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Giraffa: Tales from the Wild and Captive World!

What a bumper year in the world of giraffe!

The year kicked off in the captive world, when the newly formed International Association of Giraffe Care Professionals (IAGCP) hosted the first ever giraffe conference in Phoenix, Arizona, USA. The conference attracted practitioners and experts from across the globe, including the likes of Dr Anne Innes-Dagg, the pioneer of giraffe research. Read more about this stimulating event in this issue, including abstracts of all the presentations and posters.

Sadly midyear many of you would have read about the Rothschild's giraffe of East Africa being listed as an 'endangered' subspecies by the IUCN Red List. This was achieved thanks to the efforts of the IGWG and the Giraffe Conservation Foundation. On the positive side, this listing has sparked a couple of initiatives in Kenya, including the development of the first National Giraffe Strategy. Very exciting and something which we hope will help to inspire decision makers and conservationists across Africa to better manage and conserve their giraffe populations.

Last but definitely not least, I would like to encourage you to read this jam packed edition of *Giraffa* to the very end as to not miss our important announcement for a very first in Africa!

With this in mind, I would like to wish you all a wonderful festive season full of excitement, but also rest in preparation for an exciting year of 'giraffing' ahead in 2011.

Merry Christmas and a Happy New Year,

Julian

IGWG Mission Statement

Preserving the evolutionary potential of all giraffe populations utilising:

- *Morphometric and molecular genetic analysis*
- *Behavioral ecology*
- *Population dynamics*
- *Landscape conservation*
- *Zoo and wild management strategies*
- *Awareness and education*
- *Scientific and popular communications*

Inside this issue:

Rothschild's giraffe joins list of species threatened by extinction

Giraffe Conservation Foundation

The Rothschild's giraffe is the latest charismatic African mammal to be declared "Endangered" by IUCN (the International Union for the Conservation of Nature), adding to the growing number of species under threat of extinction. The recent analysis by Fennessy and Brenneman 2010 indicates that the Rothschild's populations are in peril and the IUCN Red List supports this (http://www.iucnredlist.org/apps/redlist/details/174469/0).

There are currently nine recognised giraffe sub-species and the Rothschild's is the second most imperilled, with fewer than 670 individuals remaining in the wild. Historically ranging across western Kenya, Uganda, and southern Sudan, it has been almost totally eliminated from most of its former range and now survives in only a few small and isolated populations in Kenya and Uganda.

In Kenya, all known wild populations of Rothschild's giraffe have been eradicated by agricultural development and remnant populations are confined to National Parks, private properties and other protected areas. These remaining populations are physically isolated from one another making it impossible for them to interbreed and population growth is further hindered as a result of the closed nature of these conservation areas which have reached or exceeded carrying capacities.

Sixty per cent of the world's remaining wild population of Rothschild's giraffe are found in Kenya (with the remainder in Uganda), a country that has recently shown its commitment to giraffe conservation. With the launch of a National Giraffe Conservation Strategy, the first giraffe-focussed conservation action plan of its kind, the Kenya Wildlife Service (KWS) is leading the way. This Strategy will work to conserve all three of the giraffe sub-species found in Kenya, in particular the endangered Rothschild's giraffe. Its development marks a first in giraffe conservation and raises awareness for the significance and urgent need to conserve these animals.

Despite low population figures and an "Endangered" status, little is known about the ecology and behaviour of Rothschild's giraffe in the wild, an issue that must be addressed if we are to develop and implement effective conservation strategies. To this end the Rothschild's Giraffe Project was launched in Spring 2010. This project seeks to provide the first scientific review of Rothschild's behaviour and ecology in the wild, and provide information about key ecological and habitat requirements necessary for the development and implementation of meaningful conservation initiatives.

Dr Julian Fennessy, well known in African conservation circles for his pioneering work in giraffe conservation, comments "I am delighted and of course saddened at the same time that the Rothschild's giraffe has finally made the IUCN Red List status. We have been striving for this for a while now and hope this will highlight to the world the critical state its tallest creature is in. As the second giraffe subspecies (of 9 known) to now be listed as endangered, we all have our work cut out to develop sound conservation strategies to improve the situation in the short, medium and long term. The whole thrust of our work here is to put strategies in place BEFORE it is too late - extinction is simply not an option."

The Giraffe Conservation Foundation (GCF) is actively supporting the Rothschild's Giraffe Project as well as other giraffe research across Africa. These include the provision of technical support and funding, sharing data and results for a comprehensive approach to giraffe conservation. "I can't imagine a world without giraffes, this news makes it imperative we must act to protect and preserve these magnificent creatures." comments Lynn Sherr Patron, Giraffe Conservation Foundation (GCF). Having already raised a significant amount of funding to help support research into the West African giraffe (approximately 220 left in the wild in all of West Africa), focussed efforts by GCF will raise awareness of the plight of the Rothschild's giraffe and help protect this subspecies in the wild for generations to come.

If you would like to know more about GCF or specifically the Rothschild's Giraffe Project please go online to:
www.giraffeconservation.org or
www.girafferesearch.com

Contacts:

Giraffe Conservation Foundation
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www.girafferesearch.com

Kenya Wildlife Service
www.kws.org

Giraffe lovers overseas: a trip to IAGCP at Phoenix Zoo 22-24 February 2010

Paul Rose[1] & Sarah Roffe[2]

[1] Sparsholt College Hampshire [2] East Midlands Zoological Society: Twycross Zoo

In February 2010, Sarah and I travelled to Arizona to take part in the inaugural International Association of Giraffe Care Professionals conference hosted by the Phoenix Zoo. The conference aimed to gather together scientists and researchers, zoo professionals and giraffe keepers from around the globe to share ideas and information regarding captive management, conservation and biology. This was a very exciting event (in spite of it raining in the desert!) as numerous 'zoo celebrities' were present including Dr Julian Fennessy from the Giraffe Conservation Foundation and, most impressively, Dr Anne Innis Dagg, the pioneering zoologist who first completed research on wild giraffe in South African in 1957 and author of the 'bible' for those who work with these animals 'The Giraffe: its biology, ecology and behaviour.' Both Dr Fennessy and Dr Dagg, alongside of a host of other giraffe experts gave stimulating and entertaining talks about their research.

R-L: J.Fennessy, A.Phelps, A.Innis-Dagg, J.P. Suraud & P. Rose

Much debate centred on the classification of the giraffe and whether subspecies really are just that. Recent DNA evidence now suggests that the nine subspecies are so genetically and reproductively isolated that each should be

treated as a species in its own right; this of course has massive implications for conservation breeding programmes. What would also be of note to those managing giraffe in the UK is that as of this summer, the IUCN is distinctly classifying Rothschild's giraffe as 'Endangered.' This makes our attempts to sustainably breed and manage this (sub)species in British zoos all the more important. Currently, with a wild population of less than two hundred and fifty individuals, only the Nigerian giraffe is given its own class of endangerment by the IUCN. To date, the viable wild Rothschild's population could be even less than seven hundred individual animals.

As well as the formal presentations, there were workshops on designing new enrichment devices for giraffe, how to set-up a training programme (with an emphasis on the new idea of 'microshaping') and a hoof-trimming practical, where delegates go to practice their trimming techniques on cow legs (dead ones of course!). Trips around the facilities at the Phoenix Zoo and at Reid Park Zoo in Tucson provided interesting points of notes on a range of issues from crush cage design, ease of access for veterinary procedures, types of flooring and how to instigate a public-feeding experience in a safe and stress-free environment (for both giraffe and zoo visitors).

Sarah's and my reasons for attending this event were to showcase the research that Twycross Zoo has been conducting over the past number of years, and that was precisely the title of our presentation, 'Five years of giraffe-centred research at the East Midlands Zoological Society; what do we know and where do we go?'. Apparently this presentation was good enough to win an award, which was heartening for us both and an excellent accolade for the work that Twycross is involved in. Our presentation touched on an array of subjects; from nutrition and the development of an 'ideal' diet, to evidence-based enrichment (remember, browse is no longer merely an enrichment item!), as well as visitor-effects and managing operant conditioning programmes. We hoped to provide a synopsis of the depth of research that can be done in the zoo; to highlight areas for improved management and to show how little we still know about optimum management of giraffe in captivity.

If anyone would like more information on the conference, and to hear any of the talks (as these will all be available online), as well as the work of the IAGCP, please contact the IAGCP directly at info@giraffecare.org; alternatively check out more details on their website, www.giraffecare.org, or follow their work on Facebook®.

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International Association of Giraffe Care Professionals (IAGCP) 2010 Conference Awards

Amy Phelps, Paige McNickle & Lanny Brown
International Association of Giraffe Care Professionals (IAGCP)

As IAGCP is a brand new organization and prior to this inaugural conference had not yet established a membership, the awards committee for 2010 was comprised of the executive board and a 4th impartial party. With the exception of the Attendees' Choice Award, nominees were chosen and votes were cast by this committee. In the future, awards will be given as follows:

IAGCP, 2010 ATTENDEES' CHOICE AWARD

The IAGCP Attendee's Choice Award recognizes a presentation chosen by the conference attendees. Attendees each submit a vote for the presentation that they consider most outstanding, regardless of the topic or criteria. The presentation receiving the most votes receives the award, and the award is presented by one of the voting attendees.

The 2010 recipient of the Attendees' Choice Award is Paul Rose and Sarah Roffe of Twycross Zoo for their presentation "Five Years of Giraffe-Centered Research at the East Midlands Zoological Society: Twycross Zoo, Where have we been and where do we go from here?" Paul and Sarah presented five years of extensive work on enrichment and captive activity time budgets, training, diet and nutrition, visitor experience, and more. Their work has allowed them to improve the husbandry practices for the giraffe in their care and their willingness to share this information enables all facilities managing giraffe to benefit from their findings and experiences.

The following awards will be given once every 2 years, at each bi-annual IAGCP conference. 6 months prior to the conference, the IAGCP membership will cast nominations for these awards. The Board of Directors, along with 3 impartial individuals, will vote, considering both current conference presentations and previously nominated individuals.

International Association
of Giraffe Care Professionals

www.giraffecare.org

IAGCP CONSERVATION AND RESEARCH AWARD

The IAGCP Conservation and Research Award recognize those whose outstanding efforts have made a significant contribution to conservation or research efforts for giraffe. It is presented to recognize exemplary work that has improved the future of captive giraffe management and care, made a significant discovery that enhances our knowledge of the species, or to acknowledge conservation and field research efforts that have positively influenced wild giraffe populations.

The 2010 recipient of the Conservation and Research Award is Dr. Julian Fennessy. Dr. Fennessy is considered one of the foremost giraffe experts in the world and as a key leader of the Giraffe Conservation Foundation and the International Giraffe Working Group he has been a champion for giraffe conservation worldwide. Dr. Fennessy is revolutionizing the way the world views giraffe in terms of their speciation/sub-speciation, ecology, and conservation. His ground breaking genetic research suggests that giraffe subspecies are indeed so unique that they must be protected and conserved at that level.

IAGCP EDUCATION AND OUTREACH AWARD

The IAGCP Education and Outreach Award recognizes the outstanding achievements of educators and/or students who have created and implemented education programming that promotes conservation efforts to the benefit of giraffe, or further augments and develops an overall appreciation of the species. The recipient of this award has created innovative and sustainable, science-based education programs with a particular emphasis on giraffe. Programs focused in the development and continuing education of professionals working with the species may also qualify for this award.

The 2010 recipient of the Education and Outreach Award is the Uganda Wildlife Education Center. The UWEC is a unique facility located in Entebbe, Uganda that serves to rescue and rehabilitate injured wildlife while practicing extensive conservation and education programs that focus on working with the younger generations of children in the communities surrounding the Center. Most recently, UWEC has built a giraffe focused conservation education program around 3 rescued, non-

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releasable giraffe with a new savannah exhibit. The exhibit includes a feeding deck, allowing local children visiting the Center to have intimate experiences with the giraffe, inspiring the youth of Uganda to protect giraffe for future generations. UWEC has also shown a clear commitment to continuing the education of its staff, sending representative Henry Opio Oding to the 2010 conference. Henry also spent several weeks working with keepers in California and Arizona zoos to enhance his knowledge and skills in captive giraffe care.

IAGCP TRAINING AWARD

The IAGCP Training Award recognizes outstanding training achievements that directly benefit the giraffe in the care of the recipient. Recipients of this award have developed a positive reinforcement based training program in which all behaviors are trained without the use of punishment or aversives and exclusively without the use of physical and chemical restraint. This award recognizes cooperative training that enhances the quality of life for the giraffes involved. Recipients of this award often inform and inspire others to develop first-rate training programs, contributing to the continuing education of their peers through public presentation at professional conferences and publication in various newsletters and journals.

The 2010 recipient of the IAGCP Training Award is Gerardo Martinez of Africam Safari in Puebla, Mexico for his presentation "Increasing the Medical Options, Giraffe Training." Gerardo leads an extensive training program with the giraffe in Africam Safari's collection, using operant conditioning techniques to train complex medical husbandry behaviors including TB testing, blood draws, hoof care, and artificial insemination. Gerardo has developed a program that greatly enhances the quality of life for the giraffe in his care, and his work raises the minimum standards for all captive collections.

IAGCP ENRICHMENT AWARD

The IAGCP Enrichment Award recognizes an individual or team whose unique enrichment programs have made them a leader in the field of captive giraffe care. The recipient of this award has implemented progressive enrichment programs and activities that give captive giraffe increased opportunities to engage in a variety of natural behaviors and therefore provide the visiting public with greater opportunities to observe giraffe behavior. Recipients of this award often inspire others to develop first-rate enrichment programs, contributing to the continuing education of their peers through public presentation at professional conferences and publication in various newsletters and journals.

The 2010 recipients of the IAGCP Enrichment Award are Kate Meinhardt and Erin Teravskis of the Nashville Zoo for their poster presentation "Using Puzzle Feeders to Increase Natural Behavior in Giraffe." Kate and Erin demonstrated a progressive and well-developed enrichment program, utilizing unique ideas to encourage longer foraging times and a reduction in stereotypies with the giraffe in their collection. Furthermore, they have shared their enrichment ideas with other professionals through their poster presentation, encouraging other facilities to evolve their giraffe enrichment programs as well.

The following awards will be given as warranted, and not necessarily every year or at every conference. They will not be given more often than once per conference, and some conferences may not have a winner in particular categories. These awards are open for nomination at all times by any member of the organization.

THE PIONEER AWARD

The Pioneer Award is an honor that recognizes those who have a made a noteworthy and significant contribution to giraffe worldwide in an unprecedented way. The recipient(s) of this award has gained unparalleled respect from the global giraffe community. Their work has had a great and positive impact on the giraffe field as a whole. They have demonstrated an exceptional and unmatched level of expertise, innovation, leadership, and determination. The International Association of Giraffe Care Professionals presents this honor with the hope that the achievements of its recipient(s) will serve to inspire future generations for the benefit of giraffe worldwide.

The 2010 recipient of the Pioneer Award is Anne Innis Dagg, PhD. A true pioneer, both as a woman and a scientist, Dr. Dagg traveled alone to Africa in 1956 and through an association with Rhodes University in Grahamstown she became the first scientist to extensively study giraffe, publishing the first book devoted to the species: *The Giraffe, It's Biology, Behavior, and Ecology.* She has since published *In Pursuit of Giraffe*, and *The Social Biology of Older Animals*. Dr. Dagg's work opened many doors for subsequent generations and has inspired countless individuals working with giraffe. In honor of Dr. Dagg's tremendous contribution, this award will now be named the Anne Innis Dagg Pioneer Award.

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THE TIKI ANIMAL IMPACT AWARD

The Tiki Animal Impact Award is an honor that recognizes those who's work has positively impacted the life and well being of a specific individual or group of giraffe. Recipients of this award have demonstrated an overwhelming amount of compassion, dedication, and innovation, leading to a meaningful impact on and overall enhancement of the quality of life for the animals under their care. They have gone above and beyond, exceeding high standards of care, continuously maintaining their dedication and prioritizing the needs of the giraffe in their charge. The International Association of Giraffe Care Professionals presents this honor with the hope that it will inspire others to uphold the high quality of care demonstrated by the recipient(s).

The 2010 recipient of the Tiki Animal Impact Award is Amy Phelps and the keepers and caretakers of "Tiki," a disabled giraffe at the Oakland Zoo, in Oakland, California. Oakland's giraffe team has used positive reinforcement based training methods to train this giraffe for a wide variety of physical therapies and medical treatments, thereby greatly enhancing the animal's quality of life. They have also published extensively on these accomplishments, sharing information with other facilities managing similarly disabled and ill giraffes, and raising the standard of care for all captive giraffe.

THE CAMELOPARDALIS INNOVATION AWARD

The Camelopardalis Innovation Award is an honor recognizing those who have made monumental advancements in the knowledge of the giraffe species and sub-species as a whole. Recipients of this award have demonstrated an exceptionally high degree of skill and innovation that has served to bring forth advancements in understanding and perception of giraffe worldwide. Their efforts have given us new data and added significantly to the global knowledge base for the species. The International Association of Giraffe Care Professionals presents this honor with the hope that the legacy and thirst for knowledge of the recipient(s) will both inspire others and further promote the species.

The 2010 recipient of the Camelopardalis Innovation Award is Jean Patrick Suraud and the Association to Safeguard the Giraffes of Niger. In 1996 it was estimated that there were fewer than 50 individual Nigerian giraffe in Niger. After Jean Patrick and the ASGN's extensive conservation work within the local communities, the current population estimate is about now estimated to b about 175 individuals, meaning there has been a 250% increase in the population since 1996. This project is considered one of most successful population recovery efforts with any species. Jean Patrick's work has shone a bright light on giraffe conservation in a variety of media outlets.

THE SAMBURU COLLABORATION AWARD

The Samburu Collaboration Award is an honor recognizing those who have come together and united for the benefit of giraffe. The recipients of this award have demonstrated a high degree of teamwork in addressing the needs of giraffe. Their collaborative efforts have served to bring forth advancements, benefiting giraffe, not possible through the actions of one single individual person or organization. The International Association of Giraffe Care Professionals presents this honor with the hope that others will be inspired and motivated to come together and share in this spirit of collaboration.

The 2010 recipient of the Samburu Collaboration Award is Deb Schmidt, Ph.D, and the organizers and participants of the first Giraffe Nutrition Workshop, held in May of 2005. This collaborative meeting of zookeepers, veterinarians and nutritionists led to a significant change in the diet and nutrition recommendations for captive giraffe and spread awareness of the current nutrition related medical issues effecting our captive collections. This meeting began a culture of collaboration, bringing together experts from a variety of facilities and backgrounds to advance and improve our current giraffe care protocols.

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An interdisciplinary approach to training: thinking outside of the box, working to reduce fearful behavior with giraffe at the Oakland Zoo

Lisa Clifton-Bumpass & Amy Phelps
Oakland Zoo

ABSTRACT
The Oakland Zoo's giraffe team has successfully met the collection's husbandry and training needs by reaching outside the exotic animal care industry. When staff was faced with training complex medical husbandry behaviors, keepers brought a domestic animal training consultant to the training team. Many training solutions were discovered through the integration of methodologies and training protocols from both domestic and exotic fields. These tools allowed animals with a low threshold for fear-flight-freeze responses to benefit from systematic processes of desensitization to novel stimuli. The science of applied behavior analysis gives exotic and domestic animal husbandry and training professionals several exacting tools to reduce the stress and fear-based responses of animals to novel objects and people. The Oakland Zoo uses classical conditioning to change an animal's association with novelty from fear to operant interactions, often referred to as choice. Using a training construct known as "Stranger Danger" informs the training plan design, core skill assessment, reinforcement hierarchy, bridge selection, and team training processes. Key strategies in training giraffe by shaping behavior are effectively applied to many other behavior management needs: measuring behavior, reinforcement choice, team building, micro shaping and the micro shaping strategy, reinforcement hierarchies and an adaptation of Karen Pryor's training game: "101 things to do with a box," allowing an animal to interact with new people and objects from the positive quadrant of behavior modification. Assessing the learning styles, rate of acquisition, and the social preferences of specific individuals within the Oakland giraffe herd allows trainers to extrapolate the methods used within domestic animal behavior modification to benefit the giraffe. Dramatically reducing the fear-flight-freeze response facilitates the training of advanced and often invasive medical husbandry behaviors that can be accomplished in protected contact and entirely without the use of physical or chemical restraint of the giraffe.

Keywords: Micro shaping, micro shaping strategy, reinforcement training, team training, fearful, classical conditioning, operant conditioning, Kay Laurence, Alexandra Kurland, Karen Pryor

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The unique anatomy and physiology of the giraffe brings many unique challenges to the captive management of the species. Their sheer size and species specific needs complicate routine husbandry practices and anesthesia becomes extremely dangerous. In the majority of zoological institutions, medical treatments are typically accomplished either by placing the giraffe inside a mechanical restraint or squeeze device, as in the TAMER by Fauna Research, or by forcing the animal to comply by utilizing equipment such as movable wall or hallway panels. Because of the historic physical risks involved in standing sedations and anesthesia with giraffe, the Oakland Zoo giraffe collection is currently managed by the practice and application of reinforcement based training methods which allow the animal to willingly participate in many procedures without physical or chemical restraint. All behavior management and routine husbandry care of the animals is anticipated and trained for by using the methods from the science of Behavior Analysis relying on the least invasive, and minimally aversive practices and procedures to create behavior change. This allows staff to anticipate the specific care and needs of individuals within the collection and proactively train behaviors that facilitate medical husbandry and daily management. Excluding emergency or surgical procedures, animal management and veterinary staff are able to work as a team in concert to treat and manage various conditions with less distress to the giraffe, as their participation in the procedure is both voluntary and cooperative in nature and a part of their regular routine. Proactively training behaviors allows the management program to plan and prepare for unpredictable emergencies and succeed when the staff and animals are presented with unusual circumstances. Additionally, routine reinforcement training conditions strong positive emotional responses to interaction with humans and novel equipment.

Many zoological institutions are investing in the expansion of continuing education programs and the development of training skill sets for keeper staff. Recognizing the growing need to develop more involved behavior modification protocols, the Oakland Zoo giraffe keeper staff sought the expertise and mentorship of the zoo's volunteer training consultant, Lisa Clifton-Bumpass, who had been working with a variety of other species within the zoo.

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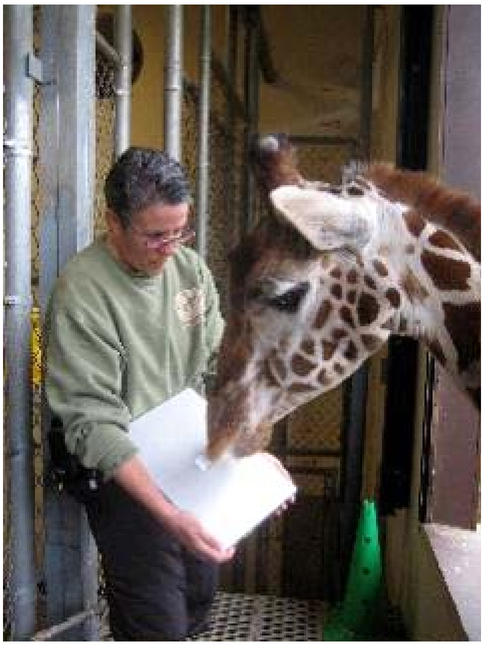
The volunteer training consultant displayed evidence of several key factors proving her qualified to fulfill this role including proficiency in teaching people how to train, a strong awareness of the sciences of animal behavior, the ability to work under the guidance of keepers, and independently assessed competency of mechanical training skills. After Lisa joined the giraffe team, under her guidance staff developed pivotal mechanical skills that allowed members to take on more intricate training projects. The training evolved from being a system that relied on simple baiting and luring techniques to the current system built with a foundation in refined behavior shaping skills.

