foraging in bamboo forests in *Sichuan* province *Qinling* mountains. Generally solitary, pandas have defined territories and females do not tolerate other female presence in their territory.

Pandas communicate using vocalizations and odor marks. They are capable of climbing and seeking refuge in hollow trees and rock crevices, although they do not use permanent dens. This is why pandas do not hibernate, instead they seek for warmer regions, similarly to other subtropical mammals.

Pandas rely mainly on their spatial memory, more than relying on visual memory cues. Social encounters happen during mating season. After mating males and females go separate ways. (Bailey, 2004).

Life expectancy in the wild is 12 years, nevertheless a Chinese female named Basi, lived up to 25 years. In the same year, Meimei a panda that was hand raised reached 36 years in the Zoological Garden of *Guilin* city.

Mexican Pandas originated in 1975, with the first couple of pandas that were a present from The Chinese Popular Republic to Mexico as a symbol of friendship and good will (Téllez-Girón, 1979).

MATERIALS AND METHODS.

We worked with Xin-Xin, a female panda, aged 23, from the second generation of pandas born in Mexico under human care, Tohui and Chia-chia.

Xin-xin characterizes by a high activity level, curiosity and a recurrent head balancing stereotypic behavior while walking and aggressive displays.

Data comes from 2011 to 2013 period, training was performed in two separate sessions, a morning (9 am) and an afternoon session (13:30) with an average duration of 10-15 minutes.

There were 20 different exercises of commands, which are listed below.

1. In and out commands 2. Sit 3. Walk 4. Oral opening (keeping mouth open) 5. Sternal recumbency (thoraccic and abdominal auscultation) 6. Lateral recumbency 7. Pelvic limb handling 8. Thoraccic limb handling 9. Nail trimming 10. Hold still position (standing on four limbs) 11. Hold still standing on two legs	12. Hold still on two limbs on top of a tree tunk. 13. Head handling 14. Coat brushing 15. Handling plantar surfaces (plantar pads) 16. Caudal region handling (hold position, handling and sampling) 17. Lateral position for injection or handling. 18. Ear handling 19. Blood sampling sleeve. 20. Turn

Methods: Protected contact, approach and treat. Desensitization from work elements (target, food, keeper voice and whistle), then commands are associated with signals and specification of the objective using a target.

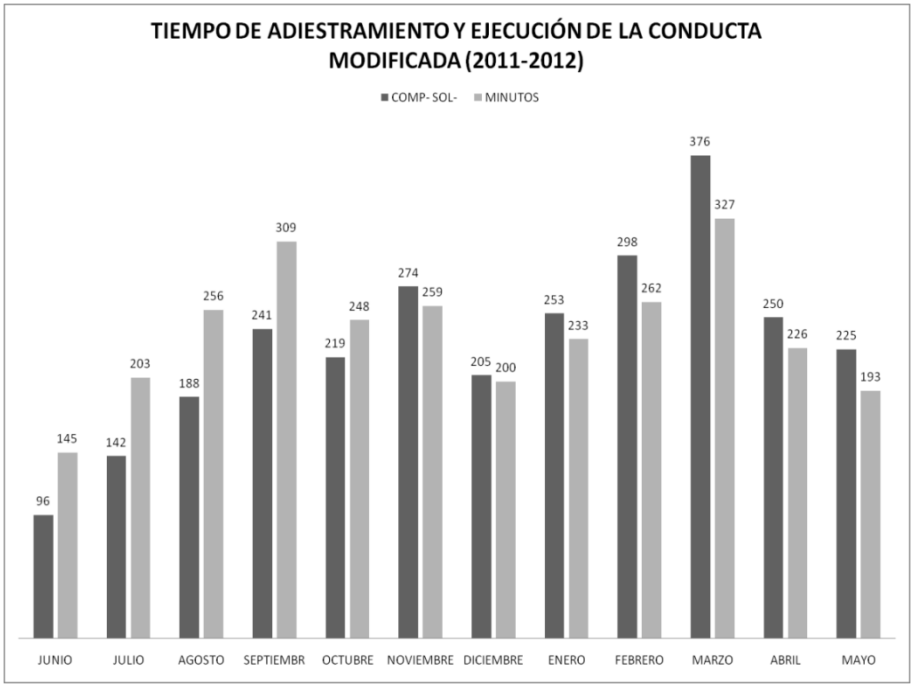
On each session Xin-Xin showed progress, that we reinforced with food treats, voice and an sound signal (whistle) plus a visual signal. The animals cooperated voluntarily at all times and they were never forced. Sessions were shorter of longer according to the individual´s motivation. In case the subject didn´t respond appropriately to the training session "time off" was used, therefore we worked with a total absence of negative reinforcement techniques or any sort of punitive treatment.

