TITLE:

A SCIENTIFIC AND CONSERVANCY APPROACH TOWARDS SUSTAINABLE USE MANAGEMENT OF ELEPHANTS IN NORTH-WESTERN NAMIBIA

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PERIOD: **2 years (possible extension to 5 years)**

1.1 SUMMARY

The proposed project to identify and monitor elephants in the Kunene region of Namibia is an extension of the MET policy related to the consumptive utilisation of resources, ongoing CBNRM initiatives and more recently the Hoanib River Catchment Study.

The proposed project focuses on the collection and sharing of elephant identification and monitoring data, with the aim of improving the understanding of elephants in the target area. This information will be incorporated into long-term Ministry of Environment and Tourism (MET) and conservancy elephant monitoring programmes.

Information collected will include an intensive survey of local knowledge as well as previous scientific research on elephants in the focus area. Gaps identified through this process will be further investigated. These include, conservancy elephant monitoring and problem animal

reporting systems, elephant numbers, their residence time, movements, population age structure and social behaviour will be investigated.

Information will be collected by scientists as well as conservancy designated wildlife managers. These information systems will be combined and implemented at a practical management level, with the aim of better enabling conservancies to sustainably manage increasing elephant populations in partnership with the Ministry of Environment and Tourism. Elephants are becoming increasingly important income generators for local conservancies and information is required to guide decision making, particularly related to consumptive use of elephants. This revenue has the potential to contribute to rural livelihoods as well as ensuring good monitoring practises over the long term.

The project will be undertaken in conjunction with the Ministry of the Environment and Tourism and emerging conservancy structures.

The project will initially focus on the Hoanib River catchment for intensive scientific work. However the project will be expanded to include the entire elephant range and at least six conservancies for the establishment of monitoring systems.

1.2 BACKGROUND

1.2.1 Social background

The north west of the Kunene Region has been the focus of conservation efforts since the early 1980s. During the 1980's large scale illegal hunting of elephant was common practise and numbers were in decline. Community consultations at this time resulted in the mobilisation of community support for conservation. This combined with effective MET law enforcement and support from NGOs resulted in elephant numbers stabilizing and then increasing once more.

Increasing elephant numbers combined with a demand for land from the human inhabitants of the area has resulted in an increased conflict between man and elephants over scarce natural resources. With the view to addressing conflict and creating incentives for conservation the MET amended the Nature Conservation Ordinance, allowing communal farmers to manage and benefit from wildlife, including elephant. This has significantly changed the perception of many local communities to problem animals, shifting the focus to the identification of locally applicable management solutions. A sound basis for decision making derived from local knowledge and appropriate scientific input is believed to be central to establishing sustainable management solutions. The first step is the development of effective information systems on which to base decisions.

The Hoanib River Catchment Study highlighted the need for an in depth study on elephants as they are economically and socially the most important form of wildlife in the north of Namibia. The Namibian Government has taken innovative steps to address wildlife management on communal areas by the adoption of communal area conservancy legislation. This in effect gives communal farmers the right to manage and benefit from wildlife if certain conditions are met. Farmers wishing to work together need to establish a representative body with a constitution and a defined boundary with neighbours in order to gain these user rights. This body is then gazetted and registered as a conservancy which then has legal status. Within

the Hoanib catchment four communities are in various stages of conservancy establishment (see Figure 1).

