

# **Earthwatch Field Report 2003**

## **Namibian Elephant & Giraffe Trust**

PRINCIPAL INVESTIGATOR: **(1) Keith Leggett, Ph.D.**  
**(2) Julian Fennessy, Ph.D. candidate**

POSITION/TITLE: Researchers

AFFILIATION: Independent Researchers  
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PROJECT TITLE: A scientific and conservancy approach towards  
sustainable use management of elephants and  
giraffe in northwestern Namibia

RESEARCH SITE: Northwest Namibia, Kunene Region

START AND FINISH DATES: Team I: May 2 - 16, 2003  
Team II: May 19 - June 2, 2003  
Team III: June 23 - July 7, 2003  
Team IV: July 11 - July 25, 2003  
Team V: August 15 - 29, 2003

NO. OF EARTHWATCH VOLUNTEERS: 34

## **HIGHLIGHTS:**

(a) Elephant research concentrated on activity budgets, identification and monitoring, with the aim of improving the understanding of elephant in the target area. This information will be incorporated into long-term Ministry of Environment and Tourism (MET) and conservancy elephant monitoring programmes. Throughout the year the giraffe research focussed also on continual identification of giraffe, monthly and seasonal activity budgets, giraffe dna/systematics and population structure. This information will form the majority of the doctorate thesis which in turn will be incorporated into Ministry and CBNRM conservation management plans.

Information collected during this Earthwatch season will be combined with local knowledge as well as previous collected data to develop a sustainable management plan for elephants and giraffe in northwestern Namibia.

(b) During the 5 Earthwatch expeditions scientists and volunteers collected data on 6 previously unidentified elephants and collected over 75 hours of activity budgets and social interaction studies. Throughout the Earthwatch expeditions data collected resulted in the largest activity research on giraffe in Africa been completed. Furthermore, identification of animals increased by some 30 individuals.

These studies helped in the understanding of numbers, social interactions, daily activities, feeding regimes and movement of both elephants and giraffe in northwestern Namibia. While these animals have been photographed by just about every filmmaker interested in desert-dwelling animals, however very little research has actually been carried out and/or published.

## **OBJECTIVES**

(a) The elephants involved in this study are resident for the majority of their time outside of protected areas and within the communal areas. As populations of both man and elephant are increasing, the chances of increased confrontations are inevitable. Opportunities do exist for the mitigation of this conflict to the benefit of the local population, the environment and wildlife populations. The conservancy approach in Namibia however provides the vehicle for solutions to some of these problems. The rights of use over wildlife have resulted in a far more positive attitude towards elephants. Elephants are now potential assets to rural populations and benefits are being generated through consumptive and non-consumptive use of wildlife. This broadens livelihood options, increases rural job creation and skills, and provides communities with local development funds.

Historically there were probably between 2500 and 3500 elephants in the northwest. This population was hunted extensively by Boer hunters in the latter part of the 19<sup>th</sup> century without ever really decreasing their numbers (Viljoen, 1987). By the 1960's, the number of elephants in the north was estimated to be between 600-800 (Owen-Smith, 1970). This number was further reduced by war and drought to approximately 357 individuals by 1983 (Viljoen, 1987). Since this time, it is believed that elephant numbers have recovered to the 1960's levels. There have been two previous studies on these elephants (Viljoen, 1988; Lindeque and Lindeque, 1991). However these

studies were undertaken either during or very soon after a war (1975-1990). The disturbances caused by large numbers of troops driving around the Kunene district have no doubt impacted the elephants' movement and social behaviour. The area has entered a relatively peaceful period with only occasional poaching or problem animal incident (one elephant was shot at Omarumba in 1997). Disease is still a problem with one animal dying of anthrax in 1991/2 prompting the MET to immunise all other animals in the area. Therefore in light of the expansion of elephant numbers and relative stability of the area, movement and behaviour patterns need to be re-addressed.

The desert-dwelling giraffe population of Namibia's northwest is relatively unknown with minimal attempt previously to understand their unique ecology (population dynamics, seasonal movements, forage behaviour, forage chemical composition, flight behaviour). Possibly one of the most uniquely adapted species to this arid environment, giraffe have only been observed drinking on a handful of occasions in the Hoanib River, though free-water is available throughout periods of the year (Scheepers, 1992; Fennessy *et al.*, 2001). Therefore it is not only important to better understand their behaviour and forage adaptations but also incorporate gained knowledge into the established conservancy program. Giraffe, like elephant and rhino, are important attractions in this environment and increased information and awareness of their importance will add to the tourist experience and the greater rural knowledge. This research complements the on-going megafauna monitoring program in the northwest.

Shortridge reported the earliest giraffe densities and distribution in the Kunene Regions in 1934 of approximately 200 individuals. However, giraffe have roamed throughout the region and the Hoanib River catchment for a far longer period as rock paintings in the area have shown. Viljoen's estimated numbers of giraffe in the Kunene in 1982 (317) varied little from Loutit & Douglas-Hamilton's estimates in 1990 and 1995. Both ground and aerial methods were used during these surveys; therefore, estimates are useful only in providing a recent historical overview of the region, rather than for comparative studies. The MET estimated 548 giraffe residing in the Kunene Region in 1998 that represents a marked increase from previous reports, while the MET 2000 preliminary results indicated 100% growth from 1998. However, very little scientific data is available on the giraffe of this region.

(b) Specific objectives for this year's Earthwatch research season

#### Elephant Research Objectives

The following objectives were investigated during the 2002 season:

- a) the home ranges of elephants;
- b) resident times of elephants in various areas;
- c) Activity budgets and behavioural interactions;

#### Giraffe Research Objectives

The following objectives were investigated during the 2002 season:

- a) social structure and population dynamics;
- b) home range analysis and seasonal residence times of desert-dwelling giraffe;
- c) forage behaviour research, with particular focus on seasonal movements and forage use in relation to moisture content and chemical composition (forage collection);
- d) activity budgets, with respect to comparison with other studies in Africa; and
- e) flight behaviours and habituation to tourism (both long- and short-term exposed areas).