Observation methods: Data collection for each session was logged in a format to record time, presentation and advances of commands and behaviors, ambient temperature and relative humidity for each event.

RESULTS AND DISCUSSION

For the first period of sessions for 2011 to 2012 the time to response was reduced for each behavior asked, as shown in figure 1. Changing from 96 responses in 145 minutes to 376 responses in 327 minutes. Which is 46 points of distance. This can be translated as a progressive advance in the conditioning process.

Fig. 1. Training time and behavior execution 2011-2012



Learning for behavior modification implies a physical modification of the brain; these experiences relate to memory, modeling the brain, thus creating individual differences (Feldman, 2005). As a result of the complex and continuous interaction between three systems; effective system (pre-frontal cortex); cognitive system (parietal- temporo- occipital) and expressive system; which relate to execution functions. (De Zubiría, 1989). New learnings are a dynamic process, that is susceptible of revision and readjustments from new cycles that involve the aforementioned systems. Therefore, it is a continuous process. (De Zubiría, 1999). There are also other fundamental factors, intelligence, experience, and motivation; even when all factors are important, motivation is key to any action. Speaking of learning, motivation can be defined as "wanting or willing" to learn. In this case the age and historical management

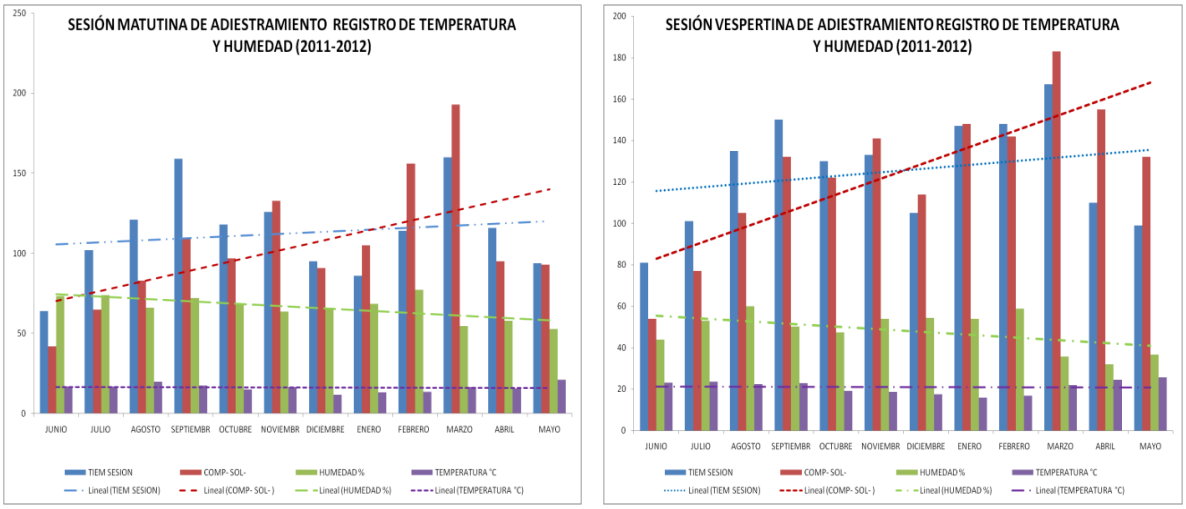
conditions of the subject, also play an important role in the relationship with the keeper as a part of the affective-motivational systems that have enabled access to the behavioral work.

Figures 2 and 3 show differences in work sessions (morning and afternoon sessions) with afternoon session with more responses from the individual, considering that the species is crepuscular.

Mainka y Zhang (1994), have reported adult female pandas held in small enclosures with an activity peak during afternoon hours, in this case, pandas showed more aberrating behaviors. This could mean that the observed responses in the afternoon being more efficient when compared to morning sessions, which could be a proposed strategy to reduce stereotypic behavior.

Regarding temperature and humidity registers, they did not have a significant effect throughout the year. A possibility is that the changes in temperature and humidity could have had a beneficial effect by decreasing humidity and increasing temperature in the afternoon sessions.

