Project Proposal

Spatial & Feeding Ecology, With an Emphasis on Self-Medicative Behavior, of a Troop of Free-Ranging Chacma Baboons

Wildcliff Nature Reserve, South Africa

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Introduction

Base-line behavioral and spatial data is being collected on resident troops of chacma baboons, *Papio ursinus*, found on the Wildcliff Reserve. Additionally, the reserve is in the process of habitat restoration, which includes the removal of black wattle stands (*Acacia mearnsii)* and other alien species and the controlled burning of senescent vegetation. At the present time about 10% of Wildcliff Nature Reserve is covered in dense black wattle stands. Eradication of these stands is currently underway and by the end of October 2008, approximately 50% of the stands will have been removed by the organization, "Working for Water," and others. However, the stands will not be completely cut and removed. For many of the trees, the organization is using a process called ring-barking which will eventually kill the stands, but not for some years (Giddy, pers. comm.). Restoration is needed to protect the endemic species found on the reserve, but there is some question as to how much the baboons may be impacted, both directly and indirectly, by removal of these stands. There is some question as to how much the resident troop depends on the stands as a food source, so this is an ideal time to begin a longitudinal study that addresses feeding ecology.

Long-term studies documenting the spatial & feeding ecology of the troop should improve and level of habituation and observation and determine how the troops respond to the loss of these stands as a habitat and potential food source and should provide insight into the plasticity of this species and these troops in particular.

Wildcliff Nature Reserve

Wildcliff encompasses approximately 955 hectares (2350 acres) of deep kloofs with afro-montane forest, rocky mountaintops and high meadows of fynbos and renosterveld. The reserve lies between latitudes and longitudes 33º57'S and 21º2'E with elevations from 290m to 1130m. The boundaries lie between 20º58.9'E on the west to 21º3.0' on the eastern side, and 33º58.5'S on the south to 33º55.9' at the northernmost point in the Langeberg mountain range of South Africa's Western Cape (Giddy, 2007).

The Cape Floral Kingdom is one of the world's six floral communities. Although it is the smallest, it is, however, the richest per area unit and comprises approximately 3% of the world's plant species. Of vascular plants found at Wildcliff, 70% are endemic. It is one of the five Mediterranean-type systems found on the "hotspot" list and is the only hotspot that encompasses

an entire floral kingdom (Cowling & Pierce, 2004). These statistics reinforce why invasive species must be removed at Wildcliff, so endemic species may continue to thrive.

The dominant floral types at Wildcliff are varieties of fynbos, which include the proteoids, ericoids, restoids and geophytes. In addition, pockets of afromontane forests and renosterveld are found on the reserve.

For a century of more, parts of Wildcliff have been used for agriculture, including cattle farming. The property was purchased in 2007 by Dr. Ian Giddy and Jennifer O'Grady Giddy for the Wild Cape Nature Trust so that that the property could be conserved and restored and research and education could take place.

Chacma Baboons

Wildcliff hosts two troops of chacma baboons. One troop consists of 12-13 members and the other has in excess of 50 members, with many infants and juveniles (Fust, 2008). They are routinely seen at and around Wildcliff. To date they are still considered unhabituated although they are becoming used to the attention of researchers. Chacma baboons are omnivorous animals that consume a variety of both plants and animals. Plant items typically include: leaves, roots and tubers, wood, bark, stems, seeds, grains, nuts and fruits and parts of the flowers of the native fynbos. Animal items consist of birds, mammals, reptiles, eggs, carrion, insects, and terrestrial non-insect arthropods (Sloan, 2008).

To date, no fecal analysis has been completed on the baboon troops at Wildcliff. Professor Chris Appleton has written benchmark papers (1986) describing the gastrointestinal parasites found in Chacma baboons in the Drakensberg Mountains of South Africa. His results may give insight into what can be expected and special attention will be placed on identification of the following parasites; *Balantidium coli, Chilomastix mesnili, Entamoeba coli, Endolimax nana, Iodamoeba buetschlii, Strongyles (including Oesophagostomum and Ternidens), Enterobius cf. vermicularis, Physaloptera caucasicam, Streptopharagus cf. pigmentatus, Trichuris trichiura and Bertiella studeri*. In particular, *Oesophagostomum* will be targeted, due to the fact it is a particularly hazardous nodule worm. Repeated infections can cause significant complications such as secondary bacterial infections, diarrhea, severe abdominal pain, weight loss and weakness that can result in high mortality (Brack, 1987).

