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Alicia Walsh

University of New Hampshire - Main Campus

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Diet Analysis for Wildlife Management: Protecting the Cheetah in Namibia

—Alicia Walsh (Editor: Benjamin Bertrand)

During the summer of 2014, I did scat, or fecal, analysis of carnivores for the Cheetah Conservation Fund (CCF) in Namibia in order to help manage and protect the cheetah, Africa's most endangered big cat. I learned firsthand how important and complex species conservation is. Before I went to Namibia, I was naïve about wildlife conservation and had no exposure to exotic animals. During my time in Africa, I learned to work with people from different cultures and truly gained a passion for animal conservation. After this experience, I am looking forward to getting more involved with animal conservation and possibly working with exotics for a career.

I am currently a senior biomedical science major at the University of New Hampshire planning to apply to veterinary school next fall. I have always had a love for animals and a passion for science and medicine. At home in Franklin, Massachusetts, I spent two summers working in a small animal clinic. My sophomore year of college, I pushed myself out of my comfort zone and participated in a yearlong class that challenges students to work together and manage a dairy herd. Professor Drew Conroy, who taught the course, has spent a significant amount of time in Namibia, Africa. After hearing his stories and seeing his pictures and videos, I decided that I wanted to work in this beautiful country.

Dr. Conroy told me about the International Research Opportunities Program (IROP) grants and helped me draft a proposal for the research project that was proposed to me by the Cheetah Conservation Fund in Namibia. Dr. Anne Schmidt-Küntzel at CCF helped me finalize my proposal and agreed to be my foreign mentor.

My proposal was to work at CCF for nine weeks to analyze the diets of carnivores in the surrounding commercial conservancy through genetic identification and scat analysis. Analyzing the carnivores' scat would help identify their prey. This information would aid CCF in understanding how the entire ecosystem interacts, and help them in their efforts to manage and protect the wild cheetah.



The author and her UNH mentor at the Cheetah Conservation Fund.

Namibia and the Cheetah

The cheetah's numbers, like those of many wild animals in the world, are declining. The smallest of the African big cats, cheetahs are built for speed, capable of reaching seventy miles per hour in three seconds. They are often referred to as the "greyhounds of cats" (Cheetah Conservation Fund). They are sleek, beautiful animals, prized in the past by royalty and in the present as pets. Having cheetahs as pets is illegal and poses a big threat to the wild cheetah population. In addition, the cheetah has been shown to have low genetic diversity.

Namibia is located on the west coast of the southern tip of Africa, and gained independence from South Africa in 1990. Parts of rural Namibia are organized into conservancies where people are in charge of managing the natural resources. Tourism to view (and sometimes hunt) the wild animals is an important source of income in Namibia. Conservancy members manage the land and animals together to create a tourism market. Their success in wildlife population management is a model for the rest of Africa. This system encourages everyone to protect and keep a close watch on the wildlife to help prevent poaching. It's a win-win for people and wildlife. Namibia is one of the only countries to address conservation in their constitution, so it was perfectly suited to my project.

The results of my research showed which prey the carnivores, including the cheetah, were eating. These results will help CCF protect the cheetah in several ways. In addition to wildlife tourism, a second important source of income for Namibians is the selling of livestock animals by the farmers. The loss of a single livestock animal can be detrimental to a family. It's a common misconception among Namibian farmers that cheetahs are responsible for killing their livestock. Since cheetahs hunt during the day, the farmers see them, and assume that they are killing their livestock. In a desperate attempt to protect their

livestock, the farmers resort to trapping and killing cheetahs. My research supports previous findings that the diet of the cheetah mostly includes wildlife; none of my samples contained evidence of livestock. CCF uses these results as proof to show farmers that cheetahs are not preying on their livestock and, therefore, should not be killed.



The author extracting DNA from scat in the CCF's genetic lab.

Another problem the cheetah faces is competition for prey among larger and stronger predators. They are frequently forced away from their kills because larger predators, such as leopards, hyenas, or lions, threaten them. My project helped to determine which species cheetahs are competing with for prey. CCF works to release injured cheetahs or abandoned cubs back to the wild, so this information could help make an educated decision as to where to release these cheetahs.

