Niassa Carnivore Project

Mitigation of negative human impacts on large carnivore populations:
Niassa National Reserve, Mozambique

Annual Progress Report
February 2009

This male lion and his radio-collared brother (LICM06) are the first male lions over the age of six seen in the intensive study area in the past three years (K. Begg).

By:
Colleen M. Begg & Keith S. Begg

In Collaboration with

;

Sociedade para a Gestão e Desenvolvimento
da Reserva do Niassa. Moçambique

Principle sponsors:

Acknowledgements

Our sincere thanks go to Sociedade para a Gestão e Desenvolvimento da Reserva do Niassa (SGDRN) for granting us permission to work in the Niassa National Reserve. In particular we thank Anabela Rodrigues, Sandra Almeida, and Rod Mavuja for organising fuel, customs and immigration formalities and other logistical assistance. Agostinho Jorge (SRN Employee) has become an integral part of the project this year and we thank him for all his enthusiasm and assistance particularly with the Lion-Hyaena call up survey, Negomano questionnaire survey and trophy monitoring. We are most grateful to the reserve warden, Gilberto Vicente and his staff at the Mbatamila headquarters, particularly Wim Ebersohn, Mbumba Marufo and David Chambal for all their assistance and support. Special thank you to the "Nkuli" team – our dedicated field and camp assistants (Euzebio Waiti, Alberto Mussoma, Moderu Saidi and Pedro Sandali) as well as Oscar Muemedi and Ndugu Alberto for their work during the first phase of this project. Our thanks to Dr Mike Kock (WCS Field Veterinary Programme) and Dr Rui Branco for their ongoing veterinary assistance, Dr Craig Packer for regular advice on many issues, and The Smile Studio, Cape Town (Kristen) for x-rays of the dental pulp cavities from leopard and lion teeth.

This project would never be possible without the enthusiastic support of all our sponsors that make working in such a remote region possible. The Niassa Carnivore Project is substantially funded by Panthera and the Innovation Award of the Rufford Small Grants Foundation. We reserve special thanks for Blaine and Susan Philips and the Fair Play Foundation for their ongoing support of carnivore conservation in Niassa through Fauna & Flora International (FFI-USA) since 2005 and to Doug Walker, Howard and Joyce Cosgrove and Peter and Eleanor Nalle for their contributions in 2008. Thank you to Fauna and Flora International (Rob Brett & Katie Frohardt) who have been instrumental in procuring funding for this project over the years. In addition we thank Safari Club International (Flint Chapter; Marc Somers) and the Dallas Ecological Foundation for their contributions to the lion and leopard components of this project. We thank WCN for their invitation to be guest speaker at the WCN Expo in San Francisco, USA (October 2008).Luambeze Investimentos Lda (Gonzalo Banus & Jamie Wilson) is thanked for ongoing assistance with flights and supplies in and out of the reserve. The project is administered by The Ratel Trust and we thank Stephen Clark for his ongoing legal and financial assistance in his capacity as a trustee.

In addition we would like to extend our appreciation to all the sponsors of the first phase of the Niassa Lion Project and Niassa Wild Dog Project (2004-2006): Fauna & Flora International (Patrick Ward & Matt Rice); Safari Club International - Flint Chapter (Marc Somers); Zambezi-Kavira Conservation Foundation (Westley Logan, Derek Littleton & Don Price); Kambako Safaris (Jumbo Moore); Concerto Nominees Ltd (Gary Tullis, Howard Hunter); Londo Lodge (P.J and Evelijn); Luwire (Jamie Wilson & Derek Littleton); Gonzalo Banus, Bob Gerber, Eveline Stalling, Phillip Lowell and Stuart Godin.

Many thanks to all concession managers, professional hunters and the Niassa's MOMS community and reserve scouts who regularly provided us with details of their opportunistic sightings of wild dogs, lions and leopard and information on human-carnivore conflict. We particularly thank Jorge and Lauritz from Singa Camp, (Niassa Hunters); Tharia, Dave and Michelle from Sable Camp, (Johan Calitz Safaris); Jumbo, Brad, Ruth, Stuart, and Johnnie (Kambako Safaris); Derek, Don, Paul, Alan and Paula (Luwire), Rob & Jos (One Africa); Dave and Matt (Safrique), Phillippe and Betrand (Metapiri) and Jamie, Marc and Eveline (Luambeze Investimos Ltd).

Table of Contents

List of Tables

List of Figures

List of Plates

Niassa Carnivore Project

Mitigation of negative human impacts on large carnivore populations in Niassa National Reserve, northern Mozambique

1.0 Mission Statement

The Niassa Carnivore Project serves to secure and conserve the large carnivore populations (lion, leopard, spotted hyaena and African wild dog) in Niassa National Reserve, northern Mozambique by promoting coexistence between carnivores and people. We acknowledge the costs to Niassa communities who live with carnivores while recognizing the potential of these carnivores to provide substantial ecological, cultural and economic benefits to Niassa Reserve and Mozambique. This mission is being achieved through direct mitigation of human-carnivore conflict, targeted pragmatic research, development of locally based monitoring systems, mentorship and training of local conservationists and community outreach (education and awareness).

Reporting period:	January -November 2008
Project Leaders:	Colleen Begg & Keith Begg
Research Assistant (part time):	Agostinho Jorge
Field Assistants:	Euzebio Waiti & Moderu Saidi
Camp Assistants:	Alberto Mussoma & Pedro Sandali

The Niassa Carnivore Project Team:
Mudero Saidi, Alberto Mussoma, Euzebio Waiti, Pedro Sandali (above, left to right))
Agostinho Jorge-SRN (below left)
Keith, Colleen and Ella Begg (below right)

2.0 Introduction and Justification

Niassa National Reserve (NNR) is located in northern Mozambique on the border with Tanzania. It is one of the largest protected areas in Africa (42 000 km^2) and is considered to be one of the "Last of the Wild" and most undeveloped places in Africa. Despite decades of war and neglect with only recent rehabilitation (2000), this extensive wilderness has survived intact and supports a full complement of carnivores. The protected area supports the largest concentrations of wildlife remaining in Mozambique including viable populations of the African lion (800-1000 individuals) and the African wild dog (more than 350), as well as important populations of leopard and spotted hyaena. For large carnivores the extensive areas of wilderness needed to support viable populations are becoming increasingly rare and NNR is therefore a national and global conservation treasure.

The Niassa Carnivore Project has been working in NNR since 2003 in close collaboration with SRN (The Society for the Development of the Niassa Reserve -the Management Authority of NNR), Niassa communities and tourism operators. Rock art in the area shows that Niassa has always supported a human population and today more than 30 000 local residents live inside the protected area spread across 40 villages. Shifting subsistence agriculture is the primary land use and main economic activity. Cattle are absent due to tsetse fly (Glossina spp.), the vector for the disease trypanosomiasis, but smaller livestock, primarily goats and chickens, and domestic dogs are present in the larger villages.

The African lion is listed as vulnerable with an estimated 23 000 to 40 000 lions remaining in Africa (Nowell et al. 2006) while the African wild dog is considered endangered with less than 8000 individuals remaining (IUCN/SSC, in prep, 2008). As a result of the work of the Niassa Carnivore Project, NNR has been identified as a priority for both lion (2006; Nowell et al 2006) and African wild dog (IUCN/SSC, in prep, 2008) conservation in eastern and southern Africa. The lion population is believed to be one of only five lion populations left in Africa that is currently increasing. The importance of these populations for global conservation efforts is increased by their transfrontier links to populations in Tanzania through the Selous – Niassa Wildlife Corridor. The Niassa-Selous African wild dog population is the second largest wild dog population remaining in Africa. In addition, Niassa Reserve provides the core and source of largely unprotected lion and African wild dog populations extending from the east coast of Mozambique at Pemba to the western boundary with Malawi at Lake Niassa and extending 100 km southwards (Chardonnet et al. 2008; IUCN/SSC, in prep).

Aside from their conservation importance and status as flagships of Niassa, we believe that if we can secure these carnivore populations in the long term this will have broader biodiversity and social benefits for NNR and will go a long way towards securing NNR as a whole. The conservation of lions in particular touches on many of the major ecological and social challenges facing NNR at present and all these carnivores have the potential to generate significant revenues for communities and management of NNR through tourism initiatives. Grassroots community outreach and extension work will be fundamental to successful conservation efforts as the costs to communities living with large carnivores is significant through the loss of life, livelihoods and livestock. Similarly, there are currently serious threats to the large carnivores from people, including retaliatory killing as a result of human-carnivore conflict, indiscriminate snaring, the sport hunting of underage individuals (lion, leopard) and various disease risks, particularly rabies and canine distemper spread from domestic dogs (Table 1). Successful sustainable conservation will require a multifaceted, collaborative approach that addresses both human and carnivore needs and incorporates targeted research and monitoring, development of locally derived, innovative solutions to mitigate threats and minimize conflict, training & mentorship of local conservationists and community outreach. In NNR there exists a narrow window of opportunity (less than 10 years) for a conservation success story.

This report represents the progress that has been made towards achieving the objectives in the 2008 calendar year.

3.0 Overview

3.1 Main achievements (2003-2007):

1. Completion of the first biodiversity survey of Niassa carnivores with 24 carnivore species identified (2003).
2. Lions and African wild dogs identified as research and conservation priority for NNR (2004), MOU with SRN signed and Niassa Lion and Wild Dog Project proposal (Phase I) finalized and funding obtained.
3. NNR identified as a priority Lion Conservation Area in Southern and eastern Africa (IUCN Cat Specialist Group 2006) on the basis of data provided by the Niassa Lion Project.
4. In collaboration with SRN, a pilot community based monitoring program is implemented in NNR to monitor human wildlife conflict and status of special species based on Namibian MOMS (Management Orientated Monitoring System) model (2006).
5. Niassa Lion sport hunting regulations developed by the Niassa Lion Project and implemented in collaboration with SRN and Niassa tourism operators. This system includes a points system for assigning quotas based on lion age. Niassa Reserve becomes the only sport hunted area in Africa where a mandatory six year age limit for lion trophies is enforced.
6. Completion of first questionnaire survey of human lion conflict in NNR reveals that there have been at least 75 lion attacks in NNR in the past 30 years, with 11 people killed and 17 injured between 2000 and 2006 alone (Begg et al. 2007).
7. Collation of wild dog sightings shows a population of at least 350 African wild dogs in NNR spread across 39 packs (Begg & Begg 2007). Rabies is identified as a serious potential risk to this population. A vaccination campaign is initiated (2006).
8. The transfrontier Selous -Niassa Wild dog population (Niassa National Reserve, Mozambique; Selous Niassa wildlife corridor and Selous game Reserve Tanzania) is considered the second largest wild dog population left in the world.
9. Production of NNR promotional DVD in Portuguese for Mozambican audience and publication of article in Africa Geographic Magazine (June 2007) to increase awareness of NNR and its conservation importance to broader audience.