Currently the core of the Oakland Zoo giraffe management program is a reinforcement training skill set required for shaping and chaining simple and complex behaviors that develops the giraffes' behavioral flexibility, effectively providing them with the tools needed to thrive in the captive environment. Today's reinforcement training and behavior modification is rooted in the science of Behavior Analysis (BA), which is the scientific study of behavior. BA attempts to understand behavior, measure responses or change, describe and predict behavioral outcome. The keystone to the Oakland training program is a process called "Micro shaping" in which the trainer creates a systematic series of incremental behavior changes allowing the learner to function in the training environment at high rates of reinforcement and high success rates (95% and higher) as the muscle movements of the behavior are rewarded.

Giraffe are often considered a species that has a low threshold for flight and demonstrates the "freeze, fight or flight" response to all novel stimuli introduced into the captive and wild environment (referred to as neophobia). The foundation of the Oakland Zoo's giraffe training program is a series of shaping games taken from modern science based positive reinforcement companion animal training. These shaping games are used throughout the giraffe training program and are relied on to build a strong training foundation and as a tool for assessing and developing the giraffe's learning style. Through the employment of shaping games, learners develop into individuals who are highly adaptable in an ever-changing environment, less accident-prone, and are better prepared for unexpected events, sounds and items such as windblown trash entering their environment. Through building the process of learning flexibility, and teaching the process of interacting with multiple novel stimuli, individual animals learn that new things in the environment are positive opportunities for reinforcement. This translates to training for medical husbandry behaviors when the giraffe's first reaction when presented with a novel item changes from the fear of the freeze-fight-flight response to cooperative interaction. For example, when presented with an opthalmoscope for the first time, a giraffe with an eye injury who had participated in these shaping games readily approached and targeted the equipment with his cheek.

The core of these shaping procedures is an adaptation of a game created by Karen Pryor, "101 Things To Do With A Box," (also called "101 Things") which is a popular tool within the companion animal clicker training community.

"This training game is derived from a dolphin research project in which I and others participated, "The creative porpoise: training for novel behavior," published in the *Journal of Experimental Analysis of Behavior* in 1969." (Karen Pryor)



In this game, the learner is introduced to a wide variety of novel objects such as traffic cones, hula hoops, medical equipment, a ball, a laptop computer, stuffed toys and carefully prescreened people who are strangers. Each training session presents a new learning opportunity to train interaction with a different non fear-inducing object. The novel object/person is presented in a manner that allows the animal to choose to interact with the object in order to have access to reinforcement. A linear progression of behavior is developed through reinforcement that allows a specific behavior pattern to be selected.

The careful conditioning of animal interaction with many novel objects through tiny steps and stages is the core principle of the shaping game.

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In the “101 Things” game, the trainer shapes simple behaviors that encourage the animal to interact in some way with novel stimuli. Through a series of successive, incremental approximations the trainer may build the behavior from looking at the novelty to touching it with the muzzle, smelling the object/ person to pushing the cheek against an ophthalmoscope, rolling an object on the ground with it’s nose or foot, or placing a foot inside a hula hoop resting on the ground. An example would be shaping the behavior of standing on a radiograph plate holder to facilitate radiographs of the tips of the giraffe's pedal bones with both stillness of the foot and duration. Each of these stages is a clearly defined, reinforce-able approximation of the final behavior. The approximations are dependent on the learning style and experience of the individual animal. Initially, any glance at the plate holder is bridged and reinforced. Moving through the approximations, as the giraffe's behavior demonstrates that there is no fear, the plate is placed on the ground and any movement of the specified foot needed for the radiograph is reinforced in a manner that supports the goal behavior. The successive approximations build on one another in thin slices of behavior, toward the final picture.

"101 Things" has also been adapted into "The Stranger is not a Danger” game (also known as “Stranger Danger”). In this training protocol, unknown or unfamiliar humans are used in the same manner as novel objects. For example, the trainer has the carefully screened stranger stand in a location where the giraffe can be bridged and reinforced for turning its head in the direction of the new person. In the beginning stages it is not important if the animal looks directly at the target human, but in the direction of the new person, teaching the muscle action patterns of looking in one direction or another. The starting point for this exercise is determined by assessing the distance (or point) at which the onset of fear for the learner can be measured and therefore avoided, which is referred to as sub-threshold to the fear response. As the giraffe's noticing or looking at the stranger takes on a more relaxed posture, the “stranger” is moved forward in small increments within the animal’s comfort zone, and the giraffe is reinforced at each stage at a high rate of reinforcement for their behavior.

After the “stranger” is within a comfortable distance, they can also be used as training targets, shaping the giraffe to touch the person's hand or arm with the muzzle. The "Stranger Danger Game" allows the trainer to generalize interacting with unfamiliar individuals, people wearing unfamiliar clothing or veterinary uniforms and equipment, effectively creating a positive conditioned emotional response to both known and unknown people. Both 101 Things and Stranger Danger interaction procedures prepare animals for unforeseen emergency examinations by consulting veterinary staff, introduction to new keeper staff and volunteers to the area, as well as ensuring a high level of positive and cooperative giraffe participation with public feeding opportunities.

Additionally, Stranger Danger and 101 Things create a strong reinforcement training foundation that builds toward target training, which supports the building of other behaviors. All training strategies rely on core competencies in measuring animal behavior, finding appropriate reinforcers and individual food preferences. Both measuring behavior and selection of reinforcement are based on strong observational skills. One may choose to measure behavior based on muscle action patterns, lack of tension in large muscle groups, rate of behavior, and duration of behavior.

Historically, keeper staff have trained the giraffe using multiple people due in large part to the sheer size of the animal and the inability of one trainer to work a behavior from the ground and reinforce at the giraffe's head level in a timely manner. In the Oakland Zoo's giraffe training program there are three key roles filled by keepers in each training session. These roles consist of the feeder (the person at the animal's head level who delivers the physical reinforcement), the trainer (the person who marks behavior), and the observer (the person who watches the giraffe's body language, collects data, and indicates readiness for the next approximation in the shaping plan). This differs from traditional group training in that there is a training plan that all members work to support cohesively. The training process starts with writing a plan, pre-briefing before each training session, the training session, and ultimately debriefing. In group training, each person acts independent of the others and is not relying on the skills and observations of each team member. This system of team training is differentiated from group training in that each member, often with multiple animals being trained simultaneously, is an integral part in the smooth acquisition of new information for the learner. Specific to team training with giraffe, the actions and decisions of each person directly impacts the overall behavior picture of the animal. For example, if the feeder

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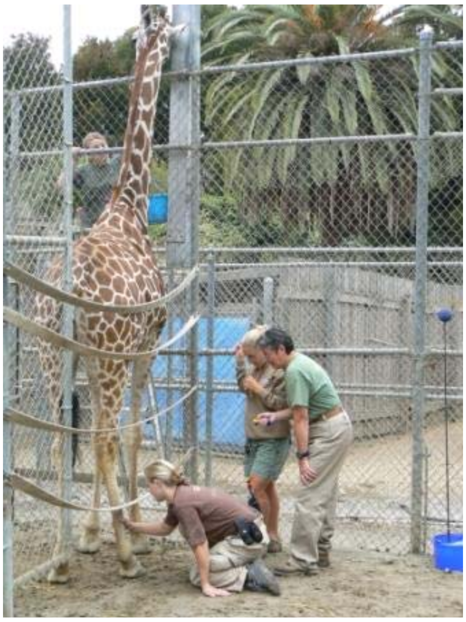
mishandles food the animal could be rewarded for behavior other than what was being bridged. Furthermore, if the feeder does not deliver food in a location that supports the desired behavior, the behavioral outcome can be counterproductive. For example, in order to get the desired behavioral momentum for a side step to a left hip target, the feeder should deliver food to the right side of the giraffe, allowing them to "swivel" the hips away from and then back toward the target.

Utilizing team training, complex behaviors are carefully shaped through the use of Micro shaping. Micro shaping is a training process developed by Kay Laurence of *Learning About Dogs* in England. As a shaping method, it places the learner at a 95% reinforcement rate as each criterion is raised to reduce stress, frustration, aggression, and confusion as well as reducing learning or training error rates. The design of a Micro shaping plan starts with studying how the learner moves his or her body and identifying where the best placement of reinforcement should be to maintain the behavioral momentum of the action patterns. Additionally, each session is limited to a short session working on teaching muscle actions in fixed specific muscle groups. The environment is set up to increase the accuracy of reinforcement delivery to the learner without creating competing or conflicting reinforcement events. As an example, a micro shaping session would be limited to 10 repetitions of reinforcing a giraffe for the process of lifting it's foot onto the x-ray plate holder target as opposed to traditional training which would reinforce for only the event of the giraffe placing a foot on the target correctly, which results in a lower rate of reinforcement for the accidental placement of the foot on the target.



The Oakland Zoo giraffe training program also utilizes the micro shaping strategy. The micro shaping strategy was developed by Alexandra Kurland as a protocol for shaping the behavior of fearful or anxious animals. In the micro shaping strategy, shaping of new behaviors are augmented by reinforcement of well known behaviors. By breaking up training sessions of new behaviors with short sessions of interacting with keepers during a well-known behavior, the rate of reinforced behavior increases thereby reducing training stress. Returning to the model of training foot placement on a target, the learner might be asked to complete three sessions of 10 trials (or repetitions) of foot on target with a set of 10 repetitions of an already trained nose targeting behavior.

Micro shaping and the micro shaping strategy allow keepers to control the giraffe's body movements relative to the captive environment, and position the animal for access to their body (effective in both free and protected contact management systems). The giraffe learns to position it's body using specific movements on cue. Keepers train the giraffe to move forwards or backwards on the verbal cues "move up" (take 1 to 2 steps forward), and "back up" (take 1 to 2 steps backward). Hip and shoulder "move-in" behaviors are established on both the right and left sides of the body, allowing keepers to move the animal sideways. The giraffe's position is maintained using a stay or station behavior. Body targets are established to control the position or placement of the nose, cheek, neck, chest, and knees, allowing keepers to slightly angle or adjust the giraffe's body with refined, deliberate body movements. Giraffe are taught that each foot has an assigned different target (differentiated by shape, texture, and color); the target then becomes the cue for a specific foot placed in an exact location with duration. The purpose of the foot target behaviors is that they facilitate the specific placement of the feet for the application of topical treatments, detailed examination of minor injuries, proper foot positioning for high quality radiographs, and other hoof care procedures. Other verbal cues that benefit the management of the individuals within the herd are the recall (come when called) and name recognition which allow specific animals to be called into holding yards off of the exhibit reliably and expediently.

Early on in the giraffe's learning history, a series of basic, non-invasive behaviors are trained. These behaviors are target based in nature and serve as the building blocks towards more complex and invasive procedures. Before basic medical husbandry behaviors, such as eye exam or monitoring

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respiration with a stethoscope can be accomplished, the giraffe must be conditioned thoroughly in order to be comfortable while being touched by both humans and medical equipment. The previously discussed training games used to condition the giraffes to novel stimulii facilitate the use of medical tools and equipment like ottoscopes, small dental tools, and flashlights in the herd's general care. Our experience has demonstrated that as a prey animal, giraffe generally exhibit greater relaxation when being touched on the head and neck region and an increased level of fear or stress related body language when keepers manipulate their legs and feet, so systematic tactile desensitization procedures begin at the head and work down the body.

For tactile body conditioning and manipulation, the giraffe is moved into a position allowing staff safe access to the animal while reinforcing a stay position during the systematic conditioning for touch related exercises. As physical exam, palpation, and manipulation of the abdominal and urogenital regions may be necessary, giraffes are conditioned for specific medical examination protocols. Systematic desensitization and conditioning allows for transabdominal ultrasounds with pregnant cows, preliminary training for milking in preparation for potential hand rearing of a calf, cleaning of the prepuce in bulls, and opportunistic free catch of urine samples for routine lab work. Training for physical interaction, basic exam related procedures, and foot target behaviors are the corner stones that contribute to the skills allowing diagnostic radiographs of the lower limbs. The giraffe is trained to place a specific foot on its corresponding target (with duration) while the radiograph plate and portable machine are moved into position, and the image is taken.

Proactive hoof care is a vitally important part of any captive giraffe management program. Strict attention to foot care is a key component in keeping giraffes sound and active in the zoo environment. Training for hoof exam, trimming and filing procedures, begins with trimming from the ground, where the giraffe places the foot on it's corresponding target (with duration) while staff remove outer wall overgrowth and take back the length of the toes as necessary. To accomplish more advanced trimming procedures that are therapeutic in nature, and to gain access to the sole of the foot, giraffes are eventually taught to lift a specified hoof off the ground following a physical cue, and to balance on three feet while maintaining that position. The foot lifting behaviors are shaped so that the giraffe supports all of their own weight and simply shifts their balance to stand on three legs. The lifted leg remains relaxed and keepers can manipulate the exact positioning of the leg for safe and accurate inspection, trimming, and filing.

As general anesthesia is of particular risk to this species, and as the captive geriatric population increases, it becomes of greater importance for exotic animal keepers to plan for and train more invasive and complex medical and husbandry protocols. Training these sophisticated medical husbandry procedures requires moving beyond basic shaping, to more advanced shaping and chaining practices. Because the Oakland Zoo giraffes have a large reinforcement history built around the face and mouth as a result of the hand feeding practices and shaping games, training for these invasive procedures begins with teaching the open mouth behavior. As giraffes age, dental abnormalities are often found which develop into abscesses or points on the molars and premolars that can impede the animal's ability to eat normally, resulting in undesirable weight loss and ancillary general health erosion. It is important to be able to routinely examine the entire mouth without creating high levels of stress or risk to the individual.

Giraffes are trained to open their mouth following a visual cue and maintain the position while dental tools, small flashlights, or a hand is inserted to inspect the teeth, gums and tongue. In the event of food particles becoming lodged, the cooperative trained open mouth behavior allows staff to clean or brush teeth, and provide care and treatment of wounds in the mouth, and irritation or redness in the gum tissue. Proactive dental care allows veterinarians to plan for anesthesia or standing sedation as necessary to manage and treat infections and other serious conditions that may arise.

The ability to draw blood and give injections without the use of chemical or physical restraint is an important tool in captive

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giraffe management. Blood samples are often required for lab work as part of a pre-shipment examination in preparation for moving animals between facilities. Specific values in the blood may need to be monitored when using drugs such as oral non-steroidal anti-inflammatories that carry the risk of potential negative side effects on the kidneys and other organs. In addition to blood work, animals often require injections to deliver necessary vaccines, contraception, antibiotics, or the use of disease modifying osteoarthritis drugs (such as glycosamonioglycans, AdequanÒ and LegendÒ) used in the treatment of geriatric or arthritic giraffes. Giraffes at the Oakland Zoo are trained for hand injection in large muscle masses as in the hindquarter and shoulder regions. These behaviors are achieved when the giraffe is trained to the auditory cue, "move in," signaling hip or shoulder placement at a hatch door in the fencing. The giraffe then holds their position at the access hatch for the duration of the injection. The blood draw protocol is trained so that the giraffe voluntarily participates in the process of having blood taken from their jugular vein. The giraffe is conditioned to tolerate the pressure of the needle stick, while remaining in position and blood is collected. The hand injection and the jugular blood draw are performed in a holding yard where the giraffe is completely unrestrained and has the option to walk away from the training session at any time.

At the Oakland Zoo, several different types of non-traditional physical therapies are used in conjunction with traditional western medicine to treat various medical conditions and minor injuries, while both authorized and supervised by veterinary staff. Acupuncture is used as part of the pain management plan for several different individuals who have suffered various injuries, from concussion fracture of the pedal bone, muscle and tendon tenderness, chronic disease processes such as ringbone and osteoarthritis, and arthrodesis or surgical fusion of the fetlock joint. As with hand injection training, the giraffe holds a stay position and allows the veterinarian to insert acupuncture needles into specific points along their shoulders, forelegs, and feet, which also facilitates injection of small amounts of vitamin B-12 into various acupuncture points as required.

The Oakland Zoo also employs stretching exercises; massage therapy, and chiropractic care as an adjunct to routine integral husbandry practices in order to maintain the physical health of the giraffe herd. Stretching is a form of physical therapy that increases the flexibility of the muscles and the connective tissue, and is used with a geriatric giraffe cow to help the muscles, tendons, and ligaments maintain elasticity, thereby reducing the risk of strains or pulls. Staff members have trained specific giraffe to offer each of the front legs when given the physical cue. The behavior is shaped so that the leg can be extended out in front of the shoulder or folded under, requiring the giraffe to maintain balance on three feet throughout this process. These cooperative treatments are done in protected contact, without restraint or confinement, and the giraffe can choose to walk away from the training session at any time. The giraffe often self-stations at the treatment location, in the correct position for the stretching process and offers her front leg without being cued, when no food reinforcement is present in the environment. This requesting behavior occurs when the geriatric giraffe experiences increased discomfort as measured by limping, shuffling, muscle tension, spasm, edema and swelling.

Massage therapy is a common treatment for equine athletes and potential benefits include enhancement of the animal's muscle tone, increased range of motion, reduction in localized edema, stimulating circulation, and the release of endorphins. Equine sports massage therapy is routinely used in various veterinary-approved pain management protocols. Staff members use the "stay" behavior to hold the giraffe in position and the massage therapist gains access to the giraffe's body using step stools and ladders through protected contact barriers. Appropriate conditioning and desensitization for tactile palpation prepares the giraffe for the handling required in a basic physical examination, but the body work associated with massage requires greater pressure and varying hand positions. Training for massage therapy prepares the giraffe for the different types of touch, management and manipulation of their body often associated with more invasive veterinary procedures.

Through anticipating the specific needs of giraffes within the collection, and proactively training behaviors that facilitate medical husbandry for these individuals, prepares staff and animals for unforeseen medical emergencies. By identifying the husbandry and management trends in the captive setting, core training is identified which supports treatments and care, and is integrated into the daily management practices. For example, the adolescent 2 year-old bull giraffe in the herd, Mabusu, presented to keepers with a moderately serious laceration to the lower eye-lid,

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exposing the subcutaneous fatty and muscle tissue layers. Having only been part of the Oakland Zoo's herd for just over one year, Mabusu's training history consisted of two primary shaping games: 101 Things To Do With Your Head, and "Stranger is Not a Danger". His participation in these games allowed for the building of a strong reinforcement history that included his face, the closeness of strangers, and the interaction with novel looking and smelling objects. Previous to the injury, no invasive eye care protocols had been trained or undertaken. As a result of the injury, the immediate emergency first aid care required flushing and the application of eye antibiotic ointments followed by routine medical evaluation requiring examining strangers to come within inches of his face, prolonged close examination the eye with a pen light, thorough eye flushing, twice daily application of antibiotic ointments, and regular examination by staff. The process of teaching “101 Things” and "Stranger Danger" allowed for Mabusu to avoid dangerous anesthetic procedures and invasive surgery. As a direct result of the conditioning to new people, targeting his face, and exposure to novel objects resulted in reinforcement history that allowed Mabusu adapt quickly and enabled the close examination of his eye by the zoo's visiting veterinary eye specialist.

The extensive training program at the Oakland Zoo has facilitated the building of bridges between zoo staff, advanced expertise from non zoo specialties and the research community, and has provided unique treatment mechanisms for coping with unforeseen medical difficulties. The trained voluntary jugular blood draw enabled the zoo to participate in a nutrition study, and provided staff with the ability to pull blood to assist another institution in boosting the immune system of a hand reared giraffe calf. Tactile training for palpation of the abdominal and urogenital region allowed staff to hand milk an injured giraffe cow in the event that she was unable to care for her newborn calf. Most recently, The Oakland Zoo has participated in the preliminary stages of a giraffe EEG (electro encephelogram) study with initial findings and the first recorded brain activity.

The voluntary participation in medical and husbandry procedures as a result of positive reinforcement based training and Behavior Analysis has many direct benefits for the animals. Positive reinforcement based training can be successfully employed in both free and protected contact systems. It is an effective management tool for facilities that use a restraint device as well as for facilities that do not have access to restraint equipment. It is recommended that all zoological facilities exhibiting giraffe employ mechanical restraint devices capable of facilitating standing sedation or general anesthesia as a treatment mechanism for surgical procedures that cannot be accomplished by training. However, effective training procedures reduce the need for physical force typically used to gain compliance. Reinforcement training can be used in all environments including a restraint or chute, without the use of the device's squeeze capabilities, by employing the chute as a hallway, allowing safe access to the animal's body.

Careful training for medical procedures by keeping the process voluntary in nature for the giraffe, has demonstrated less measurable distress associated with the protocol, equipment and specific staff. The animal does not struggle, fight or attempt to escape, and the process is conducted with a higher degree of safety for both the giraffe and the humans involved. Giraffes who are conditioned to a wide range of novel stimulii and environmental conditions demonstrate a strong conditioned emotional response to all aspects of their captive environment. They exhibit a quantifiable reduction in the fight or flight response and are less reactive to “unexpected sights and sounds” overall. The Oakland Zoo has found that methodical training systems have multiple benefits. By thoroughly conditioning animals, they become safer to work while in close proximity, and have fewer accidental injuries resulting from spooking or bolting.

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In conclusion, reinforcement training shapes animals that are less stressed, who present a greater repertoire of natural behaviors while on exhibit, making them better ambassadors for their wild counterparts to the visiting public. Additionally, thorough conditioning allows both the animal and keeper staff to have the tools necessary to provide for the needs of animals without creating avoidable distress, allowing animals to thrive and function well in the captive environment. Effective and humane care entails an understanding of the natural history of the species, species ontogeny, and reinforcement training skill sets. This planning prepares the giraffe for potential husbandry and medical issues in advance, instead of addressing emergencies as they arise. Preparation for the unanticipated events that can develop throughout the animal's life protects the individual from unnecessary risk and emotional distress.

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REFERENCES

Ramirez, Ken. Animal Training. Chicago: Shedd Aquarium, 1999. Behavior Analysis in Animal Training 5/29/09
www.behavior.org/animals
www.clickertraining.com/node/167 (101 Things)
www.clickertraining.com/node/1627 (Micro Shaping)

RESOURCES

Animal Cognition – www.animalcognition.net

Cambridge Center for Behavioral Studies – www.behavior.org

Applied Behavior for Animal Training Courses www.learningaboutdogs.com (internet based shaping and Micro shaping courses)

www.naturalencounters.com/trainingEducation.html

www.sheddaquarium.org/adult_programlistings.html#ADULT_PROGRAMS

www.legacycanine.com/workshops/chicken-camps.html

Evaluating the dynamics of Thornicroft's giraffe through photographic database construction

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ABSTRACT
The Thornicroft's giraffe is one of the least researched subspecies of giraffe. There has not been an accurate population estimate of Thornicroft's giraffe in decades; except for those based on limited observational surveys. Current research is being conducted on the Thornicroft's giraffe through photographic monitoring. Identifying individuals from a population through photo identification provides many benefits. This form of "marking" animals for study is one of the most minimally invasive techniques that can be used. This allows for the least amount of stress to be put on the animals as possible. Also, as a researcher, one is on a much more intimate level with the subject of research which allows for a more in depth understanding and ultimately a higher quality of data. Of the 111 photos that were analyzed, 65 unique individuals were identified. Of the 65 individual giraffe, 46 were female and 19 were male. Efforts to track individuals through their lives will greatly contribute to the basis of knowledge about the subspecies including a current population estimate. This project will contribute to future research and conservation efforts on Thornicroft's giraffe.