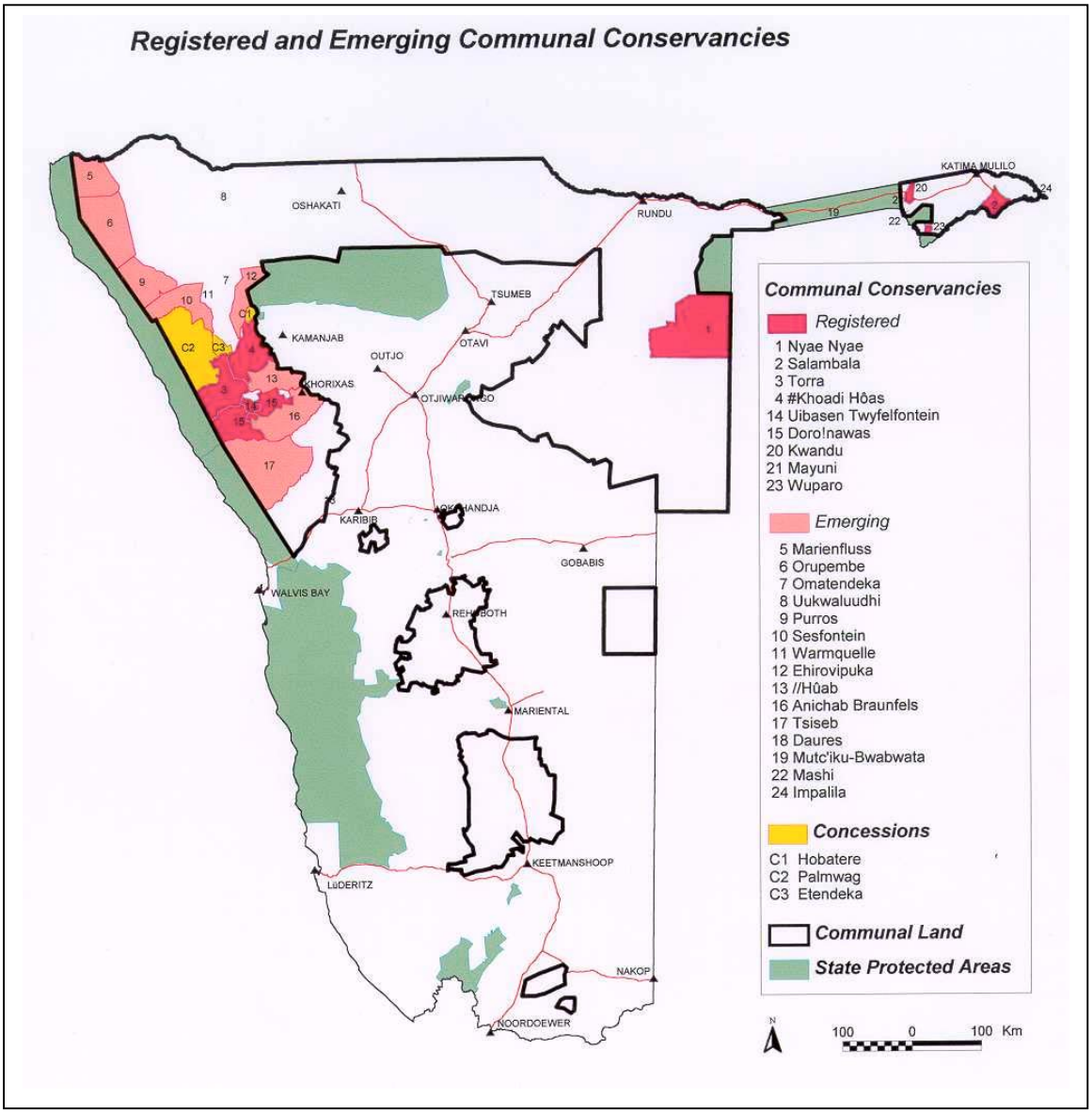

Figure1: Registered and emerging conservancies in Namibia

≠Khoadi //Hôas has been registered for two years and are benefiting from consumptive and non-consumptive use of wildlife. In addition, they have completed a land use and tourism plan. Ehirovipuka has met all the requirements of conservancy formation and are in the process of submitting their application. Omatendeka conservancy has elected a committee, completed a constitution but is struggling with boundary disputes. Sesfontein conservancy has completed all the requirements and the application has been approved by the Regional Governor and local MET office. Ongoing internal conflict has resulted in indecision on behalf of the MET and the conservancy is still awaiting an official response. Puros Conservancy has been approved but as yet not gazetted. Torra has been gazetted and is obtaining significant benefits from consumptive and non-consumptive tourism. Both Torra and Purros although not part of the Hoanib Catchment are included as they form part of the known elephant range. Conservancies to the south should also be included as they also form part of the elephant range, however the area involved is extensive and it would not be possible for either the researchers or IRDNC to cover this area sufficiently. The project will however aim to make links where possible and look to expand into this region with any possible extensions to the project.

IRDNC is currently providing support to all the above mentioned conservancies with the exception of ≠Khoadi //Hôas, where assistance would only be offered if all parties are in agreement. All the targeted conservancies have community appointed wildlife or resource management officers whose task it is to act on the behalf of the members take responsibility for the management of natural resources. Where emerging conservancies will also benefit from the establishment of wildlife monitoring systems prior to registration.

The project has chosen to deal with conservancies as they are the legally recognised structures for wildlife management in the communal areas. The traditional leadership in the areas where the project will take place will be regularly consulted in the design and implementation stages of this project. Once the project is underway the traditional leadership will be regularly updated on the project's achievements.

1.2.2 Physical Background

The Hoanib River catchment is one of twelve major catchments that occupy the semi-arid areas of northwestern Namibia. All twelve rivers flow into the Atlantic Ocean or end in the Namib Sand Sea. Many originate in commercial farmlands, flow through communal farming areas and, near their mouths, traversing a protected conservation area. The Hoanib catchment in particular occupies an area of 17 200 km, 3% of which lies in private farm lands, 91% in communal farm lands, 6% is protected in Etosha National Park and Skeleton Coast Park.

The Hoanib River constitutes the boundary between the former Damaraland and Kaokoland, since Independence in 1990 these two areas have been incorporated into the Kunene Region (see Figure 2). The catchment area of the Hoanib can be divided into three broad geographic sections. The eastern section (east of the Khowarib Schlucht) is relatively densely vegetated with mopane woodland dominant. The middle section of the Hoanib (from the Khowarib Schlucht to Skeleton Coast Park eastern boundary) is sparsely vegetated. In the western section of the river (from the Park boundary to the coast) virtually no vegetation exists outside of the river course. A broad flood plain (some 70km^2), before the moving dunes of the coast, offers substantial grazing for wildlife after flood events during the wet season.