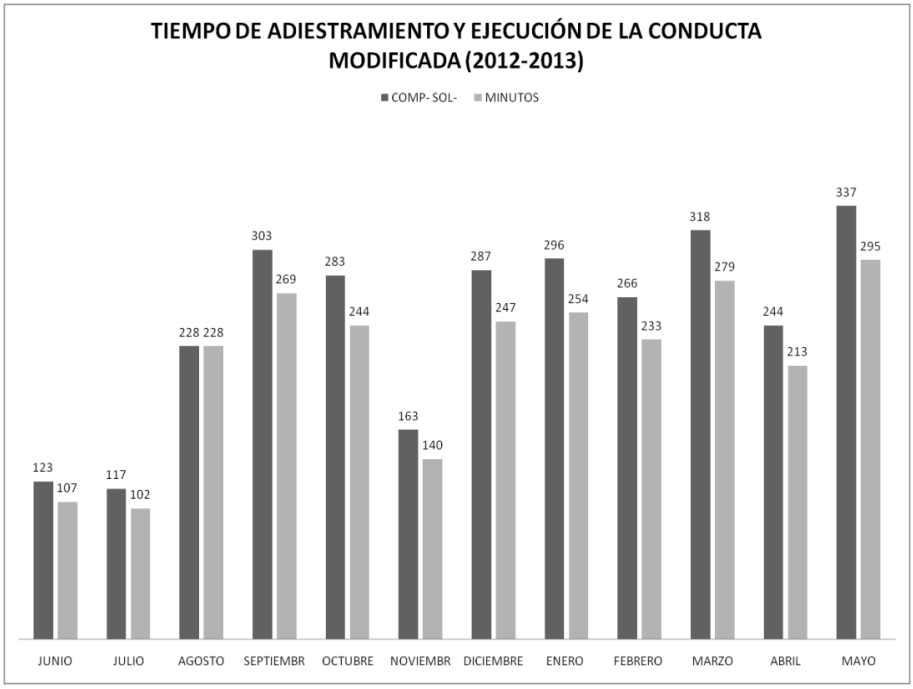
Fig. 2 y 3. Morning and afternoon sessions, humidity and temperature register 2011-2012.



February and March showed an increment in behaviors asked due to reproductive management, therefore training was beneficial in later performance, because even when more behaviors were asked, a good response was observed on the afternoon training sessions.

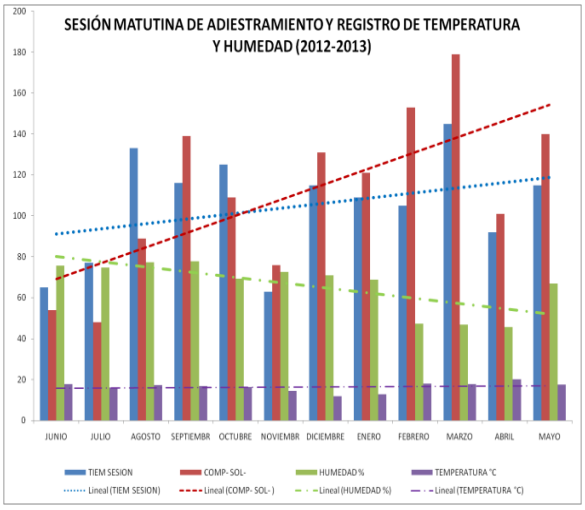
In regards of the period from 2012-2013 each session benefited from favorable responses from the subject, with allows new challenges in exercises and reinforcing previously achieved ones. This culminated in 20 complete actions. Fig. 4.

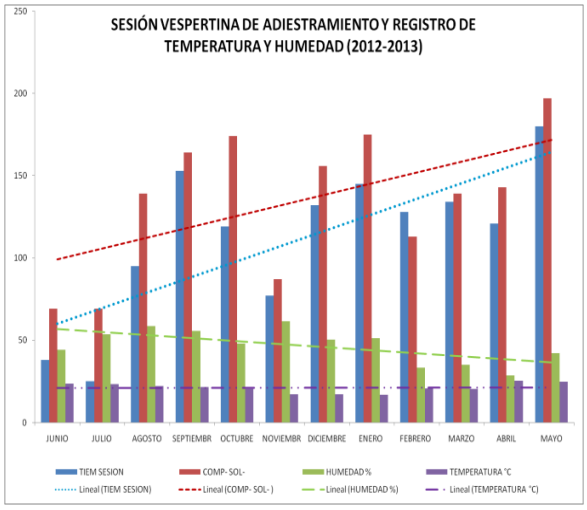
Fig. 4 Behavior time and execution 2012-2013



Afternoon sessions were consistently more successful, plus increasing rapidness of learning (fig. 5 y 6).