INTRODUCTION
The Thornicroft's giraffe is a subspecies of giraffe unique to Zambia's Luangwa Valley. They are geographically isolated and comprise approximately 1% of the world's giraffe population (Fennessy, 2008b). This isolation is most commonly attributed to the Rift Valley escarpment which prevents genetic flow with other giraffe in neighboring areas. Due to the low numbers of Thornicroft's giraffe and the extreme isolation, this subspecies is very susceptible to a genetic bottleneck and the problems inherent in small populations that make them vulnerable to extinction. The Thornicroft's giraffe is currently listed as "lower risk: conservation dependent" according to the IUCN Species Survival Commission Red List (Fennessy, 2008a). Giraffe numbers in total are about 140,000 individuals which is a third of that of the African elephant who has long been considered "endangered" under these standards. Although giraffe are a very ecologically important species in Africa, they have received this status based upon current conservation efforts that are in place. If any factor of current management and conservation were to change, the species would be at risk of gaining a higher risk status. This is why reevaluations of the species' status must be made frequently. Major threats that could significantly impact giraffe are habitat loss and fragmentation. There has not been an accurate population estimate of Thornicroft's giraffe in decades; however, based on limited surveys the population appears to be increasing. Population numbers have ranged from 30 individuals in 1900 to a "guestimate" of 700-880 individuals in 2008.

Giraffe have constantly changing herd structures that can be described as loose or fluid (Fennessy, 2008a). In the past this lack of heard structure has been attributed to the lack of communication within the herd. However, recent research has suggested that giraffe can communicate with infrared sounds in a similar way that dolphins do (Unknown, 2009). Maternal bonds with giraffe have often been described as weak. Cows have been documented leaving their calves for extended periods of time while they search for food or water. There are numerous hypotheses explaining this behavior including conserving the calves water and energy recourses (Unknown, 2009). Giraffe have an average gestation period of 448 days (Castillo et al., 2005). Commonly mammals have a breeding season that coincides with times where food is abundant to compensate for the greater energy demands maternity requires. Giraffe, however, are unique in that they breed and reproduce all year long. This also allows for a giraffe to become pregnant while still lactating. These reproductive behaviors can have a large impact on daily activities of giraffe depending on what stage of reproduction they are in.

Until recently little research has been conducted on Thornicroft's giraffe, thus little is known about their population dynamics. The goal of this research project is to better understand this rare subspecies through photographic monitoring. This technique has been used for years on a variety of species such as otter (Gilkinson, et al., 2007), dolphin (Grellier, et al., 2003), cheetah (Kelly, 2001), and even small cetaceans (Würsig, et al., 1990). By developing a photographic database tied to individual sighting information, much can be learned about the ecology and behavior of these animals. The database will allow for us to sex, age, and identify individual giraffe, and furthermore track the movement, reproduction, survivorship, and behavioral patterns of individuals. Once information is gained about individuals there are possibilities for capture-mark-recapture population estimates (CMR). This project will set the foundation for effective long-term research and monitoring efforts on this subspecies for management and conservation.

METHODS
Identifying individuals from a population through photoidentification provides many benefits. This form of "marking" ani-

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mals for study is one of the most minimally invasive techniques that can be used. This allows for the least amount of stress to be put on the animals as possible. Also, as a researcher, one is on a much more intimate level with the subject of research which allows for a more in depth understanding (Unknown, 2009). This ultimately leads to a higher quality of data.

Current research is being conducted on the Thornicroft's giraffe through photographic monitoring. The Zambian Carnivore Program (ZCP) has field crews on the ground conducting a carnivore research project. Opportunistically they take photos of giraffe from the road. This does slightly bias the data by limiting it to giraffe that frequent the road area; however, the road system is relatively widespread which allows for a large proportion on the population to be sampled. When giraffe were encountered, photos were taken of every individual present in the herd. It was vital to retrieve photos of all sides of the animal in order to match them up in the database. This, however, was not always possible in the field, so it sometimes took multiple sightings to correctly match both sides of the giraffe. At the time the photo was taken, detailed information was recorded such as location, date, time, number of individuals in the herd, sex, age class, and specific habitat information. These data were then coupled with the photographic information and from there individual identifications were made.

In previous photo identification research projects population estimates have been made based on a combination of physical tagging as well as photos. This project made estimates solely based on photographic sightings. Past efforts have also made use of computer programs to identify individuals such as Interactive Individual Identification System, otherwise known as I3S (Rowat, 2008). This software identified sharks based on the unique spot pattern behind their gills. A system of this likeness would be beneficial for this project, however, for the time being individuals are being identified by hand.

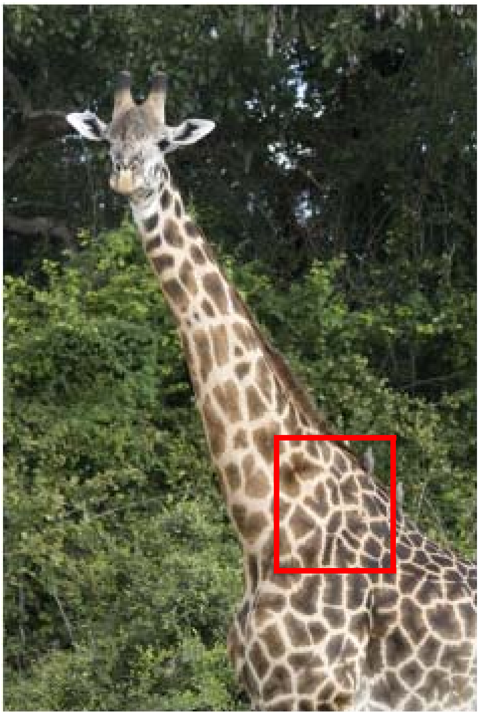

Figure 1. Standardized area used for identifying individuals

Giraffe can be identified based on a variety of distinguishing characteristics including spot size and shape, tail length, variations in color, and ossicones (horns) (Unknown, 2009). Other unique abnormalities such as tumors and scars can be used to make identifications as well. In order to most efficiently and consistently identify giraffe a standardized area on the base of the neck was chosen to make identifications from. The area is displayed in figure 1. Coat patterns are unique to individuals and remain unchanged for their entire lives, although shade may change with age (Unknown, 2009). Identification by ossicones was avoided due to the fact that they grow as giraffe age. This would make it difficult to identify individuals from year to year. Sex is another distinguishing characteristic that is used. Males have a very obvious penal sheath and testicles. Males also have knobby dark faces compared to that of a female. This difference is displayed in figure 2.

Once an individual is identified every resighting event can be recognized. Efforts to track individuals through their lives will greatly contribute to the basis of knowledge about the Thornicroft's giraffe. Giraffe that are first identified as juveniles can be followed in the database for many years. A population estimate can also be gained from this data by using a Capture Mark Recapture (CMR) technique. Capture-Mark-Recapture is a popular repeated sampling method used by biologists worldwide to determine population size, survival, and recruitment rates (Pradel, 1996).
This method works by capturing a sample of the population, marking and releasing them, then conducting repeated resighting or recapture surveys.

This can be expressed by the equation below (Robson, 1964).

$$N = \frac{MC}{R}$$

N= Number of individuals in the population (Unknown)
M= Number of animals marked in the population
C= Number of individuals surveyed for marks
R= Number of marks found in sample C

When a giraffe is entered into the database it will be considered a "marked" indi-

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Figure 2. The noticeable differences between male and female giraffe. The bottom Photo shows the knobby dark face of a male where as the female on the top has a lighter smoother

vidual. Then as additional surveys are conducted resighting events can be made. For example, if there were to be a sighting of 15 giraffe and 4 of them were previously identified in the database where there are 52 identified individuals the equation would be expressed as follows:

$$N = \frac{(52)(15)}{4}$$

This would give us a population estimate of 195 Giraffe. As more individuals are identified and more resighting events are made the estimate becomes increasingly more precise.

RESULTS

Photos collected by the field crew were divided by date of observation and were accompanied by data that included the number of individuals in the sighting. One by one the photos were analyzed to pick out individuals. The giraffe was first identified by sex. This allow for it to be categorized in the database. The giraffe's spots were then analyzed based on the standardized area of the neck mentioned previously. If the giraffe did not match any that had been previously identified it was entered into the database as a new individual. Giraffe were categorized based on sex and then given a unique sequential number. For example, male identification numbers are M001, M002, M003, and so on. The same system was used for females. When analyzing a photo that had numerous giraffe in it the individual in the foreground was always the one that was analyzed.

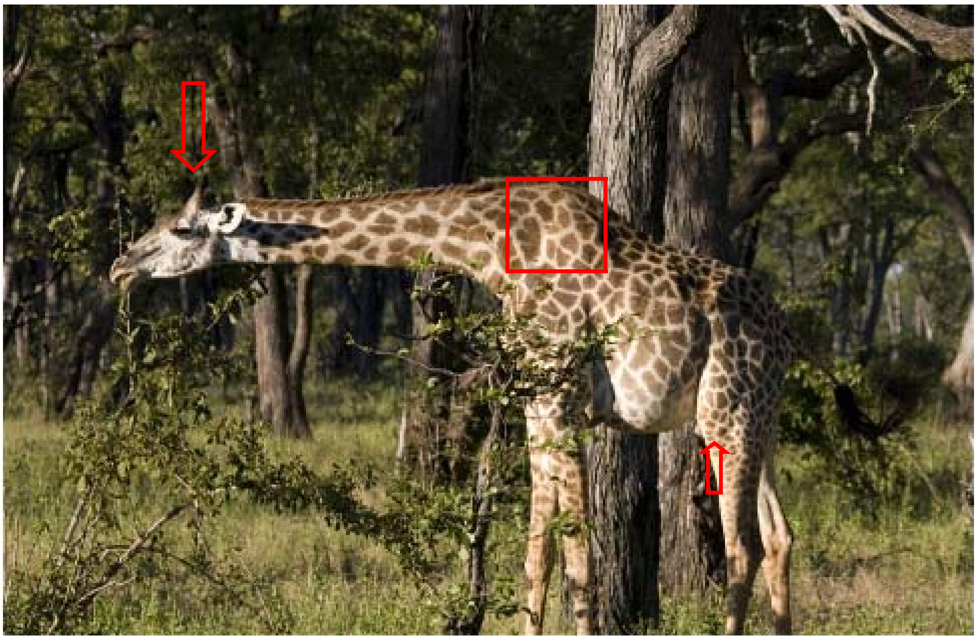
Individual Giraffe that have photos of the front or back of the animal can allow researchers to match the left and right sides of the animal. Unfortunately in the field this was not always possible so many individuals were identified by only one side. The database has been adapted to compensate for this and takes into account that the same giraffe may be entered into the database twice based on each side. Giraffe can be sorted based on the side the photo was taken and a population estimate can be made based on just left or right side photos.

Of the 111 photos that have been analyzed thus far 65 unique individuals have been identified. Of the 65 individual giraffe, 46 were female and 19 were male. They were identified based on the following characteristics: unique spot shape in standardized area and gender. Below are photos of three individual giraffe. The unique characteristics used to make individual identifications are acknowledged on the photos.

DISCUSSION

Future efforts on this project should investigate ways as to create a software program to help in the identification of indi-

Figure 3. The above giraffe is a female based on the absence of a penis and the smooth light colored face. It has been identified as an individual based on the unique spot pattern at the base of the neck. This Giraffe would be given the identifying number F001.



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viduals. This would help catch any human error that might occur in the identification process as well as make the overall procedure much faster. The time consuming nature of picking out individuals by hand is the only element that is really hindering this project. A much more precise population estimate will be able to be calculated once a greater number of giraffe are identified. Further efforts should also be conducted to modify the database to classify the photos based on quality. This was seen in studies such as that conducted by Gilkinson (2007). In this study otters were identified based on their nose scars. Photos that were taken of individuals were ranked on a scale of 1-4 based on quality. Photos that were ranked as a 1 were considered too poor to use and were not analyzed further.

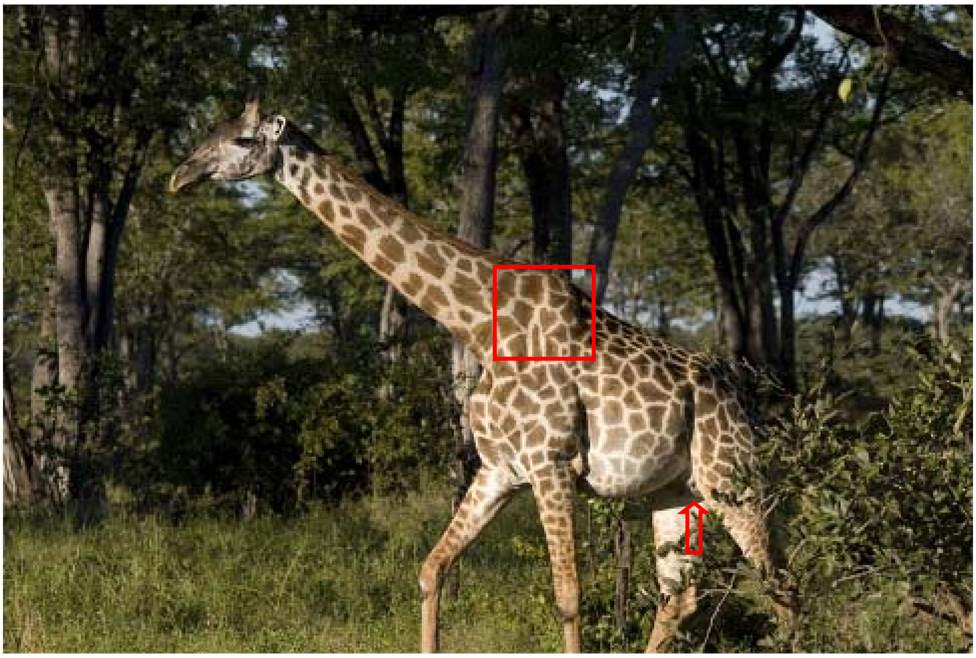

Figure 4. The above giraffe is a female based on the absence of a penis. It has been identified as an individual based on the unique spot pattern at the base of the neck. This Giraffe would be given the identifying number F002.

Images with higher rankings were then analyzed and the photo of each individual with the highest quality ranking was used in the final database. A system like this would be extremely beneficial to implement into this project. Many times photos received from the field crews will have numerous giraffe in them and there will not be a prominent giraffe in the foreground to identify. Photos like these would receive a low ranking and would most likely be ruled out of the ultimate database. This would greatly cut down on the confusion of determining which giraffe is the primary one being identified. This would also apply to photos of giraffe that don't contain their whole body, photos that are blurry, and photos taken in poor light.

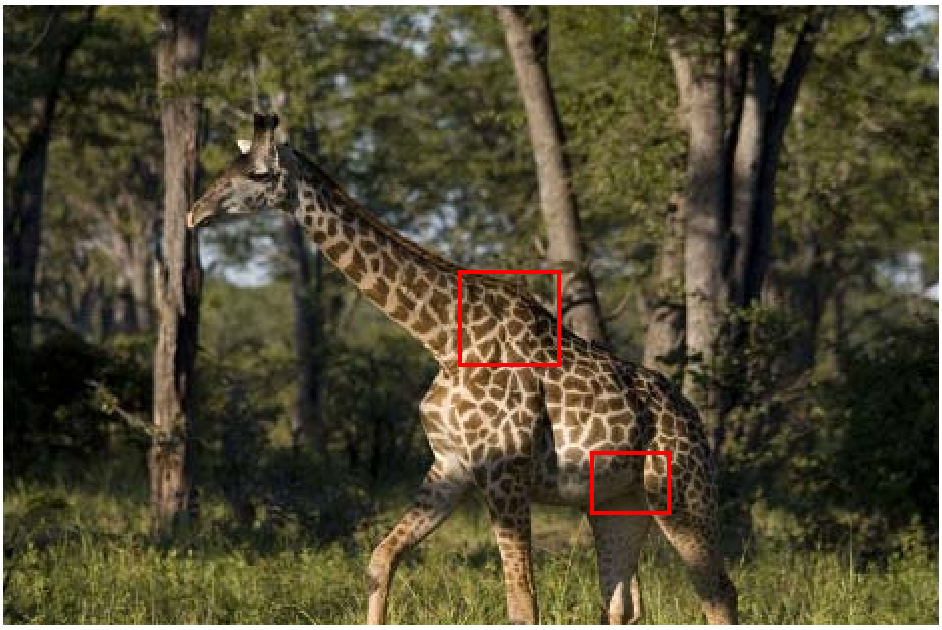

Figure 5. The above giraffe is a male based on the presence of a penis. It has been identified as an individual based on the unique spot pattern at the base of the neck. This Giraffe would be given the identifying number M001.

Evaluating the dynamics of Thornicroft's giraffe through photographic database construction

Of the 65 individual giraffe, 46 were female and 19 were male. This ratio of females to males suggests that female use of the road system is much higher than that of males. This could be attributed to easier travel which in turn conserves energy. This is important due to the high amount of energy expelled when pregnant or calving (Castillo et al., 2005). Further research should be conducted on this occurrence.

CONCLUSION

This project will contribute to future research and conservation efforts on Thornicroft's giraffe. Through Photoidentification, various ecological factors can be determined such as a current population estimate. Conclusions made from the database will also give us a more conclusive idea of the ecology and behavior of this species. Hopefully the information gained will give the scientific community a better understanding of this rare and amazing subspecies.

ACKNOWLEDGEMENTS

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LITERATURE CITED

Del Castillo, S., Bashaw, M., Patton, M., Rieches, R., & Bercovitch, F. 2005. Fecal steroid analysis of female giraffe (Giraffa camelopardalis) reproductive condition and the impact of endocrine status on daily time budgets. General & Comparative Endocrinology, 141, 271-281.

Fennessy, J. 2008a. An Overview of Giraffe Taxonomy, Distribution, and Conservation Status, With a Namibian Comparative and Focus on the Kunene Region. Nambia Scientific Society, 56, 1-15.

Fennessy, J. 2008b.Thornicroft's Giraffe Research Expedition. IUCN/ SSC Antelope Specialist Group. Unpublished.

Gilkinson, A., Pearson, H., Weltz, F., & Davis, R. 2007. Photo-identification of sea otters using nose scars. Journal of Wildlife Management, 71, 2045-2051.

Grellier, K., Hammond, P., Wilson, B., Sanders-Reed, C., Thompson, P. 2003. Use of photo-identification data to quantify mother–calf association patterns in bottlenose dolphins. Canadian Journal of Zoology, 81, 1421-1427.

Kelly, M. 2001. Computer-aided photograph matching in studies using individual identification: an example from Serengeti cheetahs. Journal of Mammalogy, 82, 440-449.

Pradel, R. 1996. Utilization of capture-mark recapture for the study of recruitment and population growth rate. Biometrics Journal, 52, 703-709.

Robson, D., Regier, H. 1964. Sample Size in Petersen Mark-Recapture Experiments. Transactions of the American Fisheries Society, 93, 215-226.

Rowat, D., Speed, C., Meekan, M., Gore, M., & Bradshaw, C. 2009. Population abundance and apparent survival of the Vulnerable whale shark Rhincodon typus in the Seychelles aggregation. Oryx, 43, 591-598.

Unknown. 2009. Thornicroft's Giraffe Population Structure & Dynamics Research. Giraffe Conservation Foundation. Surey, England. Unpublished.

Würsig, B., Jefferson, T.1990. Methods of photo-identification for small cetaceans. Reports of the International Whaling Commission, 12, 43-52.

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The curious incident of the giraffe in the night time

Zoe Muller

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Giraffe get a bad rap. Ask any safari guide in Africa about their behaviour and they will delight in telling you how female giraffe are bad mothers, apparently abandoning their young hours after giving birth and leaving them alone and vulnerable in the African bush. Captive giraffe keepers too will recount stories and numerous occasions whereby the mother-calf relationship has been problematic in their experience – at best the mother refuses to let her newborn calf suckle or come close, at worst she rejects it completely causing the keepers to intervene to save its young life.

In the wild, giraffe have been observed to exhibit an unusual parenting system whereby they hide their young for the first 1 to 4 weeks of life – giving rise to the notion that mothers 'abandon' their young soon after birth. Rather than being symptomatic of neglect however, this behaviour serves to protect the infant from the dangers of its new environment. Hiding and leaving it in a secure place affords the newborn cover and protection from agile predators, ensures it remains in a shady place avoiding overheating, and keeps it shielded from the dangers and injury-opportunities of the open savannah.

The diligent mother can keep her calf hidden for the first few weeks of its life while returning regularly to feed and check up on it. As it gets older and stronger she then starts to take the calf out and herd it with other young calves sometimes in a 'crèche' system formed by females in the same group. Typically the adult females take it in turn to look after this 'crèche', allowing the other mothers to leave in search of forage and other resources. This system has evolved to ensure maximum calf survival in some areas and female giraffe are actually maximising the survival potential of their young, making them rather undeserving of the 'bad mother' reputation!

I am currently studying a population of Rothschild's giraffe located within the Soysambu Conservancy in Kenya. Having spent many hours of my life observing giraffe in the wild (both in Kenya and elsewhere in Africa) I was already doubtful of their reputation as bad mothers, but recently I witnessed an incident that really made me re-think what we know about giraffe parenting behaviour and I feel compelled to share it with you.

There are approximately 65 Rothschild's giraffe based in Soysambu Conservancy, and they are pretty successful reproducers. There is always an abundance of young giraffe at any one time, and their survival rate is good given the absence of lion on the property. Part of my research involves identifying all giraffe individually, which means I get to know them very well, and one in particular caught my attention. One of the females (identified as F008) has a four-week old calf at foot – this calf has a seriously deformed hind leg making it instantly recognisable. It was either born with a deformed leg or it was injured early on, but the calf could always be observed having great trouble walking and as such, spent most of its time in a stationary position.

Doting mum that she is, F008 could always be found right next to her calf, standing with it and being vigilant to the surrounding area. Over many field trips and behavioural observations I have never seen F008 much more than about 20m from her compromised calf, and on each occasion she has been standing vigilant next to it regardless of the rest of the herd's behaviour. Often all adults in a herd will synchronise their behaviour – i.e. they will all be foraging or ruminating together - but F008 would not do this. Regardless of the herd's behaviour she would always be standing with her calf, remaining vigilant and very close by. This female's behaviour is interesting to note in itself – she was clearly compromising her own health (through decreased foraging opportunity and increased stress from extra vigilance) to protect her calf, thwarting this notion of 'bad motherhood' - in this individual at least.

On 4th May 2010 I headed out into the field for my usual daily observations and on the transect I found a large herd of giraffe in an area where they are not normally found. This was a surprise, but what was even more surprising was their behaviour. The giraffe at Soysambu are well habituated to vehicles and are normally very relaxed and calm. On this morning however, I found a large herd of 17 females all highly vigilant and running around in apparently bizarre patterns. They were also scared by the appearance of my vehicle – something that never normally bothers them (I can usually get within 5 metres of most of them!)