PHASE II: 2007-2010

Mitigation and Awareness: Ongoing

3.2 Phase II: Broad Goals

1. Use targeted research to determine the status, density and threats to lions, leopards, spotted hyaenas and African wild dogs in NNR and develop indicators and survey protocols that can be used for ongoing monitoring by local conservationists and SRN.
2. Examine the local contexts of large carnivore attacks, particularly by lions (humans, livestock) and identify, test and finally implement locally derived, practical solutions with the active participation of local communities.
3. Develop and refine the Community-scout monitoring program to provide ongoing assessment of threats to carnivores, levels of human-carnivore conflict, and status of special species as well as provide incentives for community based natural resource management.
4. Assess and minimize the levels of disease risk (canine distemper, rabies, canine parvovirus) to African wild dogs and lions.
5. Collaborate with SRN and sport hunters to develop and implement sport hunting guidelines and providing independent monitoring of trophy quality for lion and leopard to ensure sustainable hunting while maximising economic returns to communities and SRN.
6. Initiate and manage community outreach initiatives (environmental education and extension work) in Niassa communities to promote the cultural, economic and conservation value of large carnivores and the use of effective conflict mitigation methods.
7. Ensure monitoring and conservation of carnivores in NNR is sustainable (not researcher driven) by providing appropriate training and mentorship, detailed surveying protocols and required equipment to NNR staff and local conservationists.
8. Disseminate the findings, mitigation strategies and protocols to inform broader national and regional conservation strategies and collaborate with local organisations wherever possible.

4.0 Study Area

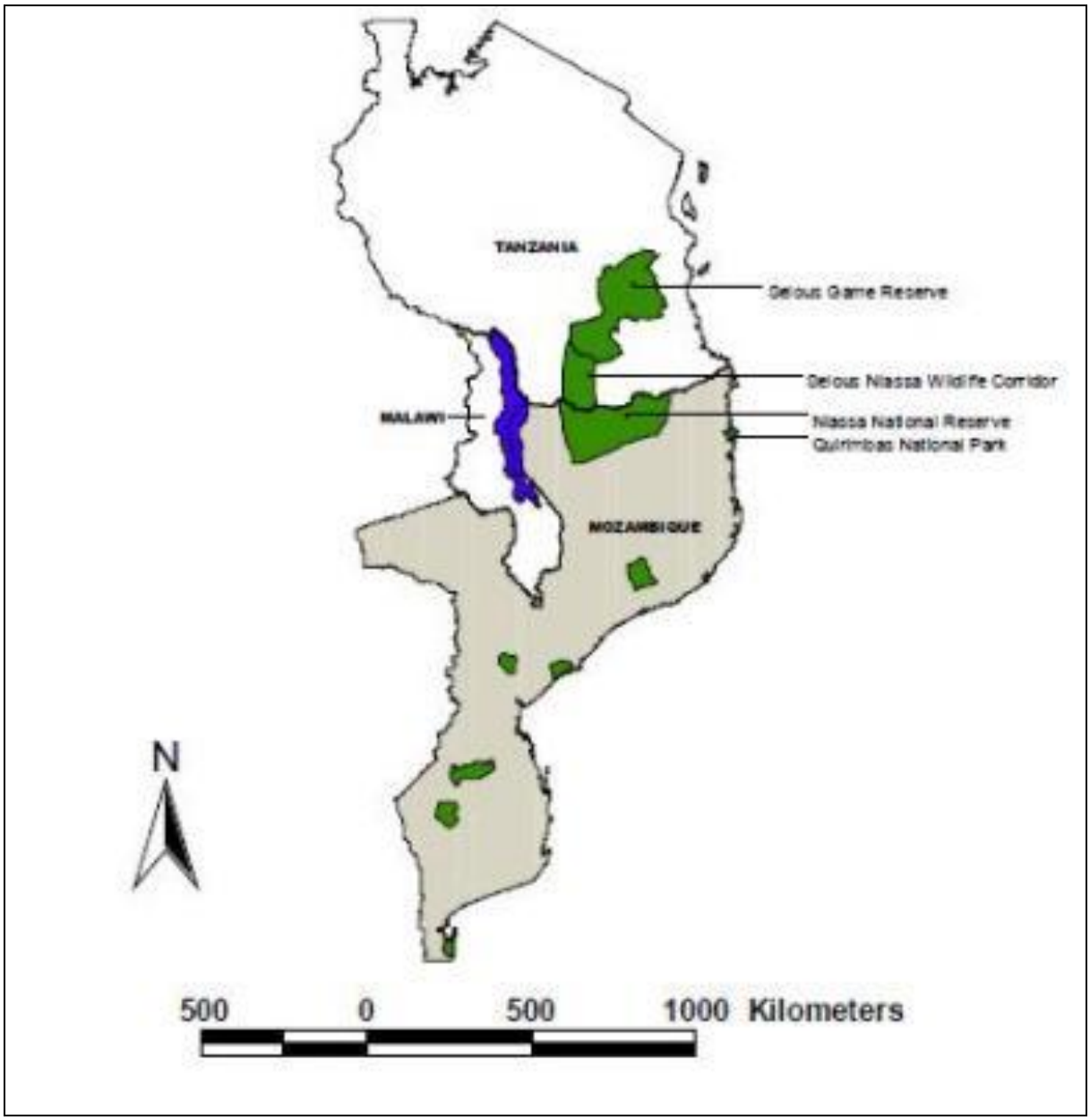

Fig 1: Regional Map showing linkage between the Niassa National Reserve, Mozambique and Selous Game Reserve, Tanzania through the Selous Niassa Wildlife Corridor.

4.1 Intensive Study Area

Intensive ecological research is focused in a specific study area situated along the Lugenda River in concession block “L5-South” designated for ecotourism. The study area borders two sport-hunting concessions on the south bank of the Lugenda River (L8, L7) with ecotourism concessions to the west (L4-East) and east (L5-north). It includes Mbamba village, a major village inside the protected area, which supports approximately 3000 people and encompasses a mosaic of habitats (riparian, Acacia woodland, open wooded grassland, mixed woodland and miombo woodland) as well as an arc of granite inselbergs. The southern boundary of the intensive study area is a 30 km stretch of the Lugenda River, which is the most intensively fished area along the 350 km of the Lugenda River contained within NNR. The river provides a critical protein and income source for several communities. The intensive study area therefore represents many of the larger challenges faced by NNR as a whole. While intensive research and radio collaring is focused in this area surveying and monitoring of the status and threats to the large carnivore populations in NNR occurs throughout the protected area.

Plate 1. Satellite Image of intensive study area situated on the north bank of the Lugenda River showing the extensive braided channels and arc of inselbergs.

5.0 Overview of Methods

The Niassa Carnivore Project (NCP) works in close collaboration with SRN, Niassa communities and tourism operators (ecotourism and sport hunting). The aim is to complement SRN's current conservation activities by providing input (data, equipment, funding, training) specifically focused on large carnivore conservation. NCP has a four-pronged approach:

1. Targeted pragmatic research and monitoring
2. Direct mitigation of threats particularly human-carnivore conflict
3. Mentorship and training
4. Environmental education, awareness and community outreach

5.1 Targeted Research and monitoring of threats and status

Sound ecological and social research underpins all our activities, as we believe that only with a good local understanding of the issues can effective conservation be achieved. In addition targeted research provides baseline information against which the success of conservation efforts can be assessed over time. Our research activities include:

a. Radio-marking of selected lion and leopard with a combination of GPS and VHF radio collars to understand movement patterns, density, age structure, prey with a particular focus on the movements patterns of lion around villagers (why and when do they enter the village fields.
b. Remote camera trapping to determine the relative densities of different carnivores, density of leopard in hunted and non-hunted areas (to inform sustainable sport hunting quotas and provide a baseline), and movements of animals around village fields.
c. Track and visual transects to assess prey density and relative densities of large carnivores.
d. Questionnaire surveys throughout NNR to assess past and present human-carnivore conflict, mitigation methods already used by communities, cultural value of carnivores and influence of spiritual leaders etc.

Ongoing monitoring of the status of the carnivore populations and their threats is critical to assess the effectiveness of conservation efforts and identify problems and threats before a crisis develops. It is essential that monitoring is simple, sustainable (achievable in terms of funds and manpower) and relevant to the conservation objectives. It needs to be closely linked to mentorship and training of local conservationists to ensure it is not researcher driven but an integral part of the natural resource management system in NNR. NCPs monitoring activities include:

a. Development of a Community Monitoring System (following the Namibian model of MOMS – Management Orientated Monitoring System) whereby community monitors are identified by traditional leaders in each village to collect relevant information (sightings of special species, human- wildlife conflict, disease). These community monitors provide an important link between reserve management and communities and are a way for communities to get actively involved in natural resource management.
b. Lion and spotted hyaena call-up surveys to assess density, age structure and changes in population structure over time (every three years).
c. Annual monitoring and assessment of all lion and leopard sport hunted trophies to assess off take and trophy quality etc.
d. Disease analysis from blood samples taken from domestic dogs as well as wild carnivores in collaboration with Mozambican State Veterinary Department

5.2 Direct Mitigation of threats

This is the main practical focus of the project: finding pragmatic locally based solutions to decrease the threats to people from large carnivores and to large carnivores from people. Research and monitoring have identified between 2003-2008 have identified the main threats to carnivores in NNR. These are listed in Table 1 in order of priority.

5.3 Mentorship and Training

NCP provides training and mentorship to both NNR staff and local villagers. Our activities include providing SRN staff with direct field training on the project, providing field staff with critical equipment where needed so they can work effectively (GPS, computers, binoculars, cameras), identifying and training local villagers as field assistants (GPS use, driving skills, radio tracking, basic car maintenance, trapping etc) and by sourcing and providing funding for subprojects and training run by SRN (vaccination of domestic dogs, MOMS training workshops etc). In addition, NCP provides SRN with equipment and skills needed to continue with monitoring activities (camera traps, call-up equipment, predator traps).

5.4 Education, Extension and Awareness

At present environmental education and extension work in Niassa communities is in its infancy. NCP reports information back to communities through local village meetings, posters and the community scouts. However the intention is to initiate more specific environmental education in NNR in future if funding can be found. The aim would be to spread information on mitigation measures, assist individual communities with protection measures, reaffirm cultural important of carnivores and provide basic ecological information on the NNR system. NCP also disseminates information from the project to a broader Mozambican and international audience through scientific papers, public presentations, film, photography and popular articles.

Table 1: Ranked threats to large carnivores in Niassa National Reserve – 2008

Threat	Ranking	Comments
Inadvertent snaring and poisoning	High	Snares set for ungulates for meat, inadvertently catch carnivores
Human –Conflict / Retaliatory killing	Medium	Loss of life, injury and stock losses
Sport hunting of underage individuals	Medium	Lion and leopard in sport hunting concession in protected area
Disease – rabies and canine distemper	Medium	Spread from 200-300 domestic dogs resident in protected area
Targeted snaring for skin trade	Medium	Mainly for leopard, some lion
Road causalities	Low but increasing	Particularly wild dog, increasing as roads are upgraded
Traditional medicine	Low	All species

6.0 Progress towards achieving Objectives - 2008

6.1 Targeted research and monitoring

6.1.1 Radiomarking

- In the past four years (2005 –2008), 12 lions (6 females; 6 males) and six leopards (3 males; 3 females) have been radio-marked in the intensive study area. At present, eight lions and six leopards are radio marked, with three lions and two leopards (all young adult males) currently unaccounted for.
- All captured animals are measured and aged and a DNA and blood sample is taken. DNA samples are sent to Prof Conrad Matthee at Stellenbosch University, South Africa for phylogeographic work on the species, while the blood samples are sent to the National Veterinary Department in Maputo for disease analysis.
- In 2008, five lions and five leopards were radio collared with new Vectronics GPS radio collars (Plate 2). These GPS collars take a position reading four times a day and the information can be downloaded from 1-2 km away or from an airplane. One lion collar has malfunctioned and has been removed from the lioness and has been sent for repair.
- The GPS collars are very expensive ($4000 / collar) and do not have a long lifespan (1-2 years at best) but their use is considered justified in NNR due to the nature of the terrain (woodland with deep river and erosion gullies), poor road network, extended wet season and low observer traffic. In 2008 the GPS collars greatly improved our knowledge of lion and leopard movement patterns and home range and are critical if we are to understand lion movements around human settlements in NNR, particular during the wet season. However continued collaring of leopards is not considered will only continue if funds are obtained to cover all the core items. We believe the cost of GPS collars cannot be justified if it occurs at the expense of other critical conservation work such as mitigation of conflict, disease prevention, trophy monitoring etc; these must be the first priority.