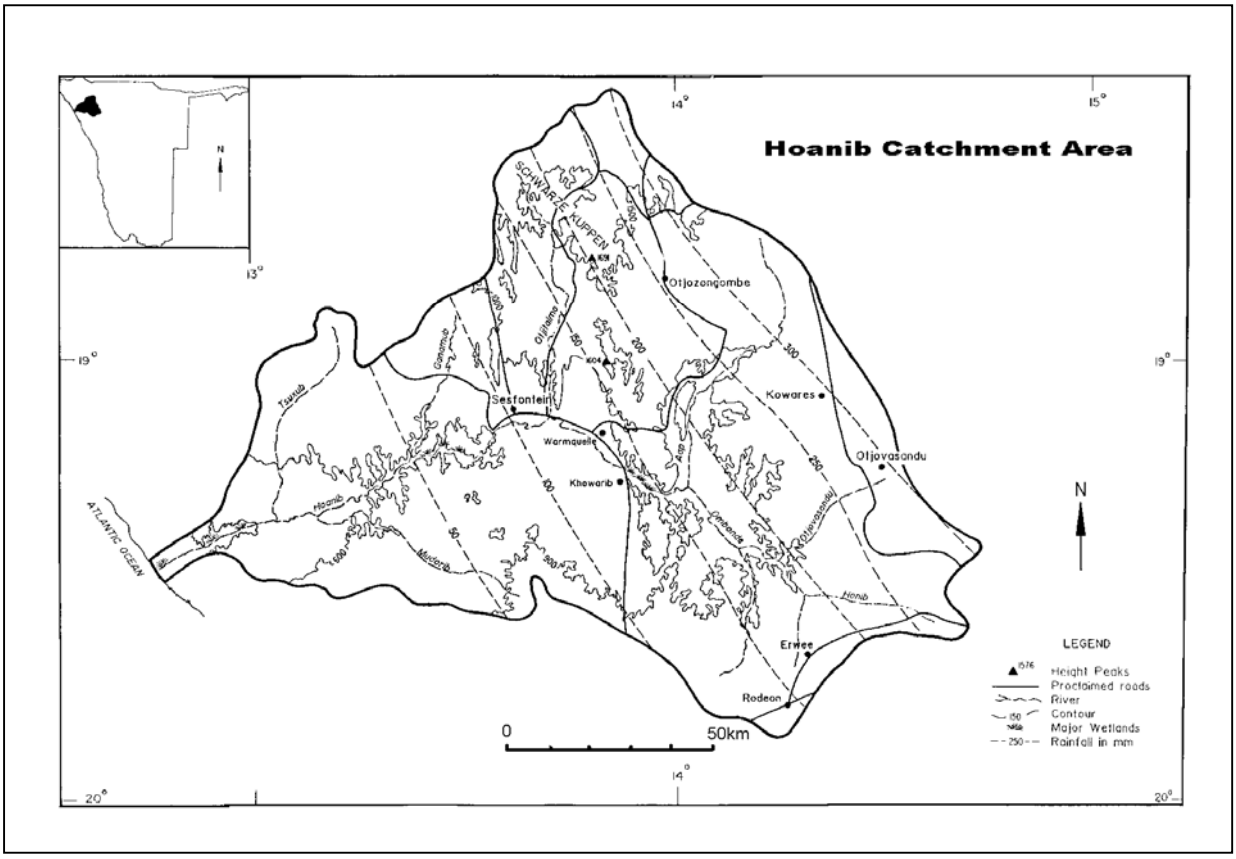

Figure 2: Location of the Hoanib River Catchment

The Hoanib River forms a "linear oasis" where the wetlands formed by the river are the most important biological and socio-economic areas in the catchment. They provide surface water for domestic stock and wildlife as well as providing a readily available source of water for communities living in the area. The water is being increasingly used in garden and irrigation projects as well as for the expanding tourism industry. The biophysical nature of wetlands and other water sources varies over time and is dependent on rainfall and water extraction. Elephants use the wetlands and borehole water extensively. They require at least 100L of water a day, while they can go 3 days without drinking and travel large distances to find fresh water. The sheer volume of water they require puts the added pressure on the wetlands and waterholes that are already used extensively by domestic stock and people. Conflict arises between elephant, stock and people at these watering points.

1.3 THE ELEPHANT STUDY

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 to 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, as well as providing communities with local development funds.

1.3.1 Historic perspective

Historically there were probably between 2500 and 3500 elephants in the north-west. This population was hunted extensively by Boer hunters in the later part of the 19th Century without ever really decreasing their numbers (Viljoen, 1987). By 1960's the number of elephants in the north was thought 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 thought that elephant numbers have recovered, however not to 1960's levels. Table 1, is a summary of elephant numbers in Kunene region.

Table 1: Elephants numbers in the Kunene region.

Researcher and Year	**Estimated Elephant Numbers**	**Area**
Historical (Pre 1900)	2500-3500	Kunene
Owen-Smith (1970)	600-800	Northern Kunene (Koakoland)
Joubert (1972)	211	Northern Kunene (Kaokoland)
De Villiers (1975)	279	Northern Kunene (Kaokoland)
Visagie (1977)	82	Southern Kunene (Damaraland)
Le Roux (1978)	135	Southern Kunene (Damaraland)
Viljoen (1987)	357	Kunene
Carter (1990)	253	Kunene
Loutit and Douglas Hamilton (1992)	366	Kunene
Loutit (1993)	359	Kunene
Loutit (1995)	415	Kunene
MET (1998)	579	Kunene

1.4 REVIEW OF PREVIOUS RESEARCH

The first substantial research to be conducted on the elephants of the north-west was by P.J. (Slang) Viljoen as part of a PhD. study between 1980 and 1983. Numerous papers resulted from this work (Viljoen, 1987, 1988, 1989a,1989b; Vlijoen and Bothma,1990) in all aspects of the ecology of the Kunene elephants. Some of the main conclusions from this work were:

1.4.1 Status and distribution

Viljoen estimated the population of the elephants in the northwest to be 357. These elephants were split into 3 distinct populations with no contact between the eastern and western populations detected during this study. There could have been possible genetic exchange via

the transitional population. However, this latter population made infrequent contact with both the eastern and western groups.

The Eastern Elephant Populations

This population inhabits the eastern regions of the Kaokoveld bordered by Ombombo Owambo in the north, the Huab River in the south and in the west by the Joubert Mountain range extending down to the Grootberg Mountain range. A total of 207 different elephants were counted in this region with a possible maximum of 250 depending on the season. There was a marked seasonal fluctuations in the population density as these elephants migrated freely to and from Etosha National Park and the former Ovamboland (4 "O's" region) and sometimes into the Outjo district. Movement patterns were generally north-west, south east orientated.

