TECHNICAL REPORT

May 2006

Factors affecting human-elephant conflicts in Nyae Nyae Conservancy and Khaudum National Park, Namibia

Tammie K. Matson

PhD BSc (Hons)

Contact Information:

Dr. Tammie Matson
Human-elephant conflict research project
Nyae Nyae Conservancy & Khaudum National Park, Namibia.
C/o "Karinya"
M. S. 172
Allora QLD 4362
Australia.
Email: tammiekmatson@hotmail.com
Tel./Fax. +61 746 666 161

Report distributed to:

Nyae Nyae Conservancy
Ministry of Environment & Tourism (Tsumkwe & Windhoek)
WWF
ICEMA
Nyae Nyae Development Foundation of Namibia
The Rufford Maurice Laing Foundation
Namibia Nature Foundation
Wilderness Safaris Namibia
Wilderness Trust
Satcom

Abstract

The objective of this study was to quantify the factors affecting human-elephant conflicts in an area of relatively low human population density, in the absence of abundant, large scale crops, with a growing elephant population. Most of the human-elephant conflict incidents that occurred in the last five years in Nyae Nyae Conservancy and Khaudum National Park, Namibia took the form of damage to water installations (52.5%). Almost half of the conflicts occurred in the hot dry season. The number of conflicts increased steadily between 2000 and 2003 and then began to decline in 2004 when concrete enclosures were built around water installations at particular villages. During this time, the number of elephants counted in annual waterhole counts increased every year. A total of N$551, 500 worth of financial damage was caused to infrastructure between 2000 and 2005.

Herd size influenced the intensity of conflict more than any other factor, with herds of less than five elephants causing more conflicts than any other herd size. However, distance to nearest drinking point for elephants and distance to Khaudum National Park also significantly influenced the intensity of conflict. The limited data suggested that the presence of a cement crib may reduce the level of conflict. Not surprisingly, more conflicts occurred in areas of high elephant densities than those in areas of low elephant densities.

Recommendations for future management of human-elephant conflicts in the area include developing further tourism and trophy hunting opportunities, selective culling of 'repeat offender' bulls, locating water holes for elephants to drink at far from villages and providing cement cribs for clean, more accessible water than is available in pumped, dam-style water holes. Despite the small sample size (n=41), this study goes some way towards providing site-specific solutions to ameliorate conflicts with elephants in Nyae Nyae Conservancy and Khaudum National Park. The overall positive attitude of people surveyed in Nyae Nyae Conservancy suggests that a harmonious outcome is possible, because although most respondents viewed elephants as a threat to their livelihoods (86%) they also recognised the value of the species for sustainable development in their conservancy (>93%).

Keywords: Elephant; Human-elephant conflict; Community conservation.

Introduction

Human-elephant (*Loxodonta africana*) conflicts occur frequently wherever communities of humans and elephants co-exist in Africa and Asia (see review by Osborn & Parker, 2003), especially so on the borders of protected areas (Nyhus et al., 2000). African wildlife managers are faced with the dual increasing challenge of conserving viable populations of elephants while also reducing their socio-economic impacts on humans (Hoare, 1995; Zhang & Wang, 2003).

Elephants occur throughout northern Namibia, and pose a considerable threat to the sustainable livelihoods of rural people throughout their range. They have been known to destroy crops, damage water points and injure or even kill humans (Lindeque, 1995; O'Connell-Rodwell et al., 2000). However, the persistence of elephant populations is of concern to conservationists because most of the elephant's range lies outside protected areas in communal areas and conservancies (Hoare, 2000; Ministry of Environment & Tourism, 2005). Thus, with increasing numbers of humans living in rural Africa and concomitantly, a growing elephant population, (Blanc et al., 2005), the relationship between elephants and people is a growing conservation concern (Tchamba, 1995).

Mitigation of human-elephant conflicts requires a complete understanding of the problem, its locality-specific causes and attempts to solve it, in order to develop effective management strategies for local communities (Sitati et al., 2003). Community support is key to the success of any measures to reduce conflicts, and the success of Namibia's community-based natural resource programme (CBNRM) has gone some way towards returning benefits from wildlife to local communities (O'Connell-Rodwell et al., 2000).

Considerable research has been done on quantifying crop damage caused by elephants, which is one of the most common types of human-elephant conflict in southern Africa where rural people are dependent on traditional agriculture for their livelihoods (Osborne & Parker, 2003; Barnes et al., 2005; Malima et al., 2005). O'Connell-Rodwell et al. (2000) found that electrical fencing was effective in ameliorating crop damage and reducing costs at the community level in the East

Caprivi Region of Namibia, which has high population densities of people and elephants and thus, has among the highest incidence of human-elephant conflicts in the country (Lindeque 1993). However, much of the elephant's range in northern Namibia is arid or semi arid and thus is not ideal for traditional agricultural practices. Nonetheless, even in areas where there are few crops, conflicts between people and elephants are escalating. Little is known about the factors affecting human-elephant conflicts where the community affected is more reliant on subsistence hunting and gathering than on traditional agriculture and conflict thus takes the form more often of damage to water installations than crop depredation, as is the case in Nyae Nyae Conservancy.