Plate 2: Agostinho Jorge, SRN employee and NCP research Assistant radio collaring his first lion in 2008 and Pedro Sandali (NCP field assistant) tightening the collar on a male leopard (LECM04) captured close to camp.

6.1.2. Lions

- In October a long-term goal of the project was achieved when two females from a pride of lions known to frequent Mbamba village surrounds were radio collared (one VHF and one GPS collar). In August 2008 this pride was observed resting in close proximity to the Mbamba clinic. The pride consists of two adult females, one young male and two young females with another male lion seen with the group on one occasion. Field Assistant, Euzebio Waiti will be monitoring this pride throughout the wet season (Dec – March) to assess when and how often these lions are coming into the machambas (fields) and village. This will help us to understand why lions are coming into the village surrounds and will help us to develop ways to minimize interactions between lions and people (see section on Human- carnivore conflict).

- Individuals from the F-pride (4 adult females), which have been collared since October 2007, are also known to visit the village fields during the wet season (2008 wet season data) and will continue to be monitored.
- Data from the GPS collars clearly shows the use of the Lugenda River as a territorial boundary during the wet season and much of the dry season (Fig. 2). While both lion prides and male lions do cross the river in the second half o f the dry season (July-December), the majority of their movements appear to be concentrated on either the north or south bank during a single season.
- Four lions have died: one was snared, one sub adult male got stuck in a warthog burrow and died, one adult female died of old age and one sub adult female died of unknown causes). A malfunctioning collar on one female has been removed. The deaths are not thought to be related to radio collaring.
- 2 adult male lions over the age of 6 years were seen in the study area in 2008. One of these males was radio-marked with a GPS collar. These are the first males over the age of six seen in the study area since the since 2006 (Plate 3).
- Through opportunistic sightings, and following of radiomarked individuals the primary prey of lions has been assessed (Fig. 3)

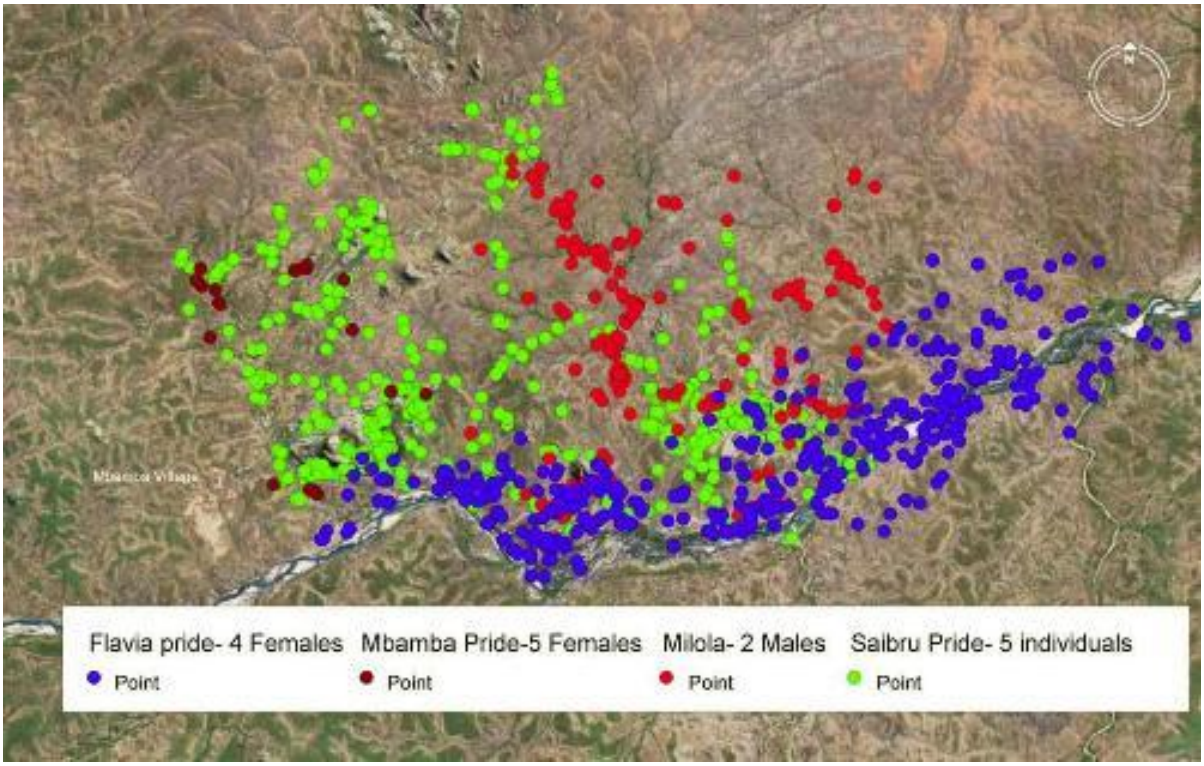

Fig. 2: Preliminary movements and home ranges of three lion prides and one male coalition (red) all collared in the intensive study area. The Mbamba pride (brown) and Flavia pride are known to visit Mbamba village during the wet season and are being closely monitored.

Plate 3: A coalition of two adult male lions has been identified in the intensive study area. One has been radio-marked with a GPS collar so that we can monitor his movements and home range. Both males are 6-8 years old with black noses, worn teeth and full manes with no bare patches behind the ears. These are the first over six year olds to be seen in the study area since 2005.

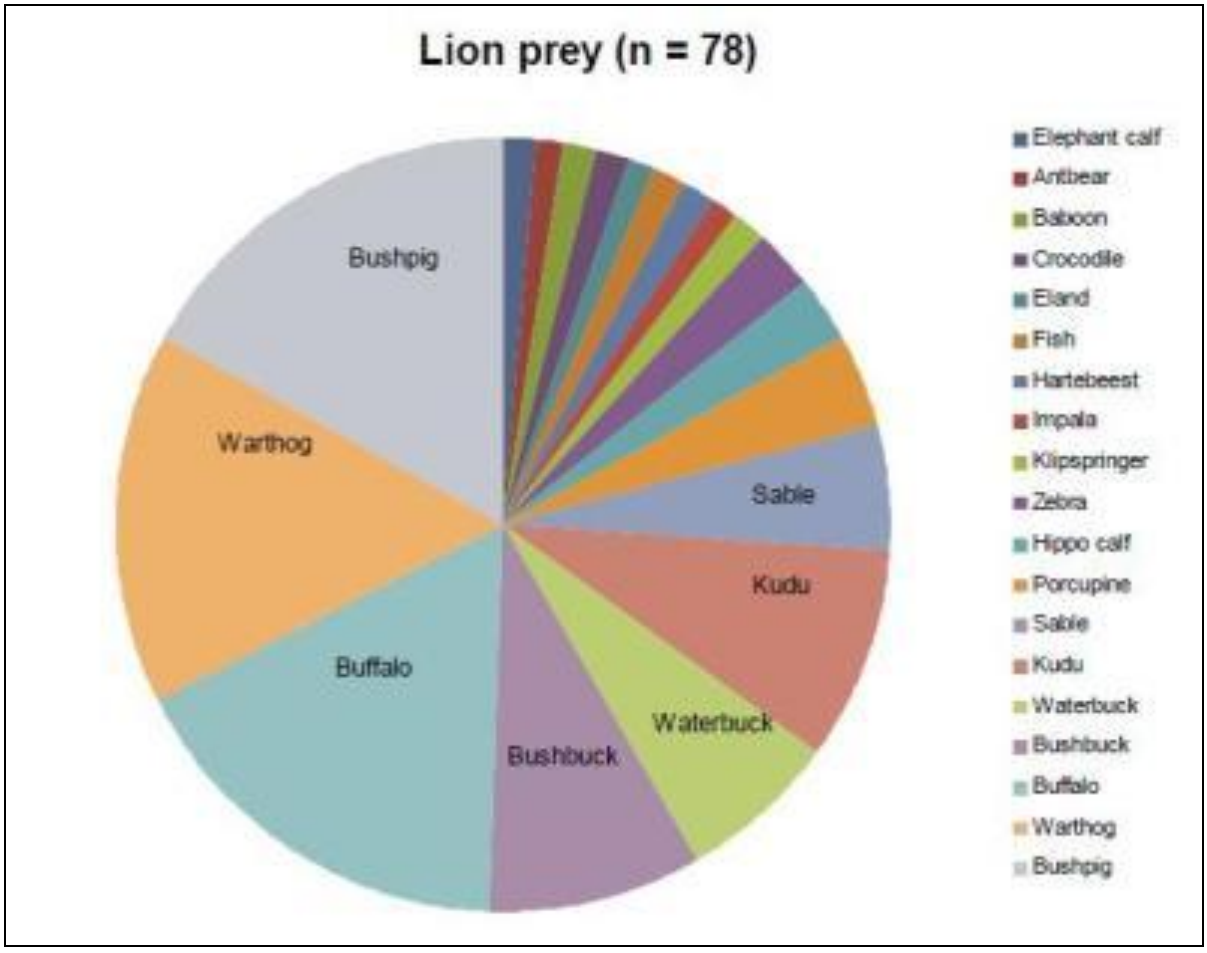

Fig. 3. Prey of lions in NNR taken from all sightings (opportunistic, radiomarked animals) between 2005-2008 showing the predominance of bushpig, warthog and buffalo as prey items. These data do not include people that have been killed by lions and small prey items are likely to be underestimated.

6.1.3. Leopards

- The aim is to identify all leopards in a 50 km^2 intensive study area along the Lugenda River to determine the population density and age structure of this population. The intensive study area for leopards will be extended as more information is gathered. This information will be used to assess the current leopard quota in NNR and ensure it is sustainable (see section on leopard trophy monitoring).
- Six leopards were radio marked this dry season, five of these with GPS radio collars. This brings to eight the total number of leopards radio marked since 2007 (five males and three females; Plate 4).
- Neither of the young male leopards marked in 2007 have been seen or heard this season despite extensive camera trapping and baiting. The collars on these leopards are very reliable and can be found even when an animal dies. We therefore believe these two individuals have simply moved out of the study area, and this is probably a feature of young males in the population.
- The home ranges of four of the radio-marked leopards are shown in Fig. 4. Of particular interest are the female home ranges, which show little overlap and a large variation in size. Eliza –LECF01 is a woodland leopard with a home range of approximately 70 km^2 while Isabel-LECF02 is a river leopard with a small home range of approximately 10 km^2 centred on the islands of the extensive braided channels in the Lugenda River.
- The biggest surprise has been the movements of an old adult male leopard (LECM03; Fig. 9, red dots). In a two-month period he travelled more than 1000 km^2 crossing four concessions and utilizing both sides of the river (Fig. 5).
- One of the main aims of leopard capture is to validate visual cues for leopards in NNR. Sample sizes are small but suggest that there may be a relationship between body length, weight and shoulder height and age with older leopards being bigger than young leopards. However this trend is not shown in the bigger sample from trophy animals (Table 2).
- Leopards in NNR appear small with a maximum body weight recorded of a collared male 51 kg, with the adult females only weighting 28-30 kg (n = 3)

Table 2: Measurements of 2007 and 2008 male leopard trophies and collared animals taken by Professional Hunters in NNR from all age categories

Measurement	<2 years Mean (N)	2-4 years Mean (N)	> 4 years Mean (N)	Total Range	Total Sample Size (N)
Trophy Animals					
Nose- tail tip body length cm)	200 (8)	205 (11)	205 (5)	178-290	24
Weight (kg)	49 (8)	49 (11)	66 (5)	44-70	24
Shoulder Height (cm)	51 (8)	63 (13)	65 (5)	53-84	26
Neck Circumference (cm)	52 (6)	50 (11)	55 (5)	48-56	22
Collared males					
Nose- tail tip body length cm)		194 (2)	227 (3)	187-265	5
Weight (kg)		35 (2)	42 (3)	30-51	5
Shoulder Height (cm)		43 (2)	53 (3)	39-68	5
Neck Circumference (cm)		43 (2)	46 (3)	39-50	5

Plate 4: Collaring leopards during the 2008 field season. Note the new research and monitoring Landrover in the background that was kindly sponsored by Panthera.