I stopped the vehicle to watch and expected them to settle but they carried on running around and when they did stop, they would stare intently over to one particular area of bush where they seemed to be congregating. I needed to find out what they were so excited about and so I drove over to the area they were all staring at, and instantly realised. F008's injured calf had died and its body was lying in an open area of grass. From the look of it, it had died maybe an hour previously and appeared to be from natural causes.

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It was a sad moment for the calf and I felt for its mother F008 who was one of the females running around, but I was fascinated by what was happening and so I decided to retreat, sit quietly and watch what happened. My observations of unusual behaviour lasted for four days and I will outline what I observed;

3rd May (Day 1)

08:00 Upon finding the carcass (approximately an hour after death), there were 17 female giraffe in the area all of which were running around looking distressed. Their movements were haphazard, they were highly vigilant and very unsettled. I positioned the vehicle away from the carcass but in good view of the area where I sat and observed the herd for the next 3 hours. All 17 female giraffe ran around the area being vigilant, continually approached/retreated from the carcass and showed extreme interest in it. F008 (the calf's mother) was in the group.

16:45 That afternoon I returned to find 23 female giraffe and 4 juveniles in the area, again all quite restless, walking around and being vigilant towards the carcass. This time I observed the adult females approaching the carcass and 'nudging' it with their muzzles, then lifting their heads to look around before bending down to nudge it again. F008 was present and involved in this behaviour with the other adult females. The juveniles were tentatively approaching the carcass, would bend down to it, apparently sniff it and then jump up suddenly and run away for a few metres before returning to repeat this behaviour.

21:30 I returned that evening as I expected to find some predators in the area – instead I was surprised to find 15 adult females all clustered around the carcass, closer than they had been during the day. They were highly vigilant and did not move off as I approached. F008 was present and close to the carcass.

4th May (Day 2)

09:50 I expected that this morning the carcass might have been taken by predators during the night, but upon my return I found it to be intact, in the same position and surrounded by 7 adult females, including F008. All were walking around the carcass and being vigilant towards it.

15:35 There were 15 adult giraffe in the area, this time 11 females had been joined by 4 males. The females (including F008) were still circling the carcass, approaching/ retreating and inspecting it by bending down and sniffing/ nudging with their muzzles. I noticed that while the females showed great interest in the carcass, the males showed none – they were either foraging or inspecting the females for mating opportunities. At no point did any male go near (closer than 100m) to the carcass.

20:45 I returned again at night to try and observe predator activity on the carcass, only to find it still untouched and surrounded by 3 adult females, including F008. They were all positioned around the carcass, no more than 10m from it. All were being vigilant to their surroundings and scanning the area. There was no foraging or ruminating behaviour.

5th May (Day 3)

07:45 On first inspection of the area no giraffe could be observed. However after stopping the vehicle and scanning with binoculars I noticed that there was one adult female present - F008, the deceased calf's mother. I wrote in my notes that she seemed to have left the carcass for the first time since it had died and that she had moved to stand under a large tree approximately 50 metres away from it. She was not foraging or ruminating, just standing still in one spot being vigilant to her surroundings.

I sat in the vehicle and observed her for about ten minutes until I drove slowly over and she moved away. I went to inspect the carcass - it was gone!

After a lot of searching I finally located its remains and found that it had been half devoured by predators (probably hyena) during the night. It was at this point that I realised it had been dragged approximately 50m to the left of its original location – and was now resting by the big tree in the exact position I had seen the mother

The curious incident of the giraffe in the night time

(F008) standing upon my arrival in the area.

So my initial recording that she was 50m from the carcass was in incorrect – in fact when I had arrived and first observed her, she had been standing *over* the half-eaten remains of her calf.

14:00 Later that day, F008 was back in the same spot as I had disturbed her from earlier – standing over the carcass in its new position by the large tree. She was just standing there being vigilant, and not foraging or ruminating. No other giraffe were around.

17:45 F008 was still there, still standing by the tree and remains, being vigilant all around. Still no other giraffe in area.

6th May (Day 4)

08:45 F008 was still in the area, but was now standing approximately 200m away from the tree where the carcass was yesterday. She was standing in an open area and being vigilant towards the tree where the carcass had been located. Upon attempted inspection of the carcass site, it was found to have been taken completely by predators with nothing remaining.

14:00 No giraffe sighted in area.

7th May to 12th May (Days 5 to 10)

The site has been visited several times throughout each day to see if giraffe have returned to utilise the area. No giraffe have been seen there since F008 was the lone female on the morning of 6th May.

What I have observed over the past few days has been highly fascinating to me, since I have never seen anything like this in wild giraffe. I am not going to speculate on the motivations or possible 'emotions' driving this behaviour – I will let you draw your own conclusions as you so wish – I simply wish to report on the interesting chain of events that I observed during this curious incident. I find surprising that F008 was still present on the morning of 6th May (Day 4) since the carcass had clearly been the focus of much predator attention during the night. I also find it interesting to note that F008 had allowed herself to become removed from her herd, putting herself in the precarious position of being alone at night in an area that had clear predator activity occurring within it.

At this point it is interesting to note the extensive literature available on cases of similar behaviour around carcasses in elephant communities. It is well documented that elephants show great interest in the carcasses and bones of other dead elephants and herd members, often viewed as evidence of their empathic nature and ability to 'mourn' their dead. Regardless of such anthropomorphic labels or attribution of human emotions however, what is clear is that elephants do exhibit unusual and uncharacteristic behaviour around the carcass of a dead elephant (Douglas-Hamilton *et al.*, 2006; McComb *et al.*, 2006).

Reports of such behaviour are wide and varied; in the presence of a deceased herd member elephants may "roam continuously around about 50m from the deceased", guard the carcass and not feed for eighteen hours (Joshi, 2010), "hang around the area" (Sikes, 1971), continually approach and retreat from the carcass, surround and examine the body, or even "protect the carcass from predators as best they can for several days" (EWB, 2010). Mothers have also been known to allow themselves to become separated from their herd in an effort to remain with their dead calf.

Despite the large amount of evidence for such behaviour in elephants (regardless of the motivating factors) this exploratory / investigatory behaviour of dead conspecifics and apparent 'protective' behaviour of the carcass has seldom been recorded in other mammal species and certainly has never been observed in giraffe.

Giraffe are highly social creatures but we are only just beginning to understand the complexities of their social systems and family networks. This incident provides us a unique insight into one aspect of giraffe behaviour that we are rarely afforded a glance of – that of family ties and the effects of the loss of a herd member. I hope that by reporting these observations, people who have had similar experiences or observed such behaviour might report on them so that we can build a clearer picture of this aspect of giraffe behaviour and ascertain whether this is an isolated incident, or if it is much more prevalent in mammals than we have initially allowed ourselves to believe.

The curious incident of the giraffe in the night time

REFERENCES

Douglas-Hamilton, I., Bhalla, S., Wittemyer, G. and Vollrath, F. (2006). Behavioural reactions of elephants towards a dying and deceased matriarch. *Applied Animal Behaviour Science*, 100 (1–2): 87–102.

Joshi, R. (2010). How Social are Asian Elephants, *Elephas maximas*? New York Science Journal, 3(1): 27-31

Mc Comb, K., Baker, L. and Moss, C. (2006). African elephants show high levels of interest in the skulls and ivory of their own species. *Biol. Lett.* 2: 26-28.

Sikes, S.K. (1971). The natural history of the African elephant. New York: American Elsevier.
388 p.

Elephants Without Borders (2010). Blog on website:
http://elephantswithoutborders.org/blog/?p=151
Last Accessed 12th May 2010

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Snaring, Poaching and Snare Removal from Giraffes in Serengeti, Tanzania

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The giraffe population in the Serengeti ecosystem is subjected to poaching pressure, mainly through the use of wire snares. This takes place mainly in the western parts of Serengeti National Park and Grumeti Game Reserve, where poachers specially set snares high in trees to capture giraffe by the neck. The animal dies an agonizng death while circling the tree struggling to free itself, thus becoming progressively more entangled in the wire noose and eventually asphyxiated. Snares are heavy gauge cable usually sourced from mining or other industrial applications. Some giraffes suffer wounds from snares set on the ground for other game animals, and in these cases the injuries are usually on the lower legs or feet.

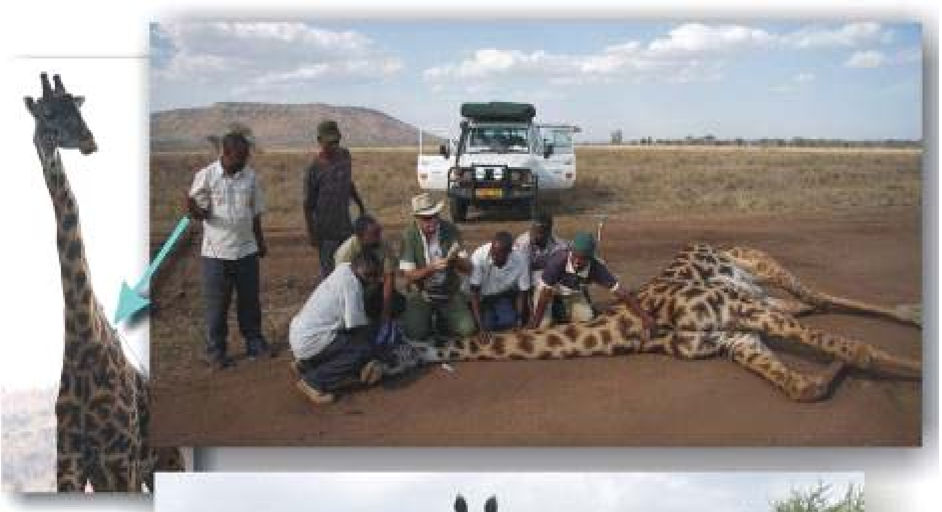
If any wild animal has broken free from a snare and is seen and reported to veterinarians, it can be immobilized and treated. In most cases such treatment is successful. The mainly affected species in Serengeti in approximate order of cases are zebra, elephant, giraffe, lion and hyaena.

A female giraffe killed by a poacher's snare specially set in tree. The meat from this animal was never taken and it also had a small calf which was unlikely to survive alone. On the same day a snare was removed from another live giraffe nearby.

Giraffes are immobilized with standard drugs remotely administered via a dart, but peculiarly they are the only species that often does not fall down and thus become recumbent when drugged. Once the drug has taken full effect a giraffe is often still on its feet - showing a typical disorientated short-stepping gait bumping into trees and obstacles, and an elevated "star-gazing" posture of the head. At this point it has to be physically brought down by a team of about six assistants who have been given a thorough briefing beforehand. A long, thick but fairly soft rope is held in front of the giraffe by at least three men on either side and then these two 'teams' cross over behind the animal to encircle its legs. As the rope tightens around the slowly moving animal, the giraffe falls to the ground and is then further restrained by the assistants who weigh down the neck and tie up the legs. It is not really known why giraffes don't easily become recumbent like other drugged animals.

Because the design of a giraffe's circulatory

Snaring, Poaching and Snare Removal from Giraffes in Serengeti, Tanzania



system necessarily involves high blood pressure, recumbent posture will of course be potentially dangerous because of blood pressure changes and compromised ability to breathe. Therefore wildlife veterinarians carrying out short-duration procedures like snare removal usually inject a reversal drug once the animal is physically restrained on it side. If this is given intravenously its effect is rapid and the animal must be kept fully blindfolded and restrained by the combined efforts of the co-ordinated team. To avoid metabolic complications setting in, the capture team has to work very quickly to remove the snare with cutting tools and treat the snare wound. Treatments usually involve topical and injectable antibiotics, and also remedies to prevent fly maggot infestation in the healing wound. In some snare cases where wires are loose and have not caused wounds, they are merely pulled off over the head. Sometimes there are logs or parts of a tree attached to the wire that the giraffe has been dragging along. After all necessary procedures are complete, members of the capture team simply let the animal go in unison. Because by this time there are no effects of the immobilizing drug, it regains its feet on its own, albeit in an unavoidably ungainly manner.

Giraffe populations are now being scientifically studied again in Serengeti for the first time since the 1970s. The researcher, Megan Strauss (email: strau102@umn.edu), is gathering data to attempt to quantify poaching as a mortality factor in the population. Giraffes give poachers a high reward in terms of volume of meat and are a popular target in areas where larger quantities of game meat can be rapidly removed from a protected area onto neighbouring village land and sold. Undoubtedly there are other causes of giraffe mortality, especially amongst juveniles, but poaching is a worrying current threat. Conservation personnel may have thus far largely assumed that giraffe populations are little affected by poaching, or simply been preoccupied with species facing apparently more immediate and obvious threats.

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Sticking our necks out: developing a National Giraffe Conservation Strategy for Kenya

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As we learn more about phylogeography of extant giraffe sub-species, it is becoming increasingly likely that Kenya is the 'epi-centre' of giraffe evolution. Kenya is the only country in Africa to be home to three of the nine currently recognised sub-species of giraffe; the Masai giraffe (*Giraffa camelopardalis tippelskirchi*), the Reticulated giraffe (*G.c. reticulata*) and the Rothschild's giraffe (*G.c. rothschildi*). Given its heritage in terms of giraffe diversity and speciation therefore, it is fitting that Kenya is the first country to develop the first ever national conservation strategy dedicated solely to giraffe anywhere on the African continent.

The National Giraffe Conservation Strategy for Kenya is being developed in collaboration with the Kenya Wildlife Service (KWS) and will provide national guidance on the conservation and management of all three sub-species across Kenya. The guidelines will define the role of the government, conservation partners and other stakeholders whilst raising awareness about the plight of giraffe and highlight the (generally declining) population trends occurring within Kenya. Kenya clearly has a large role to play in giraffe conservation Africa-wide, given that it is home to three sub-species and one of only two giraffe sub-species classified as 'Endangered' by the IUCN RedList (*G.c. rothschildi* and *G.c. peralta* - the West African giraffe)

Expert advice has been sought and culminated in the formation of a panel to advise, help develop and drive the Strategy forward. This panel is known as the National Giraffe Conservation Task Force (NGCTF) and its members are a collection of giraffe and conservation experts from Kenya and around the world. Members of the NGCTF are:

- Dr. Charles Musyoki
  (KWS Senior Scientist)
- Dr. Julian Fennessy
  (Chair of the IUCN SSC/ASG Inter national Giraffe Working Group and Founding Trustee, Giraffe Conserva tion Foundation)
- Dr. Juliet King
  (Northern Rangelands Trust)
- Dr. Rick Brenneman
  (Henry Doorly Omaha Zoo)
- Dr. Phillip Muruthi
  (Chief Scientist, African Wildlife Foundation)
- John Doherty
  (Reticulated Giraffe Project)
- Ali A. Hussein
  (Manager, Garissa Giraffe Sanctu ary)
- Zoe Muller
  (Rothschild's Giraffe Project)
- Thadeus Obari
  (Senior Scientist, KWS)
- Christine Odhiambo
  (CEO, Giraffe Centre in Nairobi)

All members of the NGCTF contribute a range of knowledge and expertise, and we are very excited about working together and moving forward to create this pioneering National Giraffe Conservation Strategy.The Strategy will be based on the Grevy's Zebra Conservation Strategy (2007-2011) also formulated with KWS, which has so far proved extremely successful in raising awareness of the conservation issues surrounding the Grevy's zebra in Kenya and across its borders. Since its inception, the Grevy's Zebra Conservation Strategy has proved pivotal in securing the future for Grevy's zebra in Kenya and has ensured that areas containing Grevy's zebra continue to be protected. By developing similar guidelines for giraffe in Kenya we can hopefully have a similar outcome and secure a future for all three sub-species in Kenya.

The first meeting of the NGCTF was held on 8th March 2010 at the KWS Headquarters in Nairobi, during which the way forward was discussed and key features of the Strategy identified. It was also during this meeting that sub-committees were determined for each of the three giraffe sub-species. Responsibility for the Masai giraffe was passed to Thadeus Obari and Christine Odhiambo, the Reticulated giraffe was assigned to Dr. Juliet King, John Doherty and Ali A. Hussein, whilst responsibility for the Rothschild's giraffe was passed to Dr. Julian Fennessy and Zoe Muller.

The second meeting was held on 7th May 2010 at the Giraffe Centre in Nairobi, allowing the Task Force to explore the way forward in greater depth and to discuss the specific challenges facing each of the sub-species in Kenya. Presentations were given on two of the Kenyan sub-species, with specific threats and risk factors discussed for each.

John Doherty of the Reticulated Giraffe Project presented his group's report on the reticulated giraffe which, whilst occurring in higher numbers than Rothschild's giraffe in Kenya, have suffered the largest population decline in the recent past. Ten years ago there were an estimated 28,000 reticulated giraffe in Kenya whereas now the figure is closer to 3,000 – 5,000 individuals (2010 estimate).

Sticking our necks out: developing a National Giraffe Conservation Strategy for Kenya

Such a massive population decline in ten years is clearly very worrying and further highlights the drastic need for urgent conservation action for giraffe in this part of the world. The reticulated giraffe is found in the northern areas of Kenya and as such faces some unique challenges. Northern Kenya has experienced unprecedented levels of human population increase in recent years, owing to an influx of refugees from Somalia and southern Sudan, many of whom are food-insecure and at risk of starvation. Poaching is a problem and unfortunately, a giraffe is easy to shoot and provides a lot of meat and hide for a small effort. Habitat loss, human-wildlife conflict and poaching are the main factors affecting the reticulated giraffe in Kenya today.

Zoe Muller then presented her team's report on the Rothschild's giraffe which faces very different issues to those of the reticulated giraffe. Rothschild's giraffe are the second most imperilled giraffe sub-species (after the West African giraffe) in Africa and there are thought to be less than 650 individuals remaining in the wild today. Over 400 of these are located in Kenya and so the country has a clear and important role to play in the conservation and protection of this sub-species. All Rothschild's giraffe in Kenya are confined to managed conservation areas such as National Parks, Conservancies and private sanctuaries. Whilst this scenario offers increased protection from threats such as poaching, habitat encroachment and human-wildlife conflict, it does also bring problems of its own.

Under truly free-ranging conditions, giraffe move across wide areas in search of food and other resources. When confined to an enclosed area however, this opportunity is limited and as such results in increased browsing pressures on the environment. In Kenya, the habitats containing Rothschild's giraffe appear to be under intense browsing pressure leading to extensive bark-stripping, increased tree mortality and a subsequent cycle of habitat degradation. In short, the giraffe are outgrowing their enclosed environments which may be contributing to population crashes and inhibition of population growth. To alleviate these pressures, new areas and habitats must be identified for the future translocation of Rothschild's giraffe herds to enable population growth.


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We are eagerly anticipating the report for the Masai giraffe, which will be held at the next meeting.
The National Giraffe Conservation Task Force is due to meet again in late July 2010, at a two-day retreat outside Nairobi sponsored by KWS, Giraffe Conservation Foundation and African Fund for Endangered Wildlife. This event will provide an opportunity to develop a large part of the Strategy documentation and to refine it further. It is hoped that a draft of the Strategy will be in place by the end of 2010 and that the final document and resulting action will be implemented by early 2011. We will keep you updated with our progress, so watch this space!

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More questions than answers: A preliminary interpretation of phylogeographic genetic structure in giraffe

Russell Seymour
International Giraffe Working Group

In a previous edition of *Giraffa* (Seymour, 2007) I introduced my PhD work (Seymour, 2001) that used giraffe as a 'model' species to examine apparent conflicts between data sets for describing subspecific, geographically structured variation in mammals; this article describes elements of my genetics research. The results were largely congruent with the prevailing taxonomic opinion, but some interesting, and even surprising, patterns did emerge; I'll discuss three of these here.

BACKGROUND

My genetic analyses used sequences from 98 museum specimens from all over the recent range of the giraffe. The value of museum specimens for intraspecific analyses can not be overemphasised; they frequently provide finer resolution by filling in areas in historic distributions where giraffe no longer occur and so can no longer be sampled and where skull, skin and genetic data are available they provide comparative data from the same individuals (the focus of my thesis).

The genetic sequence data used represents a 262 base pair segment of the highly variable left domain of the mitochondrial DNA control region. I can provide you with details of the analyses undertaken if you are interested but, for the sake of this article, it is sufficient to say that all of the 'standard' analyses provided congruent results.

NORTH VERSUS SOUTH

The detailed distribution of the giraffe varies between authors (e.g. Dagg, 1962; Kingdon, 1979 Sidney, 1965; Skinner and Smithers, 1990) but one thing they all appear to agree on is that giraffe have avoided very dry (desert) and very wet (tropical rainforest and moist woodlands) areas of the African continent leading to a historic split between the ranges of the northern and southern giraffe with an apparently wide swathe of unsuitable habitat between east African and southern African populations (see figures 1a and 1b). The exception noted on all range maps is the isolated population of giraffe in the Luangwa Valley of Zambia (*Giraffa camelopardalis thornicrofti)*. So can this separation be detected with genetic data and has it lead to differentiation worthy of taxonomic recognition?

The giraffe is currently considered to be a single species with a varying number of subspecies (e.g. Dagg 1971; East, 1999; Grubb, 2008), but this hasn't always been the case. Some authors felt the characteristic angularity of the sharply defined chestnut-red spots of the reticulated giraffe to be worthy of species level recognition (e.g. Thomas, 1901; Lydekker, 1904) while others saw a simpler, geographically-based split between northern and southern forms (e.g. de Winton, 1897). In fact, there is a north versus south split, but it is not where any of the old taxonomists thought it was, nor is it where you might expect from looking at the historic range maps.

Genetically giraffe separate into two strongly supported groups, according to the genetic data: those from Angola, Botswana, Mozambique, Namibia, South Africa, Zambia and Zimbabwe form a southern group while giraffe from Cameroon, Chad, DRC, Eritrea, Ethiopia, Kenya, Niger, Nigeria, Sudan and Uganda make up the northern group. This is as we would expect. But what of the giraffe of Tanzania and southern Kenya; the Masaai giraffe? Given the historic ranges these must surely group with the northern specimens. In fact, they affiliate with those from the south.

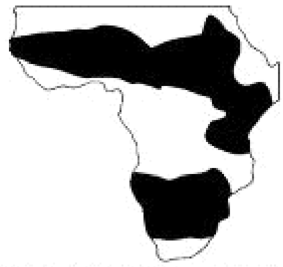

Figure 1a: *Historical Range of the giraffe. Redrawn from Dagg (1971). The historic range includes evidence from archaeological sites and extends into what is now the Sahara desert, previously less extensive.*

Figure 1b: *Vegetation Zones of Africa. Adapted from Cox and Moore (1993) and Kingdon (1997).*

WHAT IS SPECIAL ABOUT THORNICROFT'S GIRAFFE?

So why does the Masaai giraffe show a stronger affiliation to the southern giraffes when their ranges have, supposedly, been separated for so long by sub-optimal habitat? The Zambian population of *G.c. thornicrofti* grouped with the southern Africa clade, but shared a mtDNA haplotype with giraffe from both the north and south of Tanzania and so provides a clue as to what may have happened.

More questions than answers: A preliminary interpretation of phylogeographic genetic structure in giraffe

The best explanation is that, at some point in the past (perhaps to be estimated with further research), there was a migration of giraffe across the 'habitat barrier' between northern and southern populations. The geographic position and genetic affiliation of the Thornicroft's population provides strong evidence for this movement. It is not completely clear from my genetic data which direction the migration took (two techniques conflict in their conclusions; a lack of clarity probably resulting from the short fragment length used), but it is most likely to be from south to north and this direction is supported by morphological data (to be addressed in a future article).