North-eastern Namibia is on the border of Botswana, where the largest elephant population in Africa occurs (Blanc et al., 2005). Elephants regularly disperse into the region just south of Caprivi, through Khaudum National Park (KNP) and into Nyae Nyae Conservancy (NNC) (Ministry of Environment & Tourism of Namibia, 2005). (Fig. 1). Local concerns about observed increases in conflicts with elephants in the Khaudum National Park and Nyae Nyae Conservancy (formerly Eastern Bushmanland) led to this study. The objective was to quantify the factors affecting human-elephant conflicts in an area of relatively low human population density, in the absence of abundant, large scale crops, with a growing elephant population, and to use this information as a basis for site-specific solutions to ameliorate conflicts with elephants in the community.

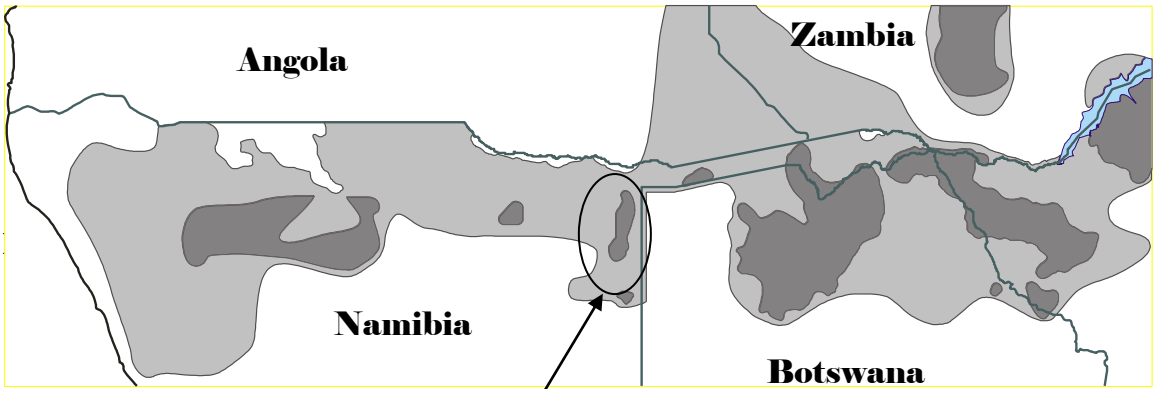


Fig. 1. Map showing the occasional ☐ and permanent ■ range of elephants in Namibia, Angola, Zambia and Botswana (AfrESG, 2002) in relation to the study area.

Nyae Nyae Conservancy (20ºS, 20ºE) comprises 9,003 km^2 and was Namibia's first registered communal conservancy in 1998 (Fig. 2). The conservancy falls within the semi-arid zone, receiving between 300mm and 500mm of rainfall per year (NNC, 2002). There are three main seasons: cold dry (June to August), hot dry (September to November) and wet (December to May).

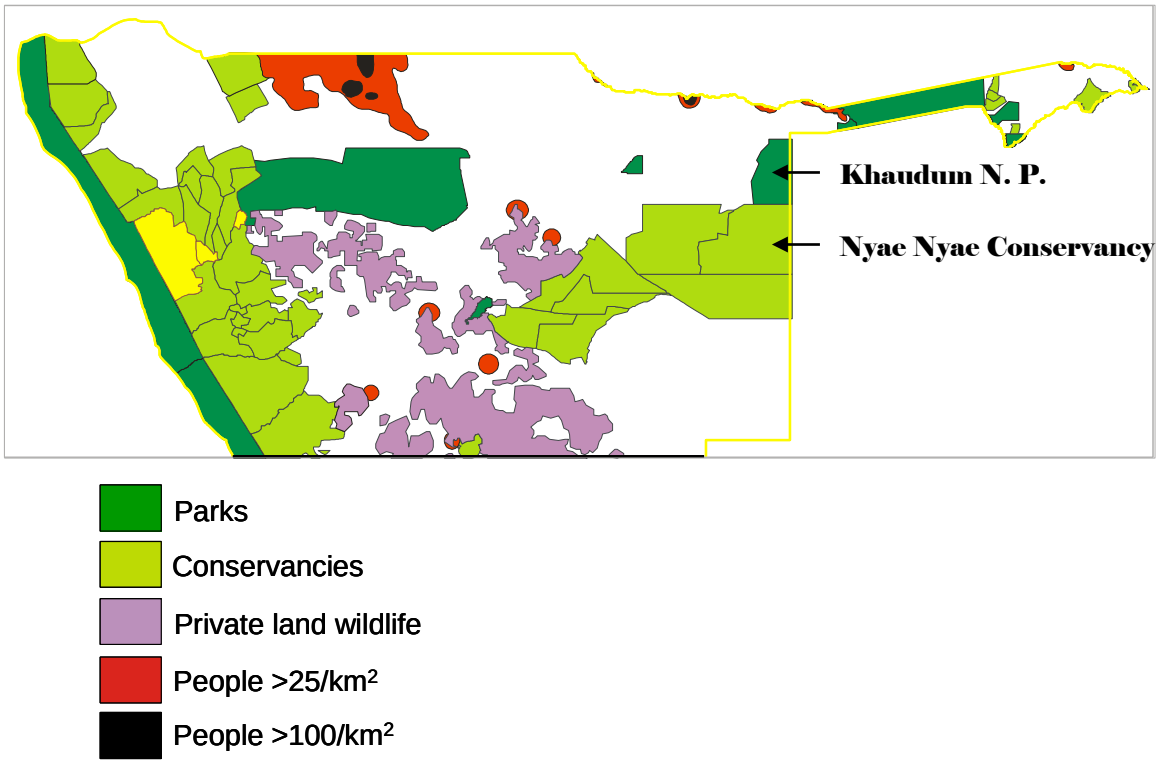


Fig. 2. Land uses and human densities in northern Namibia (from Martin 2005).