Genetic Identification and Scat Analysis: Methodology

The elusive nature of most predators makes it very difficult to determine their diet in a field setting. For this reason, I used scat analysis as an accurate and reliable method to determine their diets. Before my arrival, about one hundred scat samples were collected along CCF's property, some of which were found with the help of scat detection dogs.

I worked in CCF's state of the art genetics laboratory from eight in the morning to five in the afternoon, five days a week. The first step was determining the species each scat sample came from. To determine this, I extracted DNA from each sample and then amplified the DNA using polymerase chain reaction. The DNA sequences were then cleaned and analyzed with the Geneious software (Biomatters). The sequences were compared to a reference database, and the species were determined by sequence similarity, that is, by comparing the nucleotides of my extracted sequences with the nucleotides of reference sequences.

After determining the species the scat belonged to, I washed the scat samples in a nylon stocking in a washing machine with no soap and then left them to dry overnight. This process of washing leaves behind only the bones, hair, and vegetation that were in the scat. I could then begin analyzing the contents. Macroscopic analysis involved manually picking apart the sample contents and scrutinizing them with the naked eye to determine the prey. Microscopic analysis involved burning hairs to create imprints and looking at the patterns underneath a microscope.

Samples that contained rodent hair often had a lot of bones remaining which could be analyzed to determine the prey. This was similar to dissecting an owl pellet. For samples that did not contain bones or contained only fragments of large unidentifiable bones, the hair was analyzed using hair burning, a technique commonly used by CCF.

To burn an imprint of the hair, a strand was placed on a plastic cover slip, pressed tightly between two glass slides, and heated in a toaster oven. What remains is an imprint of the pattern of the hair. I then examined each hair pattern and compared it to a reference guide to determine the prey that had been eaten.

Results and Understanding the Environment

My project included a total of ninety-two carnivore samples. There were a total of thirty-three jackal samples, six cheetah samples, six brown hyena samples, eight genet like samples, one serval sample, twenty-eight leopard samples, six African wildcat samples, one caracal sample, one civet sample, one aardwolf sample, and one unknown sample.

My results revealed that the cheetahs are primarily competing with leopards for their prey. The top five preferred cheetah prey were red hartebeest, kudu, springbok, eland, and dik-dik. The leopard samples showed that the top five preferred prey animals were springbok, eland, warthog, red hartebeest, and kudu. You can clearly see how these two predators' prey overlaps, which results in competition for prey. That said, it is known that cheetahs mostly eat the young of the larger antelopes, while leopards are likely to hunt the adult individuals. However, it has been reported that cheetahs have been forced to give up their kills to more powerful predators such as leopard and hyena. Now, when CCF releases cheetahs back into the wild, they will be able to take my findings into consideration to locate the best release sites. For example, since my data reveals that leopards often steal the cheetahs' prey, it would make sense to release cheetahs in a location that does not have many leopards.

The brown hyena's and the jackal's preferred prey also overlapped with the cheetah's prey. The jackal samples revealed that they were opportunistic hunters/scavengers who would eat anything from elands, oryx, and dik-diks, to rodents and birds. The brown hyena results were interesting because they revealed that the hyenas ate a lot of elands. Elands are the largest antelope species, about the size of a cow, whereas hyenas are the size of dogs, so it surprised me at first to see that they could prey on something so large. Brown hyenas are mostly scavengers, so it could be that other larger, stronger predators killed the eland, and the hyena ate the leftovers.

In the scat samples that were collected for my project, there was no evidence that farmers' animals were being eaten. However, if I did this project on a larger scale and took samples from a larger area, this

might have revealed which species are preying on the farmers' animals. I am continuing to analyze and organize my data, and plan on publishing my results in a peer-reviewed journal.

My project addressed mainly human-wildlife conflict and the competition for prey to help save the cheetah, but there are many other challenges the cheetahs face. One is habitat loss and fragmentation, because of human disruption ultimately reducing the areas' carrying capacities. This fragmentation has heightened the problem of limited genetic variation by separating cheetah populations and increasing the rate of inbreeding. A population needs genetic diversity to survive environmental alterations or disasters.

