Niassa African Wild Dog Project
Monitoring and Conservation:
2004-2006

Msangezi pack (11 of 18 adults) in the Lugenda riverbed, November 2006 (KS Begg)

Prepared for

Sociedade para a Gestão e Desenvolvimento
da Reserva do Niassa
Moçambique

By

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Summary

- African wild dogs are considered Critically Endangered with only 10 populations of over 100 individuals supported across their range and a total global population estimated at less than 6000 individuals.
- Niassa National Reserve (NNR) located in northern Mozambique is an immense wilderness area (42 000 km^2) that supports significant and increasing populations of wildlife including African wild dogs.
- The objectives of the Niassa Wild Dog project (2004-2006) have been to provide an estimate of the their current density in NNR, identify potential threats, establish an effective monitoring system and provide recommendations to SRN.
- The Management Orientated Monitoring System (MOMS), first developed in Namibia, was preliminarily implemented in NNR in 2006 to provide a standardized, sustainable monitoring system in NNR particular for the collection and reporting of data by community scouts.
- Data on wild dogs in NNR are collected entirely through opportunistic sightings. Over the last four years there have been five sources for wild dog sightings: concession operators and professional hunters, Niassa residents, MOMS community scouts (2006), research team and sightings from visitors and NNR staff.
- Since 2003, there has been a steady increase in the number of wild dog sightings collected annually, with an associated increase in the reliability of the sightings.
- To date 187 opportunistic sightings of wild dogs have been recorded throughout NNR and the average pack size is seven individuals, ranging from 2-26 individuals.
- Based on pack size and location of individual sightings, 39 packs have been identified representing a minimum of 336 individuals at a density of 0.8 individuals / 100 km^2.
- An additional 15-20 packs (90-120 adults) are considered likely to be present in NNR suggesting that NNR supports at least 450 wild dogs at a density of 1.1 adult dog / 100 km^2.
- At present the NNR wild dog population appears to be stable or increasing with limited threats, although ongoing monitoring is considered essential, particularly given the rapid changes in human populations and infrastructure occurring in the region.
- This wild dog population is not constrained within NNR boundaries. It is likely that the NNR wild dog population is linked to the Selous Game Reserve population through the Selous Niassa Wildlife Corridor, forming a transfrontier population of more than 1000-1500 individuals.
- The five most common prey species (> 10%) in NNR are impala, reedbuck, bushbuck, waterbuck and kudu. Unlike other areas wildebeest have not been recorded. This reflects the low densities of wildebeest in NNR.

- Of the potential threats to wild dogs operating in NNR, the risk of a disease epidemic (rabies, canine distemper) is considered the most significant given the presence of domestic dogs both within and surrounding the protected area boundary, the rabies outbreak outside NNR in 2005, and high levels of contact between wild carnivore populations and domestic dogs.
- At present 130-160 domestic dogs are present in NNR, concentrated in two areas the Mavago-Msawize complex and the Mussoma-Mecula corridor. Both are on main access roads into NNR. The majority of smaller villages (63%) do not have domestic dogs at present.
- In 2006, Branco (2006) vaccinated a total of 70 dogs (48%) in NNR. None of the dogs vaccinated showed any specific symptoms of disease. However, these dogs experience high mortality with the majority dying within 2-3 years, presumably due to tsetse fly.
- In NNR, domestic dogs are primarily kept for subsistence hunting, protection of mashambas and guarding.
- Lion and Spotted Hyaena compete with African wild dogs in other areas through exploitation and interference competition. However in NNR the densities of lion and spotted hyaena are currently low and are unlikely to be affecting wild dog density despite overlaps in diet and habitat use.
- Despite the presence of domestic livestock, primarily goats and chickens inside NNR protected area boundary, only one report of wild dogs causing a " problem" has been recorded. Local communities do no perceive wild dogs to be "problem animals" and there is at present no evidence that wild dogs are utilised in any way by the communities. Direct persecution is not considered a threat at present.
- Instead, many Niassa residents perceive wild dogs in a positive light as they opportunistically chase wild dogs off kills to obtain meat. This is not considered poaching, as the animal is already dead. The level of interference competition by humans is unlikely to be having a significant negative effect at present. However this should be monitored if the human population in NNR increases.
- Use of wire and rope snares to catch small to medium sized ungulates appears fairly common in some areas of NNR although the level of snaring is not considered to have reached the levels described in other areas (Zimbabwe). Wild dogs are less at risk from this practice than other carnivores as they seldom scavenge and we do not believe this is a significant threat at present, however the actual level of snaring in NNR is currently unknown.
- As yet, wild dogs have not been recorded killed by vehicles in NNR and roads are not considered a serious threat. However road rehabilitation and the improving road network throughout the region is expected to results in increasing traffic in the near future, particularly on completion of the Freedom Bridge over the Rovuma connecting southern Tanzania and Mozambique.

Overview of Recommendations

Specific recommendations are discussed in detail in each section and in Section C we outline which of these goals can be achieved in 2007 by this research project.

We recommend:

1. A regular (1-3 years) assessment of wild dog status using wild dog distribution, average pack size, mortality (road kills, disease) and incidents of human-carnivore conflict as indicators of the "health" of the NNR wild dog population. This will simply involve collation of opportunistic sightings (MOMS, hunting and tourism operators, NNR staff) and will allow SRN to track changes in the population over time and hopefully identify emerging threats before they become critical.
2. Expansion of MOMS with training of SRN representative, annual reporting meetings, and identification and training of additional reserve, concession and community scouts.
3. A four-phased implementation of community scouts to reach a goal of 80% of villages in NNR (25 villages) with at least one community scout in the vicinity trained in MOMS by 2010.
4. Providing information to hunting and ecotourism operators and area managers of the MOMS system so that they can provide additional support and sightings from their concessions.
5. Initiation of ground ungulate transects to complement the aerial census results and enable the determination of correction factors for key prey species that are undercounted.
6. Modelling of the potential threats posed by disease and potential benefits of different vaccination strategies (as in Vial et al 2006) based on the information provided from this study and detailed ecological information from Selous Game Reserve.
7. Serosurveying of carnivore populations in NNR to assess the disease profile.
8. SRN reaches a final decision regarding the presence of domestic dogs in NNR by the end of 2007, to minimize further confusion.
9. Assessment and implementation of pre-emptive interventions by SRN to minimize disease risk from domestic dogs. Decisions could include (not mutually exclusive): Doing nothing under the assumption that disease risk is negligible given the low population of domestic dogs and extensive population of wild dogs; phased removal of domestic dogs from NNR, annual vaccination of NNR domestic dogs; and/or annual vaccination of domestic dogs in neighbouring communities through collaboration with state and provincial veterinary departments.
10. Assessment of the current levels of snaring and subsistence hunting and the associated bushmeat trade with a time line for possible mitigation strategies.

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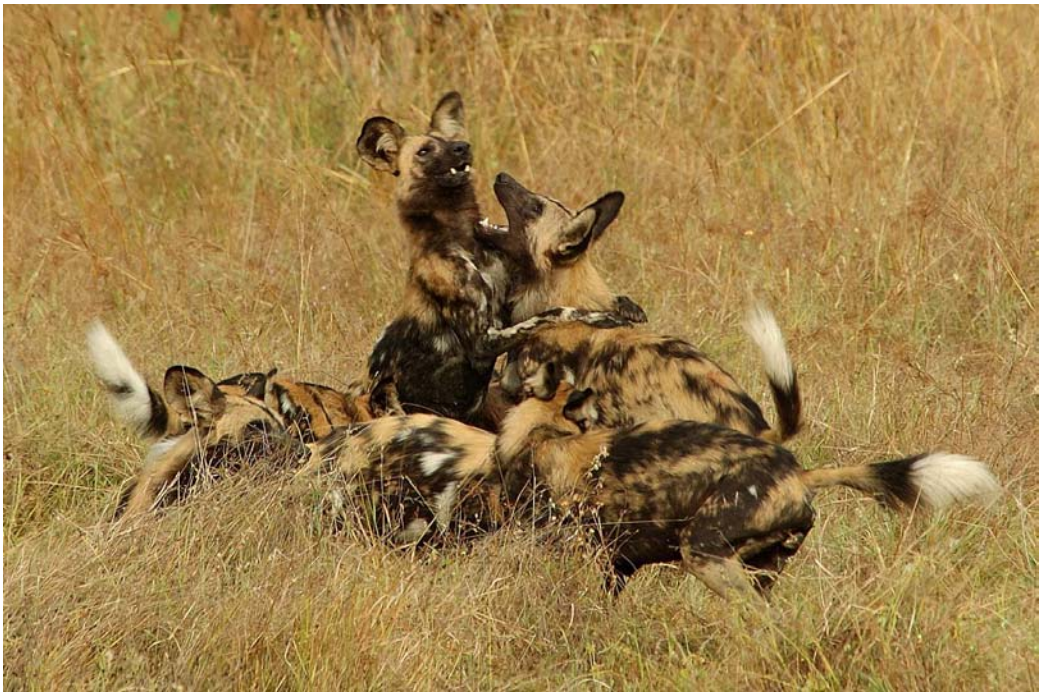


Niassa African Wild Dog Project: Monitoring & Conservation: 2004-2006

1.0 Introduction and Justification

Niassa National Reserve (NNR), located in northern Mozambique on the border with Tanzania, is an immense wilderness area of 42 000 km^2 (Fig 1). It is the largest protected area in Mozambique and the third largest protected area in Africa. The protected area was created in 1954 but abandoned during hostilities between 1975 and 1988. After the national peace accord in 1992, the Government of Mozambique entered into an arrangement to manage NNR with a private concessionaire, and in 1998, SRN took over management and development of the area (SRN, 2005). One of the goals of SRN is to secure, manage and develop biodiversity, promote its wilderness quality and use NNR as a reservoir for biodiversity in the region. To achieve this, ecological research and monitoring along with the mitigation of human-wildlife conflict are considered a vital part of the government approved Management Plan (SRN, 2006).

African wild dogs *Lycaon pictus* are considered critically endangered with only ten populations of over 100 individuals remaining in Africa and a total estimated global population of less than 6000 individuals (Woodroffe *et al.* 2004). During 2003 we collected preliminary information on the status of the wild dog population in NNR as part of a general carnivore survey (Begg & Begg 2004). These data showed that at least 150-200 wild dogs were resident within NNR. Yet this population was largely "unknown", was not being monitored and at that time had not been included in global conservation initiatives (Woodroffe *et al* 1997). SRN therefore identified the African wild dogs as both a conservation and research priority for NNR at the Maputo Biodiversity Workshop (April, 2004).

In 2004, the Niassa Wild Dog Project was formalized into a more specific research proposal and funding was procured by FFI from the Fair Play Foundation in early 2005. This project forms an important part of the broader Niassa Carnivore Project, which includes lion, hyaena and leopard. While basic ecological information is collected whenever possible, this has not been a priority as an excellent study on African wild dog ecology and behavior has been completed in Selous Game Reserve, Tanzania (Creel & Creel 2002). The Selous G.R study forms a baseline for comparison in the region and given the similarity in the two ecosystems, it is not expected that the NNR wild dog population will differ significantly from the Selous population in broad behaviour patterns, although some local differences are expected. Instead, the main aims of the Niassa Wild Dog Project have been to determine the status of the population, establish an effective, sustainable monitoring system and assess potential threats.

In this report. we bring together all the information learned in the last three years (2004-2006) so that the current status of the Niassa wild dog population can be examined and future management objectives identified. The progress towards achieving our initial objectives is assessed and specific goals for our 2007 field season are established.

In its own right, the NNR wild dog population is fundamental to global conservation efforts and represents a significant national asset for Mozambique. However this population is not isolated within NNR boundaries. Linkages between this population and wild dog populations directly to the north in Tanzania (Selous Game Reserve and the Selous-Niassa Wildlife Corridor, Fig 1) and to largely unprotected wild dog populations extending in all directions from the Quirimbas National Park on the coast to Lake Niassa in the west, suggests that this transfrontier Eastern Miombo ecosystem represents one of the last strongholds for African wild dogs in Africa.

African Wild Dogs also have the potential to be an effective "flagship species" for NNR i.e. a charismatic large vertebrate that can be used to anchor a conservation campaign because it arouses public interest and sympathy. One of the problems of using the other obviously charismatic species such as elephants and lions as NNR flagships is that these species have a significant negative impact on local communities. This can hinder local support for conservation efforts and lead to a lack of credibility (Linnell *et al.* 2000). In contrast, African wild dogs are similarly charismatic, can arouse significant public interest, are important for global conservation efforts and are currently seen in a positive light by local communities in NNR. In addition, successful protection of the Niassa Wild Dog population will necessarily also protect many other less charismatic species due to their large range requirements and can be directly linked to improvements in human health.