Fig. 5 y 6. Morning and afternoon sessions, temperature and humidity register 2012-2013.





Modified behaviors for clinical management possible behaviors are: injections, vaginal sampling, general physical examination, limb evaluation (pad check, nail trimming) eye and mouth check (including dental check), heart auscultation, respiratory auscultation, genital

check, blood sampling and coat brushing. Which are behaviors somewhat similar to those trained at Beijing Zoo by Liu Xuefeng y Li Yanqing. From 2011, this behavior has been trained for data collection from Xin- Xin.

Regarding abnormal behaviors shown by our subject, a general decrease of the amount of time used for abnormal behaviors such as head balancing movement and stereotypic locomotion was observed with the training sessions. A continuing work in this regard has been done but it is not included in the present study.

CONCLUSIONS

Training is a dynamic process that involves perseverance, patience and a profound knowledge of the individual animal that is trained, in order to establish an effective bond between the individual and keeper. Learning is a dynamic process that requires repetition to get the appropriate response to the commands, which consolidated responses learned.

In the two periods evaluated, faster and more consistent responses were observed, even when the animal was already 20 years old when the training program started.

Temperature and humidity did not have an effect on training sessions, in the other hand, afternoon sessions were overall more effective when teaching new behaviors, therefore new commands were taught in the afternoon sessions.

Even when there were other training attempts with this individual before, staff changes and a lack of consistency resulted in limited success, until the start of this program. Our success could be attributed to a positive animal-keeper bond, keeper´s familiarity and understanding of the subject, consistency and perseverance.

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Current State of Rhino Conservation in Lewa-Borana Landscape

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Lewa Wildlife Conservancy (Lewa) is a part of the Mt. Kenya UNESCO World Heritage Site, a Man and Biosphere Reserve, and is listed on the IUCN Green List of Protected and Conserved Areas. The Conservancy works as a catalyst for the conservation of wildlife and habitat in northern Kenya using a model that integrates the socio-economic development of marginalized rural communities into wildlife conservation.

Kenneth Onzere, a Rhino Monitoring Officer that has been with Lewa for three years, will be presenting on the current state of the Eastern black and Southern white rhino populations across the Lewa-Borana Landscape (LBL). He looks forward to sharing first-hand experiences related to his monitoring work, as well as an overview of the Security and Anti-Poaching Unit's efforts to protect wildlife. Kenneth will also review some of the habitat management strategies and practices that are key to the survival of rhinos and other species that depend on the health of this ecosystem.

As Lewa's *Key 1* rhino populations continue to thrive across the 94,000-acre landscape, Lewa and Kenya Wildlife Service are currently evaluating options and developing strategies to repatriate rhino populations at locally and nationally led sanctuaries across the Kenya region. Kenneth will provide a broad overview of the anticipated plans related to these repatriation opportunities.

Most importantly, on behalf of everyone at Lewa, Kenneth looks forward to expressing gratitude for the decades of support the Conservancy has received from the Bowling for Rhinos initiative and its participants. Lewa's conservation success would not be possible without supporters like you.

AAZK & IRF Taking Action in Indonesia to Protect Critically Endangered Rhino

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International Rhino Foundation

The American Association of Zookeepers' Bowling for Rhinos program is responsible for the support and protection of two of the most critically endangered rhinos in the world. With support from AAZK BFR, the International Rhino Foundation (IRF) funds Indonesian Rhino Protection Units (RPUs), protecting Javan and Sumatran rhinos in Indonesia. Thanks to continuous RPU protection, we have kept rhinos safe in all three parks where these wild populations reside, for more than a decade. While 2020 has brought significant financial stress to all conservation organizations, IRF has continued supporting vital rhino protection efforts in Indonesia, thanks to AAZK's support. IRF collaborates with our on-the-ground partner, Yayasan Badak Indonesia, to fund RPUs in three locations; Bukit Barisan Selatan National Park, Way Kambas National Park, and Ujung Kulon National Park. AAZK BFR's donation covers roughly one quarter of the RPU costs; these funds are used for the RPUs' salaries and benefits as well as operations, transportation, equipment, and guard post maintenance. The RPUs are highly trained, four-person anti-poaching teams that intensively patrol key areas within the parks. Their presence provides a significant deterrent to would-be poachers. Thanks to your support, Javan and Sumatran rhinos can survive in Indonesia with little to no evidence of poaching because of this careful around-the-clock monitoring. Attendees at this paper presentation will hear how AAZK's BFR program supports the conservation of Javan and Sumatran rhinos, including recent news and updates from the field, and success stories that have been made possible because of AAZK's tireless efforts.