## **METHODS**

### **Elephant research methods and techniques**

Earthwatch volunteers were involved in characterising, investigating the social behaviour and collation of this data onto a database.

#### **Characteristics and Social Behaviour of the northwest Kunene Elephants**

It is possible to identify individual elephants by identifying the following characteristics (based on Laws, 1966):

- a) sex;
- b) tusks;
- c) ears;
- d) tail; and
- e) footprint patterns.

This information will be collected into photographic libraries housed in the conservancies and/or support agencies as appropriate. At the same time as the photographic library is being collated, the following aspects of population dynamics will also be studied:

- a) social behaviour, not only between members of the herd but also interaction with other family units;
- b) the population structure and age distribution within the herds;
- c) activity behaviour (i.e. feeding, sleeping, social interactions); and
- d) genetic linkage studies.

Results collected from these observations will be transferred to a specially designed 'Access' database for this study.

#### **Geographical Information Systems**

Distribution patterns of large mammals are strongly influenced by environmental parameters, human persecutions and other human activities. Their distribution can be regulated by extrinsic factors such as weather conditions, food supply, vegetation and human disturbance of the landscape. All data obtained during the study will be transferred to a GIS system for easy visualisation of results.

## **Giraffe Research Methods and Techniques**

Observations of giraffe ecology (population dynamics, structure, activity budgets, forage behaviour, flight and drinking behaviour) are being conducted over three distinct seasons; wet (January to April), cold-dry (May to August) and hot-dry (September to December) season. Giraffe were predominantly observed by vehicle, however at stages giraffe were tracked and observed on foot. Observations were undertaken throughout the day, though the majority of work took place during the early mornings and late afternoons.

It is possible to identify individual giraffe by identifying and cataloguing (digital photography) the following characteristics:

- a) sex;
- b) neck patterns (right and left);
- c) tail hair;
- d) horn structure;
- e) colouration; and
- f) scars.

Activity budgets were the predominant activity undertaken and this data will be compared across the seasons and to previous research undertaken throughout the continent. In addition, the following giraffe social and behavioural characteristics were investigated:

- a) Population Structure; seasonal herd composition of giraffe was recorded. Global Positioning System (GPS) co-ordinates were recorded for either the individual or herd observed, and plotted on a Geographical Information System (GIS). Individuals are further classified into class and age categories.
- b) Seasonal Distribution; seasonal distribution data of giraffe herds were collected using the GPS co-ordinates of where herds were observed. These data are stored on an Access database that is linked to a GIS program.
- c) Forage Behaviour studies; Plant materials from 5 species that are representative of giraffe feeding habits were collected along a distance distances from the coast to assess the moisture content and chemical composition of the leaves (protein, fibre, nitrogen, ash). This study will continue through next season and results only analysed on completion.

## **VOLUNTEER TASKS AND ACCOMPLISHMENTS**

(a) All 5 teams assisted the researchers in the following activities:

- (i) Assisted the researchers in finding and establishing elephant and giraffe locations and daily movements;
- (ii) Observing elephants and giraffes and identifying individual characteristics for the positive identification of individuals;
- (iii) Carrying out activity budget studies for both elephants and giraffes;
- (iv) Recording of field data sheets;

- (v) Entry of data collected in the field onto the data bases established by the researchers; and
- (vi) Establishing camp, packing of vehicles and assisting in food preparation.

(b) In any observation study the more people that actually assist in the observation the more detailed the study will be. In principle and in practice the volunteers assisted the researchers in their identification and observation studies. The volunteers make it possible for the researchers to observe more than one animal at any time and thus allow for a more detailed study. The researchers encouraged the volunteers to identify individuals and record the observations themselves. This resulted in many more hours of activity budget observations that could have been recorded by the researchers themselves. For example, over 75 hours of elephant and 300 hours of giraffe observation were recorded during the research season by volunteers. Elephant observations are particularly difficult as they are highly mobile and often move in and out of viewing range. The same is true of identification and data entry, the more people involved in the activity the higher the quality of the activity and final product.

It is always difficult for untrained people to standardise their research ideas with the perceptions of the PI's but after 2 days in the field the volunteers were collecting high quality data. This adjustment period is a learning phase that assists both the volunteers and researchers. The volunteers learn new activities and display great enthusiasm for the tasks while it helps the researchers to adjust there research plans and methods to be used by untrained personnel.

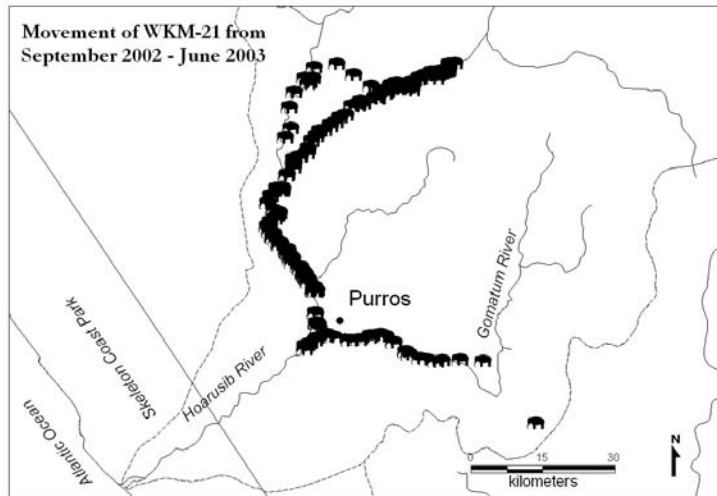
(c) The programme did not change significantly this year from the previous year. The end of fieldwork trip to Etosha National Park was considered part of the expedition rather than as an extra activity. This gave the volunteers a better appreciation of the wildlife and surrounding ecology they had observed in the northwest. The objectives of the research did not change through out the project.