The calving percentage, calculated as the percentage of calves less than one year old in the whole population was 1.9 in 1983.

The Western Elephant Population

This group of elephants inhabits an area, bordered in the north by the Kunene River, in the south by the Huab River, in the west by the Atlantic ocean and in the east by a line that can be roughly drawn from the Marienfluss in the north to Die Riet on the Huab River. This line also roughly corresponds with the 100mm isohyet although it extends to the 150mm isohyet in the south. According to Viljoen (1987), the 1980 population consisted of 86 individuals but in 1983 there were only 70 individuals left. He further postulated that there was no inflow or out flow of elephants from the area over the time period of the study. Between 1980 and 1983 the calving percentage was 1.38, although no calf survived as a result of illegal hunting and disturbance. However by 1984 the calving percentage had risen to 2.7.

The Transitional Elephant Population

This population inhabits the Grootberg Mountain range area, bordered by the Omumborombonga-Khoraxa-Ams waterholes in the north, the farms Palmwag, Juriesdraai, Spaarwater and Bergsig in the west and the Huab River up to Tweelingskop and Nantis in the east. Viljoen (1987) estimated the total population elephants at 80 for this group. Their calving percentage was 1.3 at the end of 1983.
Viljoen (1987) defined the transition population of elephants as those that are on both sides of the 150mm isohyet. During Viljoen's study they made contact with both the western and eastern populations on an infrequent basis. During the rainy season they moved northeast to the vicinity of Omumborombonga where they made contact with members of the eastern population. During the dry months they moved south-west where they infrequently made contact with herds of the western population. The extent of their natural movements was unclear as a veterinary fence, which was erected in 1976, cut through the middle of their home ranges, and disrupted their natural migration routes.

1.4.2 Home ranges and daily movements

Viljoen (1989a) calculated the home ranges of the western elephants as between 1763-2944km^2. The majority of the author's observations occurred within 40 km of a water source. Concentrations of elephants could be found in the floodplains after the seasonal flooding of

the Hoanib. Bulls moved during the period November and February and family movements occurred from January to May. The author established the drinking intervals as 48-96 hrs during the hot dry season and during the wet season between 19 and 36 hrs. In addition, Viljoen (1989a) observed that 92% of movements were within the home ranges of the elephants and to the west of the 150mm isohyet. He observed no mass migration of elephants but rather movements within a large home range. The ability to predict rainfall/floods and respond with long range movement is a feature of these group of elephants (Viljoen 1989a).

Viljoen and Bothma (1990) reported that as the temporary water holes dry up with the on set of the dry season, vegetation around the permanent water holes is consumed first. The result being that they have to move further afield to find food. Elephants usually returned to the same water hole to drink, however the relative shifts in locality were small. Whereas during the wet season, elephants roamed between temporary water holes over a large area, resulting in greater daily movements.

1.4.3 Habitat selection and food preference

Viljoen (1989b) defined the "best habitat" for elephants as the areas where elephants spent the majority of their time. That is, the habitat in which elephants were observed most frequently, occurred in the highest density, showed the highest preference in relation to the elephants' overall distribution and the sizes of habitats.
He further defined 7 different habitat types as the most common in the north:
Floodplain
River courses
Sandy plains
Rocky plains
Gravel plains
Mountains
Sand dunes

Highest preferences were observed for river courses and floodplains. Flood plains were occupied during the wet season and with the onset of the dry season the elephants moved into the river-course habitats.

The vegetation preferred by the elephants of this area were all woody species (Viljoen, 1989b). Viljoen (1989b) established that the preference foods were *Cordia sensis*, *Pachypodium lealii* and *Combretum watii* though these species did not make up the bulk of the elephants food. The bulk food species were *Colophospermum mopane*, *Tamarix usenoides*, *Combretum imberbe*.

1.4.4 Additional research

Since Viljoen's study, only one additional detailed study has been reported on the elephants in the Kunene region. Lindeque and Lindeque (1991) satellite collared and tracked wet season movements of female elephants in northwest Namibia. In this study the authors collared a young adult female in the Hoarusib River (Kaokoland), she was very distinctly identifiable individual (one tusk pointing downwards) and had not been recorded anywhere prior to 1986.

An additional satellite transmitter was attached to another female in the Hoanib River (80km south-east of the Hoarusib river), however this transmitter failed (Lindeque and Lindeque,

1991). Ground observations indicated that both herds merged for much of the study period and moved regularly between the Hoarusib and Hoanib Rivers. In addition, they suggested that the known close association between the north-western population of desert-dwelling elephants (Viljoen1987, 1989) and an elephant with no associations to family groups in the area, would seem unlikely. There was also evidence from the study that a group of elephants moved further east than had been recorded in the previously 10 years. This was previously a well-used route through the escarpment, as shown by two sites with rocks polished by elephant rubbing, and an elephant path visible until at least 1977. This locality is potentially a point of overlap or contact between the eastern, transitional and western populations (Lindeque and Lindeque, 1991). Therefore this casts doubt on the isolation and integrity of previously described populations in the area.

Lindeque and Lindeque (1991) proposed that the present distribution and status of elephants in the Kaokoland reflects a skeletal elephant social organisation. Further, these groups would consist of clans, bond groups and family herds as proposed by Moss and Poole (1983), with substantial reduction in the number of individuals normally constituting each social grouping.