WIDESPREAD IN THE WEST

Haplotypes from West Africa grouped out as a separate terminal clade within the northern group containing two unique haplotypes (from DRC and Chad) and a widespread haplotype (n=8) that spans from Nigeria, through Cameroon and the DRC into Sudan. This haplotype is shared between purported *G. c. peralta* and *G. c. antiquorum* individuals and is remarkable because it spans such a wide geographic area. On the phylogenetic tree it derives from a paraphyletic *G. c. reticulata* that itself separates into two distinct haplotypes (figure 2a); one is widespread through northern Kenya into Ethopia (n=8) while the other (containing the type specimen) is restricted to the Loroghi Mountains (n=2).

GENETICALLY DIFFERENT BUT MIXED RANGES IN THE SOUTH

The apparent genetic history in the southern African sub-region was complex. Following removal of the Thornicroft's and Maasai populations two major clades remain. The first extends from the Kruger National Park in South Africa in the extreme south east of the range, through Zimbabwe and Botswana and into north-eastern Namibia. The second southern clade occurs from southern Angola, into Etosha National Park, Namibia and continues eastwards through Botswana and into southern Zimbabwe (figure 2b). Hence there appears to be significant overlap between two quite distinct haplotypes. Interpretation of these results is problematic. The best biological explanation of this data is that there was historic separation of two distinct southern African populations of sufficient duration to allow fixation of distinct haplotypes followed by subsequent migration and mixing of the populations.

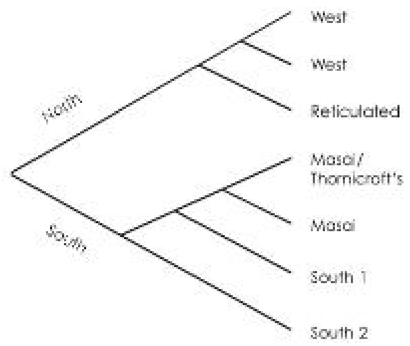

Fig.2a Genetic relationships between populations

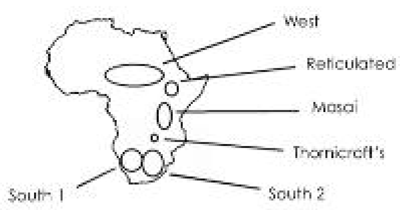

Fig.2b Approximate locations of populations

There is, of course, a far less satisfactory explanation for the observed distributions; one which I had tried to investigate previously which has since received some support: human-mediated translocations. Since originally writing up my thesis I have heard that there was a translocation of giraffe from northern Namibia to a private ranch in southern Zimbabwe, probably in the 1950s. If true, this would significantly reduce the extent of natural overlap and give far more structure to the southern African ranges. Unfortunately the report was anecdotal with no supporting evidence available; if anyone does have any information on this I would be very interested to know.

CONCLUSIONS FROM THE GENES

The genetic data tells us a complex story about giraffe variation and subspecific taxonomy. Given the strong female philopatry seen in giraffe you would expect to find geographically restricted structure in maternally-inherited mtDNA sequences. The patterns found are largely congruent, or at least non-conflicting, with the recognised taxonomic groups. Of necessity, my conclusions are tentative, and I have only told part of the story here, but the most striking elements are:

- The possible movement of giraffe from southern Africa into East Africa, with remnants of the migrating population remaining in the Luangwa Valley;
- The extent of the range of the widespread haplotype in the western giraffe; and
- The probably confused interpretation of plylogeographic patterns caused by non-documented human-mediated translocations of individuals.

Work is ongoing on giraffe genetics and I am sure that many of the questions raised will be answered; certainly the relationship between *G. c. giraffa*, *G. c. thornicrofti* and *G. c. tippelskirchi* requires further investigation.

More questions than answers: A preliminary interpretation of phylogeographic genetic structure in giraffe

Phenotypic analysis provides an interesting comparison, typically supporting, to the genetic data and I shall summarise some of my morphological and pelage pattern research in subsequent articles.

REFERENCES

Dagg A.I., 1962. The subspeciation of the giraffe. *Journal of Mammalogy* **43** 550-552.

Dagg A.I., 1971. *Giraffa camelopardalis*. *Mammalian Species* **5** 1-8.

de Winton W. E., 1897. Remarks on the existing forms of giraffe. *Proceedings of the Zoological Society of London*. **1897** (18) 273-283.

East R. 1999. *African Antelope Database 1998*. IUCN/SSC Antelope Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK.

Grubb P., 2005. Order Artiodactyla. pp.637-722. In Wilson D.E. and Reeder D.M. (eds) *Mammal Species of the World* Third edition. The John Hopkins University Press. Baltimore, USA.

Kingdon J., 1979.*East African Mammals. An Atlas of Evolution in Africa. Volume III Part B (Large Mammals)*. The University of Chicago Press. Chicago, USA.

Lydekker R., 1904. On the subspecies of *Giraffa camelopardalis*. *Proceedings of the Zoological Society of London* **1** 202-227.

Seymour R.S., 2001. *Patterns of subspecies diversity in the giraffe, Giraffa cemelopardalis (L. 1758): Comaprison of systematic methods and their implcations for conservation policy.* Unpublished PhD thesis. Unversity fo Kent at Canterbury. Canterbury, UK.

Seymour R.S., 2007. Giraffe Taxonomy: Patterns of Subspecies Diversity in the Giraffe. *Giraffa* 1 (2) 7-8.

Sidney J., 1965. The past and present distribution of some African ungulates. *Transactions of the Zoological Society of London*. **30** 1-410.

Skinner J. D. and Smithers R.H. N., 1990. *The Mammals of the Southern African Subregion*. University of Pretoria, Pretoria.

Thomas O., 1901. On the five horned giraffe obtained by Sir Harry Johnston near Mount Elgon. *Proceedings of the Zoological Society of London* **2** (32) 474-483.

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Historic distribution of giraffe in the Greater Fish River Canyon Complex, southern Namibia, and recommendations for re-introductions (*an adapted paper)

Chris Brown
Namibia Nature Foundation

INTRODUCTION

This (synthesized) report looks at the historic distribution of larger mammals in the Greater Fish River Canyon Complex (GFRCC) of southern Namibia. Based on this information, as well as the present distribution of mammals and the present environmental conditions within and surrounding the Complex, it makes recommendations for the re-introduction and enhancement of large mammal populations.

There is no single reference on the past distribution and status of large mammals in Namibia. To obtain an understanding of the situation in any particular area, prior to the influence of western exploration and settlement, requires an exhaustive search of historic and review literature. The result of such a search is usually a list of anecdotal records, reflecting often the once-off observations of early explorers, hunters, traders and travelers, sprinkled with poorly understood information that they gleaned from indigenous people.

As this is usually the only historical information we have, we have to interpret it as best we can. To do so requires an understanding of the ecology of the species concerned, the climatic features of the area and the environmental determinants involved.

THE FISH RIVER CANYON COMPLEX

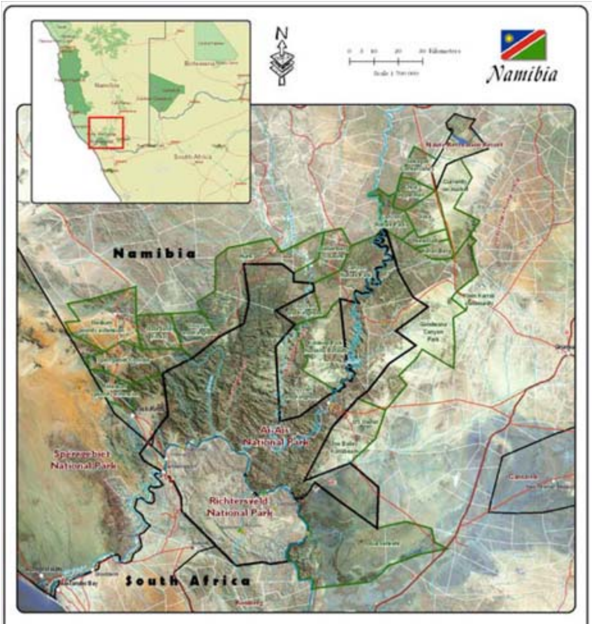
The Greater Fish River Canyon Complex is made up of a mosaic of different land holdings around the Ai-Ais/Fish River Canyon/Huns Mountains National Park. The area stretches from the Orange River in the south (where it borders onto the Richtersveld National Park in South Africa) to the Naute Recreational Resort in the north. In the west it borders onto the Sperrgebiet National Park, thereby creating a vital corridor of land between the Ai-Ais and Sperrgebiet National Parks, and in the east it reaches the top of the Klein Karas Mountains.

The GFRCC encompasses a vast diversity of landscapes, topographic features and habitats. The geology of the area ranges from relatively young rock formations of the Karoo and Nama Groups (200 and 550 million years old respectively, to rocks of the Namaqua Metamorphic Complex (about 1,200 million years), to some of the oldest rocks known, along the Orange River valley, which are over 2,000 million years old. The geology is highly visible and accessible. The key topographic features including the Fish River Canyon, the Konkiep valley, the Orange River valley, the Huns Mountains and the Klein Karas Mountains.

Between these are an array of rocky and sandy plains, rocky hillsides, plateaus, drainage lines, incised valleys and ephemeral river courses.

The GFRCC falls into the hyper-arid zone, on the western boundary of the Nama Karoo biome, with the southern regions falling into the eastern edge of the Succulent Karoo Biome. The major vegetation types are: Dwarf Shrub Savanna, Desert-Dwarf Shrub Transition and Succulent Steppe. The Complex falls within a rainfall belt of 50-120 mm mean annual rainfall. The area experiences a water deficit (rainfall minus evaporation) of over 3 m per year. Rainfall is highly variable and unpredictable, and may fall during both summer and winter months.

In terms of landforms, the GFRCC falls on the transition of the "high mountains of the escarpment" and the "foothills and slopes of the plateau country", having elements of both. The drainage is virtually all to the south, into the Fish and Orange River system. The Complex falls into the transition belt between summer and winter rainfall, with elements of both succulent winter rainfall and woody summer rainfall vegetation. Hillsides are typically dominated by *Euphorbia, Aloe* and *Boscia* species, while on the plains, the dominant



Greater Fish River Canyon Complex

Historic distribution of giraffe in the Greater Fish River Canyon Complex, southern Namibia, and recommendations for re-introductions (*an adapted paper)

species include *Rhigozum trichotomum, Parkinsonia africana* and grasslands dominated by *Stipagrostus* species. Larger drainage lines are vegetated with *Acacia erioloba, A. karroo, Tamarix usneoides, Euclea pseudebenus, Rhus lancea* and others.

Until recently (1990s and into the 21st Century) much of the land in the Complex that falls outside the Ai-Ais National Park was used primarily for small-stock farming.

Hunting of wildlife was practiced, usually as a secondary activity, and greatly in excess of sustainable off-takes. As a result, wildlife numbers were severely depressed and many species are locally extinct.

The area is totally unsuited to conventional farming due to its extreme aridity and highly variable rainfall. Because of this and other exacerbating factors, the veld condition on these farms was poor to very poor at the time that the land was converted to wildlife and tourism. The condition of the veld will take many years (probably decades) to fully recover, but signs of recovery are already evident over large areas. Another consequence of small-stock farming was the eradication of predators, and the impacts that gin traps and particularly poisons had on non-target scavengers, both mammals and birds. As a result, a number of important components of the ecosystem have been totally eliminated and others reduced to critically low levels.

POINTS OF INTERPRETATION

When interpreting historic information and publications on past wildlife patterns and status, it is useful to consider the following:

- At the time of the early western explorers, wildlife densities and distributions were changing very rapidly, as a result of trade in firearms and the exploitative and wasteful attitude of early explorer/ traders/settlers to hunting and killing.
- For example, by 1800 elephant were already extinct south of the Orange River in Namaqualand.
- Information was usually not recorded systematically. Rather, it was the unusual or the unexpected that caught the attention of early explorers and was then recorded or remembered.
- Although appearing numerous across wide-open grassy plains, it is unlikely that wildlife densities were ever consistently very high overall in the arid and semiarid regions, compared to the higher rainfall savannas. However, wildlife would have been much more visible, and would have congregated for periods in areas that had received good rainfall.
- Prior to agricultural settlement, systems were open, with no fences and other physical barriers. Some species would have followed river systems, from the perennial rivers (e.g. Orange River) along the ephemeral rivers (e.g. Fish and Löwen Rivers) and thence out onto the grassy plains. Similarly, nomadic species from the east and north would have swept in to the more arid areas on a seasonal basis and in times of higher rainfall, perhaps leaving small remnant populations around water sources while conditions were suitable.
- And finally, conditions in the south and west were probably less arid a few hundred years ago than is the case today. Evidence to support this is provided by the fact that Hippos have occurred in reed-fringed pools in the Kuiseb and Swakop Rivers within the oral historic time-scale of Nama people, confirmed by the discovery of hippo tusks in these areas.

In considering possible re-introductions of species extinct to the GFRCC, these aspects need to be kept in mind, as well as the large areas needed by some nomadic species in response to the unpredictable and variable rainfall of the region.

PAST AND PRESENT STATUS

Present and past status of giraffe (and other species) that was recorded or thought to have occurred in the area of the GFRCC.

Species

- Giraffe (*Giraffa camelopardalis)*

Historical Status

- Common

Present Status

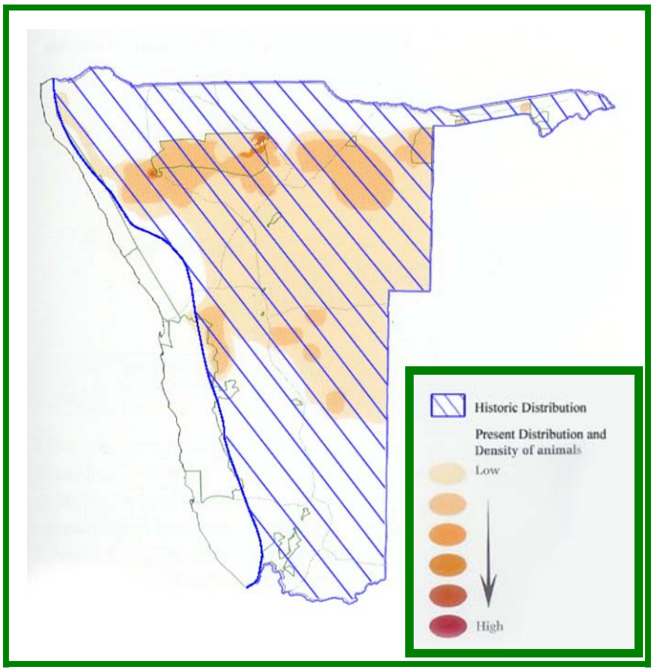
- Extinct (small numbers reintroduced show that animals prosper in GFRCC)

Notes

- Occurred in river courses and savanna areas throughout the south-west up until about 1840, when hunted to extinction. The GFRCC contains some good habitat for giraffe, particularly along river courses. They thrive in similar habitat in Kaokoveld.

Present status is based on the local qualitative experience of the author (who invites comments and corrections), while past status is based on a review of the

Historic distribution of giraffe in the Greater Fish River Canyon Complex, southern Namibia, and recommendations for re-introductions (*an adapted paper)



main literature (see References). A few explanatory "notes" are offered.

The following patterns emerge:

- Giraffe (and another 13 species) which was known to have occurred in the immediate GFRCC region were locally extinct (and subsequently been reintroduced, but remain at extremely low numbers). Giraffe was considered to be "not uncommon" to "common".
- Most other species have declined in numbers, some dramatically.

It is apparent that the larger species such as giraffe have been most severely affected. It is also apparent that the decline to extinction occurred mainly as a result of hunting, prior to land settlement and farming by western settlers.

A second wave of impacts occurred as a result of introduced land-use practices based on western farming methods. These included:

(a) the erection of fences, that cut off the nomadic/migration patterns of many species. Mobility is an essential arid-zone survival strategy to allow access to water and suitable pastures in a highly unpredictable and temporally patchy environment;

(b) unherded flocks of small-stock, which led to overgrazing and declining productivity of the rangelands. This impacted on both the farmer's livelihood and numbers of indigenous herbivores that competed for grazing;

(c) excessive utilisation of the still relatively common wildlife species in an attempt to realise and maintain a reasonable level of household income in a marginally productive, highly variable and degrading desert ecosystem; and

(d) a zero tolerance attitude to predators of small-stock, and the use of highly unselective control mechanisms, such as gin-traps and poisons, to try and totally eradicate these species. These practices have effectively eliminated the entire scavenging cohort of mammals and birds from most small-stock farming areas; research in Namibia has shown that, for every target predator killed more than 100 non-target animals were destroyed.

The impacts of small-stock farming can be clearly seen on the status of the mammals of the GFRCC. Undoubtedly, future studies on other components of the ecosystem, e. g. birds, rangeland, flora, will similarly reflect these impacts.

RECOMMENDED ACTIONS

Recommendations for giraffe are based on (a) the present and historic status of the species, (b) present ecological and infrastructural conditions of the rangeland within and surrounding the GFRCC, and the ability of the species to survive and thrive under these conditions, and (c) the appropriateness of any action within the wider socio-economic, conservation and land-use contexts.

The recommended actions for giraffe reintroductions are as follows:

1. Species that are priority candidates for immediate introduction or for prior steps in preparation for introduction, as follows:

- Giraffe—Priority species for reintroduction of 20+ animals into carefully selected areas. Animals should be sourced from arid populations in Namibia (e.g. arid northwest)

The following principles for reintroductions should be applied:

a) Reintroductions should take place within the Complex in the areas which offer the best chance of survival for the respective specie.

b) Reintroductions should be carried out with sufficient numbers of animals per site (generally 20+) to be viable. Small token introductions invariably fail.

c) Acquire game from similar habitats (e.g. Namib and Karoo Transition ecosystems) for genetic integrity and optimal chances of success.

d) Where species are likely to recolonise

Historic distribution of giraffe in the Greater Fish River Canyon Complex, southern Namibia, and recommendations for re-introductions (*an adapted paper)

or to augment existing populations by in-migration, allow this to happen rather than active reintroduction.
e) No species exotic to the GFRCC will be introduced.
f) No subspecies or components of populations from elsewhere will be introduced if there is any risk of genetic pollution to the indigenous populations' genetic integrity, and where suitable animals can be acquired from within the required gene pool.
g) In the case of introductions that have a potential impact on neighbours, full consultations will take place with stakeholders prior to any introductions.

A uniform, pragmatic and cost-effective monitoring system is recommended, based on the national "Event Book system", for all participating land owners / administrators / managers working within the Complex (see co-management and development plan for the GFRCC).

Finally, it is suggested that an annual coordinated game count be undertaken across the Complex, involving all the participating land owners / administrators / managers, and that the information gets analyzed and disseminated to all stakeholders. This information will be used by the participants to make management decisions in an adaptive manner.

ACKNOWLEDGEMENTS
I thank Mike Griffin for the loan of his rare and old books and other literature, and for his detailed and thoughtful comments on this report. I also thank Manni Goldbeck for contributing his wealth of "local knowledge" to this report, and to Rowly Brown for assistance with the maps.

REFERENCES
Alexander, J.E. 1838. Expedition of discovery into the interior of Africa. Vols 1 & 2. (1967 reprint). Cape Town: Struik.

Bigalke, R.C. 1958. On the present status of ungulate mammals in South West Africa. Mammalia 22: 478-497.

DuPlessis, S.F. 1969. The past and present geographical distribution of the *Perissodactyla* and *Artiodactyla* in southern Africa. MSc thesis, University of Pretoria.

Griffin, M. 1993. Annotated checklist and conservation status of mammals, reptiles and amphibians of the Sperrgebiet, southern Namib Desert, Namibia. Unpublished Report. Oranjemund/Windhoek: NamDeb.

Hines, C.J.H. 1990. Past and present distribution of the wild dog *Lycaon pictus* in Namibia. Madoqua 17: 31-36.

Joubert, E. 1971. The past and present distribution and status of the black rhinoceros (*Diceros bicornis*) Linn. 1758) in South West Africa. Madoqua 4: 33-43.

Joubert, E. & Mostert, P.K.N. 1975. Distribution patterns and status of some mammals in South West Africa. Madoqua 9: 5-44.

Lensing, J.E. & Joubert, E. 1971. Intensity distribution patterns for five species of problem animals in South West Africa. Madoqua 10: 131-141.

Lindeque, M. undated – prepared in 1992. Historic and present distribution of terrestrial large mammals in Namibia. Unpublished draft manuscript: Etosha Ecological Institute: Ministry of Environment & Tourism: 59 pp + Figures.

Rookmaker, L.C. 1989. The zoological exploration of southern Africa. Rotterdam: A.A. Balkema.

Shortridge, G.C. 1934. The mammals of South West Africa. Vols 1 & 2. London: Heinemann.

Sidney, J. 1965. The past and present distribution of some African ungulates. Trans. Zool. Soc. Lond. 30: 1-396.

Skead, C.J. 1976. Historical mammal incidence in the Cape Province. Vol. 1. Cape Town: Dept. of Nature and Environmental Conservation of the Provincial Administration of the Cape of Good Hope.

Skinner, J.D. & van Aarde, R.J. 1981. The distribution and ecology of the brown hyaena *Hyaena brunnea* and spotted hyaena *Crocuta crocuta* in the central Namib Desert. Madoqua 12: 231-239.

Smithers, R.H.N. 1983. The mammals of the southern African subregion. Pretoria: University of Pretoria.

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Tall Tales—Updates from the giraffe world!

AERIAL TOTAL COUNT AMBOSELI – WEST KILIMANJARO NATRON CROSS BORDER LANDSCAPE
WET SEASON, MARCH 2010

Kenya Wildlife Service and Tanzania Wildlife Research Institute

EXECUTIVE SUMMARY

The Amboseli-West Kilimanjaro/ Magadi – Natron cross- border landscape, as referred to in this report, comprises various ecologically important areas in Kenya and Tanzania. On the Kenyan side it includes Amboseli National Park and the surrounding group ranches, the southern part of Kajiado district from Namanga to Magadi and Nguruman. On the Tanzanian side, the ecosystem covers Natron and West Kilimanjaro areas. Although this broad cross-border landscape is a very significant area for wildlife conservation, it has seldom been considered in its entirety as a conservation unit. Consequently past aerial censuses and other studies have been confined to smaller areas (e.g. Amboseli National Park and West Kilimanjaro), leading to a partial understanding of wildlife interrelations in the area. In addition, there has been no recent census to determine wildlife and domestic animal numbers and their distribution in the whole region. This census report therefore forms an initial attempt of covering the Amboseli- West Kilimanjaro landscape as a unit. Further, this census provides important means to evaluate the impact of the recent 2008/2009 prolonged drought, on both wildlife and livestock in the landscape. The drought led to substantial mortalities among some of the species, particularly the grazers (wildebeest, zebra, buffalo and cattle).

A total aerial count of wildlife species, livestock and human activities in Amboseli-Namanga and Magadi areas in Kenya, and West Kilimanjaro and Natron areas in Tanzania was conducted from 1st to 6th March, 2010. This was a joint cross-border exercise between Kenya Wildlife Service (KWS) and Tanzania Wildlife Research Institute (TAWIRI), with additional support from African Wildlife Foundation (AWF), Amboseli Trust for Elephants (ATE) and other stakeholders. The census covered 24,108 km2 area including 8,797 km2 of the Amboseli ecosystem and 5,513 km2 of the Namanga-Magadi areas in south-western Kenya together with 3,014 km2 of the West Kilimanjaro and 7,047 km2 of the Natron areas in North Tanzania.