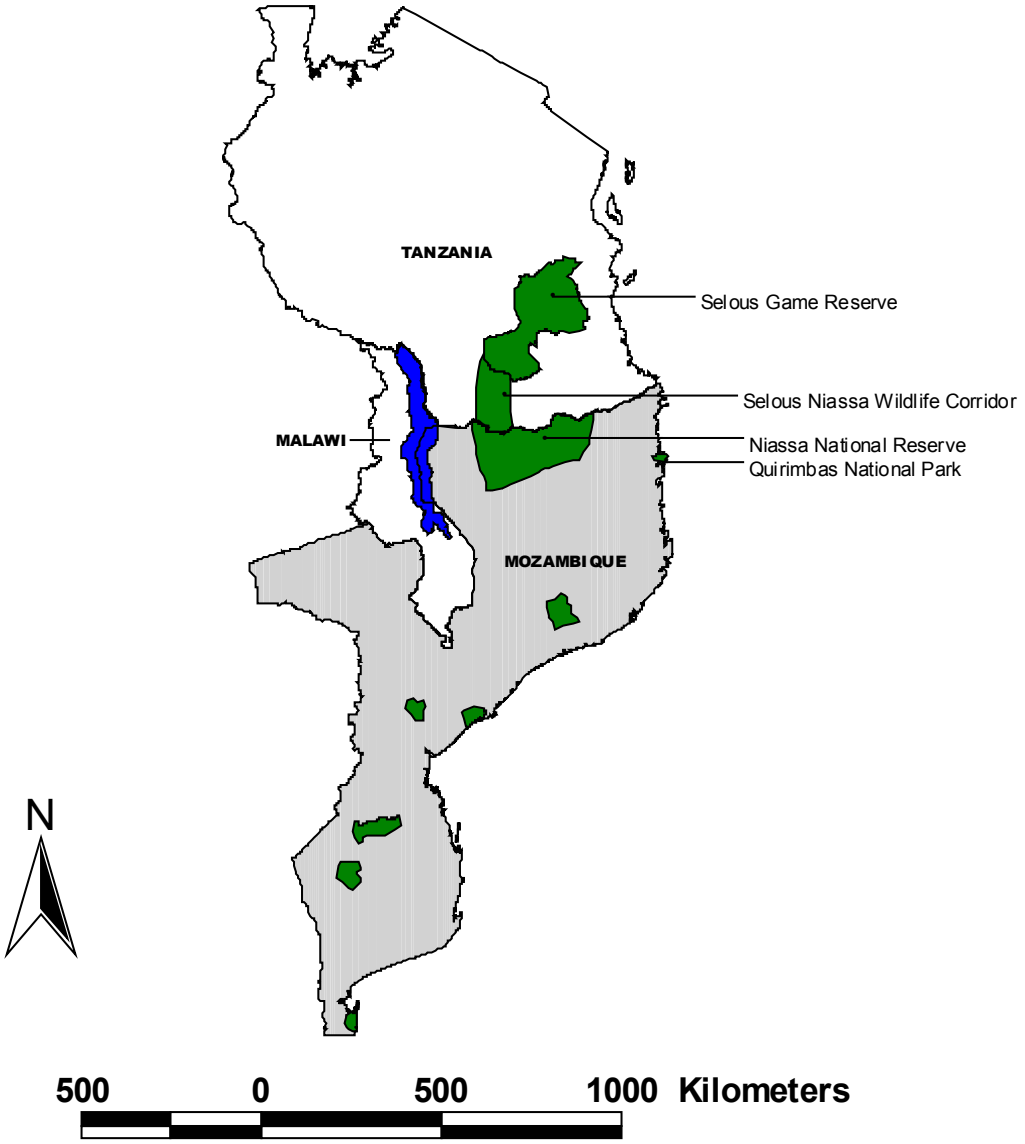
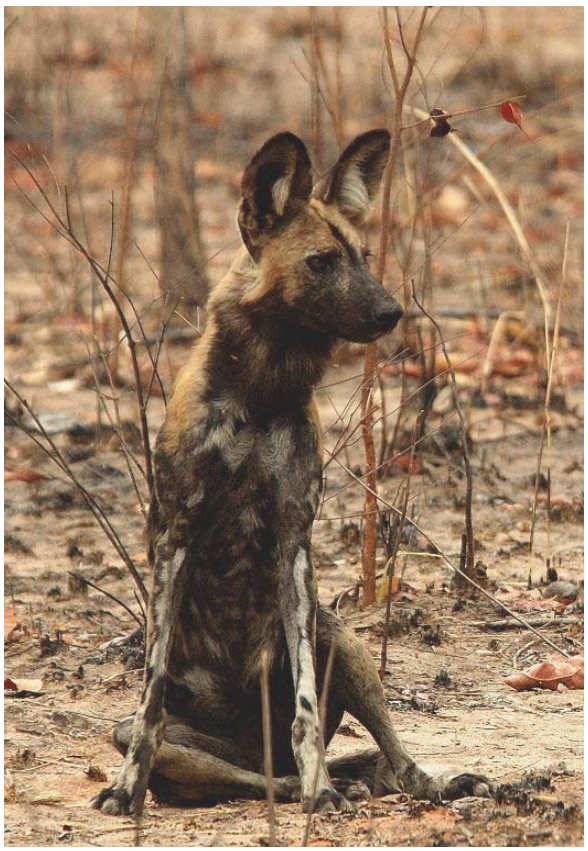


Fig 1: Regional Map showing linkage between the Niassa National Reserve, Mozambique and Selous Game Reserve, Tanzania through the Selous Niassa Wildlife Corridor.

2.0 Broad Objectives (2004-2006)

During the last three years the objectives of the Wild Dog Project have been to:

- Provide a reliable estimate of the current density of African Wild Dogs in NNR with preliminary ecological data on distribution, pack size, prey and habitat use (through opportunistic sightings).
- Develop an effective and sustainable monitoring system for African Wild Dogs and human-carnivore conflict
- Provide a detailed assessment of potential threats to this population.
- Provide recommendations to SRN for future monitoring activities, management interventions and research needs based on the information presented in this report.
- Provide training to local research assistants to increase current monitoring capabilities.
- Provide some material support to provincial veterinary officials for assessment and control of disease (vaccination campaigns).
- Initiate an education campaign regarding the disease risks of rabies to human health.



3.0 Study Area

NNR is located within the Eastern Miombo Woodland eco-region (WWF 2001), which is characterised by geological stability over a long time period, a long dry season, flat topography interrupted by monolithic granite inselbergs (Fig 2), sluggish drainage on the plateau, old nutrient poor soils, frequent fires, and relatively low levels of large herbivores with episodic high levels of insect and small mammal herbivory. The drainage is dominated by the Rovuma and Lugenda Rivers, which are large sand bed rivers with strong perennial flow. The central watershed between these two rivers feeds numerous seasonal rivers as well as an extensive seasonally inundated wetland network (SRN, 2005). Timberlake et al (2004) recognized five broad vegetation groups within NNR: forest, riverine, deciduous woodland, dambos or wetlands and granite inselbergs. The primary vegetation of this watershed is dry to mesic Miombo woodland variants (>50 %). At lower altitudes towards the Lugenda and Rovuma rivers, vegetation is increasingly dominated by different types of dry mixed open woodland (*Milletia spp* and *Combretum sp*) and wooded grasslands (*Acacia spp* with locally common palms *Hypaene coriacea)* interspersed with clay pans and small patches of *Euphorbia cooperi* and *Combretum*. thickets on cemented soils. Riverine forest is poorly developed but present along the main rivers with well developed montane forests on Mecula and Joao mountains. (Timberlake 2004, Desmet 2004).

The overall faunal diversity of this region is moderate as the long drought and frequent fires result in vegetation with relatively low carrying capacity. In addition, many species are seasonally dependent on the non-miombo vegetation to provide food, water and shelter during periods of drought and extensive fires. NNR supports the full complement of herbivores (excluding black rhino) and carnivore species expected in the region, albeit at relatively low densities at present. In addition approximately 25 000 people live inside the designated protected area in more than 40 villages (Fig 3). Shifting subsistence agriculture is the primary land use and main economic activity (Cunliffe 2005). 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.

NNR experiences a marked seasonal climate and can be divided into two main seasons, the hot-wet season from mid-November until the end of April and a prolonged dry season that may last up to six or seven months (May to November). During the hot-wet season precipitation averages between 250-350 mm per month (800-1200 mm a year), but it varies on a west-east gradient with higher rainfall in the west than the east. The climate is tropical with temperatures ranging from 15 –30^0 C during the hot season (hot-dry and hot-wet) and 10-20^0 C in the cold-dry season.

3.1. Intensive Study Area

In 2003 we identified an intensive study area in the south-eastern section of the core area of the reserve along the northern bank of the Lugenda River (Fig. 4). This area incorporates approximately 30 km of the Lugenda River bounded by the Mbamba River in the west and the Msangezi River in the east extending 15 km inland (approx 450 km^2) and incorporates Mbamba village (Fig. 3.) In this area individual wild dogs and lions are identified and photographed wherever possible. We liaise closely with villagers, fishermen and honey-gatherers from these villages to gain a better understanding of human–carnivore conflicts, snaring levels and local perceptions of carnivores. One of our research assistants and two community scouts (MOMS; section 4.1) come from this village.

Fig. 2: Typical Niassa landscape showing the Lugenda River, Lipumbula Inselberg and open woodland habitat with some plains areas. Mbamba Village can be seen in the far right corner

Fig 3: Mbamba Village in the intensive study area, home to approximately 1000-1500 people (approx. 300 homesteads)

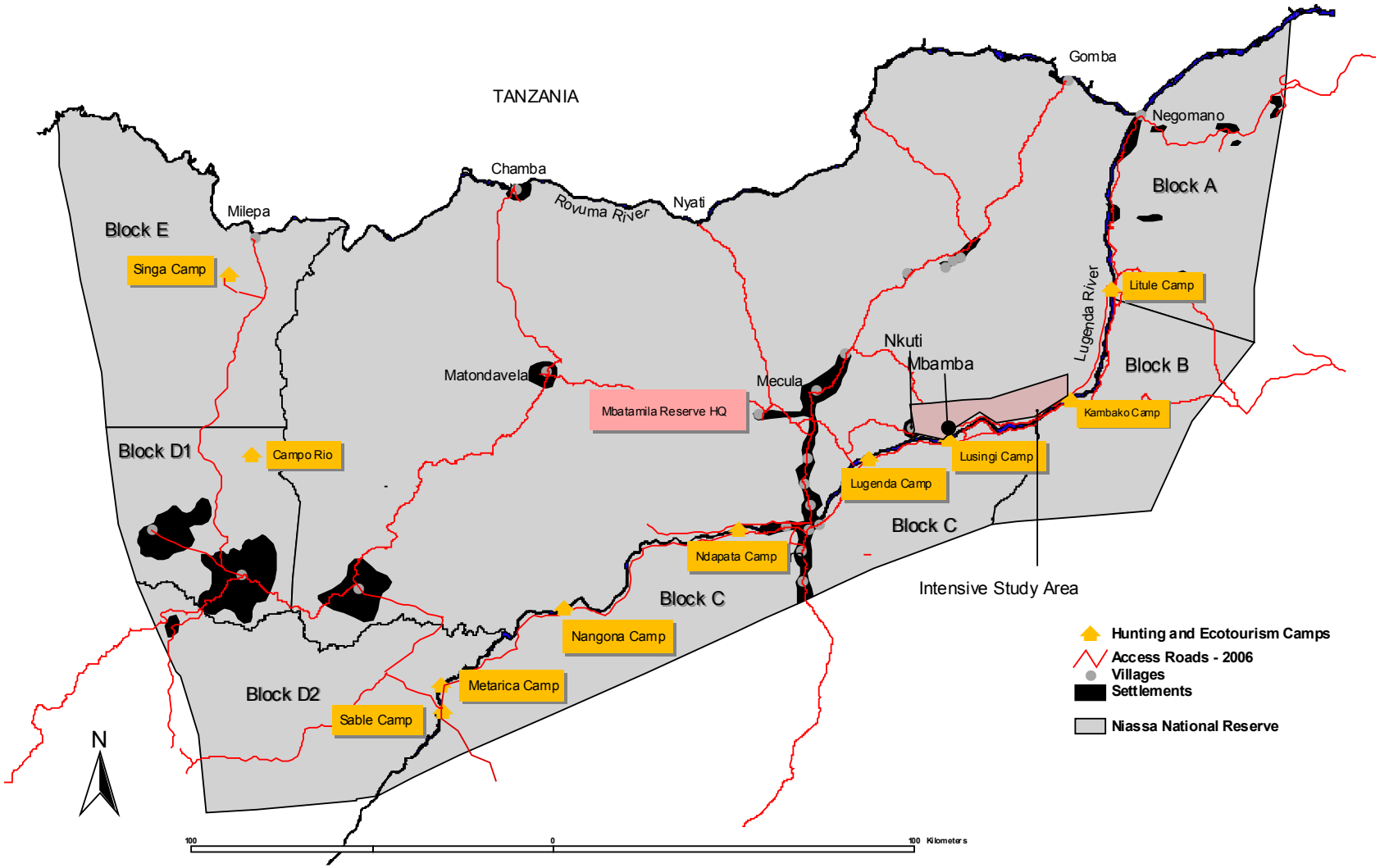


Fig 4: Niassa National Reserve (42 000 km^2) showing main access roads, settlements, hunting concessions and camps as well as our intensive study area in the south eastern corner on the north bank of the Lugenda River.