About 3000 Ju/'hoan Bushmen reside in the area, pursuing a mixed economy which combines foraging and subsistence hunting with craft sales and very limited agriculture (NACSO, 2005). Outside the main town, Tsumkwe, the human population density in NNC is generally less than 1 person/km^2 (Mendelsohn & el Obeid, 2002). The conservancy is now self-supporting and more than half of its income is derived from a trophy hunting joint venture that includes a limited quota of elephants. In 2003, 750 conservancy members each received a pay-out of N$620, as well as the added benefits of meat and employment (NACSO, 2005).

A number of protection measures have been built in NNC to protect water installations from elephants, including the loose rock walls, trenches and a

combination of these. In 2004, three tall, strong concrete enclosures were built to protect key installations at Den/ui, !Auru and Xamsa villages. At six waterholes in Khaudum National Park and one in NNC, the MET built concrete 'cribs' for elephants to drink from beside the main waterhole. These provide clean water that is more accessible than water pumped directly onto the muddy substrate of the waterhole.

Khaudum National Park (19°S, 20°E) comprises 3864 km^2 and is sandwiched between the Kavango and Caprivi Regions to the north, NNC to the south, communal land to the west and Botswana to the east (Fig. 2). The elephant population in KNP and NNC is increasing, based on aerial censuses carried out since 1977 (Lindeque, 1995; Ministry of Environment & Tourism, 1998; Dries Alberts, pers. comm.). The combined elephant population of NNC and KNP was estimated at 4815 in 2004 and projected to approach 6000 in 2005 (Ministry of Environment & Tourism, 2005). The elephant population in NNC represents approximately a quarter of those in the combined area, with a much greater population inhabiting Khaudum, approximately 3000 (Stander, 2004; Dries Alberts, MET, pers. comm.). The population in Khaudum and NNC represents almost a third of Namibia's elephants, the remainder being found in north-west Namibia (Etosha National Park, Damaraland and Kaokoveld; approximately 20%) and the Caprivi Region (over 50%).

Field Analysis

Details of human-elephant conflicts that occurred between 2000 and 2005 in KNP and NNC were obtained from the official records of the Ministry of Environment and Tourism in Tsumkwe. Villagers reported incidents of conflicts with wildlife to Ministry of Environment and Tourism (MET) staff on an ad hoc basis when government staff visited their areas as part of routine patrols. In the last five years, 41 conflicts were reported to have occurred at 16 conflict sites, including villages, enclosures, government stations and campsites. There may have been other conflicts because not all are reported by villagers, who are limited by transport. However, for consistency, only official reports were analysed in this study.

Between July and October 2005, I investigated all reported conflict sites and noted the conflict type, season, herd size of elephants and financial cost incurred. In addition, the name of, distance across and type of drinking point for elephants located closest to the conflict site was recorded. Drinking points were classified as artificial dams, concrete cribs/troughs, corrugated iron tanks or natural pans. The presence or absence of a cement crib at the drinking point, a loose rock barrier, a concrete barrier, trench or combined trench and concrete barrier was noted. Based on Geographical Information System (Arcview, version 3.1) analysis of the most recent aerial count (Stander, 2004), elephant densities of each conflict site within 12 strata in NNC were determined. The elephant density in KNP was calculated from the overall population estimate from the aerial count divided by the area, because counts for individual strata were not available. Data on trends in elephant populations was also derived from annual waterhole counts conducted by MET and NNC. The distance from each conflict site to the nearest drinking point for elephants and for conflict sites in NNC, the distance to KNP, was calculated using Arcview (version 3.1). The reliability of each drinking point for elephants was obtained from MET records based on a monthly visit by staff to each water point, but there was inadequate data to analyse this factor.

In addition, at 7 of the 8 conflict sites that were villages, a social survey was carried out to investigate community perceptions of elephants. A range of people of all ages and sexes (n=51) were interviewed at each village to provide an overall index for each village's attitude towards elephants. A positive response was given a score of 2 points, a negative one a score of 1 point and a neutral score was given 0. Questions revolved around how respondents felt about elephants, whether they had experienced conflicts and whether elephants provided any benefits (e.g. for employment and income through trophy hunting).

Conflicts with elephants were ranked as low, medium or high based on the following equation:

Number of conflicts (in last five years) x Severity = Index of Conflict

Where Severity was given a score of 1 if damage incurred was less than N$10,000, 2 if damage cost more than N$10,000 and 3 if villagers were chased, maimed or killed.

Statistical Analysis

The data was analysed using Statistica (version 7) using the generalized linear /non-linear models module with an ordinal multinomial distribution and logit link function. We used multinomial logistic regression to determine which factors significantly affected the level of conflict at each site. In all models, the level of conflict was the ordinal response, tested against the following continuous explanatory variables: herd size, elephant density, distance to nearest drinking point, distance to park and protection level. The presence or absence of a crib and season were included as categorical factors in the model. All of the continuous variables were non-normal and therefore were rank transformed. Due to the low sample size, site was not included in the model. All means are presented with standard errors.

Results

Status of human-elephant conflicts

More than half of the human-elephant conflict incidents that occurred in NNC and KNP in the last five years were damage to water installations (52.5%). However, conflicts also took the form of damage to fences (20%), crop damage (15%) and direct attacks on humans (12.5%), including the killing of a Ju/'hoan woman collecting bush foods in 2002.