During the survey, 25 wild mammalian and 2 avian species were counted. It is recognized that by the very nature of aerial total counts, numbers counted are quite likely to be underestimates. Therefore, adhering to the FSO tallies, Zebra with a population of approximately 13,740 individuals was the most numerous wild species in the entire survey area followed by Grant’s gazelle (8,362), common wildebeest (7,240), Maasai giraffe (4,164), Eland (1,992), Maasai ostrich (1,461), African elephant (1,420), Impala (1,317), Thomson’s gazelle (933) and Coke’s hartebeest (441). Livestock species recorded included sheep and goats (230,048), cattle (100,433), donkey (2,258) and camel (762). There were four main elephant cluster areas in: Chyulu; Amboseli-West Kilimanjaro area, east of Lake Natron and Magadi-Nguruman area. In the Amboseli area, the elephant population has been relatively stable, with 1,087 individuals counted in the year 2000; 1,090 in 2002 and 967 in 2007 compared to the current population of 1,266. There was a dramatic decline in the number of large herbivore species between the years 2007 and 2010: wildebeest declined by about 83% from 18,538 to 3,098; zebra declined by about 71% from 15,328 to 4,432; and buffalo declined by about 61% from 588 to 231 in the Amboseli area. Livestock similarly declined in the Amboseli area with data from comparable blocks in 2007 and 2010 censuses showing a reduction of 56% and 62% in cattle and shoat estimates. These declines can be attributed to the severe drought that occurred between 2007 and 2009.

Wildlife was widely distributed in the entire survey area. This can be explained by the fact that the land use has largely remained pastoral, allowing relative coexistence between livestock and wildlife. While pastoralism was the main form of land use in the survey area, the presence of crop cultivation in key wildlife habitats such as the wetlands is of concern to the future of the area for wildlife conservation.

Crop cultivation and other forms of development in the area threaten to block wildlife movement routes. For instance, wildlife movements into and out of Kimana Sanctuary in the Amboseli region and in the Kitenden area between Kenya and Tanzania is disrupted. Proliferation of charcoal burning poses serious concerns, as most mature trees which are key browse forage and nesting sites are targeted; this was notable in the Mailua, Meto, Osilalei, Elangata Wuas and Kaputiei areas and in Kimana Group Ranch.

This survey underlies the need for a landscape approach in conservation planning in the Amboseli- West Kilimanjaro/ Magadi- Natron cross- border ecological area. While Amboseli National Park remains a crucial wildlife refuge, the associated wildlife disperses into the adjacent areas, especially the slopes of Chyulu hills and Natron areas. We recommend that future wildlife studies/surveys should focus in assisting wildlife managers to better understand the large-scale wildlife movement dynamics in this landscape. This survey shows the key cross border wildlife dispersal areas and highlights gaps in our

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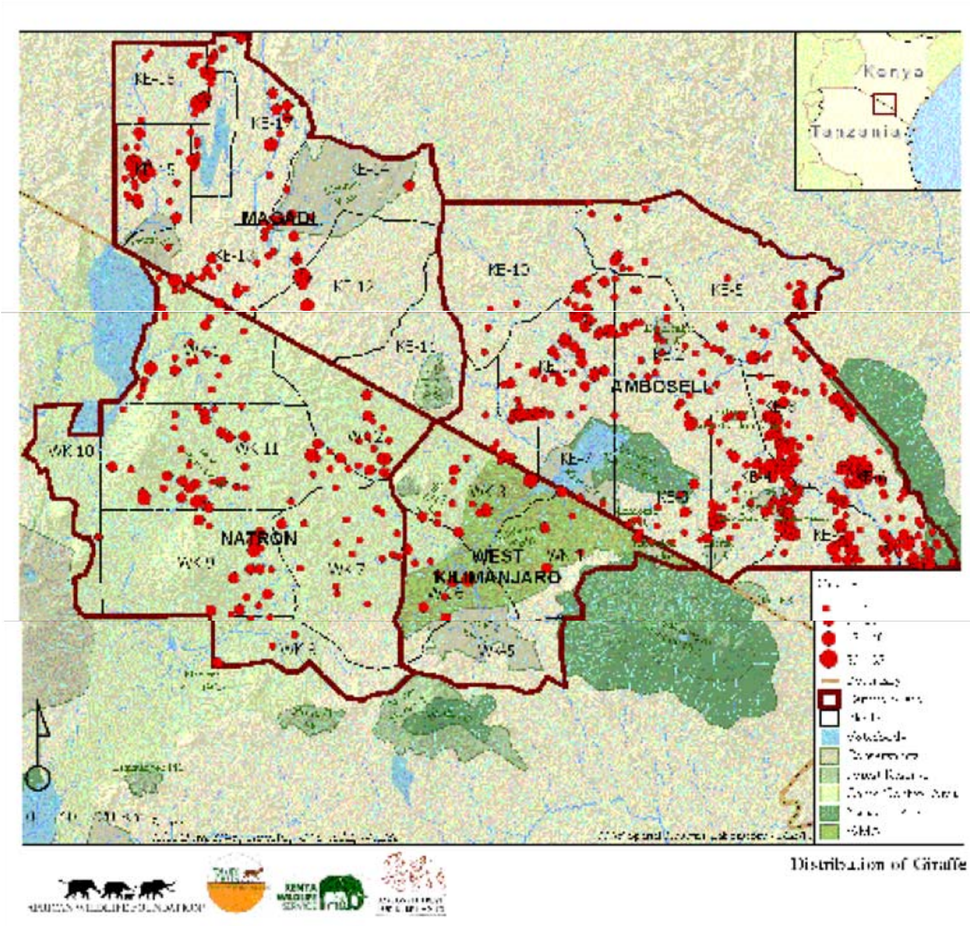

Figure Distribution of Maasai Giraffe in the study area

understanding of the interactions among the migratory species (elephants, wildebeest and zebra), that use Magadi, Natron, West Kilimanjaro and Amboseli areas. The survey further identifies some human activities which are possible threat to wildlife conservation within the survey area. Addressing these specific threats will be important for maintaining the future viability of the landscape as a wildlife dispersal area.

Maasai Giraffe

Giraffes were widely distributed in the entire ecosystem. They occurred in all the surveyed blocks except WK-5 in West Kilimanjaro region (Figure 6).The highest number recorded was in Amboseli (2,283) followed by Natron (838), Magadi (780) and were least in West Kilimanjaro (263) (Table 2). However, there were variations in densities between areas, such that Amboseli had 0.26/km2, Magadi 0.14 /km2, Natron 0.12/km2 and West Kilimanjaro 0.09/km2 (Appendix 3).

WORLD'S OLDEST GIRAFFE

David Powell

The *Carter Giraffe Building* at the Wildlife Conservation Society's Bronx Zoo is home to a zoo world record holder! The 34 year old Baringo (Rothschild's) giraffe (*Giraffa camelopardalis rothschildi*), Clara, is the oldest giraffe alive in captivity right now, according to the international studbook for the species, maintained by Laurie Bingaman Lackey. In addition, Clara is the oldest known-age giraffe ever known in the population!

Clara was born at Parc Safari in Quebec May 28, 1975. She came to the Bronx Zoo on October 23 of that year. Clara has produced nine calves at the Bronx Zoo and, from these, has 95 other descendants in the population. Fifty-three of the descendants are alive in the population right now including a grand-daughter and her descendants in Japan! Clara lives in a multi-generational herd at the Bronx Zoo that includes her son, daughter, two granddaughters and other females. Clara participates in some husbandry training but mainly chooses to sit back and observe. It is clear though that she is learning by watching others; when she does participate she shows an understanding of all of the elements of the training session. Clara is a calm, relaxed animal and other giraffe in the herd take their cues from her. Her experience with calves also makes her a great grandmother! The first giraffe birth at the Bronx Zoo was in 1922, and thirty-six more giraffe have been born there since then.

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(Photos © Julie Larsen-Maher)

Tall Tales—updates from the giraffe world!

UPDATE FROM THE SERENGETI GIRAFFE PROJECT
Megan Strauss

The Serengeti Giraffe Project is a research project focusing on the status and ecology of Masai giraffe in Tanzania's Serengeti National Park. The project was initiated in 2008 and is run by Megan Strauss, a PhD Candidate in the Department of Ecology, Evolution and Behavior at the University of Minnesota, USA.

The Serengeti ecosystem contains +/- 5,000 giraffe but this represents a drop in numbers since the 1970s. We are analyzing historical population data and collecting contemporary data to re-evaluate the status of giraffe in this high priority protected area. This project coincides with the IGWG effort to assess the status of wild giraffe and we look forward to contributing data on Masai giraffe to this assessment.

A primary objective of the Serengeti Giraffe Project is to advance our understanding of the mechanisms that influence giraffe abundance and distribution. This year we are undertaking an exciting study on giraffe antipredator behavior in collaboration with Prof. C. Packer and A. Swanson of the Serengeti Lion Project. We are using camera trapping to examine whether giraffe lower their predation risk through spatial and temporal avoidance of predators.

The Serengeti Giraffe Project is approved by the Tanzania Wildlife Research Institute and Tanzania National Parks. The Serengeti Lion Project and the TAWIRI-Messerli Veterinary Programme provide essential logistical support. We owe thanks to a number of financial supporters including the University of Minnesota's Global Spotlight Grant, the Bell Museum of Natural History, the National Science Foundation, the Riverbanks Zoo, the Minnesota Zoo, the Columbus Zoo, the Chester Zoo, the Explorer's Club and the American Society of Mammalogists.

For more information about this project, please contact Megan Strauss at strau102@umn.edu or visit www.serengetigiraffeproject.org.

Lions feed on a young female giraffe in the study area. (Photo © taken by M. Strauss in Seronera, 2009.)

THE ROTHSCHILD'S GIRAFFE PROJECT, KENYA
Zoe Muller

Giraffe were once wide ranging across Africa but are now mostly confined to conservation areas, National parks or enclosed private conservancies. Over the past decade, giraffe populations have suffered a 30% drop in population numbers, a direct result of habitat encroachment, segregation of populations, severe poaching and human-wildlife conflicts.

Remaining giraffe populations across Africa are now largely isolated from one another, separated by Park boundaries, wildlife fences and the blocking of historic migration routes by human settlement and activity.

Of the nine currently recognised subspecies of giraffe, the Rothschild's giraffe *Giraffa camelopardalis rothschildi* is the second most imperilled. When it was first described by Lydekker in 1903 the Rothschild's giraffe inhabited the region from the Rift Valley of west-central Kenya across Uganda to the Nile River and northward into southern Sudan, but has since severely declined in number and range, now occupying a small percentage of its former range and thought to be extinct in Sudan.

Current population estimates for the Rothschild giraffe indicate that there are less than 670 individuals remaining in the wild (GCF & IGWG, 2009) all of which are confined to small, enclosed populations that are isolated from one another. As well as being low in number, recent genetic evidence suggests that the Rothschild's giraffe is genetically distinct from other giraffe, making them an even higher conservation priority. Accordingly, the Rothschild's giraffe has recently been declared Endangered by the IUCN.

Tall Tales—updates from the giraffe world!

The Rothschild's Giraffe Project has been established to provide a comprehensive scientific review of Rothschild's giraffe wild ecology and behaviour, as well as assessing the extent of the current problems the enclosed populations face and examining key conservation issues. The Rothschild's Giraffe Project will form the basis of a long-term monitoring plan for this subspecies in Kenya and will provide further information and suggestions for sustainable conservation strategies. Data will be used to initiate and develop an effective conservation strategy for the Rothschild's giraffe and will feed into the National Giraffe Conservation Task Force currently being developed by the Kenya Wildlife Service.

If you would like to know more about this Project then please visit the research website at www.girafferesearch.com or contact the Principal Investigator, Zoe Muller at: muller.zoe@gmail.com or visit www.girafferesearch.com.

LETTER FROM THE OUTGOING EAZA GIRAFFE EEP COORDINATOR

Dear colleagues;

Today I officially handed over the coordination of the EAZA Giraffe EEP to Tim Rowlands, curator of mammals of Chester Zoo (t.rowlands@chesterzoo.org). I am doing this, after eight years, with mixed feelings. I feel a bit sad, because I really liked coordinating this EEP and I liked to cooperation with all of you. This did not always go smooth, but I learned a lot from this and, most important, the captive population of giraffes has benefited from our discussions. However, I feel very good because firstly I have not enough time to coordinate it well in my position as director of Rotterdam Zoo. Second, in my personal opinion EEPs should never be coordinated too long by one person to get a new view towards an EEP. Thirdly, and most important, because I have found the perfect successor for coordinating this EEP. Tim Rowlands worked with giraffes for many years before he became curator, he is very skilled and enthusiastic and has a lot of institutional support from Chester Zoo, not only on paper, but also in practice.

This weekend Tim Rowlands visited me in Rotterdam Zoo and we discussed everything which is going on in this EEP. I gave him all correspondence I had with you during the past years, so he is fully updated. He knows all recommendations and I wish him lots of luck and joy with the coordination of this lovely species in Europe, together with a very dedicated species committee, a lot of skilled advisors to the EEP, a well functioning TAG and last but not least a whole lot of cooperative participants.

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Thanks to the excellent cooperation with all participants in this EEP, we managed to get the share of the hybrid giraffes in Europe down from over one third to less than one quarter of the total European giraffe population and their share is decreasing further rapidly. The Angolan and Cape giraffe populations are facing extinction in Europe, and there are only a handful of Masai giraffes, but there is simply no space for six subspecies in Europe. Fortunately we have large and healthy populations of Baringo and Reticulated giraffes and a thriving group of Kordofan giraffes. These three subspecies are having a bright future.

I want to use this opportunity to thank all of you for the good cooperation and the friendship; both will remain, as I am not lost to the zoo community, but am only looking at zoos from a different perspective, namely as director / CEO. After one year in this position I can tell you, that I surely miss the 'animal business', but am happy from this position I can play another role in the development of the zoo world in general and Rotterdam Zoo in particular.

Please send all correspondence about giraffes from now on not to me, but to Tim Rowlands (t.rowlands@chesterzoo.org). In case send it by mistake to me, I will forward it to Tim and he will further deal with it.

I hope to see all of you soon again! Tim: good luck!
Best regards,
Marc Damen
Director / CEO Rotterdam Zoo
Retired EEP Coordinator for Giraffes

Recently Published Research

Brenneman, R.A., Louis, E.E. Jnr. And Fennessy, J. 2009. Genetic structure of two populations of the Namibian giraffe, *Giraffa camelopardalis angolensis.* African Journal of Ecology 47(4): 720–728.

ABSTRACT
Two geographically distinct populations of giraffe (*Giraffa camelopardalis*) were sampled for this study, the northern Namib Desert and Etosha National Park. Population genetic parameters and relationships within subpopulations were estimated to better understand the genetic architecture of this isolated subspecies. Gene flow between the geographically separated populations can be attributed to recent translocation of giraffe between the two populations. Inbreeding estimates in the six subpopulations studied were low though we found evidence that genetic drift may be affecting the genetic diversity of the isolated populations in northern Namibia. Population dynamics of the sampling locations was inferred with relationship coefficient analyses. Recent molecular systematics of the Namibian giraffe populations indicates that they are distinct from the subspecies *Giraffa amelopardalis giraffa* and classified as *G. c. angolensis*. Based on genetic analyses, these giraffe populations of northern Namibia, the desert-dwelling giraffe and those protected in Etosha National Park, are a distinct subspecies from that previously assumed; thus we add data on *G.c. angolensis* to our scientific knowledge of this giraffe of southern Africa.

Van Sittert, S.J., Skinner, J.D. and Mitchell, G. 2010. From Fetus to Adult—An Allometric Analysis of the Giraffe Vertebral Column. J. Exp. Zool. (Mol. Dev. Evol.) 314B: [page range]

ABSTRACT
As mammalian cervical vertebral count is almost always limited to seven, the vertebral column of the giraffe (*Giraffa camelopardalis*) provides an interesting study on scaling and adaptation to shape in light of these constraints. We have defined and described the growth rates of the lengths, widths, and heights of the vertebrae from fetal through neonatal life to maturity. We found that the disproportionate elongation of the cervical vertebrae is not a fetal process but occurs after birth, and that each cervical (C2-C7) vertebrae elongates at the same rate. C7 is able to specialize toward elongation as its function has been shifted to T1. We concluded that T1 is a transitional vertebra whose scaling exponent and length is between that of the cervical and thoracic series. Despite its transitional nature, T1 is still regarded as thoracic, as it possesses an articulating rib that attaches to the sternum. The other dimensions taken (width, height, and spinous process length) show that giraffe vertebral morphology exhibit adaptations to biomechanical strain, and we have underlined the importance of the thoracic spinous processes in supporting the head and neck.

Bashaw, M. 2010. Consistency of captive giraffe behavior under two different management regimes. Zoo Biol. 29: 1–8.

ABSTRACT
Long-term animal behavior studies are sometimes conducted at a single site, leading to questions about whether effects are limited to animals in the same environment. Our ability to make general conclusions about behavior is improved when we can identify behaviors that are consistent across a range of environments. To extend Veasey and colleagues' ([1996b] AnimWelf 5:139–153) study, I compared not only activity budgets but also social behavior of an all-female group of giraffe at The Maryland Zoo in Baltimore (MZiB) to those previously observed in breeding groups at The San Diego Zoo's Wild Animal Park (SDZWAP; Bashaw et al. [2007] J Comp Psychol 121:46–53). Morning activity budgets and the maintenance of social relationships were consistent across groups. MZiB female giraffe interacted more frequently and the identity of animals that formed the strongest relationships was less predictable than at SDZWAP. Results support earlier findings that captive giraffe maintain social relationships and suggest that studies of giraffe social relationships and activity are generalizable across a range of captive conditions.

Bercovitch, F.B. and Berry, P.S.M. 2010. Reproductive life history of Thornicroft's giraffe in Zambia. Afr. J. Ecol. 48: 535–538.

ABSTRACT
Knowledge of the reproductive life history of giraffe in the wild is sparse. Giraffe have two fairly unusual reproductive patterns among large mammals: they can become pregnant while lactating, and calf mortality is extremely high.
Longitudinal records are largely absent, so tracking reproductive parameters tends to combine information from captive and field studies. In this study, we examine longitudinal data obtained over a 33-year period in one population of Thornicroft's giraffe in order to chart their reproductive careers. We found that age at first parturition was 6.4 years, or slightly later than in captivity. Giraffe bred throughout the year, with cows producing offspring on average every 677.7 days. About half of

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the calves died before one year of age, but death of a calf did not reduce inter-birth interval. We conclude that the lifetime reproductive success of giraffe is more dependent on longevity and calf survivorship than on reproductive rate.

Henderson, D.M. and Naish, D. 2010. Predicting the buoyancy, equilibrium and potential swimming ability of giraffes by computational analysis. Journal of Theoretical Biology. Early Online.
http://scienceblogs.com/tetrapodzoology/2010/06/giraffe_flotation_dynamics.php

ABSTRACT
Giraffes (*Giraffa camelopardalis*) are often stated to be unable to swim, and while few observations supporting this have ever been offered, we sought to test the hypothesis that giraffes exhibited a body shape or density unsuited for locomotion in water. We assessed the floating capability of giraffes by simulating their buoyancy with a three-dimensional mathematical/computational model. A similar model of a horse (*Equus caballus*) was used as a control, and its floating behaviour replicates the observed orientations of immersed horses. The floating giraffe model has its neck sub-horizontal, and the animal would struggle to keep its head clear of the water surface. Using an isometrically scaled-down giraffe model with a total mass equal to that of the horse, the giraffe's proportionally larger limbs have much higher rotational inertias than do those of horses, and their wetted surface areas are 13.5% greater relative to that of the horse, thus making rapid swimming motions more strenuous. The mean density of the giraffe model (960 gm/l) is also higher than that of the horse (930 gm/l), and closer to that causing negative buoyancy (1000 gm/l). A swimming giraffe – forced into a posture where the neck is sub-horizontal and with a thorax that is pulled downwards by the large fore limbs – would not be able to move the neck and limbs synchronously as giraffes do when moving on land, possibly further hampering the animal's ability to move its limbs effectively underwater. We found that a full-sized, adult giraffe will become buoyant in water deeper than 2.8 m. While it is not impossible for giraffes to swim, we speculate that they would perform poorly compared to other mammals and are hence likely to avoid swimming if possible.

Simmons, R. And Altwegg, R. 2010. Necks-for-sex or competing browsers? A critique of ideas on the evolution of giraffe. Journal of Zoology. 282(1): 6-12.

ABSTRACT
Recent years have witnessed a resurgence in tests of the evolution and origin of the great height and long neck of the giraffe *Giraffacamelopardalis*. The two main hypotheses are (1) long necks evolved through competition with other browsers allowing giraffe to feed above them ('competing browsers' hypothesis); or (2) the necks evolved for direct use in intrasexual combat to gain access to oestrous females ('necks-for-sex' hypothesis). Here, we review recent developments and their relative contribution in explaining giraffe evolution. Trends from Zimbabwean giraffes show positive allometry for male necks and isometry for female necks relative to body mass, while comparative analyses of the cervical versus the total vertebral column of the giraffe, okapi and fossil giraffe suggest selection specifically on neck length rather than on overall height. Both support the necks-for-sex idea. Neither study, however, allows us to refute one of the two ideas. We suggest new approaches for quantifying the relative importance of the two hypotheses. A direct analysis of selection pressure on neck length via survival and reproduction should clarify the mechanism maintaining the trait, while we predict that short robust ossicones should have arisen concurrently with incipient neck elongation if sexual selection was the main selective driver. The main challenge for the competing browser hypothesis is to explain why giraffe have remained about 2 m taller than their tallest competitors for over 1 Myr, whereas the sexual selection hypothesis cannot provide an adaptive explanation for the long neck of female giraffe. We conclude that probably both mechanisms have contributed to the evolution and maintenance of the long neck, and their relative importance can be clarified further.

Sullivan, K., van Heugten, E., Ange-van Heugten, K., Poore, M.H., Dierenfeld, E.S. And Wolfe, B. 2010. Analysis of nutrient concentrations in the diet, serum, and urine of giraffe from surveyed North American zoological institutions. Zoo. Biol. 29(4): 457-469.

ABSTRACT
The objectives of the present research were to conduct a survey to investigate the health history and feeding practices of giraffe in captivity in North America and to obtain samples of hay, concentrate, browse, urine, and serum to compare across zoos, possible factors relating to the development of urolithiasis. Forty-one out of 98 institutions contacted responded, representing 218 giraffe. All responding zoos fed concentrate and alfalfa hay was the primary forage. Sixty-five percent of zoos fed browse and 43 different species of browse were listed. Six zoos reported a history of urolithiasis, seven reported wasting syndrome, and 10 reported sudden death. The median daily amount (as fed) of concentrate and hay

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offered were 5.45 kg (range of 2.73–9.55 kg) and 6.82 kg (range of 2.53–12.50 kg), respectively. The concentrate:hay ratio of the offered diet ranged from 0.22 to 3.47 with a median value of 0.79. Forty-three percent of the institutions offered a ratio greater than 1:1. Samples of concentrate and hay (six zoos), serum (five zoos), and urine (seven zoos) were obtained for chemical analyses. Analyzed nutrient content of the consumed diet, measured by weighing feed and orts for three consecutive days, met recommendations for giraffe, but was excessive for crude protein and P. Concentrate:hay and serum P were positively correlated (r=0.72; $P<0.05$). High dietary P content and a high level of concentrate relative to hay may be contributing factors to urolith formation and warrant further investigation.