Section A: Monitoring System

4.0. Sequence of events

2003-2004:

- Researchers, visitors, villagers, professional hunters and reserve staff were asked for details of their opportunistic sightings of wild dogs while we were traveling through NNR and through e-mail and radio communications. These were then collated into a central database.
- Oscar Muemedi, a NNR resident from Mecula Village was trained as a research scout to assist with the ongoing monitoring and surveying of carnivores in NNR. Oscar has four years of schooling and can speak three languages fluently (Portuguese, Swahill, Cyao) with a basic knowledge of Makua. He was trained in standardized data collection and surveying techniques (datasheets, use of a GPS, use of binoculars, basic interviewing) and as taught to drive.
- An intensive study area was identified in the south-eastern section of the Lugenda Valley. All wild dogs seen in this area by our research assistants and ourselves were recorded (Projecto Nkuli).

2005:

- At the April Hunting Operators Meeting (Maputo), Professional Hunters were requested to provide photographs wherever possible to facilitate identification of the packs and were provided with specific datasheets for large carnivore sightings. In July during the extensive lion-hyaena call-up and November during trophy monitoring, opportunistic sightings from PHs were collected
- Collation of opportunistic sightings by ourselves and other observers (SRN and NNR staff, visitors to the Reserve) continued.
- In August 2005, Oscar Muemedi obtained his drivers license in Pemba (sponsored by this project) and a motorbike was purchased for him to use for further surveying. Through 2005 he visited villagers throughout NNR using a datasheet to collect information on wild dog sightings from villagers and reserve scouts throughout NNR.

2006:

- At the Hunting Operators Meeting (Maputo), Operators were again requested to provide photographs wherever possible to facilitate identification of the packs and were provided with specific datasheets for large carnivore sightings. Sightings were either sent in by email or collected during the November trophy monitoring exercise.
- MOMS system was initiated (see below). Wild dog sightings were extracted from the MOMS datasheets in November.
- Data collected by Oscar Muemedi during his village visit on the project motorbike were now incorporated into the MOMS format.

- Carnivore research in the intensive study area continued, and included the initial training of two local research assistants (Ndugu Alberto, Euzebio Waiti).

5.0. MOMS

5.1. Overview

- In 2006, SRN decided to initiate the Management Orientated Monitoring System (MOMS) in NNR. This is a simple, graphic, paper based monitoring system specifically designed for the collection and reporting of data by community scouts. MOMS is described in detail in Stuart-Hill *et al.* 2005 and is summarized briefly here.
- It was originally developed in Namibia on conservancies, but has since been expanded to Zambia, Mozambique and elsewhere. Unlike many other monitoring systems that are driven by external experts, this system allows scouts to feed information back to their communities and NNR management but still have a strong sense of ownership over the data. In this system it is essential that not only data collection but also analysis and reporting are done locally. Thus the people collecting the data also analyse and interpret it.
- Once topics or modules have been identified that need to be monitored (i.e. problem animals, vegetation, fish, predators etc), the technical support team then provides training and a kit to each person for each monitoring topic. Each scout is given a file containing colour coded datasheets for each topic: a set of yellow cards for collection of single events/ sightings, data collection, blue monthly reporting summaries and red datasheets for reporting and analysing long term trends.
- When MOMS has been properly implemented there is an annual audit of the system at the end of the calendar year. This audit is based on a yes/no activity questionnaire. The completed questionnaire constitutes the systems annual report and this can be distributed to donors, SRN etc.

5.2. Implementation of MOMS in NNR

- The MOMS system is still in its infancy in NNR.
- In September-October 2006, the traditional leaders in four villages (Mbamba, Nkuti, Macalange and Cuchiranga) identified an initial team of five community scouts (Fig 5). The only criteria provided were that the person chosen must reside full time in the village and must be able to read and write (usually 3-4 years of schooling).
- The community scouts and Oscar Muemedi (coordinator) were trained in MOMS data collection and reporting during a two-day workshop at Mbatamila lead by Agostinho Jorge (SRN) and Mbumba Marufo (Jorge & Marufo 2006; SRN; Fig 6).
- At present, the community scouts are collecting data on three modules (problem animals, special species sightings including wild dog, lion, leopard and hyaena and fish catches).

- These scouts are visited each month by Oscar, who also visits other villages where community scouts have not yet been identified, and are currently paid a part-time salary by SRN (Mt 600/ month) for their efforts.
- In addition to the MOMS community scouts, SRN also identified and trained reserve and concession scouts to collect information on special species sightings, illegal activities, problem animals and patrol effort using the same datasheets.

5.3. Assessment

- Details from all opportunistic sightings on the number of wild dogs seen, position, date and where possible activity, time, prey and habitat are entered into a database and plotted on a map using Arview software.
- All records are given a subjective reliability rating from 1-3 depending on the details given. Some records simply provide information on the presence or absence of wild dogs in an area with no further reliable information on pack size, habitat, exact location or date (rating = 1). In other cases, more details are provided on location, date and activity but pack size is estimated (rating = 2). The most reliable information is collected from recent sightings where details are given of the number of dogs in the pack, prey, location and activity (rating = 3).
- Few observers are able to provide information on the number of males and females or adults and subadults within each pack largely due to the fleeting nature of the sightings, rapid pack movements, and a lack of binoculars.
- Since 2003, there has been a steady increase in the number of wild dog sightings collected annually, with an associated increase in the reliability of the sightings (Fig. 7). In 2003 and 2004 between 10-20% of the sightings were presence or absence data, this has decreased to less than 5% of the total sightings in 2006.
- The reliability of sightings should increase further when the MOMS community scout system is extended to additional villages within NNR. Villagers who see wild dogs will be able to inform the scout in their village, and sightings will be recorded immediately rather than relayed verbally at a later date when essential details have been forgotten.
- Over the last four years there have been four main sources for wild dog sightings in NNR (Fig. 8): professional hunters and Operators ("PH"), sightings by Niassa residents and reserve scouts collected by Oscar Muemedi during his systematic surveys throughout NNR (2003-2005), MOMS community scouts (2006), and visual sightings by the "Projecto Nkuli" research team (ourselves, research and camp assistants) within the intensive study area and during research activities. In addition we also receive a small number of opportunistic sightings from NNR staff, visiting researchers, visitors etc (listed as "other"). To date we have not received any information from the NNR and concession anti-poaching scouts trained in the MOMS system in 2006. This is

largely due to the logistical difficulties in collecting the completed data reports and needs to be addressed in 2007.

- The proportion of the sightings provided by professional hunters and operators has increased steadily from 30% to 50%. These sightings are usually sent to us via email or collected at the end of the year during the trophy-monitoring trip in November. These sightings are particularly valuable as they are for the most part reliable sightings, frequently include GPS positions, and on many occasions they are accompanied by photographs of the packs.

Fig 5: The Chief of Ncuti Village choosing a MOMS Scout and providing information on wild dog sightings – August 2006

Fig 6: SRN training workshop for MOMS scouts held in Mbatamila by SRN (NNR HQ) in October 2006.

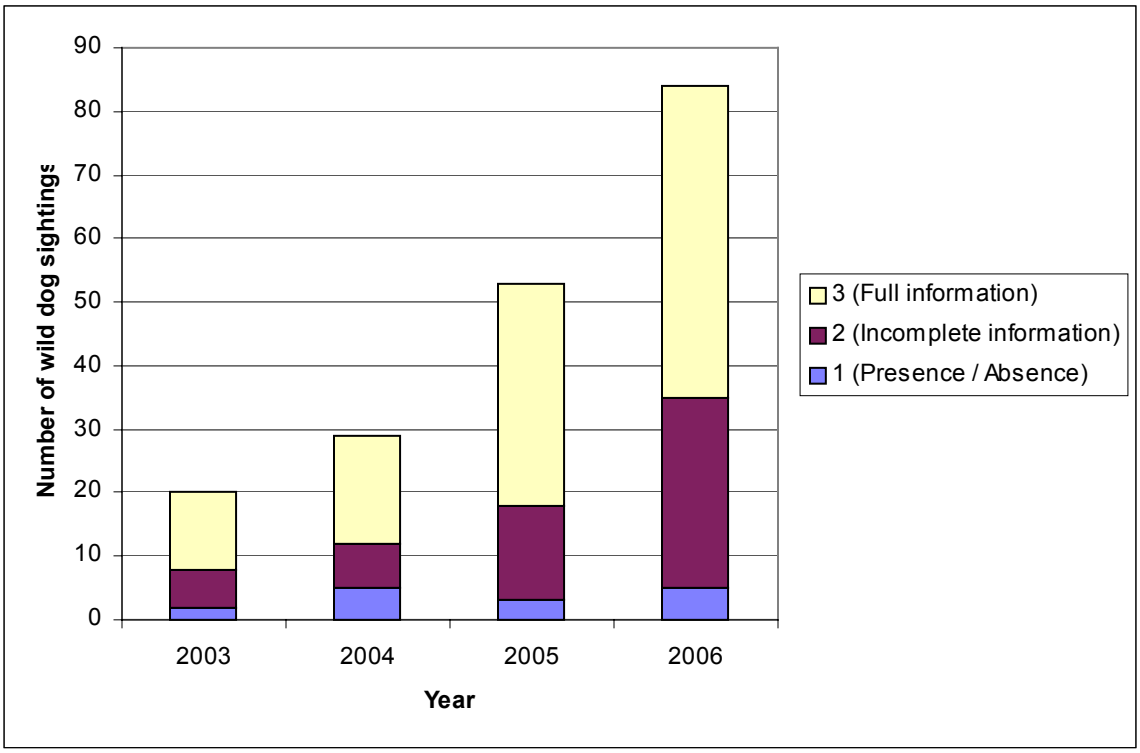


Fig 7 Reliability and number of wild dog sightings collected between 2003 and 2006 in NNR.

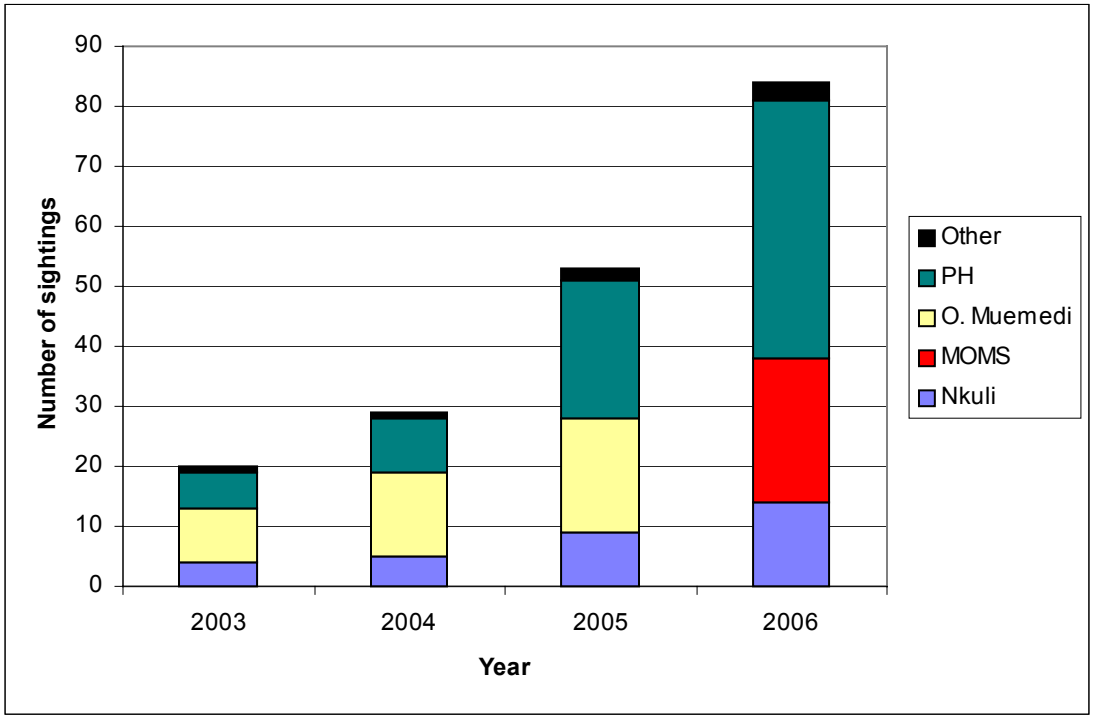


Fig 8: Source of sightings collated etween 2003 and 2006 showing the increasing cooperation from concession operators and implementation of MOMS.