The illegal wildlife trade is yet another issue the cheetah faces. Cheetahs were once a status symbol for wealth and royalty. Today there is still a market for people trying to keep cheetahs as pets. Mother cheetahs are killed so the cubs can be captured and sent off to customers. Most captured cubs do not survive the trip, so more cubs are then captured to meet demand. A cheetah will always remain a wild animal. It is abusive and unethical to raise them as a pet, and this is contributing to their population decline.

The Many Activities at CCF

The Cheetah Conservation Fund is dedicated to saving the wild cheetah. An American, Dr. Laurie Marker, founded CCF twenty-five years ago. CCF's headquarters are in Namibia, but they also have locations in the United States, Canada, and the United Kingdom. At CCF, I worked with people from Namibia, Germany, France, the United Kingdom, Belgium, and from all over the United States. CCF has many projects addressing the issues the cheetahs are facing, such as genetic research, farmer outreach and education, habitat restoration, rewilding cheetahs, and the livestock guarding dog program.

CCF works continuously on different genetic research projects in their genetics lab to aid in the survival of the cheetah. The scientists and students working at CCF have published more research on cheetahs than any single organization or group. I worked in the lab during the week, but on weekends I participated in many of their other activities. This included everything from feeding the cheetahs, cleaning their pens, tracking released cats, walking dogs, working in CCF's creamery, and participating in game counts.

A livestock guarding dog program was created to address human-wildlife conflict. CCF breeds Anatolian shepherd and Kangal dogs, and has created a model farm to show how these dogs can be used to protect livestock from predators. During my stay, I helped feed and walk the livestock guarding dogs and puppies and learned about the program. The puppies are given to farmers to guard their livestock, so that the farmers don't feel the need to kill cheetahs. This program educates farmers about the cheetah and has succeeded in changing their attitude towards them.



The main building at CCF.

As mentioned earlier, CCF's husbandry team releases injured or abandoned cheetahs they have rehabilitated back into the wild. CCF's Bushblok program helps restore cheetah habitat that is being taken over by acacia trees. CCF removes this encroaching bush and transforms it into a fuel log that can be sold and used for cooking fires. In addition to all of these wonderful programs, CCF is an educational center that welcomes visitors daily to learn about the species and everything CCF is doing to save them.

I got used to getting my hands covered in blood preparing meat for the cheetahs. Standing in the back of a moving pick-up truck holding a radio antenna also wasn't out of the ordinary. CCF is diligent in making sure that re-released cheetahs are healthy and adjusting to life in the wild. The cheetahs were given



The author saying goodbye to the ambassador cheetahs on her last day at the Cheetah Conservation Fund.

radio-tracking collars so we could find them using GPS information downloaded to our computers. Once in the area indicated, we used the VHS function of the collar, which would cause our radio antenna to beep as we got close to a cheetah. Then we got out of the truck and walked miles through the bush to locate and check the cheetah's condition. It was impressive to see how much work and analysis go into successfully releasing an animal into the wild.

Working in the creamery, I learned how to make cheese and fudge from goat's milk. CCF uses the creamery to show local Namibians that they can be self-sufficient and make these products with little equipment.

One of my favorite things I got to do while I was at CCF was the waterhole count. A waterhole count is done once a month to keep track of the animals in CCF's game reserve. My partner and I were dropped off at 5:30 a.m. at a small, concrete hide, a

camouflaged shelter, in the bush. We sat for thirteen hours and recorded all of the animals that used the waterhole. We saw everything from giraffe, to zebra, to guinea fowl. I was amazed to observe how the wildlife interacted and mingled together so peacefully.

Looking Toward the Future

Visiting Namibia was a life-changing experience for me. I worked with people from many different countries and learned about their cultures. I came to see the problems the wildlife face and all that goes into conservation. For example, at a presentation and discussion at CCF, I learned that the horn of the black rhino is believed by some people to be medicinal. As a result, the animal has been hunted close to extinction. Another thing I learned was that hunting can be beneficial to conservation. Hunting commonly has a negative stigma attached to it, but living in Namibia, I realized how hunting could play both a conservation and an economic role. The money raised by selling hunting permits is often directly used for conservation of the species, although the permits are relatively cheap. However, the farmer who owns the land where the hunting takes place is paid for its use, which encourages him to protect the wild game animals living there.