The number of conflicts between people and elephants increased steadily between 2000 and 2003 and then began to decline in 2004 when stronger protection measures, specifically concrete enclosures around water installations, were introduced at particular villages (Fig. 3). During this time, the number of elephants counted in annual waterhole counts in both NNC and KNP increased every year. A total of N$551, 500 worth of financial damage was caused to infrastructure in NNC and

Khaudum since 2000. The total costs were not estimated in 2000 and 2001, but increased between 2002 (N$55,000) and 2003 (N$230,500), before beginning to decline in 2004 (N$200,000) and further in 2005 (N$65,000).

Most conflicts occurred in the hot dry season (47.5%, *n*=19), with a similar number of conflicts taking place in the wet (25%, *n*=10) and cold dry seasons (27.5%, *n*=11).

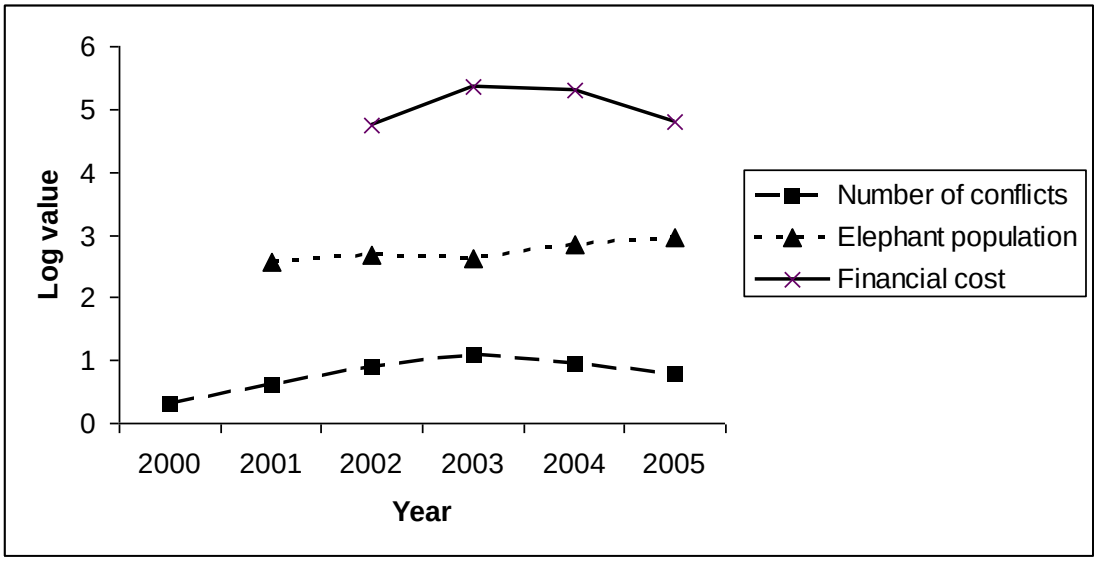


Fig. 3. Trends in the estimated elephant population in Nyae Nyae Conservancy over time in relation to the number of reported conflicts and the total annual financial cost.

Effect of herd size

The factor that most affected the level of conflict was herd size (Wald = 8.55, p = 0.003). More than half of the conflicts were caused by elephants in herd sizes of less than five (56%) and the number of conflicts declined with increasing herd size up to a threshold of more than forty elephants, where there was an increase in conflicts caused by relatively large herds of up to eighty. The average herd size causing conflicts was 19 $\pm$ 4 elephants (range: 1-80).

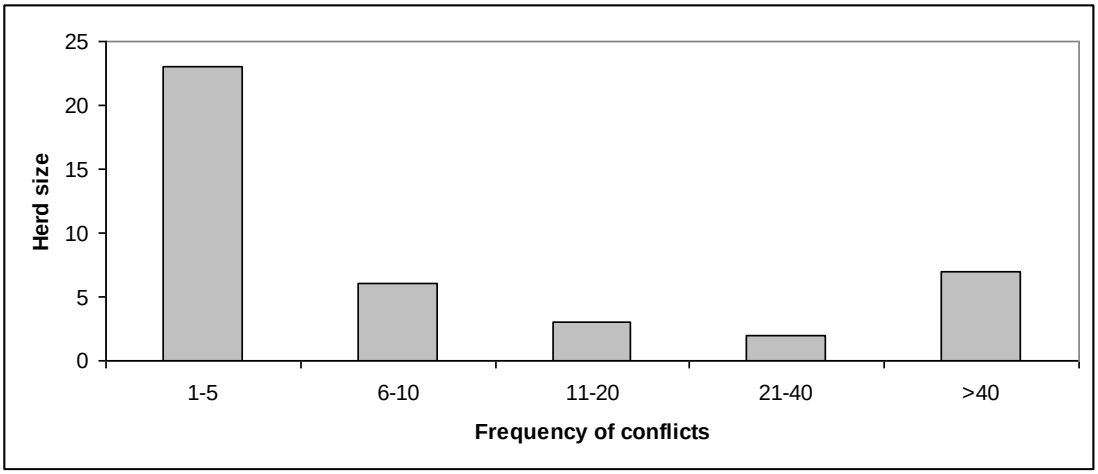


Fig. 4. The percentage of the total number of conflicts caused by different classes of herd sizes of elephants.

Effects of distances to drinking points and Khaudum National Park

The frequency of conflict tended to decrease with increasing distance to drinking points for elephants (Wald = 4.57134, p = 0.03). High conflict sites (n=3; μ=1.73 $\pm$ 0.38 km) were closer to drinking points than medium conflict sites (n=4; μ=2.70 $\pm$ 1.16 km), which were closer to drinking points than low conflict sites (n=8; μ=4.94 $\pm$ 1.45 km) (Fig. 5).