1.4.5 Conclusion

All previous research conducted on these elephants was undertaken either during or very soon after a war (1975-1990). The disturbance caused by large numbers of troops driving around the Kunene district would have no doubt impacted on the movement and social behaviour of the elephants. In addition, Viljoen's study 1980-1983 corresponded to an intensive poaching (123 individuals were believed killed by local Namibians) and arid period, further disrupting the movement and behaviour of the elephants. It has been almost 10 years since the Lindeque's study and 20 years since Viljoen's work. There have been several attempts by individuals to keep up data sheets on the desert-dwelling elephants, in particular, Rod and Ziggy Braby, Duncan Gillchrist, Steve Braine, Rudi Loutit, Tommy Hall, Blythe Loutit (Save the Rhino Trust), Des and Jen Bartlet, John and Barbara Paterson and the Hoanib River Catchment Study. However, there has been very little scientific study on these groups of elephants.

The area has entered a relatively peaceful period with only the 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 Ministry of Environment and Tourism 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. This is reinforced by the fact that 7 elephants were observed to transverse through the Khowarib Schlucht last year (G.v/d Linde, pers.com., 1999) as previously proposed by Lindeque and Lindeque (1991). This is the first time that elephants have been known to use this route since the late 1970's.

1.5 Identified Gaps in Research

The largest gaps that are still unanswered from the research are:

(a) a thorough investigation of local community knowledge.
(b) the need to establish an appropriate monitoring system of elephant at a local level.
(c) the development of locally appropriate monitoring and information flow systems from community structures to MET.

(d) the home ranges of elephants.
(e) migration of elephants to and from Etosha National Park on the western borders of the Park
(f) resident times of elephants in various areas
(g) response to rainfall in other catchment areas
(h) expansion of home ranges into areas that are now commercial farms but previously constituted elephant home ranges
(i) effect of drought on increasing elephant populations
(j) effect of increasing numbers of domestic stock and human movements on increasing elephant populations
(k) effect of the increase in boreholes being drilled and less human inhabitants at some of the formerly occupied natural springs
(l) effect, if any, of the veterinary cordon fence on elephant movement

1.6 RECENT COMMUNITY CONSULTATIONS REGARDING ELEPHANTS

As part of the Hoanib River Catchment Study community consultations were undertaken in August 1998 and April 1999. These consultations were designed to produce collaborative research projects that would address the environmental problems of the communities. During these meetings, the communities highlighted several environmental and natural resource problems, in particular with wildlife and elephants. There are a number of established and emerging conservancies in the Hoanib River catchment area. All of the conservancies would like to use both consumptive and non-consumptive tourism as the basis of their enterprises and they have expressed concern about wildlife and elephant numbers during the consultations. Elephants were without doubt the highest priority of the communities as they pose a greater threat to domestic stock and people than any other animal. The questions most raised during the community meeting were:
(a) Where do the elephants go?
(b) How long do the elephants spend in our areas?
(c) How many elephant are there?
(d) How can we make better use of the elephants for tourism (both consumptive and non-consumptive)?
(e) How can we stop elephants from crop raiding and killing domestic stock?

The following communities participated in these consultations:
Sesfontein
Khowarib
Warmquelle
Omarumba
Otjokavare
Erwee (#Khoadi ||hoas Conservancy)

The problems associated with the sustainable use of natural resources in the Hoanib River, tourism and the elephants that live in the river, was the subject of a special workshop hosted by the Sesfontein Conservancy on 7th May 1999. This workshop was attended by numerous Government Ministries and Departments, NGO's, Community Representatives and Interested and Affected Parties. This shows a genuine interest on behalf of the communities to obtain greater knowledge about the river, the sustainable use of natural resources and in particular, the elephants of their area. The Ministry of Environment and Tourism has since followed up

this meeting with several elephant meetings in the communal areas to address community problems as part of a National Policy planning exercise.

2.1 PROBLEM STATEMENT

Very little information is available to the managers and decision-makers at all levels on elephants in the Kunene. However, they do represent one of the largest economic and social costs to people living in the area. What information is available, is not readily accessible nor is it currently integrated into decision making, planning and management.

3.1 OVERALL GOAL

Contribute towards a better understanding of the Kunene Region elephants for an improved sustainable management, use and benefit to the communities.

3.2 PROJECT PURPOSE

Decision makers at all levels in the Kunene Region have an improved access to elephant information and that the two key stakeholders (MET and conservancies) have improved mechanisms for sustainable management.

4.1 RESULTS

(1) Conflict between human and elephant is better understood and recommendations made on how to manage this more effectively.

(2) Approaches for predicting/monitoring elephant movement developed, tested and evaluated.

(3) Improved understanding of elephant related issues amongst key stakeholders.

(4) Conservancies involved in data collection and development of appropriate methods of monitoring a range of elephant related issues.

(5) Contribute to conservancy staff become local elephant "experts".

(6) Scientists and conservancy staff in conjunction with MET and all interested parties develop appropriate elephant management options.

(7) Existing data and knowledge consolidated and new data added to existing data bases.

(8) Social interactions between individuals and herds characterised and examined.

(9) The current home ranges and movements of individuals and herds determined. In particular those elephants moving:

- in and out of the western boundary of Etosha National Park
- from the Beesvlakte/Serengeti to Palmwag area
- from the Beesvlakte into the Khowarib/Warmquelle area
- north and south of the Hoanib floodplain

5.1 METHODS

Work will be conducted through the recognised structures of the MET, namely conservancies. They will be the primary focus of the study.

Conservancies will be consulted individually to ensure support for this initiative and to obtain their commitment to the project and ensure the allocation of time and resources of their field managers. In non IRDNC target areas, partner conservancy support organizations will be contacted and MOUs signed detailing the extent of involvement. The MET, including regional offices, will be contacted to secure support.