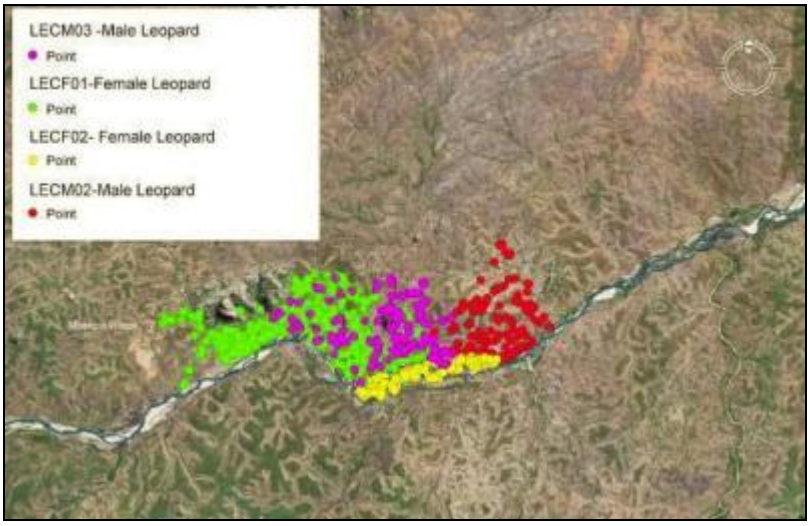

Fig. 4: Leopard movement and home ranges from four individuals (2 females; green and yellow; and two males: red and purple) radio marked with GPS collars in 2008 in the intensive study area.

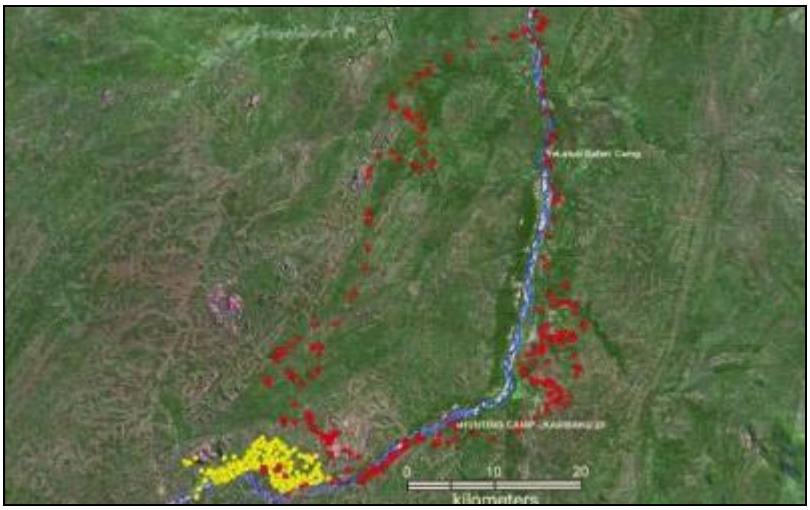

Fig. 5: Movements of an adult male leopard "Mantindano" over a two month period shown in red dots. A female leopard home range (70 km^2) is shown in yellow for comparison

6.2 Camera trapping

- Remote camera traps are being used to determine the density of leopards in the intensive study area (leopards can be identified through their individual coat patterns). They are also being used to determine the relative densities of all carnivores and for determining the movements of prey into the village fields during the wet season.
- To assess leopard density and the relative density of all carnivores, 15 camera stations (30 camera traps, two traps at each station) were set up in a 50 km^2 area along the Lugenda River and extending 2 km inland. The cameras were loosely set in a grid formation but at sites where leopard movements were likely. They were checked at least every two weeks to change batteries and download pictures and remained in place for 68 days.
- In total 42 photographs of at least 9 different individual leopards have been taken (including all the radio marked individuals, Plate 5, Plate 6). Data are still being analysed. By April all the pictures will be analysed, ID cards will be developed for each individual and a density determined using standard “capture - mark - recapture” statistical models.
- An alternative population density is being calculated from a total count of known individuals in the study area based on all trapping, radio-collaring, and camera trapping data as well as opportunistic sightings and camera trapping at bait sites where leopard activity has been observed. In total 86 images of leopard are being collated.
- A 2009 aim is to repeat the camera trapping survey in the sport hunted area on the south bank of the river to assess leopard density in different resource use areas. This will help to determine sustainable leopard sport hunting quotas and provide a baseline for future comparison.
- If possible spoor transects conducted through the study area will be calibrated against actual leopard density to provide a relatively easy, cheap and effective way to assess leopard population in the future (rather than radio-marking and camera trapping which is labour intensive and expensive). However, data collected to date suggest spoor transects are not effective in this area with a very low number of tracks recorded crossing the road. This may be due to inadequate road network in the area.

Plate 5: An uncollared male leopard captured during the day by one of the camera traps.

Plate 6: Male leopard collared with a GPS collar (LECM04) captured at night by one of the camera traps.

6.3. Lion & Hyaena call- up survey

- In July a carnivore call up survey was completed to compare with survey data collected in 2005. Exactly the same technique was used whereby distress calls (squealing pig, wildebeest calf) and hyaena whooping calls were transmitted from loudspeakers at 10km intervals along suitable roads throughout NNR through the night.
- An hour was spent at each calling station and all carnivores that responded to the calls were counted and for lions aged according to nose colouration, mane development and general body condition.
- This year two survey teams were used to ensure large coverage of NNR over a shorter period of time. The survey teams consisted of A. Jorge, E. Waiti, K. Begg and M. Saidi (Plate 7).
- A total of 104 calling stations (1040 road transect; Fig. 6) were completed, and 36 lions, 59 spotted hyaenas, 23 leopard and three packs (16 individuals) of African Wild Dogs responded. An area of 3346 km^2 was covered by the call up with almost equal coverage of riparian and woodland areas.
- The average lion response time was 32 minutes (range 6 minutes to 54 minutes) almost exactly the same as the average hyaena response time (35 minutes; range 6 – 1 hour).
- Of the lions that responded, 11 were adult females, 18 were adult males and seven were cubs and subadults of both sexes. Half of the adult males were 4-6 years old (10; 55%), with only two between 2-4 years and six animals considered older than six years (the minimum for sport hunting trophies; 33%). The males were most commonly with females (43% of sightings) 26% were alone and 21% were coalitions of 2 animals. Interestingly four of the lions older than six years old were alone, one of the old males was with a very one male and one was with a female. This suggests that it is predominantly 4-6 year old lions that are pride males.
- Of the spotted hyaenas that responded, 13 were alone (43% of sightings), 10 sightings were of two animals (33%), and only 23% of the sightings were three of more sightings with five the most hyaenas seen together. Pack sizes therefore remain small in NNR compared to other areas.

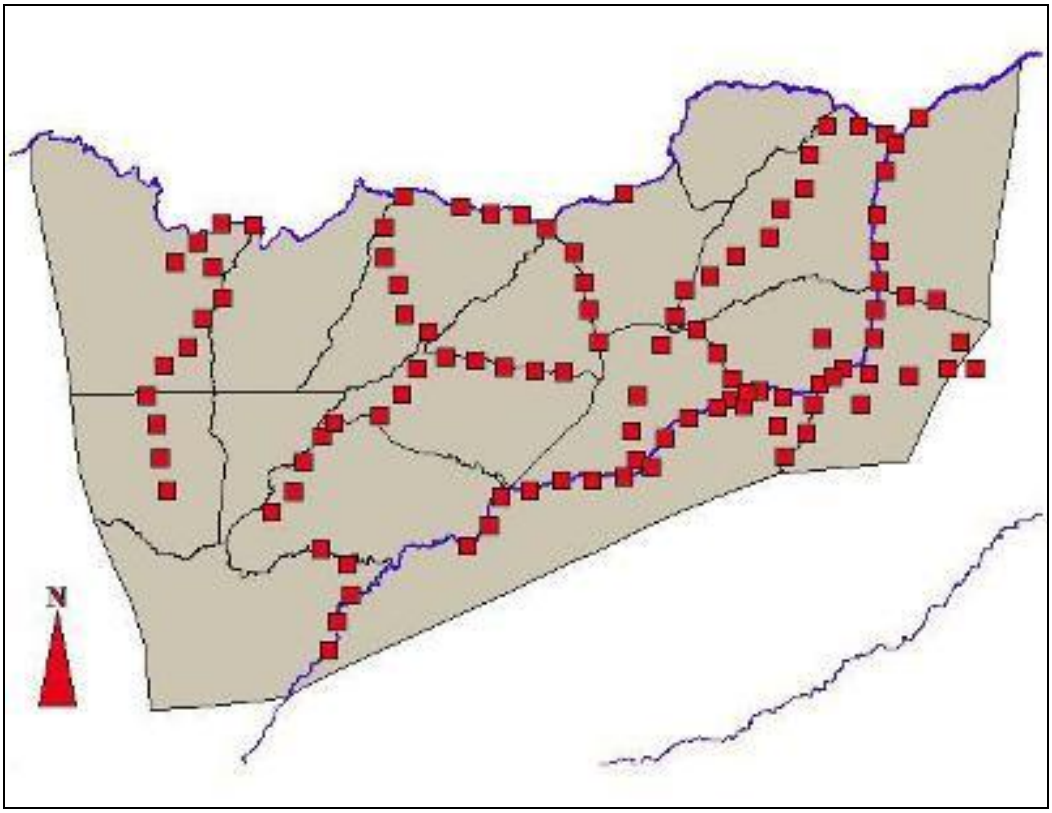

Fig. 6. Position of call stations (red squares) used during the 2008 Lion and Hyaena call up survey through NNR

- The results show that, as in 2004 and 2005, there is a significant difference in the density of lions in areas close to permanent or secondary rivers compared to watershed areas. This is expected given the prey densities are concentrated around rivers. However, hyaenas do not show this pattern.
- The results are encouraging as compared to 2005 data; they show that lion and hyaena densities are currently stable in NNR, with a slight increase in lion density in watershed habitats.
- At present the overall density is 2 lions /100 $km^{2,}$ but with 0.9 lions / 100 km^{2} in watershed areas increasing to almost 3 lions / 100 km^{2} in areas near major rivers. This is supported by research in intensive study area where there has been a slight increase in the lion population over the last 5 years with a current density of 0.03 km^{2} We still believe there to be between 800-1000 lions in NNR at present.
- Hyaena density is 3 hyaenas / 100 km^{2}, group sizes are still small compared to other areas (1-4 individuals) and there does not appear to have been an increase in the hyaena population.
- Analysis of the age structure of the lion population and sex ratios still needs to be completed. However the call-up survey confirms that suitable trophy male lions (older than 6 years of age) are present in NNR as they were seen on several occasions both within sport hunting and ecotourism concessions.
- This year, Agostinho Jorge (SRN employee) gained valuable experience in the call-up technique (Plate 7) and a full call-up kit (loudspeakers, amplifier, player, and distress calls) were donated to NNR by NCP to ensure follow up call up surveys can be conducted by NNR staff in future. We recommend that call-up surveys be completed in NNR every five years.