Proposal

I will begin gathering behavioral observations in November of 2008 on the resident troop. This will be the start of a three-fold long-term project. Observations will:

1) Increase the habituation of the baboons to human presence and provide needed base-line information on food & habitat selection. I also hope to recognize individual members of the troop so parasite analysis can begin at an individual level. Until that time, fecal samples will be collected if guidelines are met (see methodology).

2) Once the habituation level has improved, this may permit the darting and collaring of a female member of the troop. This has been outlined in a project proposal submitted by Dr. M.J.O'Riain from the Baboon Research Unit at the University of Cape Town. I will assist Dr. O'Riain however needed.

3) Once an animal has been darted, it will be possible to follow the troop more closely. This will increase the amount of time that can be spent with the troop and answer questions about home range, habitat type, movement patterns, diet selection and continued collection of scat to address questions about possible medicinal plant use and utilization of other non-nutritive food sources. Additionally, the GPS data can be input into GIS and provide a wealth of information, which could depict troop's home range, movement patterns and more.

The only aspect of this proposal not previously discussed by another researcher is that of self-medicative behaviour. The remainder of this proposal will focus on this aspect of the research I plan to conduct at Wildcliff.

Self-Medicative Behavior

With mounting evidence, the idea that primates obtain medicinal benefits from plant ingestion (e.g., Wrangham & Nishida, 1983; Huffman & Seifu, 1989; Wrangham & Goodall, 1989; Huffman *et al.*, 1993; Wrangham, 1995; Huffman, 1997; Huffman & Caton, 2001) is gaining acceptance among primatologists. It has been hypothesized that secondary compounds present in plants and other non-nutritive sources have medicinal properties, which might actually help animals fight pathogens and parasites and also improve the reproductive fitness of an individual (Hart, 1990; Holmes & Zohar, 1990), and lessen the many diseases caused by parasites (cf. Allison, 1982; Toft, Aeschlimann, & Bolis, 1991).

Objectives

1. Documentation of nutritive and non-nutritive food sources for the Wildcliff chacma baboon troops.

2. Collection and identification of all food sources whenever possible.

3. Learn to recognize the individual members of the troop and assist in the development of a naming scheme, or implement a scheme that is already designed so that data can be gathered at the individual level. When possible, close-up photos will be taken of all individuals to use as a reference. Observational date collected will include, but not be limited to, behavior, diet and urine and fecal collection and analysis. Baboon observation guidelines and suggestions written up by Kelly Sloan (2008) will be followed when possible.

Methodology

Sampling

The resident troops of baboons will be followed to collect behavioral observation, urine, and

fecal samples for the initial period of November 2008-November 2009.

Behavioral Observations and Plant Consumption

Focal-animal and ad libitum behavioral observations will also be made (Altmann, 1974). The baboons will be followed regularly. All behaviors will be noted using a continual scan method. Health of individuals will be documented to include respiratory, digestive, reproductive, locomotive, and urine functions. Additionally, any signs of illness or injury, to include wounds, decreased appetite, sneezing, coughing, nasal or eye discharge, and level of activity (Huffman *et al.*, 1997) will be documented.

When documenting feeding activities, all plant and non-plant items consumed will be noted and samples will be collected whenever possible; the location feeding took place will also be documented by GPS (Garmin, e-Trex Legend). In particular I will be looking at:

1) Ingestion of an item rare to the diet and / or of little nutritional value (e.g. leaf swallowing, bitter pith chewing). Based on reports to date, use of these plants tends to be restricted to certain seasons, in particular when re-infection of parasites is greatest. The individual ingests the plant item when infected with parasites and / or is showing related signs of illness (e.g. Huffman & Seifu, 1989; Huffman et al., 1996; Wrangham, 1995).

Consumption of soil also falls into this category. As kaolin is readily found on and around the Wildcliff reserve, special attention will be placed on the troops' movement in the area of the "kaolin quarry".