High (n=4; μ=60.3 $\pm$ 4.56 km) and medium (n=4; μ=59.4 $\pm$ 7.37 km) conflict sites tended to be further from Khaudum National Park than low conflict sites (n=8; μ=53.6 $\pm$ 8.90 km), although this factor did not fall into the model.

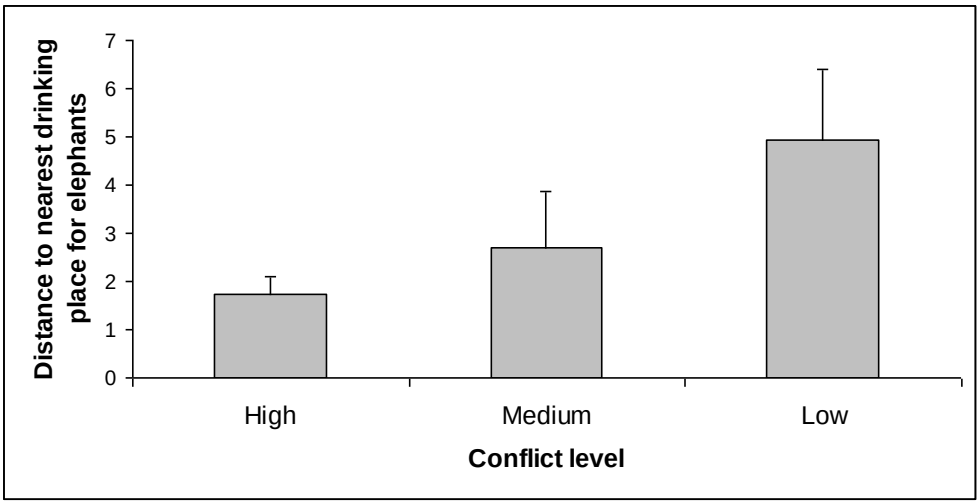


Fig. 5. Graph showing decreasing levels of human-elephant conflict with increasing distance to the closest drinking point for elephants in Khaudum National Park and Nyae Nyae Conservancy.

Effect of elephant density

Although elephant density did not fall into the statistical model, high and medium conflict sites tended to be in areas of higher elephant densities than low conflict sites (high conflict: μ=0.38 $\pm$ 0.07 elephants/km^2; medium conflict: μ=0.19 $\pm$ 0.04 elephants/km^2; low conflict: μ=0.18 $\pm$ 0.09 elephants/km^2) (Figs. 6 & 7).

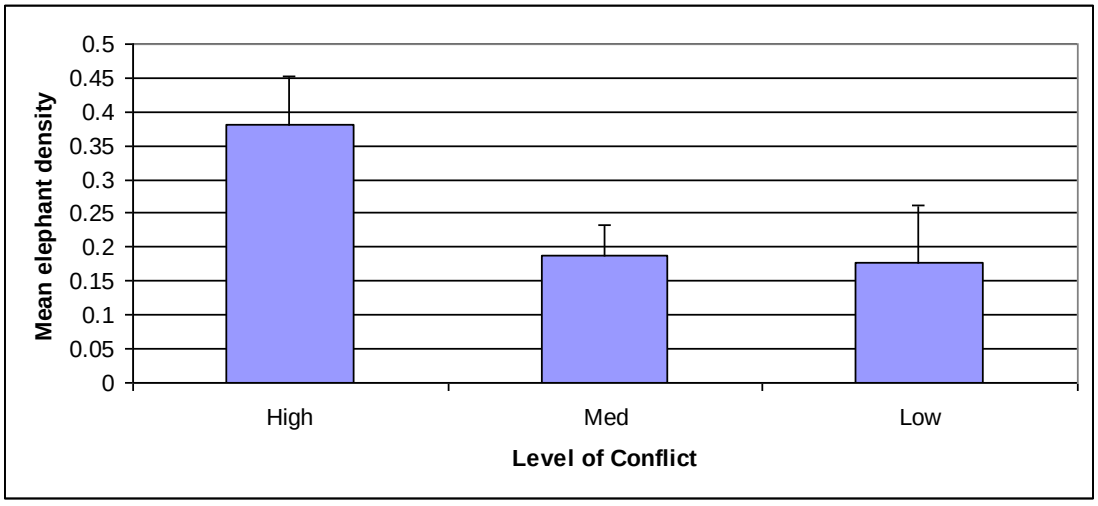
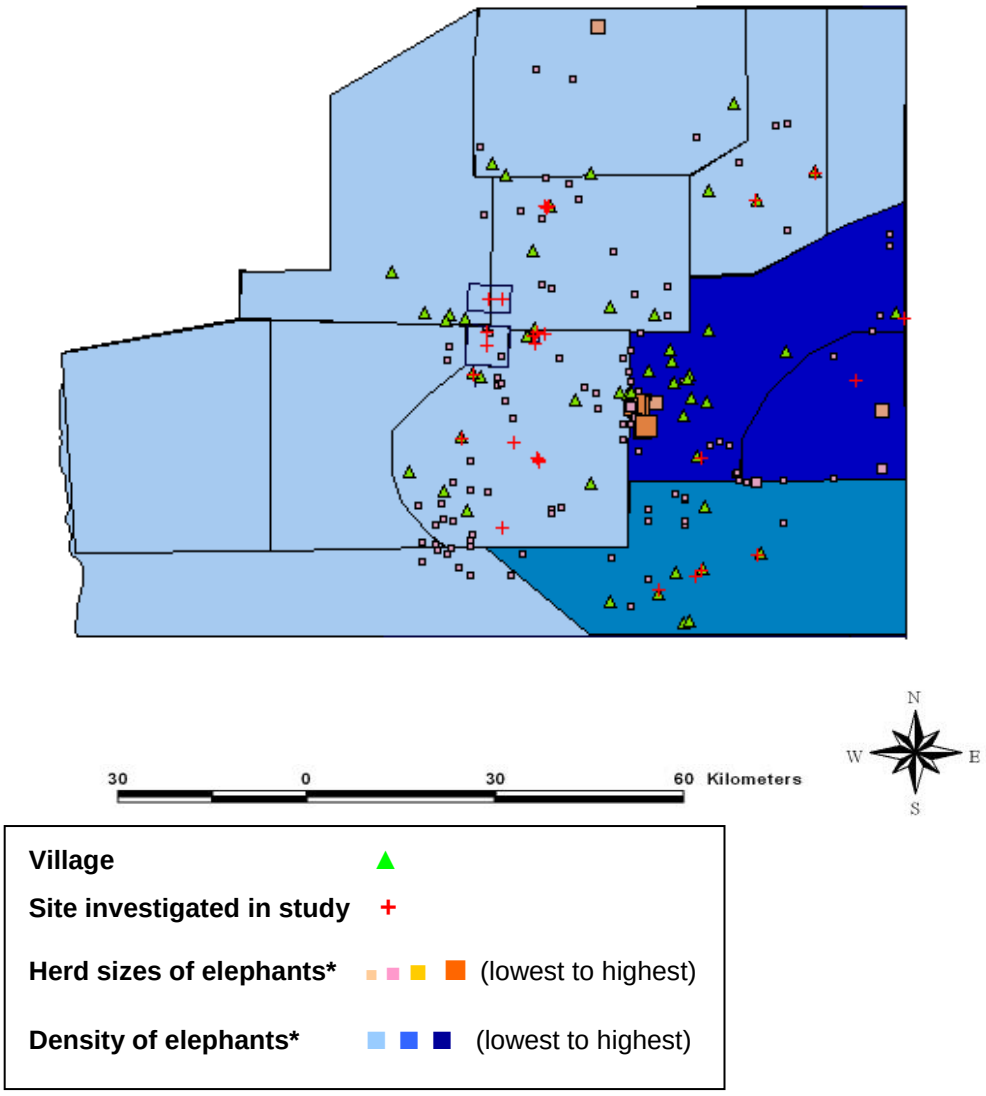