## **RESULTS**

### The elephant study

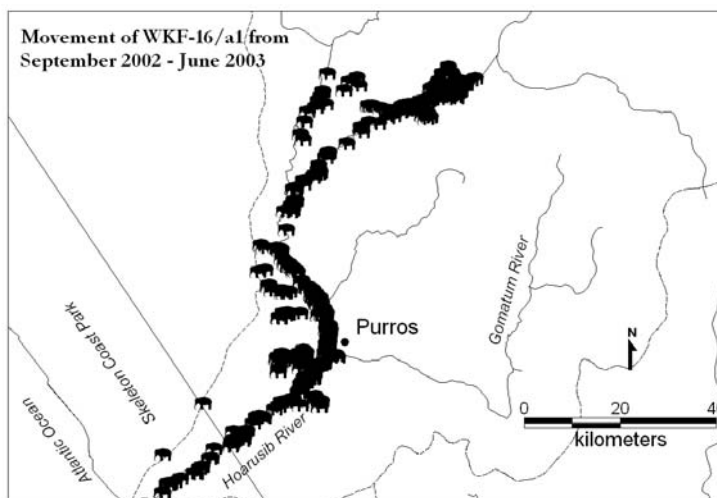
In late September 2002, funded by a personal donation by an Earthwatch volunteer, 8 elephants (and 4 giraffe) were GPS collared in the research area. The following results are a summary of four desert-dwelling elephants that were regularly seen by Earthwatch volunteers.

## WKM-21



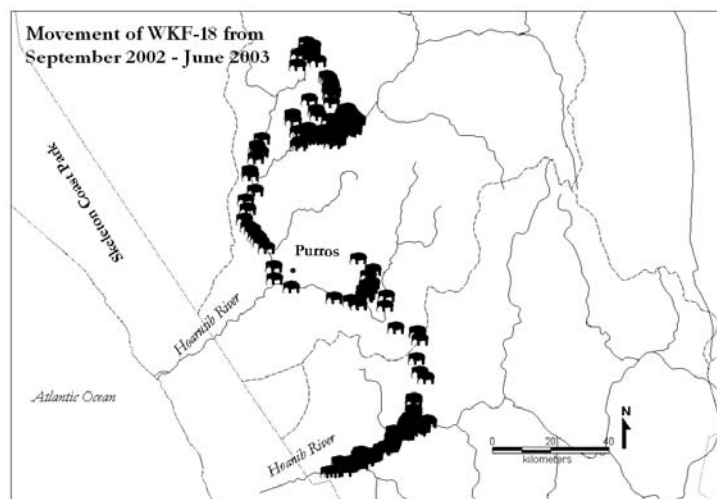
From October to December 2002, WKM-21 moved down the Gomatum River to the junction of the Hoarusib and Gomatum Rivers where he stayed for several days. Then moved upstream to approximately 20km from Purros where he spent the majority October and November. After the first flooding of the Hoarusib River (3<sup>rd</sup> December 2002), WKM-21 moved further upstream along the Hoarusib River toward Opuwo. In the January to March 2003 period, WKM-21 moved twice between the upper reaches of Hoarusib to the lower end of the Gomatum Rivers. Each of these moves WKM-21 covers over 150km in total distance. This period saw the greatest daily movement of 12.1km. WKM-21 spent all of April and on until the 19<sup>th</sup> May 2003 in the upper reaches of the Hoarusib River. His collar failed on this date and since this time data has been unavailable. His average daily movement was 7.2km and his home range for the nine months (until the failure of the collar) was approx. 3200km<sup>2</sup>.

## WKM-16/a1



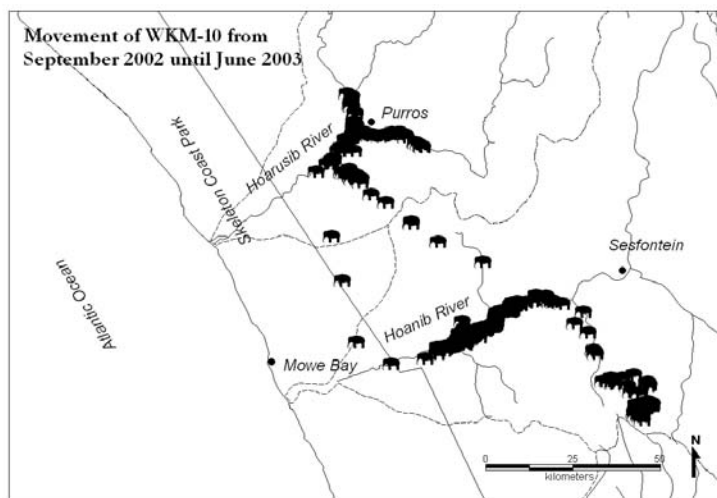
During October to December 2002, WKF-16/a1 and his family unit stayed in the Hoarusib River and moved along the river between 20km upstream and 30km downstream from Purros. The herd movement has ranged from the hills to the north of the Hoarusib River and within 5km of the coast. WKF-16/a1, spent January in the western section of the Hoarusib River between Purros and the coast. In February, WKF-16/a1 and the family unit moved from within the Skeleton Coast Park (SCP) to approximately 80km upstream from Purros and approximately 40km in a straight line from Opuwo (a total move of approximately 120km). From March until June 2003 WKF-16 remained 80km upstream from Purros in the upper tributaries of the Hoarusib. WKF-16/a1's daily movements have been small of the order of only 5-7 km and his home range for the last nine months was approximately 4122km<sup>2</sup>.