This project has three main components, which will function in their own right but the main aim will be to maximise the overlap between science and conservancy activities:

- Science
- Science and conservancy collaboration
- Conservancy activities

5.1.1 Consolidating existing data/knowledge

Intensive surveys are to be conducted in each conservancy, by conservancy management staff to collect local knowledge relating to elephants. The conservancy staff together with project staff and conservancy committees will plan these surveys.

While very little scientific data has been collected on elephants in recent years, they are possibly the most photographed and filmed elephants (at least the western group) in Africa. Data sheets on these animals were collected after Viljoens' study (1980-1983), these data sheets have been periodically updated by various individuals since this time. The Hoanib River Catchment Study has made an attempt to bring all relevant material together. However, no concise set of data sheets currently exists. Before an extensive study of the elephants it is will be necessary to collate, digitized and store previously recorded data sheets.

In addition, old photographs of the animals need to be collected, catalogued and stored for future reference. It may be possible to follow herd demographics using photo's taken over a time period.

The community knowledge and scientific data will be combined and evaluated, gaps and priority topics identified for further attention.

5.1.2 Characteristics and Social Behaviour of the Hoanib River Catchment Elephants

In collaboration with conservancy committees and staff, the project scientists will seek to implement a system of elephant monitoring that can be continued by conservancy staff.

For a detailed description of the methods to be used in this project see Appendix A. The characterisation of an individual elephant using observational and photographic techniques is not a simple procedure. Ideally, all members of the family units should be identified and characterised. During the initial stages of the project however, only the matriarch and a small number of dominant cows will be identified in each of the family units. This will allow more herds to be identified and their interactions monitored in a shorter space of time. It is envisaged that by the end of the project individual identification of all the elephants within the area should be possible. Bachelor units and lone males will also be identified and monitored whenever possible. It is possible to identify individual elephants by identifying the following characteristics:

(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; and
(b) the population structure and age distribution within the herds.

If consumptive use of elephants is to be sustainable in the communal areas specific research will be needed in the following areas:

(a) effect of off-take of old bulls
(b) effect of off-take of young bulls
(c) sex ratios and age ratios of the elephant populations
(d) number and distribution of trophy quality bulls
(e) what percentage of the bulls are breeding
(f) frequency and number of off-take from a population
(g) effect of problem animal control on off-take

5.1.3 Tracking of individuals and herds by Satellite GPS collars

The scientists acting in conjunction with the MET, conservancy committees and staff as well as well as other appropriate stakeholders initiate and undertake tracking using GPS collars. Until recently, the best method for studying herd distribution and ranges of elephants has been the radio tracking of collared individuals combined with aerial surveying. The recent advances in GPS collars have made it possible to reduce the amount of aerial surveying and tracking time. Once the collars are attached to individuals, they will record the location of the individual for up to 2 years. The time interval between location readings can be altered from hourly to daily or even weekly. This system is expensive but more than pays for itself with the reduction in effort required for aerial surveying and tracking time on the ground. The expense limits the duration and a complementary ground tracking system will be investigated and implemented. This will be done in such a way as to try to ensure its sustainability.

It is expected that initially 10 collars would be fitted. Five of these collars would be used on the eastern population (3 breeding herd, 2 bulls), three collars on the western population (2 breeding herds, 1 bull) and two collars on the transitional population (1 breeding herd, 1 bull).

5.1.4 Human/Elephant Conflict

The initial community information surveys will also allow the identification of:

(a) the general attitude to elephants in the respective conservancies.
(b) local "Hot Spots" for elephant damage and threats
(c) proposed solutions to problem areas
(d) precautionary procedures

These topics will then be more intensively investigated through a consultative approach to develop:

(a) a system for cataloguing elephant damage in each conservancy
(b) testing of selected deterrent methods in selected areas.

Once this information has been collected then a strategy of how best to approach the elephant problem can be addressed per conservancy. It may be that some areas are predisposed to elephant incursion and destruction. Once the characteristics of the area can be defined, it may be possible to come up with preventative strategies to stop the elephants raiding and if this fails, other more active management strategies may be necessary (in conjunction with MET). Regional initiatives in dealing with problem animals will be investigated for their suitability in this area. In conjunction with conservancies and stakeholders, consultants may be sought to provide appropriate solutions to elephant related problems.

5.1.5 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. These complex natural and human made interactions are not surprisingly difficult to understand and to predict. However, the union of remote satellite imagery, geographical information system (GIS) technology, and the development and advances of landscape ecology has provided a framework within which the analysis, modelling and prediction of wildlife distributions can be undertaken to suitable confidence levels.

An important philosophy of an elephant collaring and monitoring project is the maximisation of use of the data collected. To this end and bearing in mind the statement above, Geographical Information Systems (GIS) will be used in conjunction with the GPS collars to aggregate the collected data. This will be combined with relevant existing available data and ground data into a single multifaceted database that will allow spatial examination and analysis of the data in the manner mentioned above.

It is envisaged that GIS will initially be used for display and 'simple' analysis the spatial distribution of the elephant herds/individuals. Such display and analysis would include the creation of such representation as spider diagrams, histograms, triangulations and tessellations and such calculations as home range pattern identification (using many of the common models such as Kernel, Minimum Convex Polygon, Harmonic Mean, etc.), site fidelity testing, location statistics, nearest neighbour analysis, etc.