5.4 Recommendations for monitoring system

1. Continued collaboration with professional hunters, operators and future tourism operators to provide accurate data on wild dog sightings is considered a vital part of the monitoring system. All concessions should be encouraged to keep sightings books for special species detailing date, time, activity, pack size, adults/subadults, males/females and GPS location.

2. Given the importance of this transfrontier wild dog population, it would be useful to include Selous Niassa Wildlife Corridor sightings into the database and establish a system of cooperation.

3. It will be important for SRN to regularly collate and report on all wild dog sightings using MOMS information as well as opportunistic sightings by NNR and concession staff. Wild dog distribution, average pack size, any conflict with humans, and wild dog mortalities can be used as indicators of the status of the wild dog population in NNR. Additional indicators such as densities of key prey densities (impala) and incidence of disease in domestic dogs could also be added once accurate assessment of these factors is possible (see relevant sections).

4. The data collected in 2006 has shown that MOMS (particular the community scouts) has significant potential as a sustainable, locally based monitoring system for wild dogs (amongst other things) in NNR and we recommend the following to develop it further:
    a. In future, communities need to be involved in the decision of what should be monitored. In addition all data collection and analysis (monthly and annual reports must be undertaken locally by the scouts themselves not by SRN staff. Otherwise this becomes just another externally driven datasheet system. The data collected and reports produced can, of course, be copied and if need be captured digitially by SRN staff for specific management purposes, but ownership of the data must remain with the communities themselves.
    b. It is vital that a SRN representative specifically responsible for MOMS is identified and sent on a training course in Namibia so that the system can be fully implemented and meets its full potential in NNR.
    c. Further training and regular interaction with trained scouts is essential to provide technical advice, particularly in these initial stages to maintain enthusiasm and iron out problems and misunderstandings.
    d. Identification of additional community scouts is necessary to achieve better coverage of NNR. Reserve and concession scouts need particular attention in 2007 to ensure data is collected during patrols.
    e. Annual meetings need to be held in NNR where each community scout presents the data collected in his village and a combined annual report is prepared according to the MOMS guidelines. This report can then be presented to SRN or donors.

f. Development of grid maps by scouts for NNR is essential so that the location of sightings can be accurately marked on a map by community scouts who do not have GPS.

g. To minimize transport costs and logistical difficulties, bicycles will need to be used by some of the scouts to reach the meeting and training places. Meeting places could also be divided into zones given the large distances involved, with only an annual meeting in Mbatamila.

h. It is feasible that at a later date the MOMS community scouts could be used as extension officers to disseminate information on critical conservation issues (e.g. rabies prevention, mitigation methods for problem animals).

i. It is also feasible (and should be a long term aim) that the communities themselves take ownership of the system and eventually pay their representatives themselves from funds provided from concession fees. For this to happen, the villagers need to feel that their MOMS representative represents their interests, and the data contributes to management in NNR.

5. A four-phased implementation of community scouts over the next four years to reach a goal of 80% of villages in NNR with at least one community scout trained in MOMS by 2010 (32 villages; Fig. 9) is suggested.

   a. Phase I involved the first 5 scouts identified and trained from four villages in 2006.

   b. Phase 2 is the identification of another 5-6 scouts covering a further eight villages in 2007 (Fig. 9: Mecula –(2 scouts), Matondavela+ Chimoyo (1), Ntimbo 1 + Ntimbo 2 (1), Lisongile (1), possibly Chamba.

   c. Once these scouts are fully trained and MOMS successfully implemented in these areas then identification and training of scouts in the Mussoma, Manyuri, Ndalima. Mpamanda (Block C) and Nalama-Naulala zones can be trained as Phase 3.

   d. Phase 4 could be the Msawize –Mavago complex possibly with Milepa included and the final Phase 5 would be the most logistically challenging Negomano complex in Block A.

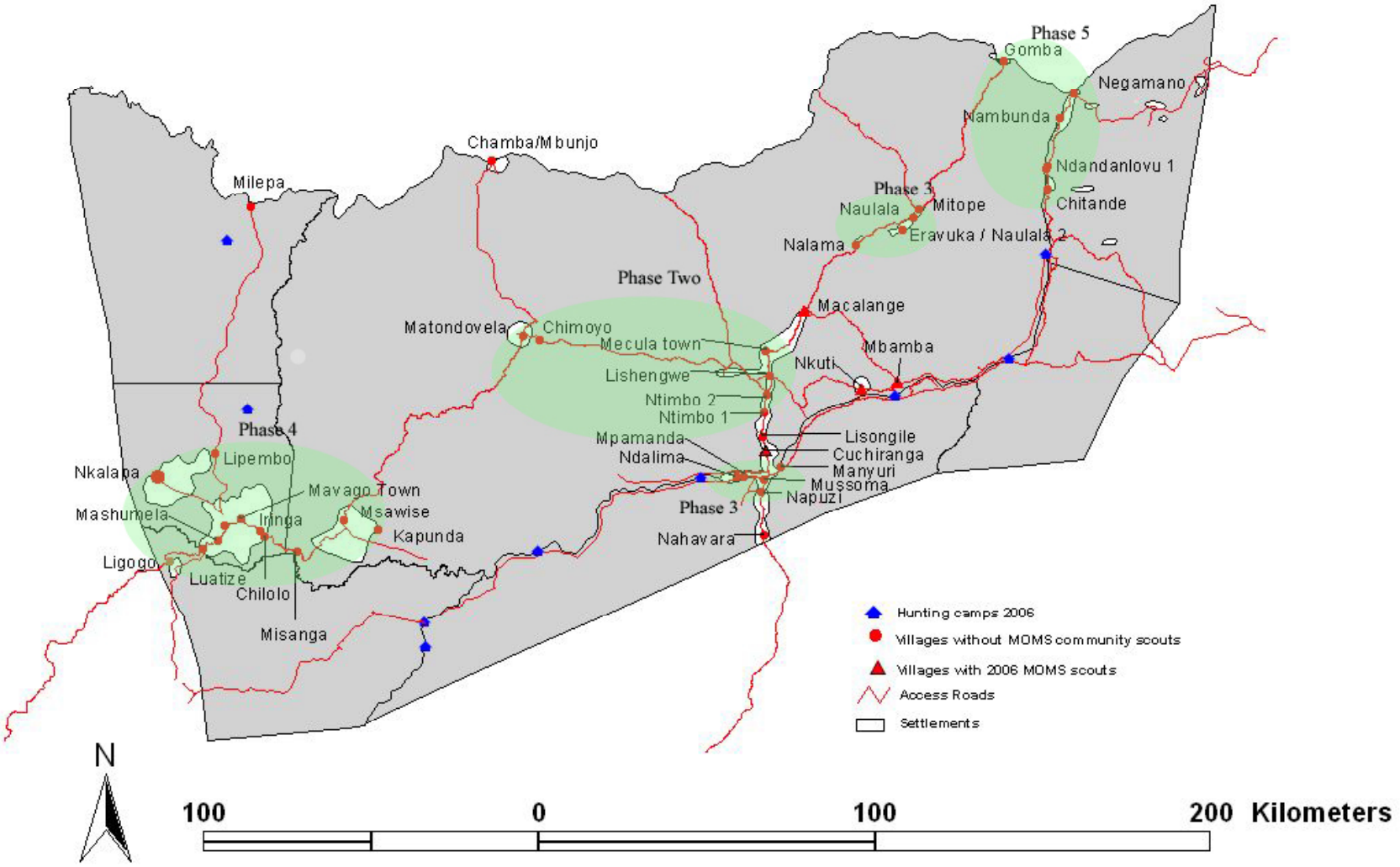


Fig 9: Proposed phased implementation of further community scout as part of MOMS, to provide ongoing information on wild dog distribution, pack size and human – carnivore conflict in villages throughout NNR.

Section B: Distribution, Density and Prey

6.0 Density and Distribution

- Since 2003, 187 opportunistic sightings of wild dogs have been recorded in NNR with 86 sightings in 2006.
- Identification photographs have been provided for individuals from 13 packs and we have personally encountered 12 distinct packs since 2003.
- Four distinct packs with overlapping home ranges have been identified within the intensive study area between the Mbamba and Msangezi Rivers (350 km^2) and are seen each year during the dry season Msangesi pack:18; Nkopola pack:7; Lipumbulu Pack:7; Sandali pack: 5). While these different wild dog packs all overlap in their utilization of this portion of the Lugenda valley they do not utilize the same area at the same time (temporal avoidance).
- In NNR average pack size is 7 individuals (139 accurately counted sightings, range 1-26 individuals). For nine sightings, adults and subadults were distinguished with an average of 6 adults (range 1-14) in each pack. These results are similar to observations from Selous Game Reserve, Tanzania (Creel & Creel 2002) where the average was 7-8 adults per pack.
- All opportunistic sightings recorded between 2002-2006 are plotted in Fig. 10. Wild dog distribution is still clearly biased by observer activity with the majority of sightings close to hunting camps, villages and along access roads. This will be partly resolved when MOMS is extended to cover more of the NNR and further concessions are opened up in the central NNR region.
- The low number of sightings in the west-central region of the reserve is unlikely to be due to a lack of wild dogs in the area as this is a region of relatively high prey densities (Craig & Gibson 2004) and the habitat does not appear to differ significantly from areas further to the west or east (Desmet 2004) but simply reflects fewer observers and roads.
- Based on the pack size and location of individual sightings, we can reasonably identify at least 39 distinct packs in NNR (24 packs were observed in 2006), representing a minimum of 336 individuals and a density of 0.8 individuals /100 km^2 (calculated from the minimum number counted in each pack over four years; Table 1).
- Using data from other wooded areas as a guide, particularly Selous Game Reserve, which is situated in the same miombo ecoregion (Table 2; from Woodroffe *et al.* 2004) we can predict that the average wild dog home range in NNR will be about 450 km^2. If we place circles of 450 km^2 around areas where we know wild dog have been seen in the last three years to get a coarse visual representation of how much area of NNR is currently covered by wild dog packs (Fig 11), it is

apparent that this can only be considered a minimum estimate of the wild dog population in NNR, given the large amounts of empty space where no sightings have been recorded.

- Conservatively, there is "room" for at least 15-20 additional packs (90-120 adults at an average pack size of 6 adults per pack) even without the level of overlap seen in the intensive study area (Fig 11).
- It is therefore feasible that NNR supports at least 450 adult individuals, at a population density of 1.1 adult dog / 100km^2. This density would not be unrealistic given the densities of wild dog in other large conservation areas (Table 3; adapted from Woodroffe *et al* 2004).

Wild Dogs outside NNR

- The NNR wild dog population is not constrained or isolated within NNR as there is no hard edge to the protected area. We have received various sightings of wild dogs to the west, east and south of the NNR boundaries.
- In 2005, Jean-Marc Andre ((Research Assistant WildCRU, University of Oxford, supported by the BP award 2005; IUCN Canid Specialist Group) initiated a survey of wild dogs in northern Mozambique, with Quirimbas National Park and Niassa National Reserve his primary study areas (Andre 2004). We understand fieldwork was completed in Quirimbas National Park and partially completed in NNR by December 2005 (Andre 2005). A detailed report was due to be completed and provided by February 2006, however this has not been received despite repeated requests and to date no data has been provided. We understand that details of several wild dog packs in Quirimbas National Park were collected during this survey. This data is important for development of regional conservation strategies but is unfortunately currently unavailable
- Additional sightings from the Selous Niassa Wildlife Corridor and elsewhere in southern Tanzania (R. Hahn, pers. com) suggest the NNR wild dog population may be contiguous with the Selous Game Reserve population which consists of at least 800 individuals (Table 4).
- This suggests a possible transfrontier population of 1000-1500 African wild dogs in southern Tanzania –northern Mozambique.