Programmatic Report
Sumatran and Javan Rhino Conservation

Submitted to the
American Association of Zoo Keepers Bowling for Rhinos Program

July 2021

A Javan rhino calf and mother spotted on camera trap in Ujung Kulon National Park. Image courtesy of the Indonesian Ministry of Environment and Forestry.

The International Rhino Foundation is grateful for the continued, generous support of the American Association of Zookeepers' (AAZK) Bowling for Rhinos program, which contributed $100,360.74 in December 2020 to support Indonesian Rhino Protection Units (RPUs). Thanks to continuous RPU protection, we have kept rhinos safe in all three parks where these wild populations reside, for more than a decade. The support of AAZK's Bowling for Rhinos event has been a vital part of sustaining Javan and Sumatran rhinos, two of the most threatened large mammal species on Earth.
IRF collaborates with our on-the-ground partner, Yayasan Badak Indonesia, to fund RPUs in three locations; Bukit Barisan Selatan National Park, Way Kambas National Park, and Ujung Kulon National Park. AAZK BFR's funds are used for the RPUs' salaries and benefits as well as operations, transportation, equipment, and guard post maintenance. The RPUs are highly trained, four-person anti-poaching teams that intensively patrol key areas within the parks. Their presence provides a significant deterrent to would-be poachers. Regularly patrolled areas show little to no evidence of poaching efforts targeting rhinos or other megafauna. Thanks to your support, Javan and Sumatran rhinos can survive in Indonesia because of this careful around-the-clock monitoring.

IRF is pleased to provide this update on our Javan and Sumatran rhino conservation programs during Q4 2020 and Q1 2021.

SUMATRAN RHINO CONSERVATION PROGRAM

Fewer than 80 Sumatran rhinos survive in very small and highly fragmented populations. These populations exist in three regions in Sumatra, Indonesia; Way Kambas (WKNP), Bukit Barisan Selatan (BBSNP), and Gunung Leuser National Parks, plus a handful of animals in central Kalimantan. Facing intense pressure from a variety of threats, the Sumatran rhino is considered the most endangered species of rhinoceros. The population is limited by small population effects, human encroachment/disturbance, and the potential for catastrophic events.

With our local implementing partner, Yayasan Badak Indonesia (YABI), the International Rhino Foundation (IRF) uses a multi-faceted approach to Sumatran rhino conservation, including protecting rhinos and other mega-fauna and their habitat through our Rhino Protection Units (RPUs), research on and captive breeding of the species at the Sumatran Rhino Sanctuary in WKNP, habitat restoration, and outreach to local communities, including education and alternative income programs.

YABI operates thirteen RPUs in Way Kambas National Park and seven RPUs in Bukit Barisan Selatan National Park. All RPUs spend at least 15 days per month on patrol in key rhino areas in each park. Two of the Way Kambas RPUs are also now protecting the Sumatran Rhino Sanctuary.

Despite the protection provided by the RPUs, the Sumatran rhino population continues to decline. In the isolated pockets in which Sumatran rhinos live, it can be difficult for breeding-age animals to encounter one another. Like many rhino species, reproductive problems ensue if females do not become pregnant.

Complete details on RPU activities during the last quarter of 2020 and first quarter of 2021 can be found in the tables below.

Table 1: Way Kambas RPU Data for October 1, 2020 – March 31, 2021

Way Kambas RPU Data	Q4 2020	Q1 2021
Avg. Days on Patrol Per Month	15.64	9.9
Total km. on Patrol	5,535	1,996.00
Rhinos Poached	0	0
Direct Rhino Sightings	0	0
# Rhino Footprints	9	0
# Rhino Wallows	0	0
Rhino Feces	0	0
Rhino Feeding Signs	0	0
Other Rhino Signs	0	0
# Cases of Illegal Activity Identified	36	11
# Traps Destroyed	6	0
# Poachers/Encroachers Documented or Turned Over to Park Authority	1	1

Table 2: BBS RPU Data for October 1, 2020 – March 31, 2021

BBS RPU Data for January 1 - Dec 31 2020	Q4 2020	Q1 2021
Avg. days on patrol per month	15.41	15
Total km on patrol	1695.55	3,622.00
Known rhinos poached	0	0
Direct Rhino Sightings	0	0
# Rhino Footprints	5	0
# Rhino Wallows	32	19
Rhino Feces	2	1
Rhino Feeding Sites	2	1
Other Rhino Signs	5	3
# Cases of Illegal Activity Identified	54	119
# Traps Destroyed	5	13
# Poachers/Encroachers Documented or Turned Over to Park Authority	10	4