Plate 7: Agostinho, Euzebio and Moderu during the lion and hyaena call up survey in July 2008. The vehicle has been temporarily painted with brown poster paint to camouflage it at night.

6.4 Community Scout Monitoring Program

- The NCP continues to provide financial support and guidance to the Community Scout (MOMS) program in Niassa National Reserve (NNR) as this is considered an essential component of sustainable monitoring of carnivore populations and their threats. It is also an important tool for engaging Niassa communities in natural resource management and mitigation of human-wildlife conflict. The program is lead by Agostinho Jorge (AJ) and Mbumba Marufo (MM), both young Mozambican graduates that are employed by SRN.
- A meeting was held with AJ and MM in June 2008 to discuss goals for 2008, to identify villages for identification of new scouts and solutions to problems encountered to date. The need for more regular meetings with the scouts as well as the possible implementation of a reward/ incentive system for scouts and communities based on a variety of criteria were discussed. In addition, the need for the data collected by the community scouts to be communicated back to the communities was reemphasized. This is essential, particularly with regard to human-wildlife conflict where the perceptions of the communities as to which animals are causing the most damage are frequently different to the reality.
- The MOMS community scout annual training and reporting workshop was completed in August lead by AJ and MM. Four new community monitors from four villages were trained. This brings to 14 the number of monitors trained from 13 villages since 2006. These monitors are collecting information on human-wildlife conflict, special species and fishing activities. Everyone who took part in the workshop received a certificate and new cap and T-shirt (Plate 8 and 9).
- At present NCP is paying a monthly stipend to these monitors however the end goal is for the communities to pay for the monitors themselves from the 20% they receive from concession and trophy fees. For this to occur it is essential that the communities appreciate the value of the information collected and takes ownership of the program and the data. Ways to achieve this were discussed with AJ and MM as well as the need for a strategy / action plan to guide the way forward over the next 3 years.
- Data collected by the community monitors is particularly important for monitoring the status of African wild dogs in Niassa. These are listed as a special species and data is collected on all sightings of wild dogs, and their pack size. Any decrease in mean pack size will be a cause for concern, compared to the baseline of 7 individuals established between 2004 and 2006. The 2008 MOMS data is currently analyzed by SRN.

Plate 8: MOMS (SMOG) training workshop 2008: Experienced community monitors teach the new scouts how to fill in the MOMS data forms (© Photo: A. Jorge)

Plate 9: 2008 Niassa Community Monitor Team with Agostinho Jorge at the training and reporting workshop held in August 2008 (© photo: M. Marufo)

6.5. Antipoaching and Snaring

- In NNR snaring of carnivores is a significant threat and can be divided into three types: inadvertent snaring where carnivores are caught in snares set for other animals for meat; targeted snaring of carnivores that are causing a problem and targeted snaring to procure the skin for trade, in this case usually leopard.
- Inadvertent snaring is indiscriminate and many carnivores are attracted by the game caught in the snares and end up getting caught themselves, however the number of carnivores killed in snares is difficult to assess accurately.
- In addition despite active and effective anti-poaching efforts by the NNR security team, subsistence snaring is particularly difficult to control due to the high volume of pedestrian traffic moving through NNR and its link to livelihoods and the need for protein. We understand that in many villages, meat is freely available on demand at about US$1 / portion.
- NCP has recorded 10 lions snared since 2005 and the reality is probably at least double this number. At least one lion is killed in Mbamba village each year and 2008 was no exception with a lion killed in the village in April 2008 (reported by villagers).
- In addition this season two additional adult lion skulls were recovered within 700m of the elephant electric fence surrounding Mbamba village, both reported by Mbamba residents. However there was no evidence of snaring or poisoning and the cause of death is unknown.
- In May, a lion regularly seen outside Mussoma village was caught in a snare but escaped. It then injured one of the hunters attempting to kill it for its skin in a provoked attack. A similar incident occurred in Mecula village in March 2008 where a lion was caught in a bushpig trap, stones were thrown at the lion and eventually she broke free.
- Evidence continues to mount of a confirmed trade in leopard skins. In addition to the three incidents reported in 2007 (2 leopards snared, 2 leopard sport hunted skins stolen), an additional two incidents have been reported this year: snares set specifically for leopard have been found just outside Xixano village bordering Block B (Kambako) and a recent leopard skin was found by the NNR security officer in Naulala village.
- A lion cub offered for sale was confiscated by SRN head of security (W. Ebersohn) and NNR warden (G. Vicente) in Negomano Village (Plate 10).
- To assist the NNR security team lead by Wim Ebersohn in their antipoaching efforts, NCP donated 9 GPS units / track loggers, one for each patrol team. These enable scouts to collect accurate records and tracks of antipoaching patrols, and allow the security team to objectively quantify patrol effort (time and distance covered) and allow detailed record keeping of poaching events, pedestrian paths, carcasses, general mapping etc (Plate 11).

Plate 10: Tanzanian trader crossing the Ruvuma River to Negomano Village, NNR to sell a lion cub. The cub was confiscated by the SRN warden and security officer (© photo: W. Ebersohn)

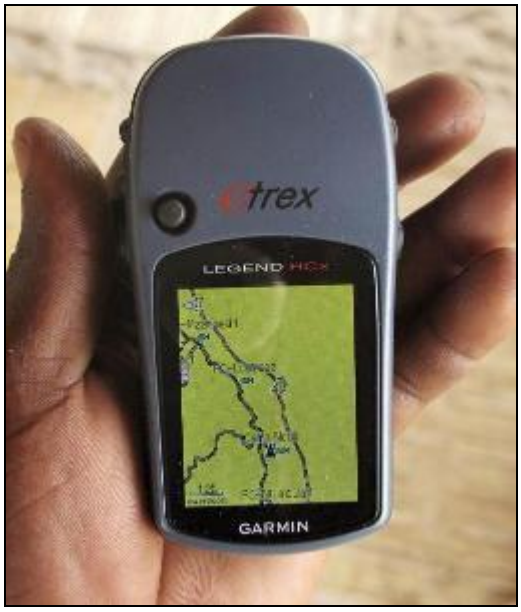

Plate 11: Nine GPS track loggers have been provided to the NNR security team.

6.6 Human-Carnivore Conflict

6.6.1 Livestock

- Cattle are absent in NNR due to tsetse fly (Glossina spp.), the vector for the disease trypanosomiasis, but smaller livestock, primarily goats and chickens, and domestic dogs are present in the larger villages.
- In Msawize four domestic dogs have been killed by large carnivores (one by leopard, one by spotted hyaena and two by lions). In Negomano village in the eastern Lugenda Valley 12 dogs have been killed by leopard. Rui Branco (see section on disease) has also recorded an increase in dogs from interactions with carnivores and baboons. Carnivores attracted into villages by domestic dogs then come into contact with people raising the potential for attack on humans.
- Four large villages currently have significant goat populations (Mavago, Msawize, Mussoma and Mecula). In many cases the goats were a gift to the communities from the Governor of Niassa in 2006-2007. Many households have not had goats in the past and have received no guidance on how to protect them from predators. Both goats and domestic dogs are known to entice leopard and hyaena into villages.

- In May 2008, a leopard killed 25 goats in Mussoma Village. The community was angry with NNR for their lack of response and had set snares for the leopard in the village. The NNR community officer, Mbumba Marufo had not dealt with this type of incident before and requested assistance.
- In collaboration with the NCP, a village meeting was held of all goat owners. It was agreed that a research leopard trap would be set in the village to catch the leopard under the condition that all goats were corralled at night. Effective corralling techniques were discussed. The Community Officer undertook to inspect the village at regular intervals to ensure goats were properly corralled. Reserve scouts were tasked with monitoring the trap and radioing immediately if a leopard was caught. The leopard was caught, a young male, unfortunately villagers were not kept away from the trap (as instructed) and the leopard was severely traumatized by the community and had to be shot by NNR.
- Experience gained from this incident has been invaluable for the Community Officer and illustrated clearly the need for a rapid response in these incidents, the need for communities to take responsibility for their livestock before the NNR intervenes and the need for extension work in villages to illustrate effective corralling techniques.
- Human-Livestock conflict in NNR can be effectively mitigated if not completely resolved by proper corralling of goats at night in goat houses (Plate 12).
- A goal for 2009 is to collaborate with SRN to develop PAC guidelines for NNR management to ensure responses to conflict are objective and consistent and the responsibilities of both NNR management and communities are clearly defined and understood. For instance, it might suggest that if goats are properly corralled then the community can expect assistance (specified in documents) from Niassa management.

Plate 12: Effective goat house built by a Mussoma village resident. Corralling goats in a well maintained goat house at night would minimize if not completely stop all carnivore attacks on livestock.

6.6.2 Mbamba Wet Season survey

- NCP research has indicated that the wet season is a peak period for lion attacks in NNR and the majority of attacks are occurring in the mashambas (33%) or villages (49%) with few attacks occurring out in the bush (Begg et al 2007).
- Between March and May, crops are harvested in the fields and this is the critical period for crop protection. To understand why people are vulnerable in the mashambas during this period, a survey and questionnaire (n = 45 interviews) were completed in March 2008 to assess the presence of potential carnivore prey and carnivores in the mashambas as well as to identify human behaviours that might be making people more vulnerable to lion attacks. Questions were asked in Portuguese by C. Begg and translated into Cyao when necessary by E. Waiti; Plate 13).
- During the 2008 wet season (Dec– March), 19 people had seen spotted hyaena, and 18 had seen leopard at least once in the mashambas. Almost two thirds (62%) of interviewees had heard or seen signs of lion of these 15 were visual sightings. Ten of the visual sightings had been at night when respondents were chasing off warthogs and bushpigs and the lion group sizes of lions varied from 1-6.

- Our hypothesis, based on data from Tanzania is that lions are attracted into the mashambas due to the high concentrations of prey, particularly bush pigs and warthogs that are feeding on the crops in the fields during the wet season. This makes sense given that warthogs and bushpigs have been shown to be a favoured prey item in NNR. This brings the lions into contact with people, which in some cases precipitate attacks.
- Through the interviews, seven species were listed as problem animals in the mashambas: warthog, baboon, elephant, jackal, bush pig, gazelle (various species of antelope) and vervet monkeys. 40% of respondents listed baboons as their primary problem, 29% said warthog and 22 % said elephant, although seven of these admitted that elephants had not been a problem to them in 2008 as the electric fence has been working well. The top three problem animals listed in 42 of the interviews were warthog, baboon and elephant.
- The majority of people who had seen lion believed the lions entered the mashambas to catch warthogs. In support of this, we received reports of at least five warthogs, and one bushbuck killed by lions in the mashambas during this period. In addition in early June a lion on a warthog kill growled at a woman collecting firewood in her mashamba. Two warthogs were found snared in the mashamba. Warthogs are not eaten, as the majority of the Mbamba community is Muslim; however on some occasions the meat is sold in other villages where there are Christians.
- Our research assistant, Euzebio Waiti, radio-tracked known lions from his mashamba and a small mountain in the Mbamba mashambas during the entire wet season (Dec – May) whenever possible (Plate 14). On at least five occasions a male lion (5-6 years old; LICM03) first collared in 2005 was heard within the mashamba. This male killed a domestic cat in the village in February. In addition a pride of 4 (LICF03) was also heard inside the mashambas on two occasions.