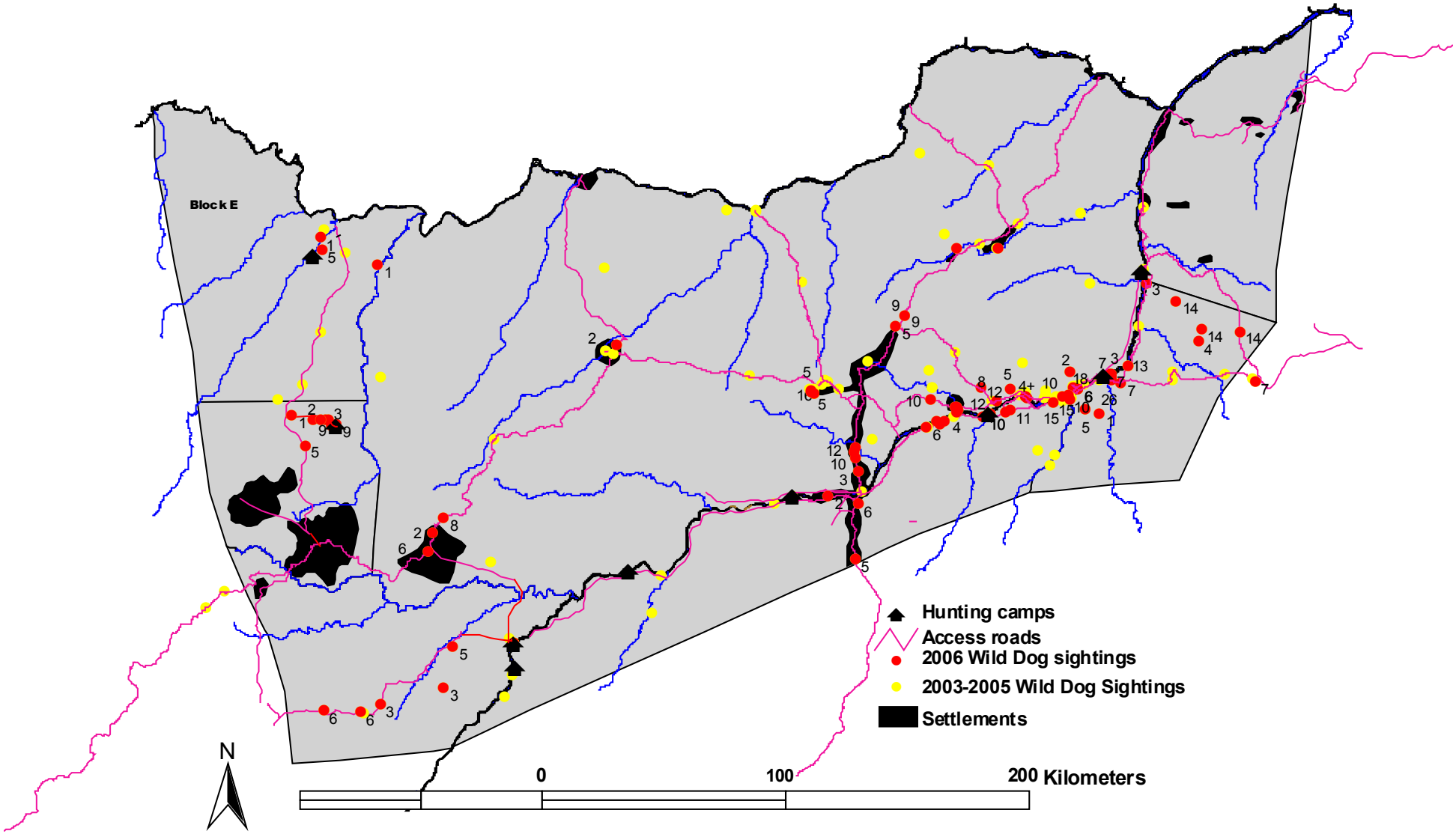


Fig 10: Distribution of opportunistic wild dog sightings collected 2003-2006 indicating pack size of 2006 sightings where possible.

Table 1: Subjective identification of distinct wild dog packs located within NR during 2004-2006 based on distribution and pack size. Packs marked in bold are within the intensive study area and packs highlighted were seen in 2006.

Pack ID	Pack Name	Pack Size	Year of observation
1	Rovuma-Gomba	16	2004, 2005
2	Naulala-Matopi	13	2005
3	Nyati-Mbanga	6	2005
4	Macalange	5-10	2004, 2006
5	Kambako-Lugenda	10-15	2004, 2005, 2006
6	Luambezi-Lugenda	15-26	2006
7	Kambako -Courtada	7-10	2004, 2006
8	**Nkopola**	**7**	**2004, 2005, 2006**
9	**Mzangesi**	**17-20**	**2005, 2006**
10	**Lipumbulu**	**7**	**2004, 2005, 2006**
11	**Sandali**	**5**	**2005, 2006**
12	Mbamba	8	2006
13	Nkuti	10-15	2004, 2006
14	Nkuti 2	4-5	2006
15	C-Ngolonge	6	2005, 2006
16	C-Lusingi	10	2005, 2004, 2006
17	C-Maranga-ranga	12	2005
18	C-Mantindano	4-5	2006
19	C- Ndalima	2-7	2006
20	C- Ndapata	17	2004, 2005
21	Mussoma	6	2006
22	Lisongole	10-12	2006
23	Nahavara	5	2006
24	Chamba	5	2004
25	Rovuma -Nyati	10-15	2004
26	Mpanda-Tinduru	9	2004
27	Mbatamila 1	5	2004, 2005, 2006
28	Mbatamila 2	16	2006
29	Bamba	12	2004
30	Chui –Matondevela	2-8	2004, 2006
31	Catembe	5-10	2004,2005
32	D2- inland	17	2005
33	D2- Sable Camp	5-10	2004, 2005, 2006
34	C- Middle Metarica	7	2005
35	Metarica	15	2005
36	Msawize	5-10	2006
37	E- Milepa	6	2005
38	D1-Campo Rio	5-10	2006
39	E- Lusheringo	10-15	2005
	39 Packs	**336 individuals min.**	

Table 2: Home ranges of wild dogs in various wooded study sites across Africa (adapted from Woodroffe *et al.* 2004)

Study Site	No. packs	Home range size in km^2 (range)
Hwange National park, Zimbabwe	4	423 (260-633)
Kruger National Park, South Africa	20	553 (150-1110)
Moremi Game Reserve, Botswana	9	617 (375-1050)
Selous Game Reserve, Tanzania	11	433 (156-846)

Table 3: Population densities of wild dogs in study areas across Africa (adapted from Woodroffe *et al. 2004)* including an estimate for Niassa National Reserve, Mozambique, from this study

Study Site	Population density (adults / $100km^2$)
Hwange National Park, Zimbabwe	1.5
Kruger National Park, South Africa	0.8-2.0
Okavango Delta, Botswana	3.5
North-central Botswana	0.5
Zambezi valley complex	2.0
Selous Game Reserve, Tanzania	4.0
Niassa National Reserve, Mozambique	Est. 0.8-1.1

Table 4: Individual opportunistic sightings of wild dogs in southern Tanzania bordering NNR (provide by Rudi Hahn, pers. com; Selous Niassa Wildlife Corridor)

Region & source	Details
Selous- Niassa Wildlife Corridor	Pack seen in May 2006 in Likuyu village
Southern Tanzania	Packs seen on main road between Tinduru and Nambtumbo towns- between Mchomoro village and Kilimasera village, 2006
Southern Tanzania	In Mchomoro village, hyaenas killed one wild dog pup, wild dogs reported to kill three hyaenas

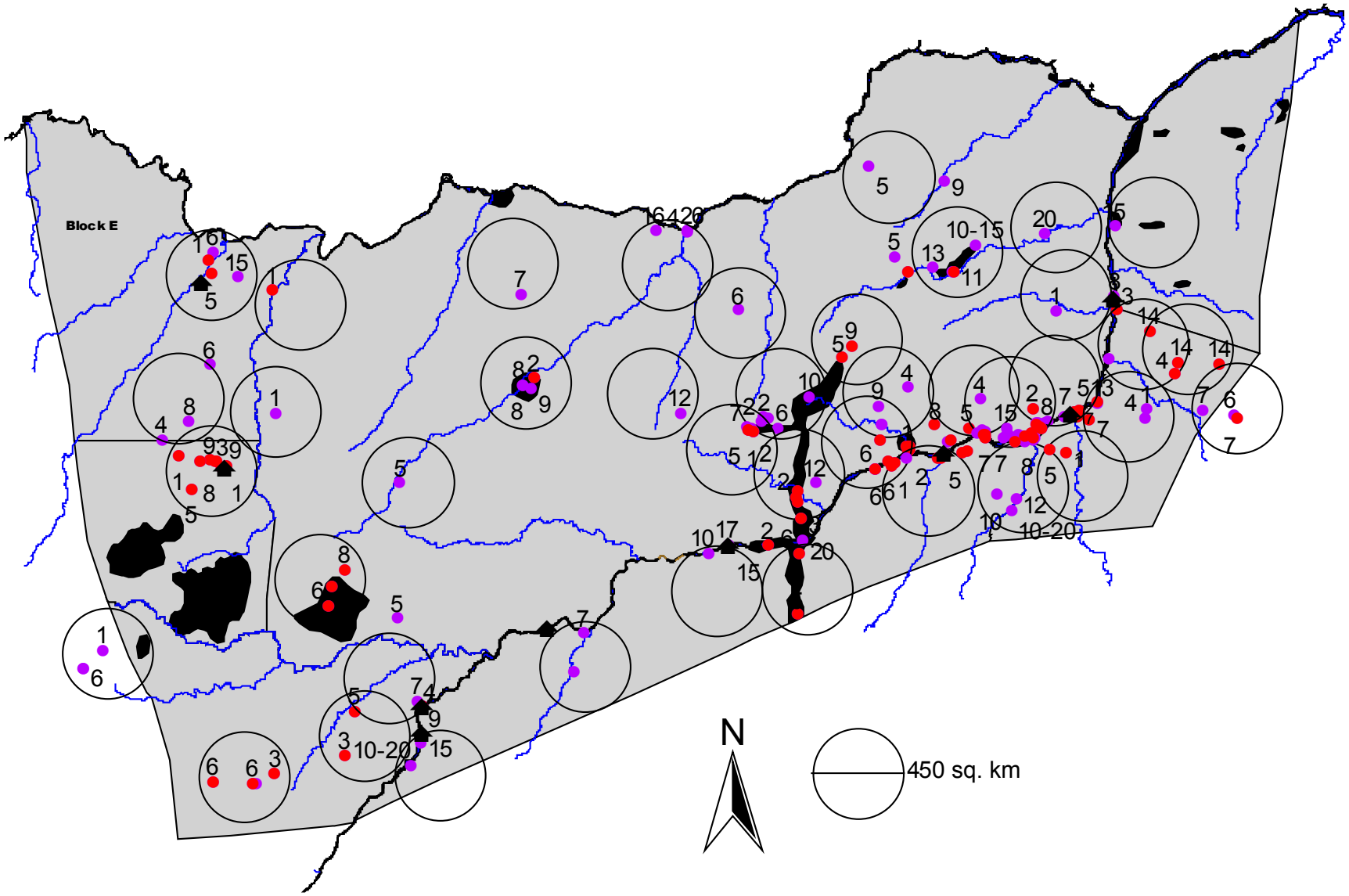


Fig 11: Hypothetical wild dog home ranges of 450 km^2 plotted around wild dog sightings to assess distribution and density of wild dogs in NNR

7.0. Prey

7.1. Prey Type

- To date, 34 prey records representing 11 species have been recorded from opportunistic sightings of African wild dogs between 2003-2006 (Fig 13). These range in size from chickens caught at Chui Scout Post (Matondevela) to an eland calf ambushed while it was with its mother.
- Since these data are based on opportunistic observations alone, not from following radiomarked individuals, it is likely that the presence of smaller prey items (impala fawns, duiker, grysbok, suni etc) have been underestimated, as these carcasses are less likely to be found.
- Local fishermen and honey-gatherers are excellent sources of information on wild dog prey as "raiding" meat from wild dog kills is a relatively common practice in NNR (see section on human impacts).
- African wild dogs are known to be generalist predators that mostly hunt medium sized antelope (Woodroffe *et al* 2004) and their hunting behaviour in NNR follows the same general patterns found elsewhere. In most areas their principal prey are impala, kudu, Thompson's gazelle (which does not occur in NNR) and wildebeest.
- The five most common prey species (> 10%) in NNR are impala, reedbuck, bushbuck, waterbuck and kudu (Fig. 13).
- In Selous Game Reserve, wildebeest are particularly important prey items yet in NNR only one wildebeest kill has been recorded. This is likely to simply reflect the low density of wildebeest in NNR at present. Wildebeest are Niassa's rarest medium sized ungulate (Craig & Gibson 2004).

Fig 12: Impala herd in wooded grassland habitat close proximity to the Lugenda River in the intensive study area.