Sumatran Rhino Program – Highlights

Rhino Protection Units (RPUs) continued their work in Way Kambas National Park and Bukit Barisan

Selatan National Park throughout 2020 and 2021. Program highlights include:

- There was no evidence of rhino poaching in either Way Kambas or Bukit Barisan Selatan.
- RPUs documented 14 rhino footprints.
- During this period, the Sumatran RPUs walked a total of 12,848.55 km on patrol. The RPUs found 220 instances of illegal activities and destroyed 24 animal traps used by poachers.
- Reforestation efforts in Way Kambas National Park are ongoing and extremely successful, more than 45 species of wildlife have been identified visiting the reforestation site since planting efforts began. Recently, the team found a fresh footprint of a tapir, a first for this particular area and a sign that replanting efforts are working.

Sumatran Rhino Protection Units

YABI currently operates thirteen Rhino Protection Units (RPUs) in Way Kambas National Park and seven RPUs in Bukit Barisan Selatan National Park. Two of Way Kambas's RPUs also regularly patrol the Sumatran Rhino Sanctuary, which is located within the park and holds several rhinos. All RPUs spend at least 15 days per month on patrol in key rhino areas in each park.

Throughout 2020 and 2021, the RPUs regularly patrolled and surveyed the protected areas in which they operate, removing traps and snares, identifying and apprehending illegal intruders, and investigating crime scenes. Their presence is pivotal in the prevention and reduction of wildlife loss and illegal activities within the park.

During this reporting period several rhino footprints, wallows, feeding sites, feces and horn scrubs were identified by RPU members in Bukit Barisan Selatan National Park and Way Kambas National Park. Most of the footprints were documented to be fresh (less than 1 week old). Footprints are typically found in areas that are safe from human disturbance, with a dense canopy made up of seedlings, saplings and full-grown trees. Other wildlife species documented in these parks include sun bear, Sumatran elephant, tiger, Sambar deer and tapirs.

Tiger print (left) and sun bear scratch (right).

Illegal activities continue in both Bukit Barisan Selatan and Way Kambas National Parks. These activities include park areas being cleared and used for seasonal plantings such as coffee and pepper and continued animal hunting. The RPUs found signs of sling snares, nylon traps and bird stakes. RPUs remove all traps, document their use with park authorities and destroy them.

A sling snare in BBSNP, used to target mammals like elephants, tigers and rhinos.

No rhinos were known to be poached in either Way Kambas or Bukit Barisan Selatan during Q4 2020 or Q1 2021. During this period, the Sumatran RPUs walked a total of 12,848.55 km on patrol. The RPUs found 220 instances of illegal activities and destroyed 24 animal traps used by poachers.

JAVAN RHINO CONSERVATION PROGRAM

Ujung Kulon National Park (UKNP) is Indonesia's first UNESCO World Heritage Site, the largest remaining tract of lowland tropical forest on the island of Java, and home to the world's last surviving population of the Critically Endangered Javan rhino, numbering 73 individuals. The International Rhino Foundation (IRF) and our local partner, Yayasan Badak Indonesia (YABI), run a comprehensive program aimed at monitoring, protecting and ultimately increasing the population of Javan rhinos. With long-time generous support from AAZK, YABI operates five terrestrial and two marine Rhino Protection Units (RPUs) in UKNP. **Thanks to the efforts of the RPUs, there have been no recorded instances of rhino poaching for many years and the population appears to be stable and slowly increasing.**

The greatest threat to Javan rhinos is that the entire population exists in a single site, making it susceptible to small population effects and catastrophic events, like disease outbreaks, earthquakes, tsunamis, and volcanic eruptions. Poaching and human encroachment remain threats as well.

Javan Rhino Program - Highlights

Rhino Protection Units (RPUs) continued their work in Ujung Kulon National Park throughout 2020 and 2021. Program highlights include:

- 100 new camera traps installed by Rhino Protection Units in Ujung Kulon National Park
- At least 1 Javan rhino calf born in the Spring of 2021
- There was no evidence of rhino poaching in Ujung Kulon National Park
- RPUs documented 8 rhino footprints
- During this period, the Javan RPUs walked a total of 6,315.33 km on patrol. The RPUs found 123 instances of illegal activities and destroyed 12 animal traps used by poachers.