Fig. 6. Effect of elephant density on the level of conflict in Nyae Nyae Conservancy and Khaudum National Park.



* Stander (2004) – aerial count.

Fig. 7. Map of Nyae Nyae Conservancy showing the location of villages and sites investigated in this study in relation to herd sizes and densities of elephants (Stander, 2004) in different strata.

Effect of provision of cribs at water points on conflicts

The presence of concrete cribs at drinking points for elephants appeared to reduce the frequency of conflicts at nearby sites. Only 38% of the closest drinking points to

high conflict sites had cement cribs, while 92% of drinking points near medium conflict sites and 50% of those near low conflict sites had cribs (Fig. 8).

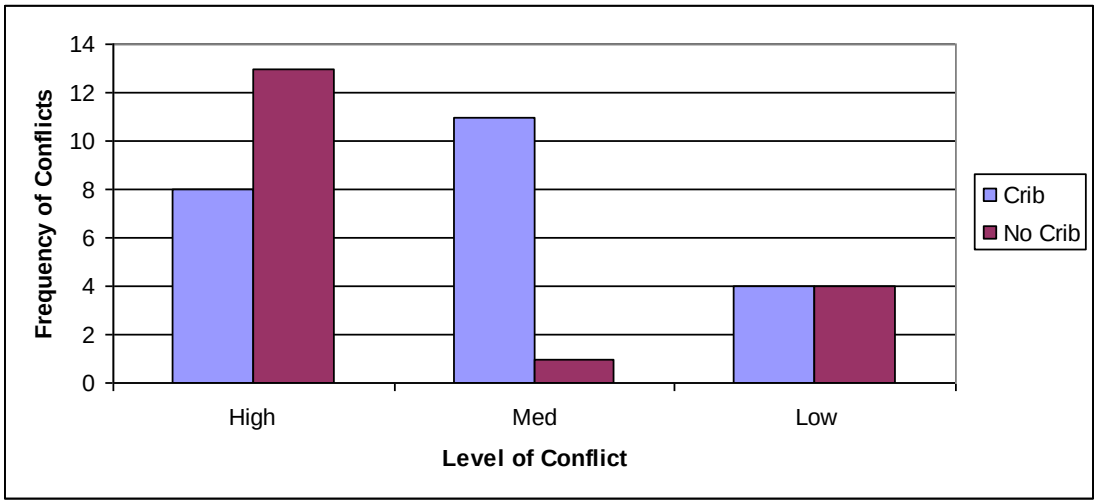


Fig. 8. The frequency of conflicts in relation to conflict level and the presence or absence of a cement crib in Nyae Nyae and Khaudum.