Plate 13: Conducting interviews in Mbamba Village mashambas March 2008

Plate 14: Euzebio radio tracking lions inside Mbamba fields during the wet season

- A survey we completed in 2006 shows that the last lion attack in Mbamba village was in February 1994, when a 55 year old man was injured in the mashamba. Three lion attacks are known from the 1980s where one child (10 years old) was killed in the village when sleeping outside and two men were killed in the mashambas. However despite the regular visits of lions to both the village and mashambas there have been no recent attacks and there is little perception that large carnivores were a problem.
- Only two people mentioned (without being prompted) the previous lion attacks in Mbamba village. All respondents said they were scared of the large carnivores, but only two people said the large carnivores were actually a problem.
- In several instances it is believed that lion attacks that occur in the village or mashambas are from "spirit lions" not bush lions and are the result of discord in the community. In the mid 1990s the three chiefs called a traditional healer from Cabo Del Gado into Mbamba village alive at the time to sort of the problem with the lions and through an elaborate ceremony the lion was apparently killed. The healer's son returned to the village in 2008 demanding payment that was outstanding from this event otherwise lion problems would begin again.

6.6.3 Negomano Questionnaire survey

- A village based survey of carnivore attacks in NNR completed by NCP in 2006 (Begg, Begg & Muemedi 2007) showed that Negomano and surrounding villages in the north eastern section of NNR were a hotspot for lion-human conflict (Fig 7).
- Of particular concern were the 11 people killed and 17 people injured between 2000-2007 however detailed information on the circumstances of each attack and methods used by communities to protect themselves were not available.
- In 2008 a more detailed questionnaire was compiled, and A. Jorge and E. Waiti then conducted a survey from the 20 – 24 September 2008 across ten villages in Block L9-Ninga (Nambunda, Chitande, Ntoanembo, Negomano Sede, Liwaya, Chihuluku, Nahavara and Ninga). A separate report has been produced (Jorge, Begg and Begg 2009) and the most important results are summarized here.
- In 2009 a similar survey will be completed in the western village complex of Mavago and Msawize were additional information is also required.
- The NCP team visited the local leaders from each of the ten villages to present the objectives of the study. All the houses (n = 700) in the study area were then visited accompanied by a local member from each village. This approach allowed the team to get detailed information on the carnivore attacks, locate the victims / their relatives and where possible visit the conflict area.
- The team recorded 72 carnivore attacks in six of the villages with 47 people injured and 11 people killed by lion (18 attacks), leopard (5 attacks), spotted hyaena (1 attack) and crocodile (48 attacks). In addition reports were received of 12 domestic dogs, one domestic cat and one chicken killed by leopard.
- Between 1969 and 2007, 18 lion attacks have occurred in this area. Only five attacks were reported between 1969-1999 however since 2000, 13 attacks have occurred with a peak of six attacks in 2006. However, in 2007 and 2008 no further lion attacks have been reported in this area. The majority of these attacks were considered attacks by natural lions while three of the attacks were considered spiritual attacks.
- Adults and old people represent more than 80% of the victims of lion attacks with children representing less than 5% of the attacks. Men are more often attacked (67%) than women (33%).

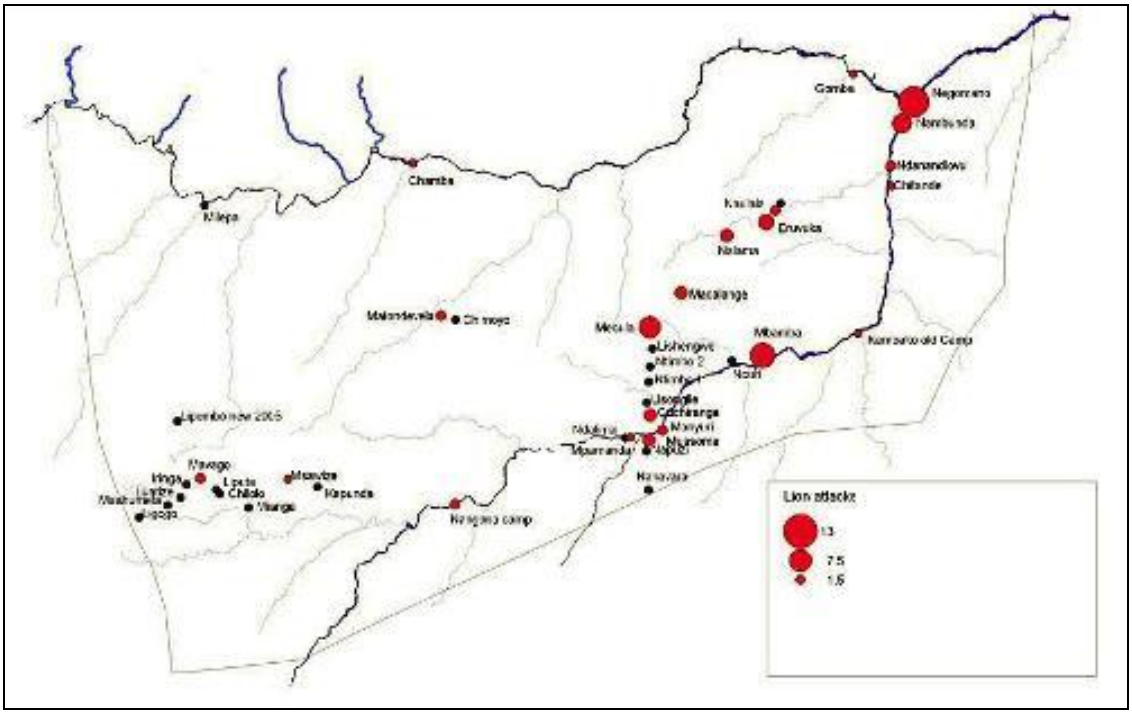

Fig. 7: Distribution of lion attacks in NNR over the past 30 years (Begg, Begg and Muemedi 2007)

6.*6.4 Mitigating conflict*

- The detailed surveys in Mbamba and Negomano village surrounds and other opportunistic records reveal that a number of behaviours place people at risk from lion, leopard and spotted hyaena attack in NNR. . Lion attacks occurred more frequently in the fields (67%) than in the villages (28%) supporting the pattern found in the original broad based survey NNR (Begg et al 2007).
- Risk factors include:
    - Sleeping on ground outside in mashambas under shelters with no or inadequate walls or doors.
    - Sleeping in the village outside the hut on the verandah.
    - Sitting outside around fires with no walls around them
    - Walking alone at night
    - Chasing warthogs or bushpigs out of fields at night with no lights
    - Walking to the toilet at night
    - Provoked attacks when hunting the carnivore or after they have been caught in a snare.
- Prevention of attacks is likely to involve increasing the tolerance of people towards the large carnivores (education, awareness), and decreasing the potential for contact between large carnivores and humans.
- The result of the Negomano interviews suggest that after the lion attacks in 2006 people changed their behaviour with regards to lions and this resulted in no further attacks (Jorge et al 2009). In some cases people abandoned isolated mashambas and started farming closer to other fields or inside the village itself. Other people build stronger houses in the fields or decided to sleep in the village rather than the fields. A few people immigrated to Tanzania.

6.6.5. Bamboo fences

- During the wet season the majority of people (80%) walk alone at night to chase off warthogs (which are raiding at night here) and bushpigs out of the fields. Only 20% use some sort of light, either a torch (n = 4) or a chenje (bamboo torch). 14 people had torches (all fishermen) but 10 had no batteries.

- In terms of decreasing contact, if warthog and bushpig presence in the mashambas can be reduced this is likely to reduce the number of lions coming into the mashambas in the wet season and reduce the potential risk of people coming into contact with lions at night when they are chasing warthogs and bushpigs.
- Warthogs, bush pigs and other animals were chased by throwing rocks by hand (34), catapult (3) or slingshot (2). The majority of men walked alone at night without lights. Other methods used to protect crops with varying degrees of success were hanging old gill nets around the boundary of a field (baboons), scarecrows, using domestic dogs (baboons), and placing a model of a leopard in an open field.
- At least half of the people interviewed knew of the “uvigo” or bamboo fence constructed around fields in Mecula village to keep out warthogs and bushpigs (Plate 15). All agreed that it worked well but the reasons given for not building them in Mbamba were mashambas too big, bamboo too scarce took too much time away from protecting the field, was too much work.
- Two people were using a simpler form of fence of dead branches with snares set in the branches to catch warthogs.
- In November 2008, NCP in collaboration with Mbamba village elders constructed bamboo fences around a field that receives high levels of warthog and bushpig damage in the wet season (Plate 16) to test its effectiveness. Pedro Sandali will be collecting data on the frequency of warthogs entering this field and an adjoining field without a fence throughout the wet season. The results of the tests will be reported back to community in 2009.

Plate 15: Bamboo fence used in Mecula village to keep bushpigs out of maize fields.

Plate 16: Members of the Mbamba community working with NCP to construct a bamboo pig fence to test its effectiveness at keeping warthogs and bushpigs out of the fields during the wet season.

6.6.6. Shelters

- The majority of people sleep in the mashambas with their wives and all children under the age of 5-6 years (80%). The remainders either sleep alone in mashamba or return to the village at night. People are sleeping under a wide variety of shelters with a large variation in the degree of protection the shelter would provide against a large carnivore.
- Only 24% of the interviewees were considered to sleep in shelters safe from lion or leopard. The safest shelters were “Sanja” (7%; house on stilts with walls), Injinjili (4%; thatch house on ground with thick logs as walls and a door) and Uyimbo (13%, proper thatch house with door and walls made from clay and branches (Plate 17, a, b, and c). The majority slept under a simple “Chilindu”, a completely open thatch shelter, or a “Kango” a similar structure with bamboo or grass walls but no door (Plate 18). In Mbamba village it was the young men who built the worst shelters. Two elderly men who both remembered the lion attacks in the village in the 1990s had both constructed substantial shelters safe for their families.
- In Negomano, people had built high bamboo walls to keep lion out after the attacks in 2006, however less than 10% of the houses showed adequate protection (Plate 19).

Plate 17: “Sanja” (top) house on stilts with walls, “Injinjili” (middle), and “Uyimbo” which all provide effective protection against carnivore attack in the fields during the wet season.

a

b

Plate 18: Shelters used in the mashambas during the wet season that provide no protection from large carnivores.

Plate 19: High thatch walls built in Negomano in response to lion attacks (© photo A. Jorge)

6.7. Trophy Monitoring and Sport Hunting

6.7.1 General activities

- C. Begg attended the SRN Operators Meeting in Maputo (12-13 June 2008). Particularly emphasis was placed on the quality of the lion and leopard trophies taken in the 2007 season and problems encountered (see Begg & Begg; Feb 2008 Trophy Monitoring report).
- All sport-hunting operators were provided with lion and leopard datasheets for the 2008 hunting season as well as the SRN lion regulations. In 2008 a questionnaire was provided for each lion or leopard hunt even if the hunt is unsuccessful.