Additionally, Hamilton et al. (1978) stated that chacma baboons are known to consume "euphorics". Apparently these food items are widely available and consumed consistently, but only in minute quantities. These plants are known to be hallucinogenic and highly toxic to humans, and most likely to other mammals. *Papio ursinus* have been observed consuming the following euphorics: *Croton megalobotrys*, *Euphorbia avasmontana*, *Datura innoxia* and *D. stramonium* (Hamilton, 1978). I do not see these plants listed as flora found at Wildcliff, but will consult botanical experts to determine if it's possible for these plants to exist on the reserve and while exploring the area I will survey for them and other plants that possess similar qualities while following the baboons.

Thring & Weitz (2005) documented medicinal plant use by humans in the Western Cape and found 36 plant species from 19 families were in general use in this geographical area. Only 58% of these plants were indigenous to South Africa, 33% were introduced species and 9% were considered naturalized species. The dominant families were Asteraceae, Lamiaceae, Alliaceae and the Solanaceae. *Artemisia afra* and *Ruta graveolens* were the most widely used. Past studies have shown that animals tend to utilize the same medicinal plants as people. So, although these plants are not listed in the Wildcliff Flora log, but I will obtain either a photographic image or actually plant samples and survey for them while following the baboons. Additionally literature review needs to be completed.

2) Ingestion of plants that are more common to the diet, but are also used ethnomedicinally and / or have demonstrated biological activity, suggesting a medicinal component. Huffman and colleagues (Huffman, 1997; Huffman, Ohigashi, Kawanaka, Page, Kirby, Gasquet, Murakami, & Koshimizu, 1998) proposed the term 'medicinal foods', borrowing the concept in traditional human societies of food as medicine (e.g. Etkin & Ross, 1982).

I have begun to review the ethnobotanical work done in the Western Cape. This aspect of my research will continue once I arrive in South Africa.

Fecal and Urine Analysis

In the field, urinalysis can be an important noninvasive tool available to researchers when monitoring the health status of an individual (Kaur&Huffman, 2004; Kelly *et al.*, 2004). Fecal and urine samples of known individuals will be taken when possible. Immediately after defecation, the fecal sample will be examined macroscopically for presence of whole leaves and proglottids; the state of the feces (firm, soft, or diarrheic) will also be documented. A representative sample free from soil will then be collected and stored individually in 5.0-ml sterile Corning™ vials. In the reserve laboratory, vials and feces will be weighed and 1-g samples will be fixed within 3 hours of collection. The primary preservative will be 10% neutral formalin and the secondary preservative will be polyvinyl acetate. The contents will be mixed and stored in a cool dark room. The samples will later be analyzed. It will be our goal to also measure parasitic load via the MGL (formalin ether sedimentation) and MacMaster flotation method using zinc sulfate and direct examination techniques (expressed as eggs/g feces [EPG]). Some parasites can be determined from microscopic examination; others, like *Oesophagostomum* eggs, are difficult to distinguish from hookworm eggs. Since I believe this troop may be parasitized by these virulent helminthes, I will also be culturing samples periodically using the Harada-Mori technique (Harada & Mori, 1955). Without expertise, the eggs need be cultured and examined at the larval stage, which is morphologically unique (Krepel, 1994).

Urine will be analyzed opportunistically to detect potential illness. This will be done using urinalysis reagent strips (Roche Chemstrip) that test for: glucose, bilirubin, ketones, specific gravity, blood, pH, protein, nitrites, and leukocytes. However, urine collection will not be a priority.

The urine will be collected off the surface of leaves or other areas that are not contaminated with feces or soil.

Summary

I propose a research project that will focus of behavior of the resident chacma baboons found at Wildcliff Nature Reserve. Initial work includes habituation of the troops so that observation is improved and it is possible for a female to be darted and collared. Subsequent studies will focus on spatial & behavioral ecology with an emphasis on self-medicative behavior.

It is my hope to work collaboratively with other researchers, as self-medicative behavior is an

interdisciplinary field. Should others need to gain experience in ethology, parasitology, botany or pharmacology, I would welcome their assistance and participation.

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