### WKF-18



After the collaring, WKF-18 moved immediately to the Hoanib River where she and her family unit spent October to December 2002. The migration route to the Hoanib River initially followed the Gomatum River, crossing the Obias Plains, then into the Gunameb River before entering the Hoanib River at the Gunameb poort. WKF-18 spent January 2003 in the Hoanib River between the Mudurib River and the Skeleton Coast Park. On the 2<sup>nd</sup> of February 2003 WKF-18 left the Hoanib River and returned to the Hoarusib River via the Gomatum River and the Obias Plains arriving around Purros on the 12<sup>th</sup> February 2003. This was the same route that WKF-18 and her family unit used in October 2002 when moving from the Hoarusib to the Hoanib River. WKF-18 and her family unit continued moving to approximately 80km upstream from Purros, where they have remained from March until June 2003. Her daily movements have been between 3-27km and her nine-month home range was 6560km<sup>2</sup>.

## WKM-10

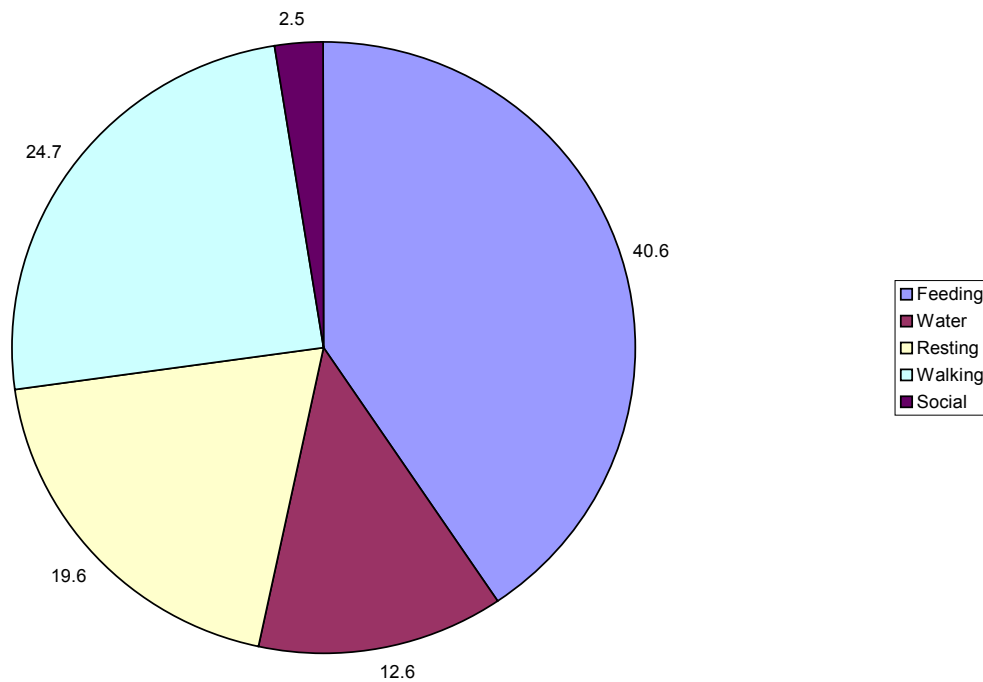


On the 28<sup>th</sup> October 2002, WKM-10 began his migration to the Hoanib River. Initially, he crossed the Girribus plains through to the top of the Obias River, where he spent a day, then followed the river to its junction with Hoanib River, arriving early in the morning on the 30<sup>th</sup> October. He then turned east and made his way to the Dubis wetlands where he spent November and December 2002. WKM-10 used a completely different migration route than WKF-18. During the January to March 2002 period, WKM-10 remained within a radius of 20km around the Mudurib River and artificial water point. The rains of mid-April coincided with his musth period and he left the Hoanib River on the 14<sup>th</sup> April 2003 and followed the other family units to the plains south of Sesfontein. He spent nearly a month in the southern area foraging in the Etendecka Mountains before returning to the Hoanib River briefly, before setting off for the Hoarusib River. He used a completely different route to return to Hoarusib River, preferring this time to enter the Skeleton Coast Park before turning north and entering the Hoarusib River approximately 40km from the coast. He was observed to be in musth from the 7<sup>th</sup> May until the 22<sup>nd</sup> June 2003. His daily movements have been between 3-32.6km and his nine-month home range was approximately 5200km<sup>2</sup>.

### ACTIVITY STUDIES

Activity budget studies are currently being undertaken and only preliminary analysis has been undertaken. These studies also include behavioural and social interactions as well as current herd associations.

Preliminary results:



Diurnal activity (as a percentage) of elephants in Northwestern Namibia.

While only preliminary data it can be seen that elephants spend the majority of their time feeding or walking between feeding areas and water. Resting also makes up a significant part of their time while water activities (drinking, wallowing or dust bathing) a lesser amount. Social activities occupy only a small fraction of the total activity time.

**THE GIRAFFE STUDY**

Identification

Throughout the past year the classification and identification of giraffe ( $n=122$ ) in the Hoanib, Hoarusib and Khumib Rivers has been invaluable in understanding the monthly and seasonal movements of individuals. Furthermore, a greater understanding of population structure, age and sex ratios, social interactions and bonds has become evident, though results are still in early analysis phase.

- Hoanib River – 71 giraffe – 2 unidentified (39 Males, 30 Females and 2 Juveniles)
- Hoarusib River – 38 giraffe (27 Males, 9 Females and 2 Juveniles)
- Khumib River – 13 giraffe (6 Males, 6 Females and 1 Juvenile)

The continued use of digital photography and identifying individual pelage patterns and colour, size, tail length and horn structure, field and database files have been the basis for recognition.

### Movement and spatial patterns

Four giraffe were collared in the study area, two in the Purros and Hoarusib River area on the 28<sup>th</sup> September 2002 and two in the lower Hoanib River on the 30<sup>th</sup> September 2002. The movements of collared giraffe No.3 (Picasso) and No.4 (Andy) for October to December 2002 are illustrated below. Collar No.1 and 2 (both collared in the lower Hoanib River) worked initially after being fitted, however, problems arose early and obtaining regular fixes from these collars proved difficult.