- Contact was made with all the new operators (sport hunting and ecotourism) and details provided of information needed on large carnivores (prey, snare wounds, leopard skin trade, conflict, breeding)
- A follow-up e-mail was sent to all operators one week after the meeting to establish email contact and confirm 2008 requirements in a format that could be copied to individual PHs.
- In October -November, all sport-hunting concessions were visited by members of NCP team to collect datasheets, photographs and other carnivore sightings and measure and age all lion and leopard trophies. Convenient dates for the visits were agreed in advance with the operators based on their hunting activities.
- In 2008, A. Jorge (SRN employee) accompanied the NCP trophy monitoring team for training in the aging and measuring of lion and leopard trophies as part of the NCP mentorship and training program. In 2009, A. Jorge will spend 6 months (June to November) with NCP gaining further experience in lion and leopard conservation work. He will remain in the employ of SRN during this period but will have a separate Terms of Reference with NCP.
- Each lion and leopard trophy was independently aged based on tooth wear, closure of the pulp cavity, and in lion's mane development, nose pigmentation and general body condition (Plate 20).
- Additional information on the opportunistic sightings of lions and leopards, visual aging cues and perceptions of lion and leopard hunting was gathered and discussed with PHs wherever possible.

6.7.2 *Summary of 2008 Trophy Monitoring*

Full details are provided in a separate report specifically on trophy monitoring of lion and leopard in NNR (Begg & Begg 2009: 2008 Hunting season) and this is available on request:

Lion

1. Four lions were taken as trophies in 2008 representing an off-take of 25% of the SRN allocated quota, (36% of the purchased quota) with seven unsuccessful lion hunts.
2. The number of underage lions taken as a trophy has decreased markedly with no young lions (< 6 years old) taken as trophies in 2008, compared to 2004 when 75% of trophies were underage.
3. Off-take of lion has dropped sharply from 80% in 2003 to only 25% in 2008 with a particularly large drop between 2007 and 2008 (50% to 25% of the quota).
4. The reason for this decrease in off-take is not caused by a decline in the lion population. Rather it reflects a decrease in the number of underage lions taken as trophies (Fig. 8). The number of lions over the age of six taken as trophies taken in the last three years has remained stable at four individuals per year. This off take is now likely to represent a sustainable off-take of lion in NNR based on the current lion population size in the operational hunting concessions.
5. In 2007 we suggested that if PHs wished to find high quality trophies they needed to bait away from the Lugenda River and utilise a higher percentage of their concessions to give the more heavily hunted areas a rest. In 2008 all lions were taken off the Lugenda River. It is hoped that this trend will continue.
6. The SRN Lion Regulations with their associated points system to assign trophies based on the previous year's trophy quality has had a positive effect and at this point the hunting of underage lions is no longer a threat to lions in NNR and lion hunting is believed to be sustainable at the 2008.
7. Five years of data on lion aging have now been collected in NNR from trophy animals as well as radio-marked individuals (n = 12) and these data show conclusively that mane development and nose pigmentation are related to tooth wear (age) and individuals can consistently placed in broad age categories based on visual aging cues.
8. Professional hunters (PHs), Niassa operators and SRN are to be commended for their commitment to sustainable lion hunting.
9. According to the SRN points system for setting sustainable lion quotas in NNR no change in quotas for the concessions are recommended for 2009 and a quota of 16 lions is recommended for the concessions active in 2008 with an additional two lions provided for each of the two new concessions as a start up quota.

10. However, despite the evidence provided by the Niassa Carnivore Project showing that lion hunting in NNR is sustainable and well monitored, a quota of only one lion per concession has been approved for NNR in 2009 by MITUR. This low quota is certainly sustainable but it negates the SRN lion quota setting system despite its proven track record and provides no incentives for PHs to hunt sustainably by only taking lions over the age of six. .

Leopard

11. In 2008 ten leopards were taken as trophies from 16 leopard hunts, this represents an off take of 33% of the approved quota. No females were taken as trophies in 2008 compared to two in 2007.
12. There was a marked decrease in leopard off-take compared with 2007 (33% compared to 100%). The reasons for this are unclear.
13. In 2009 camera trapping will be used to assess leopard density in a hunted area compared to an un-hunted area to investigate whether the lion population in a heavily hunted area has declined significantly.
14. The leopard trophies continue to show a relatively high proportion of young animals (no teeth wear; 40%) in the sample with only one animal showing significant wear on the teeth.
15. Potential visual cues that could be used by PHs to age leopards were assessed. Body measurements (total length, shoulder height, neck circumference) taken by PHs of trophy leopards over the past two years are showing no clear pattern per age category. However, data from captured leopards do suggest that body length and shoulder height might be related to age although sample sizes are still small.
16. Ongoing monitoring of the leopard population is essential given their sensitive position on Appendix I of CITES.
17. Similar to the lions, MITUR approved leopard quotas for 2009 have been substantially reduced for Niassa Operators in 2009 (less 10 animals) despite the national increase in quotas approved by CITES in 2007 from 60 to 120 animals.

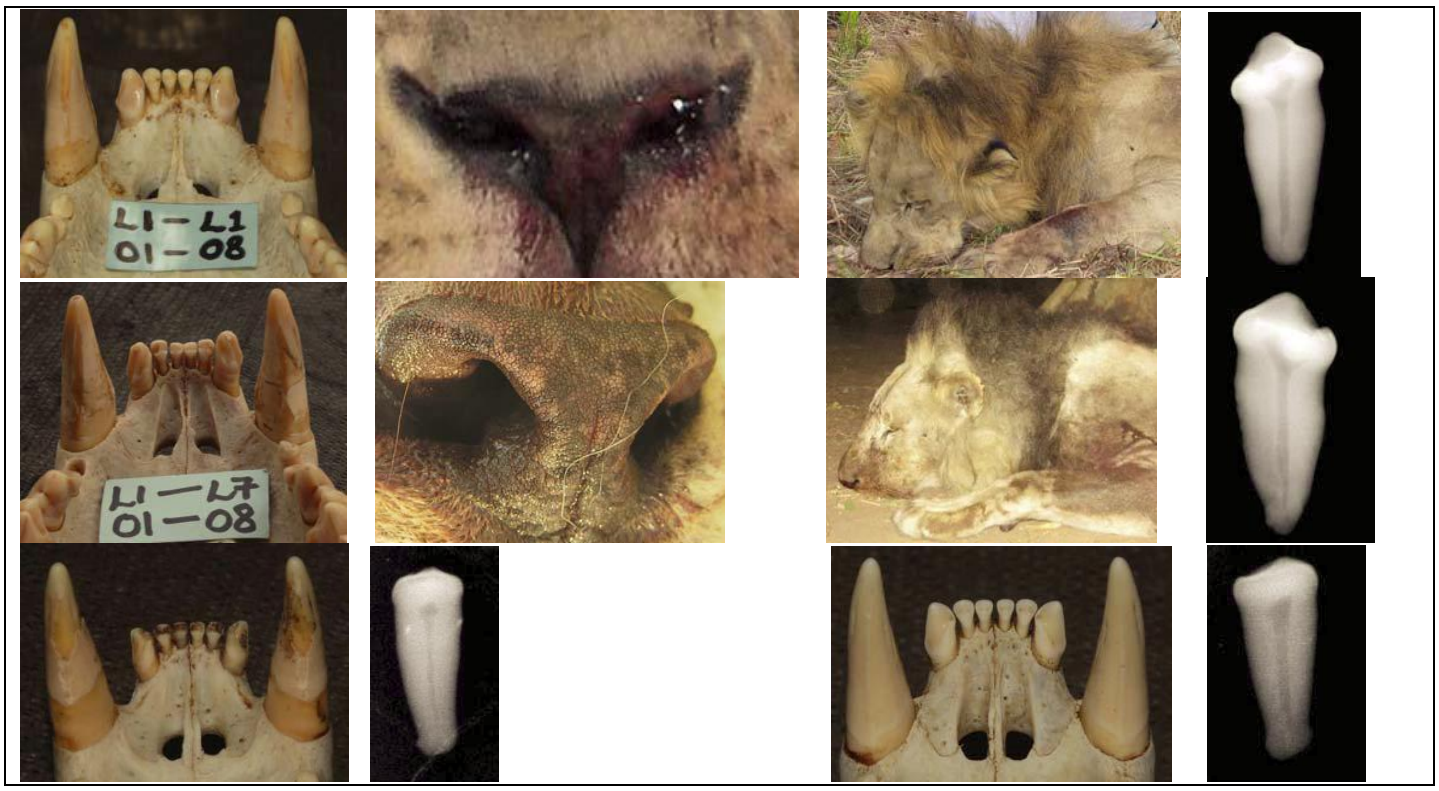

Plate 20: Examples of the type of data collected for lion (row 1 and 2) and leopards (row 3) taken as a trophies in NNR (For lion details of tooth wear, nose pigmentation, mane development and X-ray of pulp cavity as well as skull measurements are taken for each individual. For leopards, details of tooth wear, body measurements and Pulp cavity X-rays are taken. For both species PHs fills in detailed questionnaires.

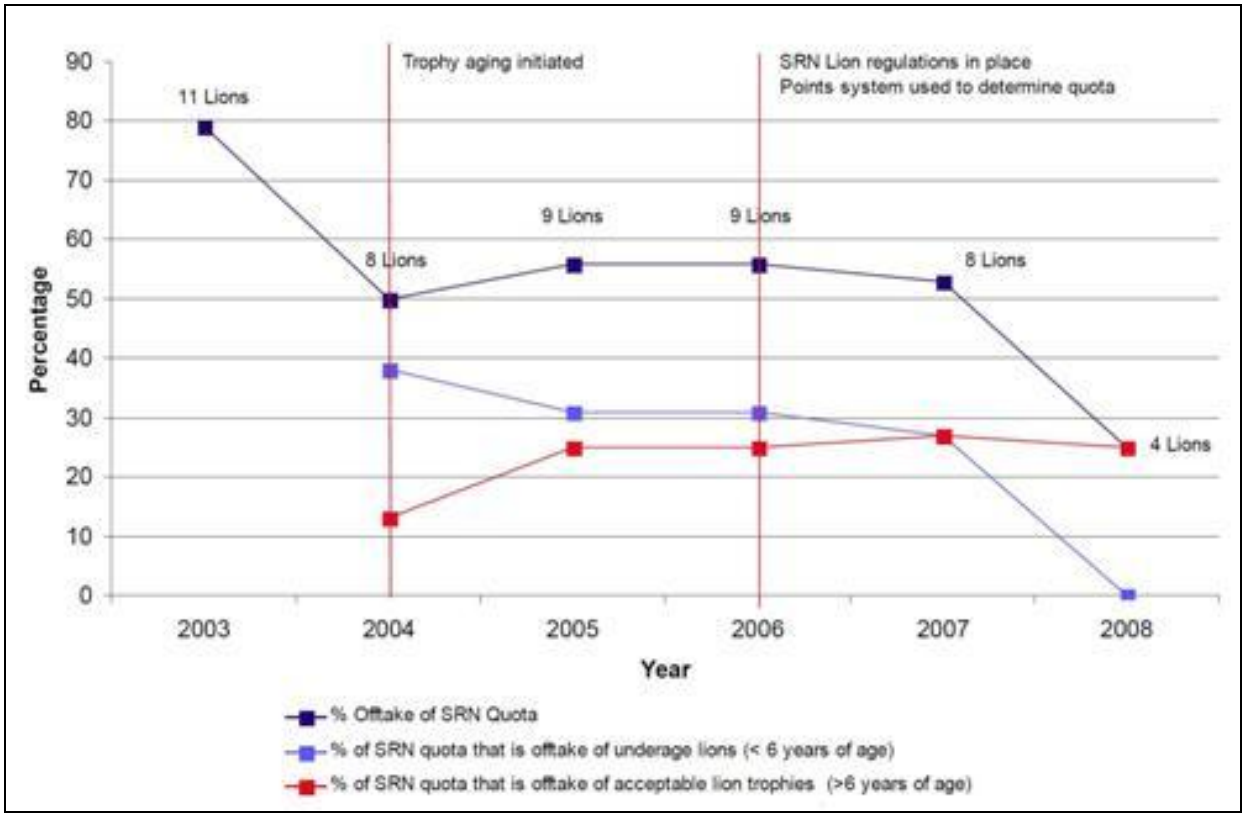

Fig. 8. Changes in off-take and lion trophy quality over the past 5 years (2004-2008) in Niassa National Reserve since trophy monitoring and the SRN lion regulations came into effect. Note the decline in off-take and the decline in the percentage of young lions taken over the past four years; however the number of acceptable trophies taken as trophies has remained constant, at four individuals per year.