Effect of community attitude on conflicts

Of the seven villages (*n*=51 respondents) involved in the social survey to determine perceptions of elephants, two villages had a negative attitude, one was neutral and three were positive towards elephants. However, there did not appear to be a relationship between areas of high conflict and poor community attitude. The only village that had high conflict (#Auru) had a positive attitude towards elephants and one of the four villages with low conflict (Xobaha) had a negative perception of elephants.

Most respondents said that they considered elephants to be 'bad', an animal that they were afraid of (86%), although 14% perceived some positive and negative elements to elephants. Most (86%) of the adults and elderly interviewed perceived elephants as a threat to their livelihoods, largely through competition for water and bush foods. However, few adults (14%) said that they did not want elephants in their area and the majority perceived value in elephants for trophy hunting (95%), tourism (95%), jobs and income (93%).

Table 1. Summary of villages' attitudes towards elephants in Nyae Nyae Conservancy.

Village	Conflict	Attitude
!obaha	High	Positive
#Aura	Low	Negative
≠Aqbace	Low	Positive
Denui	Low	Positive
Klein Dobe	Low	Positive
N≠ama	Med	Negative
Xamsa	Med	Neutral

Discussion

The purpose of this study was to determine the status of human-elephant conflicts in Nyae Nyae Conservancy and Khaudum National Park as a basis for recommendations to ameliorate conflicts and assist management of elephants by the community. The project was requested by Chief Bobo in response to the growing numbers of elephants and associated conflicts in the conservancy. Due to the small sample size of conflicts at a limited number of sites in the last five years a cautious approach has been adopted in explain these findings. Only herd size, distance to nearest drinking point and distance to park significantly affected the intensity of conflict, however this is probably due to the small sample size. Nonetheless, the key results in this study go some way towards understanding why conflicts occur in this area and allow some preliminary recommendations to be made.

The herd size of elephants causing conflicts influenced the intensity of conflict more than any other factor. Most conflicts were caused by herd sizes of less than five elephants (Fig. 4). Although the sex of 'offending' elephants was not recorded, it is suggested that small herds tended more often than not to consist largely of bulls (Dries Alberts, pers. comm., T. Matson, pers. obs.). The available data did not allow this to be determined conclusively, thus more information is needed to confirm that

small, bachelor herds are responsible for most of the human-elephant conflicts in the area. If this is shown to be the case, then there may be justification for selective culling of particular bulls that repeatedly conflict with humans, as has been suggested by the area warden as a potential management option.

Conflicts with elephants declined with herd size up to a herd size of forty, beyond which conflicts escalated. This is probably because of the high demand for water created by large herds. Provision of more accessible water, perhaps by providing cement cribs, for the large herds observed in the dry season may ameliorate conflicts caused by very large herds.

Conflicts were more frequent at sites located close to drinking points for elephants than those that were further away (Fig. 5). This suggests that conflicts might be managed by manipulating the location of drinking points for elephants. For instance, locating water holes for game further from villages may reduce the number of elephants coming in to villages seeking water.

Surprisingly, more conflicts occurred at sites far from the Khaudum National Park border than close to it. This contrasts with the trend suggested by Osborn & Parker (2003) showing more conflict with elephants where human settlements border protected areas. However, in the case of Nyae Nyae Conservancy, there are more villages in the southern half of the conservancy than in the northern half, which is closer to the park. The presence of more villages in the southern half of the conservancy and the presence of the Nyae Nyae and Nama pans, which hold water for part of the year, means that there is also more water available in the southern half, which leads to more competition between people and elephants over otherwise scarce water sources. Thus, the finding that more elephant-human conflicts occur further from the park than close to it may be a human demographic effect influencing the distribution of water holes on which elephants depend.

It is not surprising that more conflicts occurred in strata of high elephant densities than at those with low elephant densities. The population of elephants in KNP and NNC is increasing, and therefore, conflicts are likely to increase again if management actions are not taken to mitigate the impacts.

The presence of a concrete crib appeared to influence the frequency of conflicts, although more data is needed to confirm this. Cribs provide cleaner, more accessible water than the typical dam-style, bore-pumped water holes in the area. Elephants appeared to selectively drink from cribs rather than muddy water holes in KNP (T. Matson, pers. obs.). More sites of high conflict did not have a crib than those that did and an equal number of low conflict sites had a crib as those that did not have one (Fig. 8). It is suggested that the provision of clean accessible water in cribs may reduce the intensity of conflicts, however, this action is not enough in isolation.

This study suggests that a combination of measures is necessary to reduce human-elephant conflicts in Nyae Nyae Conservancy and Khaudum National Park. The recent building of protection structures around infrastructure since 2004 appears to have eased the frequency and financial burden of conflicts, however elephant populations are still increasing in the area and conflicts continue to occur. Thus, further management actions are necessary. This study indicates that locating water holes further from villages is necessary in order to reduce the likelihood of conflicts. Also, these water holes should contain cement cribs to allow more elephants to drink clean water simultaneously than is the case at the common borehole-pumped water holes in the study area. Crib-building projects are underway and more are planned in 2006.

Few of the villages surveyed in NNC received a overall negative index towards elephants, and interestingly, the village with the highest conflict (!obaha) had a positive attitude towards elephants (Table 1). Most people considered elephants to be 'bad' and a threat to their livelihoods. However, it is apparent from the survey that this community recognises the benefits associated with having elephants in their conservancy, notably the financial, employment and nutritional benefits of ecotourism and trophy hunting joint ventures.