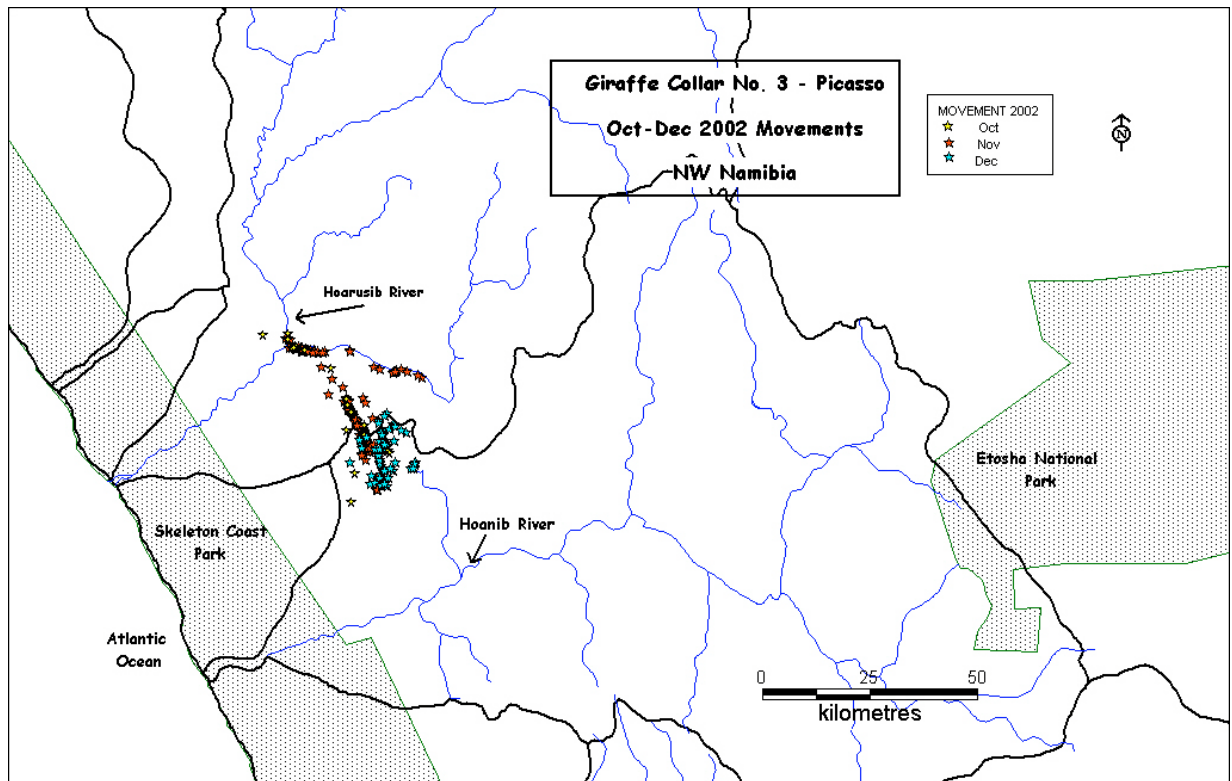
In the past six months all collars have ceased to work using the GPS system though all are functional using ground telemetry. Location data has continued to be gathered using the telemetry however, the data is greatly reduced when compared to that obtained from the GPS uplink. Furthermore, Collar No.2 has recently been able to lose/drop its collar and hopefully by finding it we can decipher whether the problem was mechanical, design or a combination of both. As these are the first GPS collars designed for giraffe it is expected that teething problems would occur, and though initially assumed to be a design fault it most likely is a combination of problems. The units have been assumed to not be calibrated correctly so again only by obtaining the faulty collars can any speculations be justified. It is expected that in the next quarter the remaining three collars be removed from the giraffe so as to better understand the problems which prevailed and for aesthetic and reduced scientific impact reasons.

#### Collar No.3 – Picasso

Collared at: Hoarusib River

Date of Collaring: 30<sup>th</sup> September, 2002

Collared giraffe No.3 spent the majority of October and November moving back and forth between the Gomatum River, tributary of the Hoarusib River, and the Okongwe area to the south, northern ephemeral tributary of the Hoanib River. In December it did not move back to the Gomatum River rather made use of the seasonal forage in the Okongwe area. With the onset of the rainy season eminent future movement will be interesting.



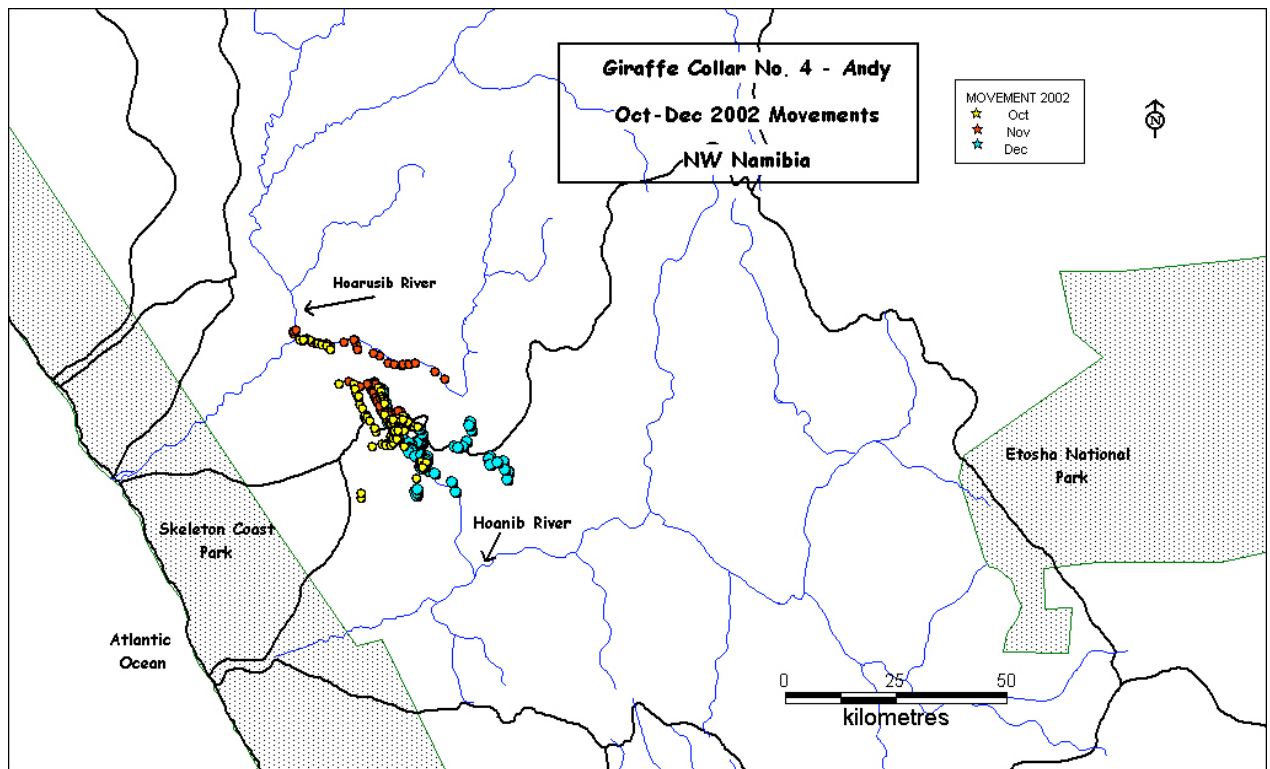
Movement of Collar No.3 (Picasso) from October to December 2002