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Review of Current Anesthesia Procedures for Captive and Free-Living Giraffe

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Giraffe anesthesia has a historical high morbidity and mortality due to their unique anatomy and physiology which predisposes giraffe to anesthesia-related complications including death. This includes their large size and cumbersome, unwieldy shape and long neck which limit physical manipulations during the anesthetic procedure and can cause related trauma to the animal. Other problems include their relative small tidal volume with large dead space and hypertension. Specific drug related problems and drug sensitivity include regurgitation, respiratory and cardiac depression, hyperthermia, etc. Accurate weight estimation can lead to problems with drug dosages. Due to the above concerns there has been an understandable hesitancy to anesthetize these unique animals, therefore various restraint devices have been developed and the use of these squeeze cages in captive animal will be discussed.

This presentation will give a historical review and personal experiences of the evolution of anesthetic techniques used both in the field and in free-ranging giraffes.

Our current anesthetic protocol for captive giraffes using thiafentanil, medetomidine and ketamine combination will be discussed and the resultant physiological parameters presented and compared to previously used anesthetic techniques. The use and limitations of this combination in field-anesthetized giraffes will also be discussed in addition to the high dose opoid technique used for capture and relocation.

Successful Concurrent Rearing of Two Giraffe Calves by a Single Giraffe Dam

Rose Borkowski[1] DVM, Brenda Irvine[2], Jennifer Robertson[3], and Mark Hacker[4]
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[2]*Lion Country Safari*
[3]*Philadelphia Zoo*
[4]*Adventure Aquarium*

Captive female giraffe occasionally reject their offspring, putting such calves at risk for illness associated with failure of passive transfer and inadequate nutrition. Rejected calves can be successfully hand raised if appropriate feeding formulas and experienced staff are available to support the animal. However, hand-raised calves may suffer disturbances of the gastrointestinal tract, infectious disease, and growth abnormalities should compromise of nutritional support occur. The ability of an adult female giraffe to nurse and rear more than one calf simultaneously is not well understood as giraffe seldom produce twins. Additionally, circumstances in which an orphaned calf may be placed with an unrelated dam that is nursing its own offspring occur infrequently. A 3 day old female giraffe calf residing at a zoological park was found collapsed and taken to the zoo hospital for veterinary care. Although the calf had been observed to nurse soon after its birth, it appeared to have suffered under-nutrition and probable immune system compromise. Within 48 hours of hospitalization, the calf responded to treatment with intravenous fluid therapy and antibiotics, but would not bottle feed. The calf was then placed in an outdoor enclosure where tapered veterinary support could be continued. Attempts to reintroduce the calf to its mother were not successful. However, the calf was soon introduced to an unrelated adult female and her newborn male calf. The unrelated dam quickly accepted the rejected calf and only rarely discouraged it from nursing. The dam also continued to nurse her own calf. No aggressive behavior between the adult and either calf or between calves occurred. Both calves were successfully reared by the dam and remained healthy. They gradually weaned without human intervention at approximately 6 months of age and appeared socially bonded to one another.

Institutions faced with care of an orphaned giraffe calf may consider its being fostered by an unrelated giraffe dam that is nursing her own offspring. Excellent nutritional support and preventive veterinary care must be available for the dam and the threesome must be closely monitored as experience with concurrent rearing of giraffe calves by a single dam is limited.

***Keywords**: adoption, calf rejection, foster care, giraffe, Giraffa camelopardalis, neonatal care, nursing,*
orphaned calf

Incorporating Modern Husbandry into a New Giraffe Barn at the Nashville Zoo

Kate Meinhardt & Erin Teravskis
Nashville Zoo

Construction started on Nashville Zoo's giraffe barn in February 2005 and since April 2006 it has been the primary holding area for our 1.2 Masai giraffe. Our barn incorporates modern ideas of giraffe husbandry with characteristics that provide convenience during the keeper's daily routine. The primary areas of the barn that we will focus on include the hay room, sand yard, mechanical room, mezzanine, loading dock, giraffe loading dock, individ-

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ual stalls and their unique features, and the giraffe restraint device (GRD).

In the past three years, multiple institutions have toured our giraffe area in preparation for building their own giraffe barns and have requested the blue prints so they can incorporate many aspects of our barn into their own plans. With use, we have discovered some challenges in the barn design. We will also discuss possible improvements to these areas so future barns can utilize them. The barn truly is a state of the art facility which allows for advanced husbandry practices, multiple training opportunities, and veterinary procedures.

Keywords: *barn, convenience, giraffe, husbandry, modern, Nashville Zoo*

The Rogue Thumb: Developing, Evaluating and Refining a volunteer-lead Giraffe encounter

Katy Schultz, Paige McNickle, Lanny Brown
The Phoenix Zoo

In June of 2009, The Phoenix Zoo opened a new Giraffe Encounter to our visitors. The vision for this encounter was to be not only a feeding experience, but a guided interaction with the Giraffe with the aid and expertise of a well-trained volunteer. Over the months since then, we have re-evaluated the encounter to identify areas needing improvement, and accordingly are refining the program continuously to provide a world-class experience for our guests. This presentation will provide information on how we developed the encounter, the crucial role that volunteers play within it, and most importantly the challenges we have discovered and overcome along the way.

Keywords: *Volunteer, Giraffe Encounter, guided interaction*

An Interdisciplinary Approach to Training: Thinking Outside of the Box, Working to Reduce Fearful Behavior with Giraffe at the Oakland Zoo

Lisa Clifton-Bumpass, Sara Mellard, Amy Phelps
Oakland Zoo

The Oakland Zoo's giraffe team has successfully met the collection's husbandry and training needs by reaching outside the exotic animal care industry. When staff was faced with training complex medical husbandry behaviors, keepers brought a domestic animal training consultant to the training team. Many training solutions were discovered through the integration of methodologies and training protocols from both domestic and exotic fields. These tools allowed animals with a low threshold for fear-flight-freeze responses to benefit from systematic processes of desensitization to novel stimuli. The science of applied behavior analysis gives exotic and domestic animal husbandry and training professionals several exacting tools to reduce the stress and fear-based responses of animals to novel objects and people. The Oakland Zoo uses classical conditioning to change an animal's association with novelty from fear to operant interactions, often referred to as choice. Using a training construct known as "Stranger Danger" informs the training plan design, core skill assessment, reinforcement hierarchy, bridge selection, and team training processes. Key strategies in training giraffe by shaping behavior are effectively applied to many other behavior management needs: measuring behavior, reinforcement choice, team building, micro shaping and the micro shaping strategy, reinforcement hierarchies and an adaptation of Karen Pryor's training game: "101 things to do with a box," allowing an animal to interact with new people and objects from the positive quadrant of behavior modification. Assessing the learning styles, rate of acquisition, and the social preferences of specific individuals within the Oakland giraffe herd allows trainers to extrapolate the methods used within domestic animal behavior modification to benefit the giraffe. Dramatically reducing the fear-flight-freeze response facilitates the training of advanced and often invasive medical husbandry behaviors that can be accomplished in protected contact and entirely without the use of physical or chemical restraint of the giraffe.

Keywords: *Tagteach, micro shaping, reinforcement training, team training, fearful, classical conditioning, operant conditioning*

Increasing The Medical Options: Giraffe Training

Gerardo Martinez
Africam Safari

Africam Safari is a safari-type zoo located in Puebla, México that shelters 9 giraffes of different ages and genders.

Given the giraffes' complex morphology and unpredictable behavior, they are one of the most difficult species to manage in an enclosed environment.

Furthermore, due to their large and delicate extremities, they usually have injuries which are very difficult to treat.

Due to the necessity of practicing preventive medicine on giraffes, and giving them adequate treatment, we implemented a training program 9 years ago using

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"Protected Contact". Within this method we use a mechanical chute that allows the caretaker to safely contain the giraffes and get close enough to take care of them without endangering themselves or harming the animal.

One of the biggest problems during the training, results from the giraffe's fast and unexpected response to practically everything around them. Despite their enormous strength, the giraffes can get hurt very easily when they get nervous because they start to kick around and it's very difficult to make them stop. Therefore, it is very important to follow all the appropriate steps in a slow manner to calm the giraffe and prevent injuries.

Thanks to the training now we can perform many medical procedures, such as Tb tests, blood samples, wounds treatment, rectal palpation, ultra sounds, hoof care and more in a safe and relaxed environment.

The institutions that have species difficult to manage and/or treat have the responsibility to find alternatives that guaranty every animal of the zoological collection will receive adequate and expert care. Today the giraffes in Africam Safari have small recovery-periods and receive adequate treatment to prevent future problems, avoid illness and pain as well as reduce unwanted behaviors that they wouldn't exhibit in optimal physical and mental health using the training sessions as a therapy to keep them busy when they are isolated for long periods of time due to illness, treatment or bad weather.

Keywords: *Giraffe; Training, chute, medical, protected contact, behavior, therapy.*

REM-Sleep as Indicator for Stress in Giraffes (*Giraffa camelopardalis*)

Florian Sicks[1,2], Günther Fleissner[2]
[1] Zoo Dortmund [2] Institute for Cell Biology and Neuroscience, Department Neurobiology of Circadian Rhythms, Goethe-University

Well balanced sleep is important for animals' well-being. Thus different studies have shown that sleep and activity patterns could be helpful in analyzing the well-being of animals (RUCKEBUSH 1975; VEISSER ET AL. 1989; SCHEIBE ET AL. 1999). Furthermore, changes in the frequency or length of sleep could provide information about the ability of individuals to cope with changes in their environment (RUCKEBUSH 1975). Especially the REM-sleep pattern seems to be important here, since it has been demonstrated in humans that REM-sleep increases at the beginning of infectious diseases or after traumatic events (MARSHALL 2002).

Because of their peculiar sleeping position during the REM-sleep phases (TOBLER 1996, HÄNNINEN 2007) Giraffes (*Giraffa camelopardalis*) are very well suited to analyze REM-sleep patterns in a non-invasive way via video observations.

Within my PhD-project it is being analyzed how the REM-sleep pattern changes after stressful situations. Therefore the sleeping behavior of giraffes is being observed before and after their transport to another zoo. In order to validate this new method, faeces samples are being analyzed with respect to the metabolite concentration of the stress hormone cortisol. Beside first results of this project, that show a high correlation between the REM-sleep pattern in Giraffes and their concentrations of cortisol metabolites, the talk will present results, how the life of a newborn giraffe could have been saved only by observing its REM-sleep pattern.

Keywords: *Giraffa camelopardalis, Giraffe, Cortisol, faeces, hormones, REM-sleep, stress*

Itchy and Scratchy: Managing a Female Giraffe (*Giraffa camelopardalis*) with Skin Allergies

Kristen Wolfe
Disney's Animal Kingdom

"Thika," a female giraffe under the care of the Disney's Animal Kingdom staff, presented with sores due to chronic itching of her neck and torso. Steroid injections are often the common treatment for such symptoms, however in ruminants, there can be side effects. For this reason, several medical and husbandry techniques were tried to avoid the use of steroids. We first altered her holding and feeding routines to decrease her ability to scratch. Her blood was then analyzed, her diet was altered and supplements added to increase her fatty acid levels. Bathing regimens along with oral allergy medications were tried. None of these changes resolved the issue. Steroid treatment was eventually used and provided some relief but this was only temporary. At this time we will be attempting to do allergy testing on her to pinpoint what environmental factors stimulate her symptoms. Though the case has not yet resolved, we are hopeful that our efforts to examine other treatment forms will prove successful.

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How Many Giraffe Species are There and why Should we Care?

David Brown
International Giraffe Working Group

For many years there was thought to be only one species of giraffe (*Giraffa camelopardalis*) with somewhere between six and nine subspecies. These subspecies of giraffes are defined by differences in their spot patterns and ossicone (horn) and skull shapes. Different giraffe subspecies will interbreed with each other in zoos. This observation lead to the assumption that giraffe subspecies interbreed with each other in the wild. By analyzing mitochondrial DNA sequences and nuclear microsatellite loci, my colleagues and I showed that there are at least six genealogically distinct lineages of giraffe in Africa, with little evidence of interbreeding between them. Some of these lineages appear to be maintained in the absence of contemporary barriers to gene flow, possibly by differences in reproductive timing or pelage-based assortative mating, suggesting that populations usually recognized as subspecies have a long history of reproductive isolation. The current taxonomic classification of *Giraffa* as one species obscures the threats to the existence of these giraffe lineages. There has been an estimated drop of 30% in giraffe population numbers in the past decade to less than 100,000 giraffes remaining on the continent. The results of the recent genetic study suggest that each of the genetically different giraffe species need individual conservation assessments and management plans. Some of the potential giraffe species are greatly endangered.

Relevant Contributors: *Dr. Rick Brenneman, Dr. Nicholas Georgiadis, Dr. Klaus-Peter Koepfli, Dr. John Pollinger, Dr. Borja Mila*

Teaching Young Giraffe Old Tricks: Changing Learned Behaviors in a Herd of Captive Giraffe

Ashleigh Kandrac
Lion Country Safari

At Lion Country Safari (LCS) in Loxahatchee, FL, the climate and the adoption of unnatural behavior by the captive giraffe herd have collided to pose a threat to the health of the giraffe *(Giraffa camelopardalis)*. In recent years, a resilient parasite known as *Haemonchus contortus* has become prevalent in the pastures where the giraffe are housed and has developed resistance to many standard de-worming drugs. *H. contortus* feeds on the host's blood while residing in the abomasum of ruminants and severe infestations can lead to anemia, "bottle jaw" and even death. The subtropical climate of south Florida provides a perfect combination of year-round moisture and heat for these parasites to thrive. The pairing of increased grazing behavior in the giraffe with the presence of *H. contortus* in the pasture has resulted in increased parasite loads in the giraffe. The giraffe have become so accustomed to grazing that each generation is learning this behavior from their elders and are often seen lying down and grazing throughout the day. The consequences of these learned behaviors poses the staff at LCS with a dual mission: stop the giraffe from grazing and control parasite levels to manage this issue. To address this problem, LCS adopted several new practices in the management of the giraffe. These changes help to curb the giraffes' grazing habit, make the pastures less habitable for *H. contortus* and reactively deal with the ramifications of *H. contortus* infections.

Unlike their wild counterparts, captive giraffe are not subjected to pressure from predators or competitive browsing. However, problems can surface as a result of their environment, as has been seen at LCS. As giraffe care professionals it is our duty to provide the best environment possible for the animals in our care and to promote naturalistic behaviors. This paper will discuss actions being taken both proactively and reactively to combat *H. contortus* in the giraffe collection at LCS and strategies to encourage more natural behavior in our captive giraffe.

Relevant Contributors: *Brenda Irvine, Curator; Dr. Elizabeth Hammond, DVM*

Keywords: *behavior, browsing, captive, de-worming, enrichment, giraffe, Giraffa camelopardalis, grazing, Haemonchus contortus, unnatural behavior.*

Giraffe Hoof Trimming Techniques Under General Anesthesia

Alexis Lécu, DVM
Paris Zoo, France

Although training of giraffe for progressive hoof trimming through use of proper chutes remains the best option, immobilization in sternal recumbency is sometimes still required to perform a corrective hoof adjustment at once. This presentation is based on a review of more than 32 giraffe anesthesia, among which 15 were done for hoof trimming.

Preparation of anesthesia location is of tremendous importance to withdraw all major causes of accident occurring during induction phase. Anesthesia protocol mainly relies on two different protocols: medetomidine / kétamine or xylazine then etorphine. When recumbent, positioning of animal should be done right after tracheal probing, with the aim of releasing four distal limbs for easy access, safely extending the neck and head, and prepar-

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ing the recovery so that standing up and subsequent first steps will be free of any obstacles.

Hoof trimming itself should be done following a determined pattern. Some basic cattle techniques can be applied, but, since there isn't any validation of these techniques applied to giraffes, use of radiographs and measurements are a good mean to reshape the hoof in the safest way. Since pattern is mostly decided upon P3 radiograph position, trimming could be performed quickly via electric grinder and appropriate **tools.** One of the drawbacks of recumbent trimming is the lack of control on ground support; hence, all angles/ measurements should be closely monitored all along the procedure.

Variations of hoof angles and length are likely to induce changes in foot support and gait, associated with digital ligaments stretched again and solar areas bearing new weight. Peri-operative mesotherapy and anti-inflammatory use can reduce painful effects of these adjustments. Reversal antidotes should be administered mainly through venous access to speed up recovery phase, to withdraw myorelaxation and reset proprioception when the giraffe initiates its standing-up sequence.

To assess best trimming methods, an ongoing study (2009-2010) is focusing on anatomical and physiological proprieties of giraffe's feet through dissections, imagery and live measurements. Results from this study could lead to changes in the goals and principles of giraffe hoof care.

***Keywords**: Hoof trimming, Giraffe, Anesthesia, Radiographs*

Immobilization and biochemical parameters in free ranging giraffe in Ruaha National Park, Tanzania

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[2]*Ruaha National Park,Tanzania*.

A total of 12 large adult giraffe (3 females and 9 males) were immobilized using 18 mg etorphine. Animals successfully darted were left until the level of immobilization was sufficient enough to restrain them by ropes and brought down by pulling or left to fall down on their own. The time to first effect indicated by female and male giraffe was 12.0 ± 1.40 and 8.13 ± 3.82 minutes, respectively. The running time was 17.0 ± 1.63 and 15.0 ± 5.90 minutes for females and males, respectively. The distances moved from injection time to recumbency was 2.2 ± 0.65 and 1.3 ± 0.8 km for females and males, respectively. The total down time was 11.5 ± 0.5 and 12.6 ± 6.0 minutes for female and male respectively. Partial reversal complemented with mechanical restraints was not applied but recovery was faster following administration of Diprenorphine. The animal neck was held by ropes to prevent hitting on the ground during attempts to wake up. During the entire immobilization period, nine animals survived while three died of different reasons that included general weakness and regurgitation, respiration compromise by poor positioning and failure to recover from immobilization after disappearance in thick vegetation.

Biochemical parameters were also evaluated and the mean values compared between female and males. The levels of haemoglobin, total cholesterol, HDL, calcium and acid phosphate did not significantly differ between female and male giraffes. However, the levels of WBC, LDL, triglycerides, uric acid, direct bilirubin, alkaline phosphates, and sodium were higher in females than in males while the levels of total bilirubin, SGPT/ALAT, SGOT/ AST, serum creatinine, serum protein and potassium were higher in males than in females. The study recommends the use of Etorphine-HCL at a dose of 18mg for field immobilization of giraffe in Tanzania irrespective of sex.

***Keywords:** Giraffe, Immobilization, Etorphine, Ruaha, Tanzania*

Reproductive Investigations of Giraffe (*Giraffa camelopardalis rothschildi*) Using Fecal Hormones and Ultrasonography

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The African Lion Safari herd of giraffe was trained to allow us to perform the complete maintenance of herd health as well as to investigate giraffe reproduction in a more in-depth and meaningful way. Giraffe were conditioned to stand in a physical restraining device for extensive periods of time and submit to various routine and novel procedures without the use of chemical immobilizers. Oral, injectable and topical medications are easily administered. Measurements, as well weights (daily or weekly) are taken. Another goal we accomplished was maintaining the hooves of the animals with minimal stress using traditional manual tools as well as with electrical implements.

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Training allowed investigation of giraffe reproductive cycles as well as fetal development. Daily fecal samples were taken rectally as well as serial blood draws to monitor hormone levels. Both males and females were also trained to submit to transrectal ultrasounds to identify reproductive structures and follow follicular development. In addition fetal development was monitored including both 3D and 4D scans.

Knowledge of reproductive parameters, morphology of the urogenital tract and correlation of ovarian events with fecal hormone profiles was consolidated. Changes in ovarian state of healthy giraffes in four states: immature, mature cycling, pregnancy and post-partum were followed. Immature giraffe showed multiple follicles, large ones luteinized forming pseudo-corpora lutea. In mature females one follicle became dominant reaching an ovulatory diameter of 1.85 + 0.89cm. After ovulation a corpus luteum rapidly forms reaching an average diameter of 3.3 + 0.24cm. Pregnancy is detectable at 28 days post copulation by an embryonic vesicle and the embryo is detected by day 37. Male accessory sex glands are similar to other ruminants.

Hormone values for fecal progestin in cycling giraffe did not follow the classic patterns of follicle development, ovulation and luteogenesis. The giraffe ovulates (with estrus occurring) during the start of the follicular phase, not mid to end as in other domestic and wild ruminants. Furthermore the corpus luteum of the previous cycle is forming at the same time as the next dominant follicle.

This information is advantageous for urogenital heath and breeding management.

Keywords: *giraffe, ultrasound, progesterone, estrogen, ovaries, corpus luteum, follicle, estrous cycle, breeding*

Starting From Scratch: Building a New Giraffe Facility From the Ground Up

Melissa McCartney
Sacramento Zoo

Staff at the Sacramento Zoo were provided the unique opportunity to design a new giraffe barn, exhibit, and public viewing deck from scratch - incorporating all the elements keepers felt necessary to providing top-notch care to their animals (and updating the current husbandry practices to meet new standards of care). Before breaking ground on the project, zoo professionals consulted with other giraffe caretakers, networked with other zoos and facilities, and sought advice from the list-serves and online communities in order to design their ideal facility. The construction process itself was challenging in that the new facility was built over the old one; the giraffes and keepers lived each day on the construction site and the animals were forced to adapt to the chaos of demolition and rebuilding as they were moved about the site as new structures were completed. The entire process depended on lots of networking, patience, on-the-fly operant conditioning, and [most importantly] dedicated fund-raising to meet budgetary goals without sacrificing any amenities in the zoo's 0.3 Reticulated Giraffe's new state-of-the-art home.

This paper will examine the design and construction process as well as how the new "Tall Wonders" facility functions – the highlights and setbacks of each step, what staff would do differently and what has been a success, and the impact on the giraffes.

Giraffe of Niger conservation

Jean-Patrick Suraud[1], Pierre Gay[2]
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[2]*Bioparc Zoo de Doué la Fontaine, France*

Limited research has been undertaken on giraffe across Africa. The Niger government and IGWG identified that *G. c. peralta*, the most endangered giraffe in Africa, is a high conservation priority supported by the IUCN Species Survival Commission.

The giraffe of Niger are genetically unique: a 2006 study showed the last of the *peralta* subspecies only reside in Niger. Additionally, a 2007 study strongly suggests that giraffe are not a single species (and nine subspecies) but at least six species. If this information is confirmed, the giraffe of Niger would likely be elevated to species level and critically endangered.

In 1996, the last 50 giraffes of West Africa were restricted to an area close to Niamey, Niger. They are a unique population in that they live outside of protected areas, have no natural predators, and cohabit with local people and their livestock. This provides an interesting model to better understand management of human/animal conflicts across West Africa.

ASGN, Association for Saving the Giraffes of Niger, focuses on sustainable human development with the conservation of giraffe the platform upon which the association promotes sustainable development and maintains the ecology of the giraffe zone in southern Niger.