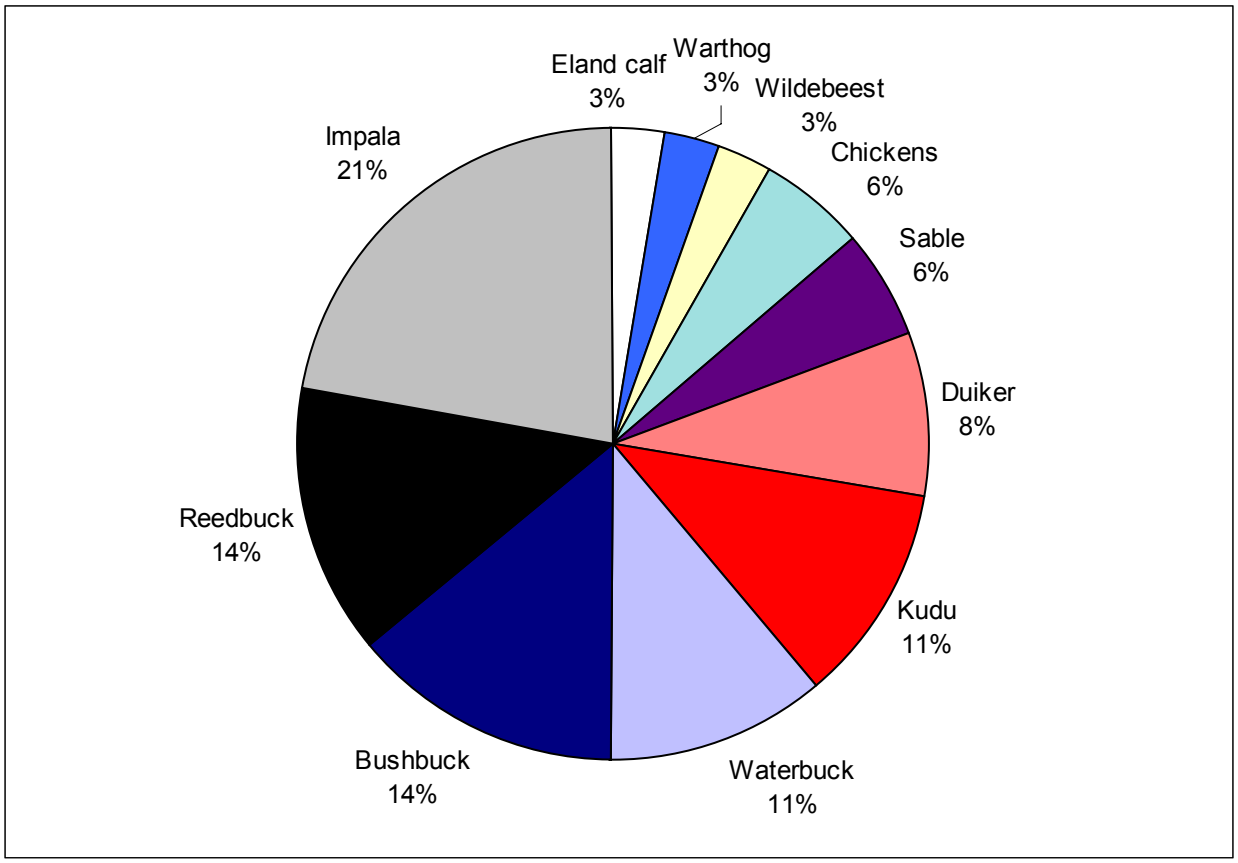


Fig 13. Prey of African Wild Dogs in NNR, collected from opportunistic sightings between 2003-2006 (N = 34).

Fig 14: Lusinge wild dog pack with potential waterbuck prey: Photo by Paul Davies, 19 Nov 2006

7.2. Prey availability

- An aerial census has been conducted every second year in NNR (Craig & Gibson 2000, 2002, 2004, 2006).
- The aerial census results show that four of the most common prey species (impala, reedbuck, waterbuck and kudu) have extremely patchy distributions in NNR and appear to have relatively low densities in NNR (Table 5; Craig & Gibson 2004).
- Reedbuck have only been recorded as prey in the west of NNR, reflecting their patchy distribution (Craig & Gibson 2004), while impala are most common in the east along the Lugenda River where they are common prey.
- It is currently impossible to examine objectively wild dog distribution in NNR in relation to prey densities as the sightings are strongly biased by observer density, and observer density is in itself strongly correlated to areas of high prey density. However, the distribution of wild dog sightings does suggest that the wild dogs may be common in the south-eastern and central region of NNR compared to the north-east, or south-western areas where prey densities are lower (Fig. 15).
- However a problem with the aerial census technique is that species that are common in habitats with heavy cover, such as kudu, bushbuck, waterbuck and impala are frequently undercounted. (Creel & Creel 2002, Craig & Gibson 2004). To complicate matters, different species are undercounted by differing amounts and correction factors have not yet been determined for NNR. Creel & Creel (2002) have shown that impala in particular are heavily undercounted in aerial surveys in Selous G.R.
- To assess this further, preliminary ground counts (road transects) were completed in 2004 and 2005 both in the intensive study area and more widely throughout NNR. In 2004 (June-October), a repeated road strip transect (n = 21 repeats, 25 km) was driven through the intensive study area within 5km of the Lugenda River and the number of animals of each species, group size, and habitat were recorded (Begg *et al* 2005). The primary aim was to determine the relative density of impala, waterbuck, kudu, sable, and zebra in the intensive study area throughout the dry season. In 2005, 10 km road strip counts were completed opportunistically throughout NNR during the lion-hyaena call-up survey (June-July; n = 25 transects). Transects were simply classified as river transects (within 5km of the Lugenda River, n=15 transects, 134.28 km) or inland transects (Miombo woodland, n=10 transects, 98 km). In both years transects were driven at 10-15 km/ hr in the early morning (05:00-09:00 hrs) and late afternoon (16:00-19:00) and prey were counted by at least two observers on both sides of the road.

- For each of the habitats the maximum perpendicular distance from the vehicle to the furthest member of a group of animals was estimated. The relative area of each habitat censused was then calculated as:

  Relative area of Habitat A = (Est. max. sighting distance in Habitat A x 2) x total length of Habitat A

  Relative densities could then be calculated as the number of animals/ km^2.
- The road strip transects show substantially higher densities for impala, waterbuck, bushbuck and kudu in NNR than predicted from the aerial census results (Table 5). Densities are particularly high within 5km of the Lugenda River (riparian, open mixed woodland, wooded grassland plains, thickets) compared to further inland in Miombo woodland (Table 5).
- A preliminary analysis of ungulate habitat preference showed that impala preferred the open wooded grassland and mixed woodland habitats and avoided the miombo and riparian woodland, kudu preferred the mixed open woodland and riparian woodland, and were less commonly seen in the wooded grassland and miombo woodland. Waterbuck showed no preference for any of the habitats but as with impala were seldom seen far inland away from the permanent water in the Lugenda River (Begg *et.al.* 2005). Too little data were available on the secretive bushbuck for further analysis.
- In general the miombo woodland away from the major rivers is relatively prey deficient compared to the floodplain habitat, where there are higher concentrations of game, more diverse habitats and year around water.
- On the Lugenda floodplain, impala, kudu and waterbuck are the most common ungulates and the most common prey species.
- The high density of wild dogs recorded along the Lugenda River in the intensive study area (37 dogs in 350 km^2; 4 packs; 10 individuals/ 100 km^2) is likely to be a reflection of relatively high densities of preferred prey (particularly impala) in the area particularly in the late dry season after extensive fires have move through the Miombo woodlands and surface water is rare.

Table 5: Relative density of common ungulate species (>10% of diet) in NNR from aerial surveys (Gibson & Craig 2004) and preliminary road transects (see methods section). Reedbuck are not included as they are not found in BlockL5 (intensive study area)

Species	Aerial Survey (animals / km^2)		10 km road strip transects (animals/ km^2)		Repeated 25 km road transect (animals/ km^2)
	Block L5	Overall	Lugenda River (n=14 ; 126 km)	Miombo Woodland (n=10, 99 km)	Lugenda River Valley (Block L5) (n= 21 repeats)
Impala	0.05	0.03	10	0	14.6
Bushbuck	0.005	0.008	0.09	0	Not counted
Waterbuck	0.12	0.09	1.3	0	2.3
Kudu	0.08	0.03	0.4	0	0.8
Sable	0.25	0.31	0.04	0.1	0.2
Warthog	0.1	0.13	0.6	0.3	Not counted
Wildebeest	0	0.02	0	0.03	0
Zebra	0.18	0.09	0	0.31	0.14

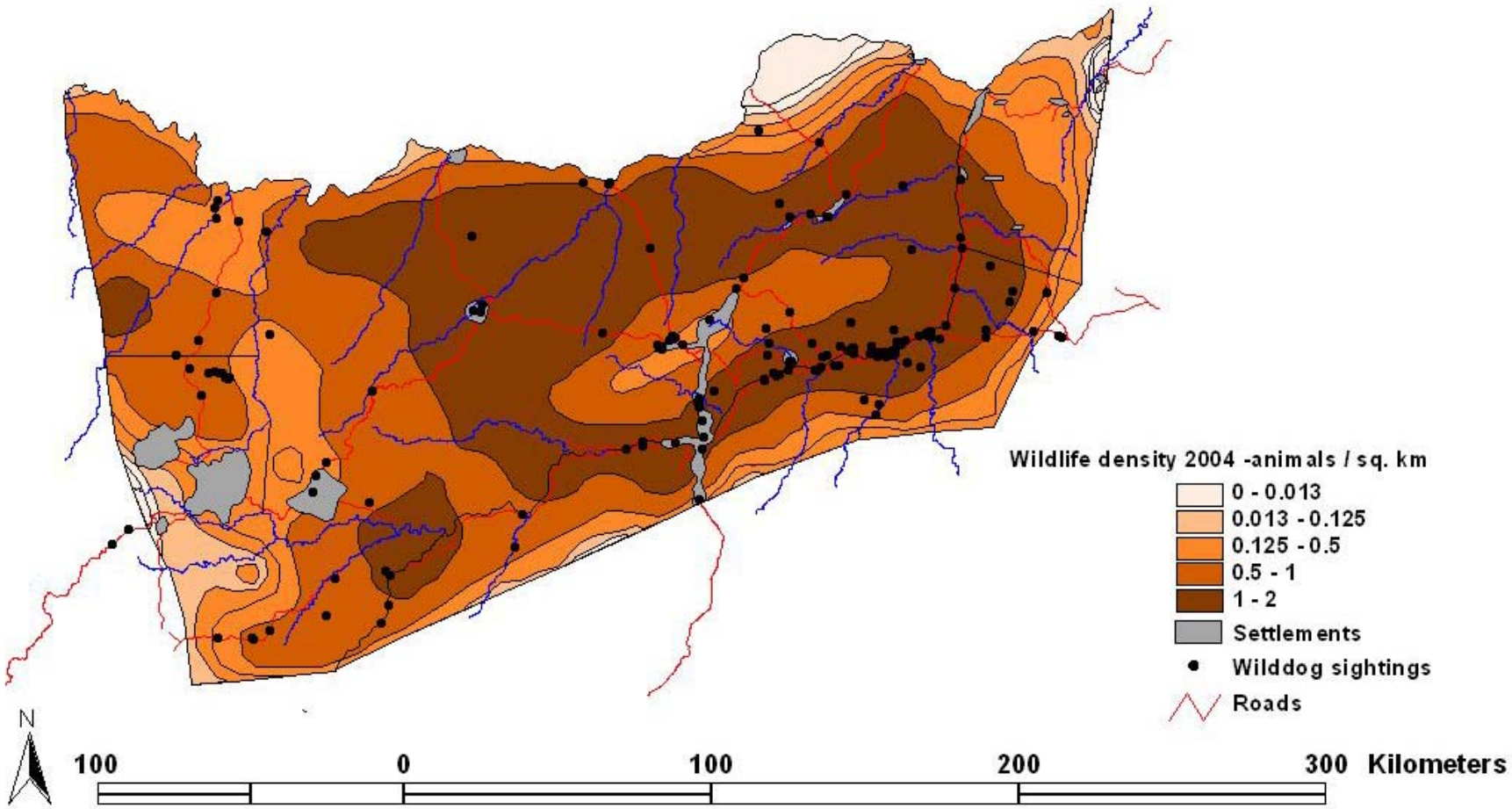


Fig 15: An index of wildlife densities across NNR expressed as the total number of animals seen per km^2 from the 2004 aerial census (Craig & Gibson 2004)

Section C: Potential Threats

- Due to the extensive area and the large population of wild dogs protected within NNR, we consider the current risk of extinction to this population to be low and believe the population is currently stable or increasing along with prey population.
- Given the importance of this population to global wild dog conservation efforts and the rapid changes in infrastructure (roads) and human population density occurring in the region as a whole, ongoing monitoring of the wild dog population and potential threats will be essential.
- With this in mind, and based on our current understanding of the situation in NNR, we have rated potential threats to the NNR wild dog population in Table 6). Each potential threat and possible interventions is discussed later in more detail.
- Aside from monitoring, some preemptive interventions, particularly with regard to minimizing disease may be more cost effective and likely to result in successful conservation than waiting until there is a crisis. This decision will need to be made by SRN and possible options are discussed in the relevant section.