#### Collar No.4 – Andy

Collared at: Hoarusib River

Date of Collaring: 30<sup>th</sup> September, 2002

Collared giraffe No.4, similarly to collared giraffe No.3, spent the majority of October and November moving back and forth between the Gomatum River and the Okongwe area to the south. However, it ventured both further east and southwest on occasions, possibly in search of seasonal forage. In December it also did not move back to the Gomatum River preferring the seasonal forage of the Okongwe area, this month venturing further south and southeast. Similarly, with the onset of the rainy season eminent future movement will be interesting.



Movement of Collar No.4 (Andy) from October to December 2002

Movements and spatial patterns of other giraffe in the study area have provided some very interesting movement behaviour that was previously only assumed for elephant. At least 10 individuals, including the collared giraffe No.1 (not illustrated), males and females, have been observed moving back and forth between both the Hoanib and Hoarusib Rivers – a distance of 70-80km. This data may in time prove to show that these giraffe have one of the largest home ranges of all giraffe though increased sightings are needed. On one occasion a female was observed just to the south of the Hoarusib River in the early afternoon by one of the researchers and then the next morning it was observed by the other researchers in the Skeleton Coast Park section of the Hoanib River, a movement of some 60km to the south over night.

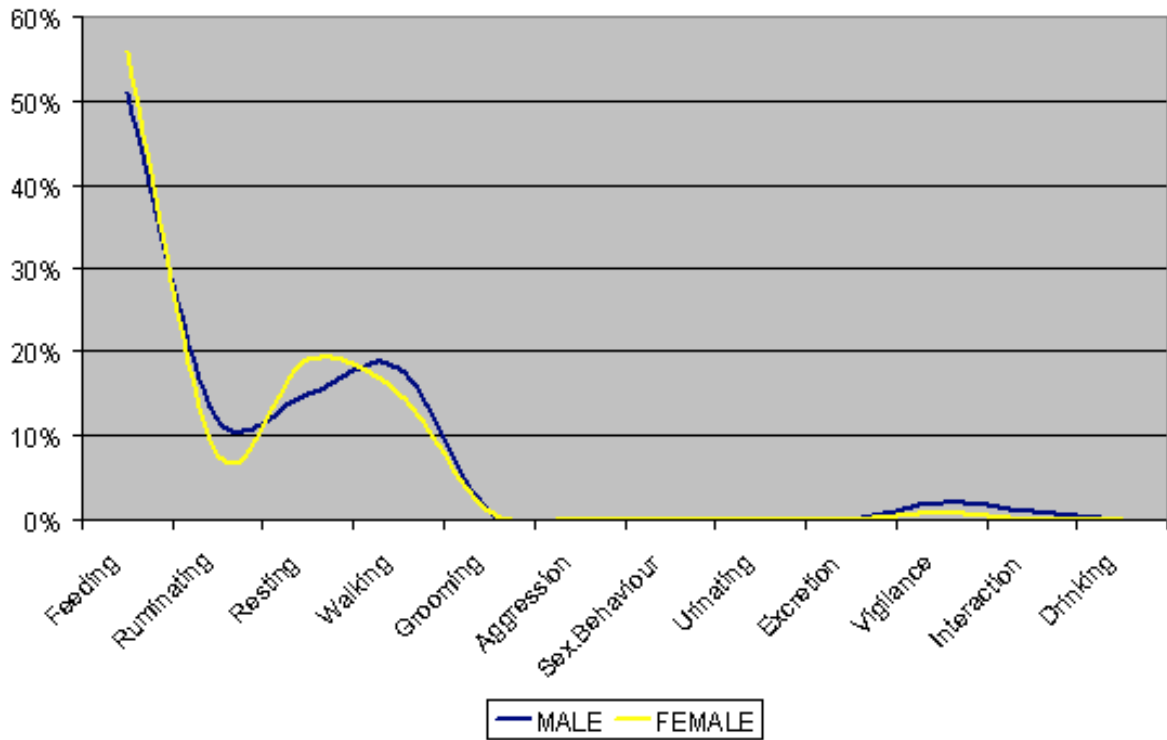
### Activity Budgets

Diurnal activity budget studies have been undertaken on and off for the past year on the giraffe populations in the lower Hoanib, Hoarusib and Khumib Rivers. Data for all populations is being pooled in an attempt to obtain an understanding on the desert-dwelling giraffe activity pattern. As the results are not finalised and thus preliminary, a comparative analysis with research undertaken elsewhere in Africa would be premature. Preliminary results Males and Females for December 2001 & 2002 are presented in Figure 5, 6 and 7 respectively.