Even if this unique population - 220 in 2009 - is still threatened because of habitat destruction, ASGN, with the help of its European representative and historical

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fundraiser, Bioparc Zoo de Doué la Fontaine, shows that in an underdeveloped country such as Niger, wildlife conservation is possible with local support and education.

Jean-Patrick Suraud, scientific advisor of ASGN is realizing field researches about population dynamics, home range, food quality, and genetics. The first results prove that since 1996, the giraffe of Niger have the world record growth rate with around 13% of increase per year. The genetic study, begun in 2009 using a suite of microsatellite loci could potentially allow us to construct the genealogical or pedigree tree of this population. In order to have a better understanding of giraffe seasonal/daily movement, 8 giraffes will be equipped by satellite collars in 2010.

Keywords : *Giraffe, peralta, Niger, conservation, local development, population dynamics, home range, genetics*

Examination into the use of serologic biomarkers Leptin, IGF-1 and Insulin: Glucose in the assessment of Giraffe health

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[2]*Department of Anthropology and School of Biomedical Sciences, Kent State University*
[3]*The Cleveland Metroparks Zoo*

IUCN states that the greatest threats to wild giraffe populations are habitat degradation and poaching. As wild giraffe populations come under greater pressure from these risks, developing accurate parameters for measurements of giraffe health becomes even more vital not only for our captive population but for long-term management and conservation of the remaining wild populations.

Prior studies suggest that the biomarkers leptin and IGF-1 in conjunction with insulin can be used as an accurate means of assessing body condition in some ruminants. Leptin, an exocrine hormone secreted by adipose tissue, has been found to increase with high planes of nutrition in multiple species, while a significant decrease has been noted with fasting or animals in poor nutritional states. IGF-1 has been shown to increase with an increasing amount of adiposity.

This presentation aims to (1) evaluate reference intervals generated from apparently healthy free-ranging giraffe from South Africa to that of the US captive giraffe population and (2) use stored serum from captive animals that underwent necropsy to evaluate leptin, IGF-1, and insulin:glucose levels in those with serous atrophy of fat and those without.

Five Years of Giraffe-Centred Research at the East Midlands Zoological Society: Twycross Zoo. Where have we been and where do we go?

Paul Rose[1], Sarah Roffe[2]
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[2] Twycross Zoo

Twycross Zoo has held giraffe since 1964. Working with researchers and students from Sparsholt College Hampshire, Twycross-specific and general 'giraffe-focused' questions have been identified and answered. This paper covers areas of particular research to highlight gains in husbandry knowledge as well as identification of new investigative areas to explore.

'Browse' provision to giraffe is an important part of management; this research has shown that giraffe show preference for some browse types. Actual nutritional benefit of browse appears poorly understood. Proposed future work would determine specific nutritional benefits of browse at a physiological level to provide quantifiable evidence for the feeding of particular tree species. Increased assessment of biologically-relevant enrichment can provide inspiration for refinement to enrichment practice to make greater beneficial impacts upon captive time budgets. Time budgets more akin to wild animals are seen when diets are manipulated to promote rumination. Enrichment evaluated at Twycross includes nutritional, sensory and occupational forms, all implemented with varying degrees of success but providing areas to expand enrichment ideas into. This research shows that despite preference for some enrichments, latent effects can be limited.

Similarly, measurement of responses to visitors and to training has found some weak relationships between manipulated variables. For example, increasing visitor numbers has no effect on use of enrichment but may impact on some performance of key maintenance behaviours ($P<0.05$); indeed findings may suggest that visitors can promote similar anti-predatory responses as seen in the wild. Success of target training sessions appears not to be affected by time of day or crowd size, but by prevailing weather conditions; something to be factored in to planned training routines.

Zoos are focusing more and more on 'evidence-based' husbandry practice; thus the overall summary of this research identifies the following points for future extension:

- Analysis of dietary components that in-

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fluence rumination.

- Full nutritional analysis of browse species fed to giraffe to ascertain nutrient availability and correlate with uptake.
- Determination of suitable browse to be harvested and fed in place of the currently best available forage.
- Highlighting the effects of zoo visitors on overall herd behaviour to enable minimisation of negative effects.
- The use of training with different individual giraffe at different times to fully evaluate when individuals are most tractable to conditioning.

Evidence collected from the animals is required to direct future change to make marked impacts on welfare. To date, it appears that small changes to giraffe husbandry can yield big differences to welfare and health but, at the same time, there is still a lot more evidence to collect before all questions have been answered.

Keywords: *research, husbandry, enrichment, nutrition, training, behaviour and welfare*

The Cincinnati Zoo and Botanical Garden's Masai Giraffe Hand Feeding program: from Concept to Success

Eric Duning
Cincinnati Zoo and Botanical Gardens

On June 6, 2008, the Cincinnati Zoo opened its new giraffe exhibit: "Giraffe Ridge." The zoo's management made the decision to establish a program that would give the public the opportunity to hand feed the five new Masai giraffes. The exhibit deck was built to facilitate this idea. Since the giraffes arrived less than a month before the opening, implementing the training program would be a challenge.

The training process during the first summer became a collaborative effort involving not only the keeper staff, but the zoo volunteers and the public as well. The zoo patrons were given a chance to offer food items to the giraffes under keeper supervision. This allowed for the testing of different food items, conditioning the giraffes to accept food from zoo guests, and offering the zoo staff a preview of how the future feeding would be operated. Over the course of the summer, three of the five giraffes began to readily involve themselves in the feedings.

The training continued during the winter months when the giraffes were kept indoors. The keeper staff were able to refine the feedings to a single food item; rye crisp crackers. Also, a few modifications to the exhibit were done which aided in bringing the giraffes closer to the patrons and allowing for the giraffes to become more comfortable. There are still a few goals that need to be reached, but the zoo now has a hand feeding program with 100% giraffe participation.

The zoo has now started to reap the rewards of a successful hand feeding program including additional revenue and a more fulfilling visitor experience. The implementation of the hand feeding program has been a learning experience for all involved.

Analysis of the fine structure of oral activities in captivity unravels control of food intake in giraffe (*Giraffa camelopardalis*)

Sonja Sara Schmucker, Dr. Lydia Kolter, and Prof. Dr. Gunther Nogge
Cologne Zoo

Giraffes in captivity often perform oral disturbances, comprising excessive tongue playing and object licking. As these highly specialized ruminants are adapted to browse by intense lip and tongue movements, their adequate performance might be critical for the development of oral disturbances. Hypothesizing an endogenous sollwert of tongue movements, the influence of browse offered in summer on oral activities of four adult female giraffes was examined and the fine structure of tongue movements was analyzed. Daytime activity budgets were recorded by scan sampling and instantaneous recording at 40s intervals. Tongue movements/minute and the associated grades of tongue contractions as well as elongations while feeding or performing oral disturbances were analyzed from video recordings by focal sampling and continuous recording.

The frequency of oral disturbances differed individually, ranging from 4.6% to 30.7% per winter day, and decreased significantly for all giraffes in summer when feeding on browse. The total proportion of feeding on roughage did not differ between the seasons indicating that the time spend on feeding is not pivotal itself. Feeding on browse or hay from closed narrow mashed baskets required significantly more tongue movements/minute than feeding, e.g., hay from open baskets. Moreover, feeding on leafy trees required to 89% strong tongue contractions compared to, e.g., 50% on leafless trees. Thus, different food and presentation forms need different manipulation and therefore may provide varying amounts of oropharyngeal stimuli. Oral disturbances were found to resemble normal feeding activities qualitatively as well as quantitatively. The average number of total tongue

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movements/day/giraffe did not differ between the seasons. Normal feeding behavior, however, contributed significantly less in winter than in summer and oral disturbances significantly higher in winter than in summer to this daily activity.

Derived from these findings a control circuit explaining the control of food intake can be suggested. It seems likely that giraffes evolved an endogenous sollwert of tongue movements, which might function as an additional saturation signal. The results emphasize the importance of appropriate food and feeding techniques for captive giraffes as easy accessible food does not require adequate oral manipulation while feeding and consequently oral disturbances serve to compensate the emerging deficit of tongue movements.

Keywords: *oral disturbances, food intake control, feeding, oral activity*

Clinical Issues Associated with Nutrition and Feeding in Managed Giraffe

Ray L. Ball, DVM, MRCVS,
Busch Gardens

Giraffe in managed facilities share many other potentially nutritionally related health concerns with other ruminant browsers, but also have a specific set of maladies that are likely related to nutritional inadequacies. Peracute mortality, chronic wasting, energy malnutrition, pica, mortality related to cold stress, pancreatic disease, intestinal parasitism, hoof disease, urolithiasis and neonatal health concerns may all result from problems associated with traditional diets, especially high levels of concentrates with associated high starch content, low physically effect fiber, and low overall feed intake. Rumen pathology is the proposed basis for numerous secondary conditions.

Peracute mortality, chronic wasting, neonatal health concerns and cold stress are well documented in the literature and anecdotally and appear to be a world wide problem related to energy malnutrition. Hypoglycemia has been proposed as the proximate cause of PMS and confirmed by recent cases summaries, but hypocalcemia may also be an important cause. It has been estimated that wild giraffe have nine times the absorptive capacity for volatile fatty acids (VFAs) than the captive giraffe examined. Volatile fatty acids (VFAs) are essential for ruminants in that they provide up to 90% of the available energy and are directly absorbed through the rumen mucosa. Retrospective assessments have been performed for cases at BGT and suggest a rumen developmental problem.

Urolithiasis, pancreatic disease, and dental disease, pica or oral stereotypes, gastrointestinal parasitism, and abnormal hoof growth/laminitis are all additional clinical problems noted in captive giraffe. Consumption of high levels of concentrates is a known cause of ruminal acidosis in domestic ruminants, affecting intake, feed digestibility, milk production, hoof health, and overall animal health. The reduction of chewing times may lead to oral stereotypes (pica) in an attempt to buffer the rumen. The reduction in chewing and ruminating also alters the salivary recycling of phosphorus, thus allowing serum levels of P to elevate and contribute to uroliths formation. A central hypothesis is that dietary induced rumenitis and resulting changes in physiology are central to the disease syndromes seen in captive giraffe.

Keywords: *giraffe, sub-acute rumen acidosis, peracute mortality, starch, urolithiasis, neonatal, physical fiber*

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Keeper Assisted Rearing of a Giraffe Calf

Jeremy Dillon and Jason Bredahl
Cheyenne Mountain Zoo

On December 17, 2007, at Cheyenne Mountain Zoo a cow gave birth to her first calf. It was a male, weighing in at 142 lbs. Staff discovered the neonate a few hours after being born, however it was apparent that he was having a hard time overall. He wasn't making real attempts at standing, his eyes were blood shot and his lower lip was swollen. It appeared he had lost strength therefore keepers helped him stand up. After 45 minutes he was standing and walking on his own (for the next two days keepers helped him stand up and lie down until he was able to do so, on his own). The next hurdle was nursing which was hindered by his swollen mouth, mother's small teats and her tail slapping when he did attempt to nurse. After hours of unsuccessful nursing attempts it was decided by staff that supplementing milk was necessary. Through hours of trial and error staff was able to get the calf to feed from a bottle.

Due to the mother's calm demeanor we decided our ultimate goal was to have the calf nurse from his mother. To achieve this we began desensitizing the mother to allow us to milk her, in an effort to keep her from drying up. During feeding times we would simulate normal nursing by having the calf walk over to his mother and we would position the bottle beneath her, near her teats. The calf would suckle on the bottle for a little bit and then we would use the bottle to guide him to the teats. This gave the calf opportunity to explore the udder, teats and make nursing attempts during bottle feedings. Over a few days this technique began to work. We started to notice a decrease in the amount of formula he would drink and started observing more substantial nursing bouts with his mother in between bottle feedings. After a week of supplemental feedings we were able to phase out the bottles completely. Today he is thriving at the North Carolina Zoological Park.

Keywords: *Cheyenne Mountain Zoo, giraffe, calf, assisted rearing, nursing*

Reticulated Giraffe: the Behavioural and Population Ecology of a Disappearing Megaherbivore

John Doherty
School of Biological Sciences, Queen's University, Belfast

The reticulated giraffe *Giraffa camelopardalis reticulata* is one of nine currently recognised subspecies of savannah giraffes. It is not the least numerous but, with a decrease in numbers of at least 80% over the past 10 years alone, it is probably the subspecies in most rapid decline. By comparison with other megafaunal taxa, giraffes have been relatively little studied and most investigations have focused on the southern of two major clades. There are no published studies of the biology or ecology of reticulated giraffes, which may represent the northern clade's earliest discreet lineage. This project aims to address the paucity of information on reticulated giraffes by investigating aspects of the animals' behavioural ecology and of the population processes operating upon them. Social network analysis will be coupled with analysis of DNA and reproductive hormones to interpret observed dispersion patterns; bioacoustics will be employed to investigate the possible use of infrasound as a medium of intraspecific communication; movements, behaviour, energy expenditure and environmental parameters will be measured using remote-sensing devices; and a combination of telemetry, direct sampling and a collaborative network of observers will be used to explore the demography of the population as a whole. It is hoped that the results will inform the conservation and management of those reticulated giraffes that remain.

Keywords: *bioacoustics, demography, Giraffa camelopardalis reticulata, remote sensing, reticulated giraffe, social network analysis*

Implementing a Safe and Healthy Public Giraffe Feeding Program

Amber Eagleson
Fort Wayne Children's Zoo

Public giraffe feeding programs are becoming increasingly popular. They provide each visitor with a personal, up-close, and safe experience with one of the most regal and magnificent animals. These programs serve as an educational opportunity and hopefully spark interest in the conservation issues that surround these creatures. Also, these feeding programs bring additional revenue for their institutions. The Fort Wayne Children's Zoo (FWCZ) decided that including a public giraffe feeding program in their 10-million dollar African Journey expansion project would be advantageous for the community and zoo.

For the program to succeed two key issues needed addressed. First, it was essential that the platform be safe for the giraffes, patrons, and zookeepers. Second, it was vital that we select a food item that the giraffes could ingest in large quantities but that would not cause digestive problems. The food needed to be palatable for the giraffes, easy to manage for the zookeepers, and be nutritionally appropriate. The

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FWCZ staff overcame both key issues, leading to a successful first season for our giraffe feeding program.

Over 612,000 visitors were given the opportunity to feed a giraffe and come face-to-face with one of the world's most remarkable creatures. All of this was accomplished while providing a safe and beneficial atmosphere- for the visitors and the giraffes.

Keywords: *giraffe, public, feeding, Fort Wayne, zoo, healthy, nutrition, experience, revenue, romaine lettuce*

Preparing to Anesthetize a Giraffe in a Confined Area

Nadine Lamberski, DVM, DACZM; Andy Blue
San Diego Zoo's Wild Animal Park

Planning and preparation are key components to a successful giraffe anesthesia. Since no two facilities will be exactly the same, it is important to understand the basic requirements of the work area as well as things to avoid. The substrate should create suitable traction to ensure adequate footing that prevents the animal from slipping. It should also be thick enough to cushion the animal when it falls. The area should be large enough (at least 20' in one direction) to accommodate the animal in lateral recumbency and to allow people and equipment to move safely around the animal. Two exits are desirable to prevent personnel from becoming trapped in the enclosure with the animal. Hazards such as hayracks and concrete drinkers should be removed or padded. Anticipate what might go wrong and how the staff should respond. Eight to ten people are necessary to position, roll, or move the giraffe as needed. Personnel should have duties assigned in advance to prevent chaos and to facilitate working simultaneously to keep anesthesia time to a minimum. Animals should be fasted when possible to reduce the risk of regurgitation. During anesthetic induction, the animal may fall over backwards, hit its head against the wall, splay, or even wedged itself into a corner and thus is unable to fall. Staff should be prepared to push, pull, or trip the animal (using ropes) to facilitate recumbency. Reducing stall size with hay bales and lining the walls with a few rows of hay bales may reduce trauma. A neck board is used to support the head and neck at a 45-60 degree angle. The neck must be kept flat and any kinks in the cervical vertebrae should be quickly remedied. The head should be maintained above the level of the rumen and should be supported immediately once the animal goes down. Problems during recovery are similar to induction. Giraffe usually stand with the rear limbs first and they do need enough room to rock and roll sternal. Ropes and straps may be useful to prevent the animal from going over backwards until it regains its balance.

Keywords: *Anesthesia, Anesthetic induction, Anesthetic Recovery, Giraffe*

Using Operant Conditioning to Manage Giraffes at Binder Park Zoo

Brett Linsley
Binder Park Zoo

The use of operant conditioning, combined with a well designed restraint chute, has played a vital role in the successful management of Binder Park Zoo's reticulated giraffe herd.

This presentation will illustrate the restraint chute's capability to safely provide staff with 360 degree access to the giraffes. The versatility of the chute allows staff to perform a variety of procedures, including vaccinations, blood draws, hoof trims, radiographs, ultrasounds, hoof blocking, and a standing castration. However, the chute works only if the giraffes are willing to enter. The methods used to condition the giraffes to station in the chute will also be presented.

Giraffe immobilizations in a semi-free-ranging environment at Fossil Rim Wildlife Center

Cassie Peterson BS, Holly Haefele, DVM, Adam Eyres, BA
Fossil Rim Wildlife Center

Fossil Rim Wildlife Center is an 1800 acre conservation center, with a drive through component, located in Glen Rose, TX at the edge of the 'hill country'. The park is divided into several different pastures, and the giraffe pasture is approximately 380 acres consisting of steep juniper-covered, rocky hills and flat grassy valleys, spotted with various tree species and dead-fall. Seasonal creeks run through it, which create small ravines, and there are two approximately 1/2 acre ponds. Weather permitting, the giraffes have access to this entire pasture, along with other species: European red deer, Grant's zebras, aoudad, Arabian oryx, fallow deer, sika deer, axis deer, white-tailed deer and bontebok. Their roughly 1/2 acre yard and barn are situated in the valley. Occasionally, immobilizing one of the giraffes is necessary for reasons such as hoof trims, contraception procedures, and wound care. The giraffes are not chute trained, and because of Fossil Rim's relatively unique layout as described above, a different approach to immobilizations is used than at most zoos.

Giraffes are immobilized using a combination of ketamine and medetomidine,

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which is administered by dart via a Dan-inject gun, and supported by guaifenesin and local anesthesia if the procedure will be painful. Staff and veterinarians monitor induction, and with vehicles, persuade the animal to "go down" in a safe part of the open pasture, away from obstacles and water. Once the giraffe is down, staff vehicles encircle the animal and padded boards are placed under its neck and laid at approximately 50° against one of the vehicles. During the procedure vital signs are monitored, oxygen is administered, and upon completion, animals are manually placed into a laterally recumbent position. All extraneous persons and vehicles are moved away, but several husbandry staff remain stationed on the animal, holding its head and neck down to prevent it from injuring itself while the reversal drugs take effect. Once the animal is deemed alert and coordinated enough, these staff quickly let go of the giraffe and move out of the area. Generally, the animal stands and walks away within 30 minutes of receiving the reversal drugs. The giraffe is then monitored for approximately 30 minutes to ensure it is fully recovered.

Keywords: *immobilization, semi-free-ranging, Daninject, narcotics, reversal, ketamine, medetomidine*

Counting giraffes: a comparison of survey methods for Serengeti giraffes

Megan Strauss
University of Minnesota

Estimating animal abundance is a goal of ecology and conservation biology. Ecologists are interested in explaining temporal and spatial patterns in abundance, while conservation biologists use abundance estimates to monitor changes in animal populations, to model population viability and to assess the success of management strategies. Several methods have historically been employed to measure giraffe abundance including aerial counts, systematic road surveys, and catalogues of individually identified giraffes. Given widespread declines in giraffe numbers, it has become important that we establish valid and reliable methods of surveying giraffe abundance. The objective of this study is to compare several survey methods including aerial total counts, vehicle-based mark-recapture sampling and camera trapping. The survey work is conducted in two areas of Serengeti National Park in Tanzania. In the Kirawira study area (210 km^2), vehicle-based mark-recapture and aerial counts are used. In the Seronera study area (240 km^2), vehicle-based mark-recapture, aerial counts and camera trapping are used. To assess the validity of the respective survey methods, results from the Seronera study area will be compared with a known population of individually identified giraffes. In addition to statistical considerations, the logistics (manpower, time and equipment needs) and cost of the various survey methods are contrasted. Progress and preliminary results are presented.

Keywords: Giraffe, Serengeti, population, abundance, survey methods, mark-recapture, aerial counts, camera trapping

Using Puzzle Feeders to Increase Natural Behaviors in Giraffe

Erin Teravskis and Kate Meinhardt
Nashville Zoo

An important goal for any good enrichment program is to increase an animal's natural behaviors while reducing or eliminating stereotypy. In *The Behavior Guide to African Mammals*, Richard Estes indicates that giraffe in the wild spend up to 72.4 % of the daylight hours feeding depending on the season and the sex of the giraffe. Although giraffe in our care do not need to spend as much time foraging due to their diet of pelleted grain, they still have a strong foraging instinct and if this need is not met stereotypic behaviors may arise. Giraffe in zoos have been observed licking inappropriate materials and pulling out and/or consuming their own or other giraffe's tail and mane hairs.

Stereotypic behaviors can be reduced by providing ways to increase appropriate foraging. At the Nashville Zoo, in addition to feeding out browse multiple times a day, we use seven different types of puzzle feeders with our 1.2 Masai Giraffe. The puzzle feeders are especially important in the winter, when there is less browse available due to Tennessee's colder climate. Each feeder has its own advantages and disadvantages. Some have been inexpensively constructed from easily obtained materials such as PVC pipes and water jugs. We will also offer additional tips on use and construction of these puzzle feeders with an emphasis on safety.

Keywords*:* *behavior, enrichment, foraging, giraffe, puzzle feeder, stereotypy, Nashville Zoo*

Giraffe Conservation Foundation
&
IUCN International Giraffe Working Group

1st 'Wild' Giraffe Indaba: 4 - 7 July 2011
Etosha Safari Lodge, Namibia

Giraffe: The Forgotten Megafauna

Hosted by the Namibia Nature Foundation

The Giraffe Conservation Foundation (GCF) together with the IUCN SSC ASG International Giraffe Working Group (IGWG) invites all scientists, students, wildlife managers, and decision-makers in the field of giraffe research, conservation and management to attend the first ever 'wild' giraffe Indaba (conference) in Africa at the Etosha Safari Lodge, Namibia, from **4 to 7 July 2011**, including a **half-day seminar** on **7 July 2011**: '*The Conservation and Management of giraffe in Africa – looking forward*'.

The venue, situated adjacent to the world famous Etosha National Park and approximately 400 km north of Windhoek, the capital of Namibia, is an appropriate setting for this valuable conservation event as the Namibian giraffe population continues to increase while others appear to be dwindling.

The theme of the Indaba is: **'Giraffe: The Forgotten Megafauna'**. Despite a general fascination for this species, giraffe have so far received little scientific attention and as such are truly Africa's forgotten megafauna.

A range of sub-themes have been proposed for the Indaba, however the event is open to new, innovative and interesting presentations and posters.

SUB THEMES

- ✓ Ecology
- ✓ Taxonomy and genetic structure
- ✓ Veterinary medicine
- ✓ Physiology
- ✓ Conservation management
- ✓ Captive management in support of the wild world

To find out more about the Indaba, please go online and download the conference package at: www.giraffeconservation.org

Or you can contact us directly at: giraffe.indaba@gmail.com

We look forward to seeing you all in Namibia in July 2011!