Table 3: UKNP RPU Data for October 1 2020 – March 31, 2021

UKNP RPU Data for January 1 - Dec 31 2020 *Terrestrial	Q4 2020	Q1 2021
Avg. days on patrol per month	15	14.8
Total km on patrol	1,440.35	1,220.00
Known rhinos poached	0	0
Direct Rhino Sightings	0	1
# Rhino Footprints	8	35
# Rhino Wallows	0	9
Rhino feces	1	7
Rhino feeding sites	4	21
Other Rhino Signs	0	5
# Cases of Illegal Activity Identified	58	46
# Traps Destroyed	1	11

# Poachers/Encroachers Documented or Turned Over to Park Authority	21	0
UKNP RPU Data for October 1 2020- March 31 2021 *Marine	**Q4 2020**	**Q1 2021**
Avg. days on patrol per month	15	14.7
Total km on patrol	1,745.98	1,909.00
# Illegal Fishing Activities Encountered by RPU Unit	8	11

Javan Rhino Protection Units

The rigorously trained terrestrial Rhino Protection Units operating in UKNP are charged with intensively patrolling key areas (using SMART) within UKNP to protect the park's rhinos and other threatened resources. A wildlife ranger, who is a qualified civil investigator employed by the National Park, leads each RPU team. The three other members are recruited from the surrounding communities.

UKNP terrestrial RPUs operate from a base station on the north-eastern border of the park and stage their patrols from the guard posts situated at strategic locations in the park, including several that require access by boat. Patrols deploy to the field for a continuous 15 days or more per month per unit, creating a significant detection risk for would-be poachers, whose chances for a good 'take' are seriously decreased. This deterrent has proved effective. Regularly patrolled areas show little or no evidence of poaching efforts that target rhinos or other threatened species (e.g., banteng, leopard, deer, primates, or pangolin). The illegal activities most frequently encountered are honey collection, bird collection, and illegal fishing.

RPUs deactivate and remove any traps or snares encountered while on patrol. They investigate all illegal activity and collect evidence. Anyone who is apprehended is taken to the National Park headquarters for further processing by a civil inspector from the park or the police.

The marine RPUs follow similar protocols to the terrestrial RPUs. Since marine patrols only began in 2020, the RPUs began by targeting areas where we know there are high levels of incursions into the park. Now, they are relying on patrol data to guide patrol routes. When the marine patrol apprehends people fishing illegally, they first release the catch back into the water. The RPUs then take the perpetrators (along with their boats and equipment) to the UKNP park office and hand them over to park authorities. Park staff confiscate the boats and equipment and collect information on each apprehended individual. They show the perpetrators a map of the park boundaries, discuss relevant laws and prohibitions and explain to the fishermen that they were illegally encroaching into park waters. The suspects are then asked to sign an official statement demonstrating that they understand the park boundaries and regulations and pledging that they will not encroach into park waters again. Park officials tell them that if they are apprehended again, they will be arrested and prosecuted and their signed statements will be used as evidence in the court case against them. These statements are filed at the park office and the suspects are released. To date, this deterrence method has proven successful as no encroachers have been apprehended a second time.

An octopus, caught illegally, is documented and released back into the water after RPUs interrupted an illegal fishing vessel.

In January 2021, we celebrated the one-year anniversary of the Javan rhino marine patrol in Ujung Kulon National Park, and these two new patrol units have been more successful than we could have imagined. Over the first 12 months of operations, the marine patrol units apprehended 220 people illegally fishing and encroaching within Ujung Kulon park waters.

One of the marine patrol units was able to see the results of their hard work in January, when they observed the Javan rhino in the photo to the right - one of only 73 in the world - visiting a salt lick on the north beach of peninsular Ujung Kulon. It's important for Javan rhinos to supplement their diet with salt, and they have historically been sighted along the park's beaches for this reason. But in recent years, as more illegal fishermen have built fishing platforms along the northern peninsula, fewer and fewer rhinos have been seen. Instead they must traverse much greater distances inland to find plants that contain enough salt. Now that the marine patrol units are effectively keeping illegal fishermen away, we hope that more rhinos will return to the beaches.