Table 6: Rating of potential threats to the NNR wild dog population

Potential threat	Rating
Disease – Rabies & canine distemper	1 - Potentially Serious
Snares –inadvertent persecution	2 – Potentially serious
Competition with lions & hyaenas	3 - Minimal threat at present, may increase
Stealing of kills by humans	4 - Negligible, may increase
Road casualties	4 - Negligible but likely to increase
Direct persecution – livestock conflict	5 – No threat at present, unlikely to increase

8.0. Disease

8.1 Overview of disease risk

- While wildlife populations are often able to survive disease, in relatively isolated populations disease epidemics have the potential to reduce numbers to levels where other chance factors may lead to extinction (Gascoyne *et al* 1993).
- In terms of conservation, rabies and canine distemper are the diseases of greatest concern to wild carnivores, particularly African wild dog and lion populations.
- Domestic dogs are the principal reservoir host of rabies, canine distemper and canine parvovirus in Africa and are known to spread these diseases to both wild carnivore populations and, in the case of rabies, to humans. Rabies is the most virulent of the two diseases. In Africa the growth rate of the domestic dog populations in most rural areas ranges between 5-10% per annum driven by a continuing demand for dogs for guarding, herding and hunting (Cleaveland 1996, Vial *et al* 2006).
- In wild dogs their trophic position, intense competition with other wild carnivores particularly lions and hyaenas, high degree of sociality and close taxonomic relationship with the domestic dog may all increase the wild dogs exposure to and transmission rate of infectious disease particularly rabies and canine distemper (Woodroffe *et al* 2004; Vial *et al* 2006).
- Rabies has resulted in declines in several wild dog populations. Between 1989 and 1991, a well-documented rabies outbreak killed most or all of the African wild dogs in the Serengeti-Mara ecosystem (Gascoyne *et al.* 1993). This outbreak coincided with rabies epidemics reported in domestic dogs. Rabies has also been identified as the cause of the loss of five packs in Botswana (McNutt cited in Woodroffe et al. 2004) and was implicated in the deaths of 11 wild dogs introduced into Namibia.
- Canine distemper is also of concern. In 1994, approximately 1000 lions (one third of the entire Serengeti lion population) and some spotted hyaenas died as a result of canine distemper
- In addition to wildlife concerns, rabies poses significant human health risks as it is a devastating and fatal disease in humans. Although often considered a relatively insignificant disease in Africa in terms of human mortality, it is likely that cases are grossly under-reported (Cleaveland 1998). In Tanzania alone, the true number of human deaths from rabies per year is estimated to be between 1000-2000 and the high cost of post exposure treatment imposes a severe burden to limited public health budgets (US$ 400 000 / year; 2002, Report by Ministry of Water and Livestock development, Tanzania National Parks).

8.2. Disease in NNR

- NNR is unusual in that 25 000 people actually live inside the protected area spread across 40 villages and the likelihood of contact between domestic dogs, people and wildlife is therefore not isolated to the boundary area but takes place within the protected area.
- The boundary between NNR and communities to the south, east and west of NNR is also not a hard edge with considerable movement of people, domestic dogs and carnivores across this boundary.
- In February 2005, there was a severe rabies outbreak in the Nipepe district, Niassa Province, northern Mozambique, 170 km south of the NNR boundary. By the end of June 2005, eight people had died and more than 500 domestic dogs had to be destroyed (with assistance from Luwire, SRN, Dr. Mike Kock and this project). A second rabies outbreak was reported in Quirimbas National Park, Cabo Del Gado Province during the same year.
- Wild dogs are known to be present in both the Quirimbas National Park as well as the Nipepe district and are likely to form part of an extended Greater Niassa wild dog population that includes the NNR population.
- The 2005 rabies outbreaks, highlighted concerns about this disease both because of the high human health risks for local communities and because of the possibility of a disease epidemic in the nationally protected African Wild Dog.
- While a rabies vaccination program is active in northern Mozambique, it has been hampered by the lack of information on disease prevalence and a lack of equipment and resources for veterinary staff.
- In 2006, a sub-project to more properly investigate the threat of disease in NNR was initiated in conjunction with SRN and the state and provincial Veterinary Departments.
- The original aims of this subproject were:
    - To survey the domestic dogs in NNR.
    - To assess the incidence of disease (canine distemper, canine parvovirus) in domestic dogs within Niassa Reserve and surrounding communities to inform mitigation programs.
    - To initiate an education campaign about the risks of rabies, the need for vaccination of domestic dogs and appropriate treatment for dog bites.
    - To investigate the potential for a targeted vaccination program for domestic dogs in neighbouring communities around NNR, to provide a buffer for wildlife species in the protected area.
    - To investigate ways to gradually remove domestic dogs from NNR to safeguard the wildlife populations.

8.3. Development of a Rabies Poster

- In April 2006, we produced a poster in Portuguese creating awareness about the dangers of rabies, signs and symptoms, treatment and guidelines (Fig 16).
- After discussions with SRN, this poster clearly stated that no dogs were allowed in NNR in accordance with the Community Policy (2006).
- The poster was developed with the generous assistance and photographs from Katie Hampson and Sarah Cleaveland of the Alliance for Rabies Control (www.rabiescontrol.com).
- An initial print run of 500 posters was produced and these were distributed to villages, clinics and schools throughout NNR and sent to Lichinga (provincial capital of Niassa Province) for distribution to surrounding communities.
- In addition Sarah Cleaveland provided a digital copy of Swahili pamphlet produced by in Tanzania by the Alliance for Rabies Control, providing more detailed information on rabies. Ten copies were printed, laminated and distributed in NNR.

8.4. Domestic dogs in NNR

- A domestic dog survey was completed by Oscar Muemedi and ourselves in 2006. A total of 136 domestic dogs were visually counted in 42 villages; 4 villages were not surveyed. Additional information provided by R. Branco for the Mavago area brings the total to 144 dogs in NNR during 2006 (Table 8). This is considered a minimum count but is believed to be the right order of magnitude with less than 200 dogs present in NNR at any one time. The exact number present in NNR at any one time varies, as there is a high mortality.
- No data is currently available on the density of domestic dogs in settlements neighbouring NNR, however anecdotal observations suggest the number might be significant particularly along the Marrupa-Lichinga and Balama-Montepuez roads.
- The villages where dogs are currently present are plotted in Fig. 18. The highest domestic dog densities are present in the south-western Mavago-Msawize complex (101 dogs; 70%) and south central Mussoma-Mecula corridor (27 dogs; 19%; Fig 19). Both these areas are on access roads into NNR with a constant flow of people in and out of the reserve. Outlying small groups of domestic dogs are also found on the Rovuma River in Gomba and Negomano.
- The distribution of domestic dogs in NNR is patchy. The majority of villages (63%), particularly in eastern NNR do not have domestic dogs, with only 11 villages containing more than five domestic dogs.

Fig 16: Rabies poster developed, printed and distributed by the Niassa Wild Dog Project throughout NNR and regionally from Lichinga to provide advice to communities on rabies. This poster was developed with the assistance of the Alliance for Rabies control (www.rabiescontrol.org), FFI, SRN and Niassa Province

- Branco (2006) found that the majority of dogs were two years old (74%) with 26% between 3-6 years of age and there appears to be a high turnover of dogs on the area with most dogs only living 2-3 years.
- At present the reasons for this and the patchy distribution of dogs in NNR are unclear but may simply be due to the high levels of trypanosomiasis infection in NNR spread by the tsetse fly. The domestic dog densities are highest in largest villages (Mecula, Msawize, Mavago) where tsetse loads are likely to be lower (less vegetation). Interestingly the villages that have domestic dogs are also the villages with the greatest numbers of goats. Predation, particularly by leopards may also be playing a role.
- In the eastern section of NNR where reserve staff has a greater influence and authority (i.e. Meculal-Mussoma corridor), the keeping of domestic dog was discouraged although not actively prevented prior to 2006 (B. Chande, warden, pers. com). SRN/ NNR staff does not have a strong presence in the Mvago-Msawize area where the highest densities of domestic dogs occur.
- Populations of domestic dogs are likely to increase in future with additional vaccination, veterinary care and increasing human populations creating bigger settlements.

8.5. Why do people keep dogs in NNR?

- Conversations with NNR residents suggest that dogs are primarily kept for subsistence hunting. In Mavago, 3 residents owning 7,10, and 8 dogs respectively all said they used the dogs when hunting with nets (Fig. 17). Branco (2006) found that the main reasons dog owners gave for keeping dogs in the Mavago area was the protection of mashambas, hunting of bushpigs, warthogs, ungulates and cane rats, and for guarding.
- There is at present little evidence to suggest that domestic dogs are an integral part of traditional community life in NNR given that they are not found in 63% of NNR villages and have a high mortality rate.
- While this requires more investigation, there is also little evidence that they play a significant sanitation role as has been found in areas of Ethiopia (S. Williams, pers. com)

8.6. Costs and benefits of domestic dogs in NNR

- Aside from disease risk, there are also other consequences of keeping domestic dogs in a protected area. Research in other areas suggests that the presence of domestic dogs in a protected area is largely incompatible with conservation goals and should be avoided wherever possible. In almost all protected areas it is dogs on the boundaries (edge effect) that are a significant problem. The potential benefits and costs of domestic dogs in NNR are summarized in Table 7.
- In areas outside of the NNR in Mozambique, domestic dogs are important for subsistence hunting and are frequently used for two main purposes a) to drive animals into nets and b) to detect

animals during hunting with firearms (A. Fusari pers. com). Domestic dogs are also seen as valuable for protecting hunters against dangerous animals (lion, leopard, and snakes) when they are in the field (Fusari & Carpaneto 2006).

- Little information is available on the ecological effects of traditional hunting with domestic dogs. In South Africa a distinction is made between controlled hunting with trained dogs for predator control and for flushing and pointing at game, and uncontrolled hunting (dogs untrained, not on leashes) which is non target specific.
- Uncontrolled hunting frequently results in non-target species, especially hares and the females and young of ungulates being flushed and killed. Traditional hunting with domestic dogs has been implicated in the decline of oribi and riverine rabbit in South Africa (Endangered Wildlife Trust), in the reduction of ground nesting birds, gazelle fawns (Taylor *et al* 2005) and in Ethiopia they compete with the Ethiopian Wolf for rodents.
- Traditional hunting with dogs is widely considered inhumane. The Wildlife and Environment Society of South Africa, which is pro-sustainable use, has issued a position statement on the traditional hunting with dogs, which states: "it is a non selective and cruel method of hunting that is extremely difficult to control or monitor. This method of hunting has a detrimental effect on wild animals particularly ground nesting birds and small mammals" (WESSA 2002)
- Free ranging domestic dogs are primarily scavengers of human waste (food and faeces) and domestic animal fatalities (Butler & du Toit 2002) and this is plays a sanitation role in some communities. However, in rural areas in Zimbabwe, dogs have been observed scavenging up to 3 km from the outer limit of the community area in protected area. Consequently domestic dogs may have a direct impact on wild scavengers (Butler & du Toit 2002).
- Domestic dogs are regularly preyed on by large wild carnivores particularly leopard, spotted hyaena and lion (Butler *et al* 2004) and are frequently killed by male baboons when they are used by their owners to chase baboons responsible for crop and livestock raiding. Generally, domestic dogs are considered ineffective protectors of domestic livestock unless they have received adequate training; they are more likely to be prey.
- As stated in the SRN Community Policy "the community policy is based on the right of people to live in the Reserve, and seeks to provide the resident population with the best possible quality of life, but which is consistent with achievement of the conservation goals for the Reserve. Living within a conservation area, resident communities will face certain restrictions that are not applicable to elsewhere outside of the Reserve". The presence of domestic dogs in NNR may be incompatible with conservation and community goals.

Table 7: Benefits and costs of domestic dogs (DD) in NNR

Potential benefits to communities of DD	Potential costs of DD in NNR
• DD may eat human refuse in villages where they occur and provide some sanitary function. • DD provide some warning of predators when hunting. • DD provide some protection in mashambas from crop raiders and guard domestic livestock (goats). • DD are used in subsistence hunting for bushmeat to find prey. • DD provide companionship as pets.	• DD which eat human faeces provide a secondary host for human parasites. • DD pull predators, particularly leopards into villages as they are prey. • DD are known reservoirs for disease which pose significant threats to humans and wildlife and vaccination campaigns are costly. • Hunting with DD is indiscriminate and difficult to control and monitor. It is considered inhumane and not supported by many pro sustainable use and animal rights organizations. • DD have been implicated in the local declines of ground nesting birds, hares and ungulate fawns and may compete with scavengers particularly vultures.