The population of elephants in north-east Namibia is likely to continue to grow, placing more pressure on both people and elephants in coming years. Several elderly Ju/'hoan people surveyed said that there were very few elephants in NNC when they were children and that this is a new problem. The Ju/'hoansi, like elephants, are

living in a much smaller area than they did previously. The change from a nomadic lifestyle to a settled one among the Ju/'hoan people led to boreholes and more available surface water, which is most likely why elephants are now more drawn to the area than before. However, elephants are likely to continue to be squeezed out of their range in more heavily populated areas like Botswana and the Caprivi, thus KNP and NNC may not be outlying habitat for elephants for much longer.

Due to the overall positive response of the community towards finding a solution for human-elephant conflicts and the results of this study, which suggest a few simple but potentially effective solutions to this growing problem, there is potential for a harmonious outcome in NNC and KNP between elephants and the Ju/'hoansi. The socio-economic benefits that people in the conservancy receive through elephants are the prime reason why they support the presence of elephants, thus further tourism and trophy hunting operations should be fostered. The limited croplands in the conservancy may be managed with electric fencing because of their small area, an action that may not be economically viable in other agriculturally-intense parts of Africa where crops are larger scale. Selective removals of 'repeat offender' bulls may be an option that the conservancy and MET could also consider. However, in NNC and KNP, because most conflicts take the form of damage to infrastructure, particularly at water holes, manipulating the key resource, water, appears to be the next step towards ameliorating conflicts.

Acknowledgments

This study was funded by the Namibia Nature Foundation, the Rufford Whitley Laing Foundation and the Wilderness Trust. Satcom and Kalahari Car Hire provided logistic support. Members of the Ministry of Environment and Tourism of Namibia, Nyae Nyae Conservancy and WWF provided outstanding local advice and practical support. I thank especially Chief Bobo, Dries Alberts (MET), Stacey Main, Leon Tsamkxao and Raymond Peters (WWF) for their advice and assistance. I am grateful to Dr. Jennifer Lalley, Dr. Kisa Ashbolt, Ron Swilling and Warren Tapp for their assistance in the field. David Putland undertook the core statistical analysis for which I am most grateful.

References

AfrESG 2002. African Elephant Status Report. Report of the African Elephant Specialist Group, IUCN Species Survival Commission.

Barnes, R. F. W., Hema, E. M., Nandjui, A., Manford, M., Dubiure, U., Danquah, E. K. A. and Boafo, Y. 2005. Risk of crop raiding by elephants around the Kakum Conservation Area, Ghana. Pachyderm 39, 19-25.

Blanc, J. J., Barnes, R. F. W., Craig, G. C., Douglas-Hamilton, I., Dublin, H. T., Hart, J. A. & Thouless, C. R. 2005. Changes in elephant numbers in major savanna populations in eastern and southern Africa. Pachyderm 38, 19-28.

Hoare, R. 1995. Options for the control of elephants in conflict with people. Pachyderm 19, 54-63.

Lindeque, M. 1995. Conservation and management of elephants in Namibia. Pachyderm 19, 49-54.

Malima, C., Hoare, R. & Blanc, J. J. 2005. Systematic recording of human-elephant conflict: a case study in south-eastern Tanzania. Pachyderm 38, 29-38.

Martin, R. 2005. Background Study: Elephants. The Transboundary Mammal Project. Ministry of Environment and Tourism of Namibia, Windhoek, Namibia.

Mendelsohn, J. & el Obeid, S. 2002. The communal lands in eastern Namibia. Namibia Nature Foundation, Windhoek, Namibia.

Ministry of Environment & Tourism of Namibia. 2005. Aerial census of wildlife in northern Namibia. Ministry of Environment & Tourism of Namibia, Windhoek, Namibia.

Ministry of Environment & Tourism of Namibia. 2005. Species management plan: Elephants (*Loxodonta africana*). Ministry of Environment & Tourism of Namibia, Windhoek, Namibia.

Namibian Association of CBNRM Support Organizations (NACSO). 2005. Namibia's communal conservancies: a review of progress and challenges. NACSO, Windhoek, Namibia.

Nyae Nyae Conservancy. 2002. Nyae Nyae Conservancy 5 year management plan (1998-2002). Nyae Nyae Conservancy, Namibia.

Nyhus, P. J., Tilson, R. & Sumianto. 2000. Crop-raiding elephants and conservation implications at Way Kambas National Park, Sumatra, Indonesia. Oryx 34(4), 262-274.

O'Connell-Rodwell, C. E., Rodwell, T. Rice, M. & Hart, L. A. 2000. Living with the modern conservation paradigm: can agricultural communities co-exist with elephants? A five year case study in East Caprivi, Namibia. Biol. Conserv. 93, 381-391.

Osborn, F. V. & Parker, G. E. 2003. Towards an integrated approach for reducing the conflict between elephants and people: a review of current research. Oryx 37(1), 80-84.

Sitati, N. W., Walpole, M. J., Smith, R. J. & Leader-Williams, N. 2003. Predicting spatial aspects of human-elephant conflict. J. App. Ecol. 40, 667-677.

Stander, P. 2004. Aerial survey of wildlife in the Nyae Nyae Conservancy, Namibia. Internal report. Aerial survey unit, Wildlife Science, Windhoek, Namibia.

Tchamba, M. N. 1995. History and present status of the human/elephant conflict in the Waza-Logone region, Cameroon, West Africa. Biol. Conserv. 75, 35-41.

Zhang, L. & Wang, N. 2003. An initial study on habitat conservation of Asian elephant (*Elephas maximus*), with a focus on human elephant conflict in Simao, China. Biol. Conserv. 112, 453-459.