Interestingly, feeding activities for both male and female are almost identical and by far the dominant behaviour. Ruminating, resting and walking are the other three dominant activities with only slight variation between each of these activities for male and female.

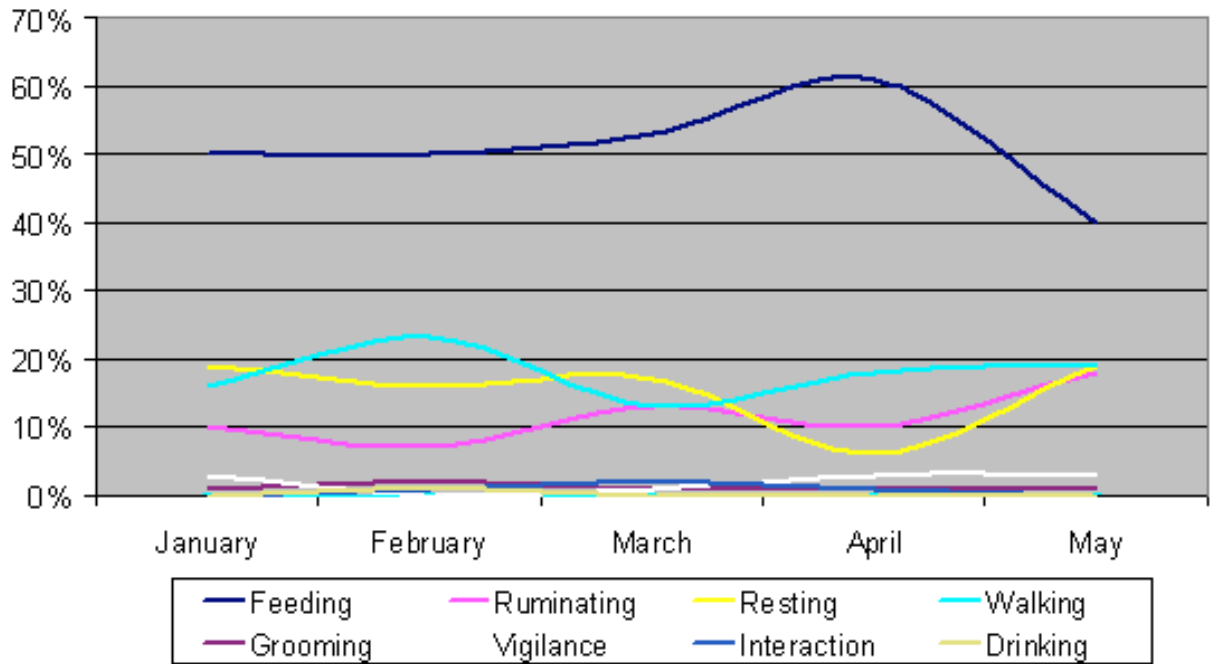
As expected, the percentage of time juveniles spent feeding is less than that of both adult males and females while resting is markedly increased.

**Bull vs. Cow Hourly Activities (Avg.)  
Wet Season 2002/3**



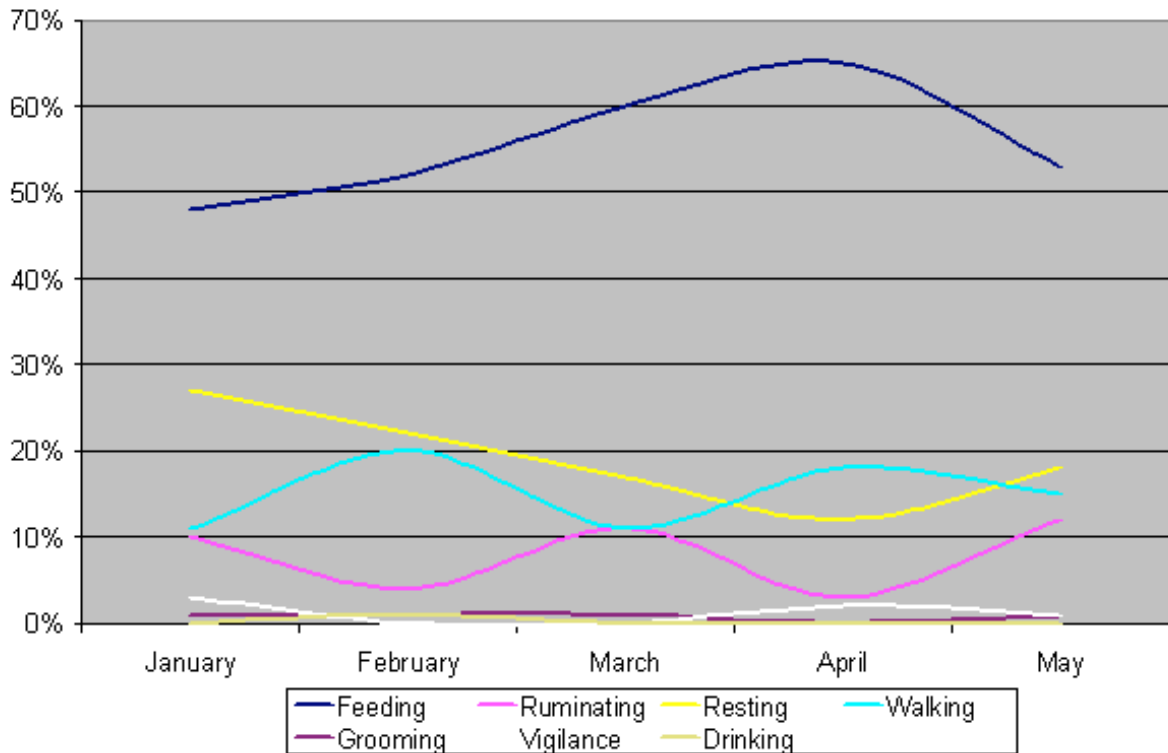
Diurnal activity (as a percentage) of Adult & Sub Adult Male desert-dwelling giraffe monthly activities – December 2001 & 2002