In addition it is hoped that GIS will allow more complex analysis, modelling and prediction of elephant distributions. The hypothesis is that, within an ecological context, one or all of the

variables of occurrence/availability/suitability of habitat types and/or vegetation, climatic and topographic variability, effects of seasonality, etc., influence and can to some extent explain the patterns found in the distribution of elephants. It is proposed that inductive reasoning will enable the prediction of elephant presence or absence, the dichotomous dependent variable. Inductive reasoning infers general relationships from the observations of particular instances. Using inductive modelling the user can identify locations at which an instance occurs, or does not occur, and attempt to determine the attributes which best describe the observed pattern. The user is able, in a quantitative sense, to express the relationship between objective and locational attributes. The core component required to enable inductive modelling is a method of systematically identifying relationships between spatial objects.

Various methodologies based on inductive modelling have been proposed. It is suggested that two possible methods, those of Bayesian statistics and multiple logistic regression, are considered.

The Bayesian statistical method investigates the relationships between data sets and provides a relatively simple analytical framework which has great potential for application to spatial data. Bayesian statistical inference is a mathematical method used for decision making under conditions of uncertainty and has previously been applied for disease diagnosis and wildlife habitat evaluation combining relative values of right and wrong (subjective probabilities) with the probabilities of right and wrong (conditional probabilities). In this application 'right' and 'wrong' equate to decisions over presence and absence and are expressed as a probability. Part of the attraction of this method is that, being normative and rational it emulates the way in which a wildlife expert might be expected to make decisions over habitat suitability for a species. In this application the method would be used to predict distribution, expressed as a probability of occurrence, but could also provide a measure of habitat suitability.

A further approach uses logistic multiple regression for the measuring of habitat suitability. This model uses environmental factors as explanatory variables against which the occurrence of a species can be regressed to assess habitat suitability and in turn can be used for production of predictive probability of occurrence surfaces.

5.1.6 Community consultations and information dissemination

Conservancy committees and their staff will be the main interface with this project. This project will also seek to work in conjunction with service organisations not only disseminating scientifically gathered information, but identifying and starting to address problems caused by elephants. Community consultations will become particularly important in having input into and supporting solutions to problem animals as part of the process of establishing policies related to problem animals.

Ongoing community consultations by IRDNC and those developed during the Hoanib River Catchment Study will be expanded and intrinsically included throughout the project. Conservancy staff will work with researchers in all aspects of work to varying degrees. Conservancy committees will be kept informed by their staff and the NRM personnel of IRDNC. Communities living in direct contact with elephants will be kept informed of the major findings of the study and consulted in decisions regarding the conservancy policies.

It is proposed that 6 monthly community and conservancy committee meetings be used to disseminate all information gathered from the project. In addition, the project will keep in

close liaison with the services organizations and other stakeholders in the Kunene, making all data available through them for further dissemination and implementation at the community level.

6.1 PROJECT DESIGN

The project will be initially be carried out over a 2-year period. Any extension to the project would be dependent on the success of the initial phase of the project.

- Project design will incorporate the active involvement of conservancies and MET. The Regional Council and Traditional Authorities and other support agencies will be kept informed of activities at six monthly Resource management forum presently being established. Wherever possible collaborative links will be forged with other research and development initiatives in the area.
- Project design must include gathering of additional essential information and synthesis of this, together with research results, into awareness materials for decision-makers, environmental education, tourists and the general public.
- Conservancy staff will assist in specific areas of research and will be given appropriate training in basic methodology (e.g. environmental monitoring and socio-economic surveys), thereby developing a skills base that would be useful in future projects within the research area. They will further be able to continue with ground monitoring after the completion of the project. The skills and knowledge will also be important for their potential involvement in the tourism industry.
- Project outputs will include:
    1. The establishment of long-term elephant monitoring systems in three conservancies.
    2. Skills transfer to six conservancy managers
    3. Integration of local and scientific knowledge
    4. Awareness materials as appropriate (e.g. poster, radio tape, video, and environmental education materials), as well as publications in the international scientific literature. The conservancy staff will facilitate the production of some of this material at a local level.
- The researchers will become involved in tertiary education and research training in Namibia related to his/her research area.
- Provide information to MET about sustainable management and off-take potential of elephants in the north west of Namiba.

6.2 Log-frame

See Appendix B for a detailed log-frame breakdown.

6.3 PROVISIONAL SCHEDULE

<u>Staff and Time Schedule</u>

Staff dealing with research components are the same as previously described for the Hoanib River Catchment Study. Dr Keith Leggett will act as Project Manager and Chief Scientist on

this project. Mr. Julian Fennessy will be Assistant Project Manager and Scientist, While Ms. Stephanie Schneider will act as liason between the scientsist and IRDNC, she will also be in charge of training and information dissemination.

Staff dealing with the CBNRM component will be in the full time employ of IRDNC. John Kasaona and Anton Esterhuisen will lead the field implementation. The Directors Garth Owen-Smith and Dr. Jacobsohn, Field Co-ordinator B. Roman and Consultancy Co-ordinator C. Nott will provide technical support. Staff will be contracted to this project at a daily fee for activities beyond their day-to-day duties.

Expected Outputs

Outputs to include:

- a data base of elephants in Kunene region;
- better understanding of the ranges, interactions and distribution of elephants in the Kunene region;
- an improved understanding of elephants by key stakeholders
- collaborative implementation of consumptive and non-consumptive management options with communities;
- recommendations for the sustainable management of elephants made to decision-makers, taking into account:
    - problem animal control
    - consumptive and non-consumptive use
- development of scientific and community-based monitoring systems
- training provided to 3 conservancies in elephant observation, monitoring and ways of reducing the impact of crop raiding elephants;
- participatory planning and implementation of deterrent methods for crop raiding elephants with local communities;
- interim and final reports for policy makers and donors;
- a booklet or series of booklets in English, Afrikaans, Damara and Herero produced by and for local decision-makers and resource users;
- an interim workshop for exchange of information and ideas;
- regular meetings with conservancy committee, traditional leaders and decision-makers using local facilitators with visual material such as slide shows, pamphlets and posters
- presentation of final research results to conservancy committees, traditional leader, decision-makers, relevant government, NGO and public forums.