6.8 African wild dogs

- In December 2007 members of the IUCN Canid Specialist Group and other key range state stakeholders met in Botswana to attend a Region wide Conservation Planning Workshop for the Africa Wild Dog. This meeting was attended by K. Begg to present the NNR data. Fig 8 presents the draft results on Wild dog status and distribution in Southern Africa showing the importance of the wild dog population in northern Mozambique
- Based on this information, the Niassa National Reserve wild dog population (> 350 individuals) linked to populations in the Selous Niassa Wildlife Corridor to the Selous Game Reserve in Tanzania is believed to be the second largest population of wild dogs left in the world.
- Deliberate killing by people of wild dogs in retaliation for stock theft are a major cause of mortality of wild dogs in other areas. However due to the lack of domestic livestock in NNR, direct persecution is not a threat here.
- The main threats to African wild dogs in NNR remain disease, particularly rabies, inadvertent snaring and to a lesser extent road kills and possibly use in traditional medicine.
- The risk from road kills can be significant in areas where high speed traffic is common. And as road networks and conditions improve in NNR and surrounds this risk increases. In November 2008, a wild dog was found killed on the tar road between Marrupa and Lichinga (Plate 21). DNA samples were taken and have been sent to C. Marsden for inclusion in a phylogeographic study of wild dogs across their range. Two additional reports of wild dog deaths just outside the protected area have also been reported. These wild dogs represent an extended NNR population and illustrate the increasing threat to wild dogs from road traffic.
- The disease threat is being addressed through the domestic dog vaccination and awareness program (see following section).

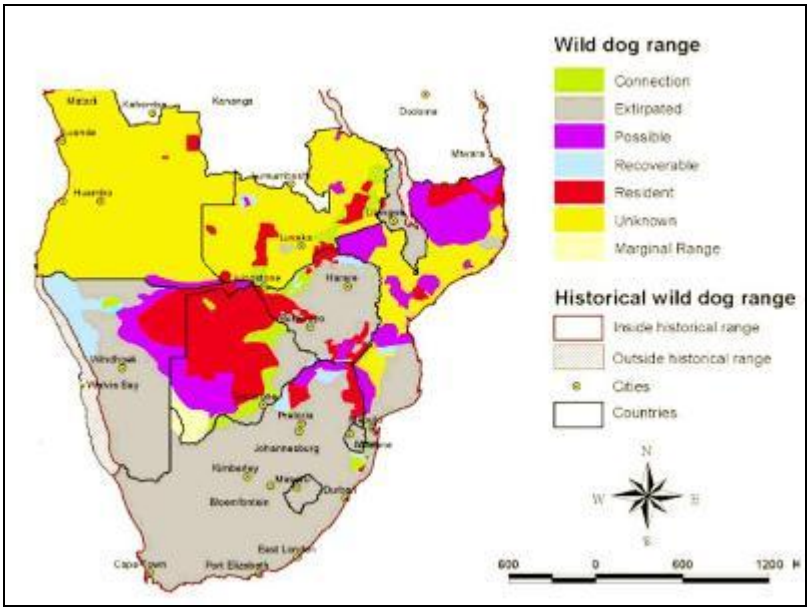

Fig. 9 African Wild Dog status and distribution in Southern Africa (IUCN, 2007, unpublished)

Plate 21: African Wild Dog killed on tar road just outside the protected area boundary (November 2008).

6.9 Disease

- Blood samples and ectoparasites from six lions were taken during capture operations and will be analysed for canine distemper, Tuberculosis, leptospirosis and toxiplasma in collaboration with the National Veterinary Department in Maputo. This will allow us to determine the disease risk to lion in NNR.
- In 2008, NCP printed a further 300 rabies posters (designed by the project in 2006) for distribution at clinics and schools throughout NNR informing people about the dangers of rabies and what to do if bitten.
- In collaboration with SRN, NCP supports a vaccination program of domestic dogs in NNR lead by Rui Branco (a Mozambican Vet). The aim of this program is to minimize the risk of disease transmission from domestic dogs to wild carnivore (particularly African wild dogs and lions) and human populations.
- In 2008, Rui completed a second vaccination program of domestic dogs inside NNR, as well as collected further data on the domestic dog population with NNR. He has produced a three year action plan for SRN to reduce disease risk in NNR based on his findings (Branco 2008). The information provided by Rui is vital for carnivore conservation as the spread of disease to lions and African Wild dogs is a very real risk when domestic dogs are resident inside the protected area and in regular contact with wildlife.
- The increase in the human population inside NNR to more than 30000 people has contributed to an increase in the domestic dog population inside NNR and the associated

increase in the risk of disease transmission from domestic dogs to people and wildlife. Rabies in particular is of concern as there have been significant rabies outbreaks in surrounding areas in 2005 and 2008.

- The reason domestic dogs are kept is largely to help farmers protect their crops from baboons and themselves from carnivores. They are also used for hunting.
- In 2008, Rui found the domestic dog population had more than doubled in the most densely population western region of NNR (Plate 22a; Mavago- Msawize area) between 2006 and 2008. The number of dog owners has also increased from 29 in 2006 to at least 44 in 2008 with the average dog owner owning five dogs.
- In 2008 146 dogs were vaccinated and registered (Plate 22b, c, d; compared to 63 dogs in 2006) representing 91% of the domestic dog population in Mavago and Msawize.
- The NNR community policy suggests that domestic dogs should not be allowed in NNR, and NCP believes that wherever possible domestic dogs should be removed from inside the protected area. However we accept that removing the domestic dogs from large villages such as the Mavago-Msawize complex without undue conflict will be difficult and vaccination and strict zoning may be the only option to minimize the disease risk to carnivores in these areas.
- However, NCP strongly suggests that the keeping of domestic dogs should be prevented from spreading to villages on the eastern side of the protected area and a dog free zone should be maintained.
- It is of concern that since expressing our initial concerns about the domestic dog population in 2006 a dog has appeared in Mbamba village (2007), formally a dog free zone. We understand that there are now 3 dogs in this village and several people have expressed an interest in procuring more. This village is in a high wildlife zone in the Lugenda River valley with significant movement of wild dogs and lions in the close proximity to the village.

a) Domestic dogs are increasing in NNR (© R. Branco)

b) In 2008 128 domestic dogs were vaccinated against rabies in communities inside NNR (© R. Branco)

c) Each owner was provided with a registration card and proof of vaccination © R. Branco)

Plate 22: Vaccination of domestic dogs in Mavago and Msawize area in 2008

6.10 Training, Mentorship and Capacity building

- We have three field assistants from Mbamba Village: Euzebio Waiti, Pedro Sandali and Maderu Selemani They continue to receive training in radio tracking, measurement of animals, appropriate behaviours around animals, driving and car maintenance, setting traps, using a GPS, compass, binoculars and filling in datasheets.
- Euzebio learned to drive in 2008 and NCP is paying for him to obtain his driver's license in Lichinga during the wet season.
- In 2008 The NCP provide SRN employees A. Jorge (Monitoring Officer) and Mbumba Marufo (Community Officer) each with the tools considered essential for effective fieldwork - GPS, digital camera, laptop, and binoculars.
- In collaboration with SRN (Management Authority of the Reserve), Agostinho Jorge spent portions of July, September and November with NCP as part of its mentorship and training program. The aim was for Agostinho to gain experience in research, monitoring and surveying techniques for large carnivores in Niassa to ensure this program is sustainable and not researcher driven.
- This year he has gained experience in call up surveys, capture and radio-marking of lion and leopard, radio-tracking, camera trapping, spoor and game counts, questionnaire surveys, survey design, trophy monitoring and aging of lions and leopards.
- In 2009 Agostinho will be spending all of the dry season with NCP and will be supported by the project but will continue to be employed by SRN.

6.11 Collaborations and Dissemination of results

- Collaborated with IGF Foundation, Ministry of Tourism (DNAC/MITUR) and Campfire Association on the "Conservation Status of Lion Panthera leo in Mozambique- Phase 1 (Oct 2008; Chardonnet et al 2008)". NCP will be providing further input on Phase 2 and the development of a National Lion Strategy.
- Contributed NCP information and comments on leopards to "An assessment of the status and distribution of leopards (Panthera pardus) and their use as trophy animals in three range states (Mozambique, Zambia and Zimbabwe)" published by the Campfire Association (Purchase. & Mateke 2008
- Presented NCP 2007 research and conservation results at the SRN Annual Operators Meeting held in Maputo during June 2008. The audience included tourism operators from NNR, NNR/SRN staff and selected government officials.
- Presentation as guest speaker on Niassa Carnivore Project at Wildlife Conservation Network (WCN) Wildlife Expo in San Francisco, USA (October 2008)
- Participated in regular informal meetings with Selous Niassa Wildlife Corridor Working Group on issues of common concern for this transfrontier conservation area (antipoaching, game movements, wild dogs, movement of people). The Selous Niassa Wildlife Corridor lies in Tanzania and connects NNR, Mozambique with the Seluos game Reserve, Tanzania making this one of the largest conservation areas in the world. Wildlife move freely across the Ruvuma River during the dry season.
- Collaborative agreement with National Veterinary Department to provide blood samples for the analysis of disease (Dr L. das Neves) and a study on ectoparasites (Prof Horak).
- Collaborative agreement with Prof C. Matthee at Stellenbosch University to provide leopard DNA samples for study on Phylogeography of leopards across their range. NNR will receive due acknowledgements on all papers and publications.
- Provided a wild dog sample from a road kill for a Phylogeographic study on wild dogs by Clare Marsden.

7.0 Selected References

Begg, C. & Begg, K. 2009. Monitoring of leopard and lion trophies in Niassa National Reserve, northern Mozambique: 2008 hunting season. Unpublished report for SRN, Maputo, Niassa Carnivore Project.

Begg, C.M., Begg, K.s. & Muemedi, O. 2007. Preliminary data on human carnivore conflict in Niassa National Reserve Mozambique, particularly fatalities due to lion, spotted hyaena and crocodile. African Indaba 5 (5).

Branco, R. 2008. Controle de caes domesticos na reserva do Niassa: Plano de Accao para o trienio 2009-2011. Unpublished report for SRN, Maputo.

Chardonnet, P., Mesochina, P, Renaud, P, Bento, C. Conjo, D., Fusari, A., Begg, C. & Foloma, M. 2008. Conservation Status of the lion (Panthera leo) in mozabique: Phase 1: Preliminary survey. Unpublished report produced for DNA/ MITUR & DNTF/ MNAG.

Jorge, A., Begg, C. & Begg, K. 2009. Interim report on Human-carnivore Conflict in negomano Village and surrounds. Unpublished report for SRN, Maputo. Niassa Carnivore Project

Purchase, G. & Mateke, C. 2008. The state of knowledge regarding leopard (Panthera pardus) in three range states (Mozambique, Zambia and Zimbabwe) in the context of improving management of trophy hunting. Unpublished report produced for CAMPFIRE Association of Zimbabwe.