Because of the extreme weather conditions in Ujung Kulon, the live-aboard boat used by the marine RPUs can only patrol along the northern boundary of the park. The marine patrol is currently unable to operate along the southern coast of the park, and because there are no guard posts along the southern coast, terrestrial teams are not able to patrol the area as frequently as necessary. It seems evident that people are now taking advantage of this gap in protection as the marine patrol has closed off the north coast - a recent terrestrial patrol found more than 100 fishing boats illegally pulled up on a southern beach. IRF and YABI have begun working with the national park on a solution which will enable us to close the protection gaps in Ujung Kulon, by building two permanent guard posts along the southern coast and hiring two new Rhino Protection Units to patrol the coastline on land, and in the shallow water along the coast with a small boat.

Additionally, Ujung Kulon National Park runs a comprehensive rhino monitoring program, tracking every individual Javan rhino. The monitoring program plays a critical role in the protection and management of this species and provides demographic data on the park's Javan rhino population that will be used to eventually determine which rhinos to move to a second site to reduce the species' risk of extinction. In May 2021, IRF purchased 100 new camera traps for Ujung Kulon National Park. Rhino Protection Units and park staff installed the new cameras throughout May and June, during their regular patrols. IRF also provided funding for the park's analysts' salaries for the period from May through December 2021. The camera trap monitoring program plays a critical role in the management of Javan rhinos. By tracking and identifying every individual animal on a monthly and yearly basis, park staff can rapidly tell if any animals have died. The deaths can then be investigated and the cause of death determined, so that park and IRF/YABI staff can react quickly to deal with any potential disease outbreaks or poaching incursions. The rhino monitoring program also provides us with demographic data on the park's Javan rhino population. This data can be used for population management decisions and to eventually determine which rhinos to move to a second site.

In mid-June 2021, Indonesia's Ministry of Environment and Forestry announced the birth of a new calf in Ujung Kulon NP (image, right). Based on reports from the UKNP monitoring team, three calves were captured on camera traps over the past eighteen months.

Conclusion

Indonesia continues to face high COVID-19 infection rates. The Indonesian government has just issued a new lockdown order for the month of July 2021. The Rhino Protection Units were deemed essential and have been allowed to continue patrolling protected areas with safety measures in place. Happily, because they are classified as essential workers, all Ujung Kulon RPU members have also just received their first COVID-19 vaccination shot.

Thanks to AAZK's continued support, the teams protecting Javan and Sumatran rhinos are able to continue their efforts. AAZK's Bowling for Rhinos funds provide critical support to RPUs to ensure they have the tools and knowledge needed to protect the most critically endangered rhino species. It is thanks to your generosity that efforts to monitor and protect rhinos continue. We value our partnership with the AAZK tremendously and know how committed keepers are to BFR, and how hard they work to raise BFR funds. Again, thank you!

Action for Cheetahs in Kenya: Resilience through Partnerships

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AAZK Bowling for Rhinos initiated its support for Action for Cheetahs in Kenya (ACK) in 2010. The support assisted with development of our field site and activities in Samburu, and National Survey projects. During the pandemic support from overseas was drastically reduced. In late 2019 we opened our online Shopify site which helped to bring in a small income through our COOL Craft sales and we implemented small online fundraisers to get us through the toughest times. Lockdowns within Kenya hit our economy and our project hard. But like the cheetah, our team has been resilient and has persisted through drought, flood, locust and COVID-19. Climate fluctuations caused shifts in the settlement around our Samburu study area, including members of our team. Locusts challenged us through their direct damage to vegetation as well as indirectly through the chemical sprays intended to eradicate them. After having three months reduced duty in the first wave of COVID, field staff were anxious to get out to see and record wildlife movements. Public gathering restrictions dampened our local outreach work, but we dealt with it through live online sessions and engaging smaller groups of people with outdoor interactions. We completed reports and publications with our research and education staff, and we developed flexible work plans. Our staff adapted to online staff meetings and presentations even with network challenges. Our scat detection dogs thrived through in house trainings and are more than ready for the rigorous field work.

BIOGRAPHY

Mary Wykstra began cheetah research and community development programs in Kenya in 2001. Using data from the first National Cheetah Survey she implemented projects centered around addressing the threats to cheetahs on a range wide scale. Mary completed her undergraduate BSc at Michigan State University, and her Master of Environmental Management at Yale School of Forestry and Environmental Studies. Mary's projects work in affiliation with the Kenya Wildlife Service, Cheetah Conservation Fund and the University of Nairobi. She has empowered more than 100 local and international students through projects in affiliation with ACK. She manages a staff of over 25 people and 4 detection dogs to address conflict and corridor conservation issues facing cheetahs on a range wide scale.