Everything I learned at CCF inspired me to do my part and try to educate others about these topics. This experience has taught me that I enjoy being in charge of a research project, and I hope to have more opportunities to do research in the future. Traveling on my own for the first time and encountering different cultures were invaluable experiences, for which I am very thankful. I am now more aware of many wildlife issues and have gained a new appreciation and interest in animal conservation. This experience has inspired me to become involved with exotics or animal conservation in the future.

This once in a lifetime adventure wouldn't have been possible without the help of many people. I would first like to thank my faculty mentor, Professor Drew Conroy, for encouraging me to pursue my dream of traveling to Africa, and for his dedication in guiding me every step of the way. I would also like to thank my foreign mentor, Dr. Anne Schmidt-Küntzel, for patiently teaching me the ins and outs of genetic analysis, assisting me with creating this project, and guiding me in the lab. I am thankful for my donors through the Hamel Center for Undergraduate Research—Ellis Woodward and Frank and Patricia Noonan—for making this trip possible. I am grateful for Dr. Georgeann Murphy's continuous support and guidance along with the rest of the Hamel Center staff. I am appreciative of all the staff at the Cheetah Conservation Fund for welcoming me with open arms and allowing me to make their facility my home for nine weeks. Finally, I am thankful for my parents, for their unconditional support and their encouragement to always go after my dreams.

References

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Author and Mentor Bios

Senior **Alicia Walsh** has always had a deep love for animals and is committed to learning more about their care and conservation. She came to the University of New Hampshire from Franklin, Massachusetts and became a bio-medical science major with a pre-veterinary intent. Her mentor, Professor Drew Conroy, told her about his research in the African country of Namibia and the research done there by the Cheetah Conservation Fund (CCF). After contacting the organization and working with Dr. Anne Schmidt-Küntzel, the geneticist at CCF, she applied for and received an International Research Opportunities Program (IROP) grant from the Hamel Center for Undergraduate Research to go to the CCF and analyze the diets of carnivores in the area. She did this research to help aid the plight of the cheetah by creating a better picture of their diet and its impact on their human and natural environments. By working on this project she learned a great deal about Namibian wildlife conservation and performing DNA and scat analysis. She discovered how much she loved traveling and working with people from different backgrounds and cultures. Alicia will graduate from UNH this spring and will then apply to veterinary schools. She has yet to decide what kinds of animals she wants to work with for a career, but this experience has opened her eyes to possibly working with exotics.

Dr. **Andrew Conroy**, professor of applied animal science and integrated agriculture, has been with the University of New Hampshire for twenty-five years. He specializes in animal agriculture, and his teaching includes Large Animal Behavior and Handling, Forage and Grassland Management, Dairy Herd Management, Cooperative Real Education in Agricultural Management (CREAM), Dairy Selection, and Dairy Cattle Diseases, among other courses. Dr. Conroy became involved with research abroad projects after recognizing the potential for student study and research of sites he visited during his 2008 year as a Fulbright Scholar in Namibia and while on consulting trips to other African countries. He has mentored many undergraduate researchers, which included helping students with capstone or thesis projects in Italy, Tanzania, Brazil, and Namibia. Alicia is the fourth of his advisees to work in Namibia and, on a visit there, he took her to see other parts of the country, as well as to visit with friends and former students. He feels that Alicia, “greatly benefitted from being taken away from her research lab and CCF for a few days,” to learn more about Namibia. Encouraging his students to publish their research in *Inquiry* is yet another way in which Dr. Conroy helps them acquire valuable skills for their future careers.

When Dr. Conroy approached the Cheetah Conservation Center about a student researcher joining them for the summer of 2014, Dr. **Anne Schmidt-Küntzel** responded. She is the Assistant Director for Animal Health and Research at the Center, which is located in Otjiwarongo, Namibia. Prior to Alicia's arrival, Dr.

Schmidt-Küntzel designed her project and helped with her IROP proposal, then guided her in the laboratory work and verified her results. This was not a new role for Dr. Schmidt-Küntzel, as undergraduate and graduate students come regularly to the CCF. Dr. **Laurie Marker** founded the Cheetah Conservation Fund twenty-five years ago and is its executive director. Dr. Marker is very passionate about conservation and knows that research is needed to make the right conservation decisions. As co-advisor on Alicia's project, Dr. Marker welcomed her into the CCF and its research work.

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