**Desert-dwelling Giraffe  
Monthly Bull Activities  
Wet Season (Jan - May) 2002/3**



Diurnal activity (as a percentage) of Adult & Sub Adult Male desert-dwelling giraffe monthly activities – December 2001 & 2002

**Desert-dwelling Giraffe  
Monthly Cow Activities  
Wet Season (Jan - May) 2002/3**



Diurnal activity (as a percentage) of Adult & Sub Adult Female desert-dwelling giraffe monthly activities – December 2001 & 2002

Forage Analysis

Ongoing monthly field sampling of 5 preferred forage species (*Faidherbia albida*, *Acacia tortillis*, *Combretum wattii*, *Cordia sinensis* and *Salvadora persica*) along a distance gradient of 50 km in the lower Hoanib River is continued to be taken. The month of July is the final sample month though analysis of the samples by the Ministry of Agriculture Laboratory in Windhoek, Namibia will take some time due to a backup of Ministry samples. The hypothesis behind the study is that giraffe potentially move in relation to the seasonal availability of forage moisture and important chemical components as their area minimal observations of the giraffe actually drinking in the past 70 years. However, with a new Ministry of Environment funded water point built in the Hoanib River, giraffe have been seen drinking on a number of occasions (giving the notion of opportunistic drinkers) as well as elephant moving into areas which giraffe previously dominated and thus temporarily displacing them due to competition for available forage resources. Increased monthly and seasonal data will help provide greater insight into this hypothesis.

DNA/Systematics.

The DNA phylogenetic research that is being conducted in collaboration with Omaha's Henry Doorly Zoo Centre for Research and Conservation is still ongoing. Tissue samples from individuals within both the desert-dwelling and Etosha populations' have been obtained and are currently being analysed. Preliminary results indicate that some inbreeding may occur in the desert-dwelling population while the current classification of the Namibian giraffe as sub species *G.C. capensis*, may not be relevant and potential possibility for a renaming of this population to *G.c. angolensis*. It has always been assumed by the researcher that this population be classified as *G.c. angolensis*, as per his publications, even though scientific nomenclature differs.

## **DISCUSSION**

(a) The data collected during this year's Earthwatch has assisted the researchers to achieve their objectives. Although the data collected is by no means conclusive it has added significantly to the data collected last year and will again provide a very good base for additional studies.

(b) Research will be continued on elephants in the research area. Most importantly, monitoring will be continued for at least another year, then the data will be thoroughly analysed and evaluated. While this year's results have not greatly influenced the research plan beyond confirming the direction and purpose of the elephant research. The overall aim of the project is to assist the MET and the communities of the focus area to derive a sustainable management plan for elephants.

Giraffe research will not continue next year as Mr. Fennessy will return to Australia to complete his Ph.D.

(c) Dr. Leggett and Mr. Fennessy are members of the MET-coordinated 'Elephant Liaison Group' which meets irregularly to discuss elephant research, policy and management issues throughout Namibia. All data gathered from the research will be reviewed through this group. This group forms the basis for elephant policy and management decisions throughout the country thus acting as the appropriate springboard for which this study can contribute to all levels of management in the country. A greater understanding of the elephant/giraffe population numbers, densities and movements will help understand a better idea of when, where, how and why these species function, with particular reference to recruitment rates and possible dispersion or re-expansion areas. These findings in turn will be integral in the establishment of the proposed world heritage sites and peace parks which has been forwarded to ministerial level and international bodies for recommendation.

## **PUBLICATIONS**

The following articles have been published by the PI's in the last 12 months. These publications are from the PI's previous project and while not reflecting Earthwatch involvement, do related to the research area.

- (a) K.E.A. Leggett, J. Fennessy and S. Schneider (2003). "Seasonal vegetation changes in the Hoanib River Catchment, Northwestern Namibia: A study of a non-equilibrium system", *Journal of Arid Environments*, 53: 99-113.
- (b) K.E.A. Leggett, J. Fennessy and S. Schneider (2003). "Does land use matter in an arid environment? A case study from the Hoanib River Catchment, northwestern Namibia", *Journal of Arid Environments*, 53: 529-543.
- (c) J. Fennessy, K.E.A. Leggett and S. Schneider (2003). "Distribution and status of the Desert-dwelling Giraffe (*Giraffa camelopardalis*) in Northwestern Namibia". *Journal of African Zoology*, 38(1): 184-188.
- (d) Fennessy, J. (2003). Pale Winged Starling (*Onychognathus naborurup*) gleaning on desert-dwelling Giraffe (*Giraffa camelopardalis angolensis*), northwestern Namibia. Bird Numbers (July). University of Cape Town. 4pp.

#### **OTHER ACCOMPLISHMENTS AND BENEFITS**

The project has received supplementary funding from two sources as a result of the 2002 Earthwatch season.

- (a) \$US70 000 for the GPS collaring activity
- (b) \$US4 000 for the running costs of the project

Both donations resulted directly from volunteer participation in the project.

#### **ACKNOWLEDGEMENTS**

##### Staff

Dr Keith Leggett (PI)  
Mr Julian Fennessy (PI)

Mr Todd Maki (Atlanta Zoo volunteer)

Ms Flora !Haradões (Base Camp Staff)  
Mr Franz Höeseb (Base Camp Staff)

##### Co-operating institutions

Desert Research Foundation of Namibia (DRFN), Namibia  
Integrated Rural Development and Nature Conservation (IRDNC), Namibia  
University of Sydney, Australia  
Denver Zoo, Colorado, USA  
Wildlife Conservation Society, Bronx Zoo, New York, USA

##### Funding

Denver Zoo	\$US2 000
WCS	\$US7 500
Earthwatch	\$US41 000