Ongoing outputs throughout the course of the Project - fact sheets summarising relevant issues for policy-makers and institutions.

- articles for relevant newsletters (e.g. Agriviews, Madoqua)
- papers for scientific periodicals
- participation in Namibian student projects
- participation of staff from Ministry of Environment and Tourism
- participation of Agricultural extension and Veterinary officers

REFERENCES

Altman, J., (1974), "Observational study of behaviour: sampling methods", Behaviour, 49, 227-67.

Carter, L.A., (1990), The Wildlife Survey of Skeleton Coast Park, Damaraland and Kaokoland, North West Namibia, May/June 1990. Report to the Commission of the European Communities, Contract: 946/89-48, Windhoek.

De Villiers, P.A., (1975), "Lugsensus – Kaokoland", Unpublished report, Dept. of Cooperation and Development, 10 pages

Douglas-Hamilton, I. and Douglas-Hamilton, O., (1975), "Among the elephants", Collins and Harvill Press, London.

Joubert, E., (1972), "Voorgestelde Damaraland Wildtuin", Unpublished report, Dept.of Agriculture and NatureConservation, SWA, 27 pages.

Le Roux, J., (1978), "Damaraland lugsensus 15 Oktober –18 Oktober", Unpublished report, Damara Verteenwoordigende Owerheld, 5 pages.

Lindeque, M. and Lindeque, P.M., (1991), "Satellite tracking of elephants in northwest Namibia", Afr. J. Ecol., 29 (196-206).

Loutit, R. (1993), "Aerial survey of Kunene district", Unpublished Data, Ministry of Environment and Tourism,

Loutit, R. (1995), "Elephant survey in Kunene district", Unpublished Data, Ministry of Environment and Tourism,

Moss, C.J., (1982), "Portraits in the wild: Behavior studies of Eastern African Mammals", University of Chicago Press, Chicago.

Ministry of Environment and Tourism, (1998), "Aerial Census of Wildlife in Namibia", Unpublished Data, Ministry of Environment and Tourism,

Owen-Smith, G.L., (1970), "The Kaokoveld – An ecological base for future development and planning", Pirn. Pinetown, 67 pages

Sukumar, R., (1989), "The Asian Elephant: ecology and management", Cambridge University Press, Cambridge.

Viljoen, P.J., (1987), "Status and past and present distribution of elephants in Kaokoveld, South West/Namibia", S.Afr.J. Zool., 22 (4)

Viljoen, P.J., (1988) "The ecology of the desert-dwelling elephants *Loxodonta Africana* (Blumenbach, 1797) of western Damaraland and Kaokoland", PhD. Thesis, University of Pretoria, Pretoria, South Africa.

Viljoen, P.J., (1989a), “Spatial distribution and movements of elephants (*Loxodonta africana*) in the northern Namib Desert region of the Kaokoveld, South West Africa/Namibia”, J. Zoo., Lond., 219,1-19.

Viljoen, P.J., (1989b), “Habitat selection and preferred food plants of desert-dwelling elephant population in the Northern Namib Desert, South West Africa/Namibia”, Afr. J. Ecol., 27(227-240).

Viljoen, P. J. and Bothma, J. du P., (1990), ”Daily movements of Desert-dwelling elephants in the northern Namib Desert”, S. Afr. J. Wildl. Res., 20 (2).

Visagie, G.P., (1977), “Lugsensus – Damaraland”, Unpublished report, Dept. of Cooperation and Development, SWA, 2 pages.

APPENDIX A
(Methods)

Individual Identification

Photographic techniques outlined by Altmann (1974), Douglas-Hamilton and Douglas-Hamilton (1975), Moss (1982) and Sukumar (1989) has been shown to be the best means of identifying elephants in the field. These methods require the development of a photographic library of each individual member of the herds. Photographs, updated at regular intervals as the individuals age, taken from the front, left and right side of each individual and added to a data sheet of the elephants details (see attached sheet). They can be used as a permanent record of the herds and by future researchers. As the herds increase they will eventually split up and form subgroups, each of which can be simply characterised using the photographic record.

Individuals can be identified by five basic techniques based on the photographs taken:

(a) Sex. Examination of the head is usually the quickest and easiest method of identification. If the head "slopes" then the animal is a male and if it has a prominent "bulge" in the forehead, it is female. In addition, the sex of an individual is usually obvious in adults as the males are larger in both body and tusk size. However, assessing the sex is much more difficult in younger animals (less than 6-10 years of age).

(b) Tusks. No two individuals' tusks are the same in either shape or size. Most elephants are either left or right tusked. This means that they favour either their right or left tusk when feeding or fighting.

(c) Ears. These vary in venation, size and the degree of sustained nicks and cuts. Since the nicks and cuts change, they need to be regularly recorded.

(d) Foot prints. Much like human fingerprints, no two foot prints are the same. At birth the grooves and cracks in the pads are virtually nonexistent but as the animals grow older the grooves and cracks become deeper and more defined. It is also possible to get an estimate of the age of an elephant by the size of its foot prints.

(e)Tail. In many elephants the tail may be used as a diagnostic tool as it is often broken or kinked and the amount of hair on each tail varies from individual to individual.

Using the photographic record and the identification record outlined above it is possible to characterise every elephant in the catchment area. Individual identification sheets will be kept and updated for individual (see attached sheet for details).