Fig 17: Nets used for subsistence hunting with dogs

8.7. R. Branco Vaccination Study (2006)

- In collaboration with SRN, State and Provincial Veterinary Department, a final year veterinary student, Rui Branco (Universidade Federal do Parana) undertook a short term study of the impact of disease associated with domestic dogs on wildlife in NNR, as part of his university studies.
- To facilitate this a 12 V 40lt deep freeze was provided by this project to the Niassa Province Veterinary Department for the storage and transport of samples and vaccines. In addition $100 was provided for veterinary equipments, $300 for blood sampling and $1250 towards subsistence and travel costs of a vet.
- While serosampling of the domestic dogs was an initial objective of this study, given logistical, time and financial constraints it was later decided by SRN and R. Branco that this would not be possible. Testing of the samples for rabies antibodies was prohibitively expensive (US$54 / sample for at least 50 rabies tests) and few laboratories in South Africa could do the tests for canine distemper and canine parvovirus (Branco 2006). Thus the incidence of disease in the domestic dog population is still unknown. To our knowledge no information is available on the incidence of disease in the neighbouring domestic dog population either.
- Instead, it was decided that a vaccination program (mutiple vaccine) would be initiated inside NNR accompanied by an education campaign on the dangers of rabies, methods of transmission, and necessity for vaccination. To facilitate this the funding was used to purchase audiovisual equipment for use in the villages. In addition, valuable information was collected on why dogs were being kept, age, sex and health of the domestic dog population. A register of vaccination was also initiated with the distribution of vaccination certificates and additional educational information on the dangers of rabies.
- A detailed report in Portuguese was submitted to SRN in October 2006 (Branco 2006).
- A total of 70 dogs were vaccinated from the villages of Mavago (54), Iringa (11), Mecula (4) and Mussoma (1). According to the domestic dog survey, this represents 48% of the total domestic dog population in NNR, but 64% of the domestic dogs in the Mavago-Msawize complex and 45% of the domestic dogs currently present on the Mecula-Mussoma corridor. It is believed that almost all the dogs in Mavago were vaccinated.
- None of the dogs that were vaccinated showed any symptoms of specific diseases.

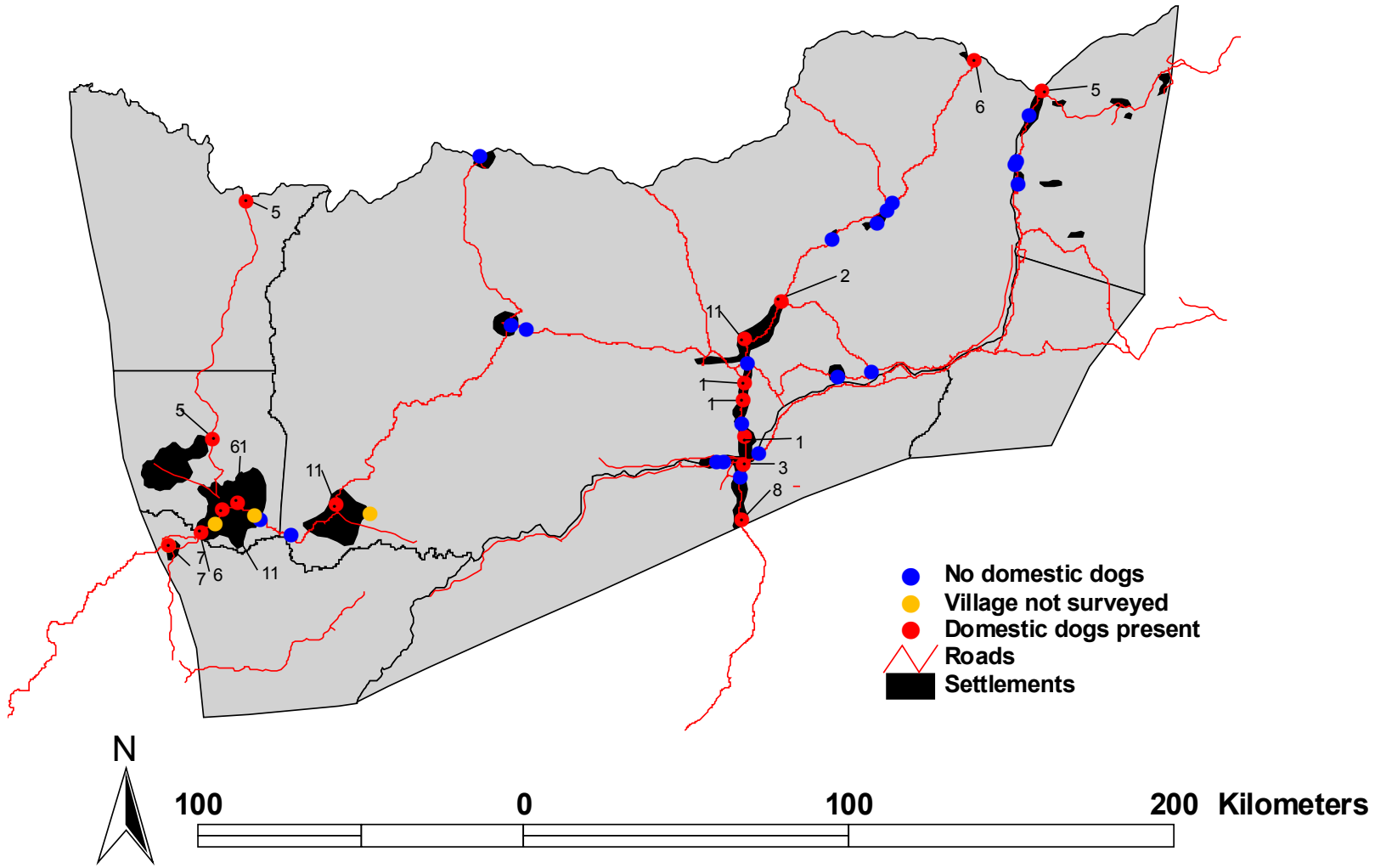


Fig 18: Distribution of domestic dogs (minimum 150 dogs) in NNR in 2006, showing the concentrations in the western Mavago-Msawize complex and along the central Mussoma- Mecula Corridor.

Fig 19: Aerial view of the Mecula-Mussoma corridor, the main access road into NNR with the fairly extensive development of settlements. Several of these villages support domestic dogs.

Fig 20: Domestic dogs in a village near Nipepe during rabies outbreak in 2005

Table 8: Domestic Dog Survey inside NNR in 2006

Village	Branco (2006) Questionaire & Obs	O. Muemedi & Begg Visual count	Total
Chamba/ Mbunjo	-	0	0
Chilola	-	0	0
Chimoyo	-	0	0
Chitande	-	0	0
Cuchiranga	-	1	1
Eravuka/ Naulala 2	-	0	0
Gomba	-	6	6
Iringa/ Mavago 2	11	10	11
Kapunda	-	?	?
Ligogo	-	?	?
Lipembo-new 2005	-	5	5
Lipute	-	?	?
Lishengwe	-	0	0
Lisongile	-	0	0
Luatize	-	6	6
Macalange	-	2	2
Manyuri	-	0	0
Mapamanda	-	0	0
Mashumela	-	?	?
Matondevela	-	0	0
Mavago	61	54	61
Mbamba	-	0	0
Mecula complex	11	11	11
Milepa	-	5	5
Misanga	-	0	0
Mitope	-	0	0
Msawize	7	11	11
Nalama	-	0	0
Mussoma	1	3	3
Nalama	-	0	0
Nambunda	-	0	0
Naulala	-	0	0
Nahavara	2	8	8
Ndalima	-	0	0
Ndandanlovu-1	-	0	0
Ndandanlovu- 2	-	0	0
Negamono	-	5	5
Ncuti	-	0	0
Ntimbo-1	-	1	1
Ntimbo-2	-	1	1
Name unknown	-	7	7
Napuzi	-	0	0
TOTAL	93	136	144

8.8. Blood samples from wild carnivores

- Blood samples from honey badgers and lions in NNR were taken during radio collaring exercises as part of the Niassa Carnivore Project (2 honey badger; 4 lions) for further serological analysis.
- Serum was drawn off and frozen in Nunc tubes.
- Four samples (3 lions, 1 honey badger) were delivered to Dr Carlos Lopez Perrieira in Maputo, however the status of these samples could not be determined and it is still unknown whether they have been analysed or whether the "cold chain" remained unbroken. An ongoing problem is the storage of the samples in the filed. A field centrifuge and better deep freezer for the collection and storage of blood samples would be beneficial and will be investigated for the next phase of the Carnivore projects.

8.9. Discussion and Recommendations

Modelling

- Considering that the Niassa's African Wild Dog population is one of Mozambique's greatest wildlife assets and of vital importance to regional conservation efforts, it is important that the presence and severity of the disease threat is assessed before the threat becomes a reality.
- The severity of the disease threat in NNR will depend on the incidence of the potential disease (in this case rabies and canine distemper) in the disease reservoir (domestic dogs), the potential impact of the disease on the target individuals (African wild dogs) and the probability of the disease being transmitted from the reservoir (domestic dogs) to the host (Wild dogs; Laurenson *et al* 2004).
- All three conditions necessary for disease to spill over from the domestic dog population to wild carnivore population exist in NNR. It is known the African wild dogs and African lion are susceptible to the both rabies and canine distemper, rabies is present in the domestic dog population contiguous to the NNR domestic dog population and domestic dogs are present in NNR and most importantly there is potential for regular contact between the domestic dog and wildlife populations as:
    - Carnivore surveys throughout NNR (Begg & Begg 2004, pers. obs) have shown that leopard, lion, spotted hyaena, honey badger, mongoose, genet and side-striped jackal are all entering villages within NNR at regular intervals.
    - Wild dogs and lions are not limited by the NNR protected area boundary and are part of a Greater Niassa population that extends at least 150 km south to Nipepe where the rabies outbreak occurred.
    - In other areas, predation of domestic dogs by wild carnivores is common with leopards responsible for the most kills (53%), followed by lions (42%) and then spotted hyenas

(5%; Butler *et al*. 2004). Predation by wild carnivores of domestic dogs is highly likely to occur in NR, given that both populations are essentially sympatric.

- This type of contact provides ideal circumstances for the transmission of infectious diseases, particularly rabies and canine distemper. In addition, given the high turnover in domestic dogs they are likely to form a common form of carrion in some villages and scavengers could be exposed to infection when consuming rabid dog carcasses.
- The level of threat to NNR wild carnivore populations from these diseases is potentially high especially if the domestic dog population increases.
- However, the relatively large number of wild dogs in NNR (more than 39 packs) and the extensive area protected is likely to decrease the risk of disease decimating the wild dog population. Even if a few packs were to become locally extinct as a result of the virus, as long as individuals from neighbouring areas could recolonize voided area, the long-term consequences of disease might be negligible (Laurenson *et al* 2004, Vial *et al.* 2006).
- It would be useful to model the potential threat of disease on the NNR wild dog population and determine the potential benefits of a different domestic dog vaccination strategies based on the information we have collected in this first phase, with additional ecological information provided by the detailed Selous Game Reserve study (Creel & Creel 2002), following the methods of Vial *et al* 2006. This potential for doing this will be investigated.

Serosurveying

- At this stage, no serosurveying of carnivores and domestic dogs has been completed in NNR due to financial and logistical constraints. It is particularly important that the opportunities provided by the radiocollaring of large and medium sized carnivores and the blood samples collected do not continue to be wasted as these are difficult to collect and these problems need to be resolved. These can be partly overcome by purchasing a small freezer, portable generator and centrifuge We will investigate ways to overcome these problems during Phase II of the project

Decisions about domestic dogs

- The issue of domestic dogs remaining in NNR needs to be addressed and a final decision taken, bearing in mind all the costs and benefits, to prevent further confusion.
- If it is agreed that domestic dogs and disease pose a significant threat then there are two main ways SRN could minimize or preempt the chances of a disease outbreak in NNR:
    - By annually vaccinating the domestic dogs both inside NNR and providing support for vaccination of dogs in a designated buffer area around NNR boundary (recommended by Branco 2006)
    - Through a phased removal of the domestic dogs in NNR and providing support for vaccination of dogs in a designated buffer area around the NNR boundary.

- The decision of which approach to take will require consideration of all the various cultural, logistical, and financial implications.
- This decision needs to be made while the NNR domestic dog population is still relatively small and isolated.

8.10.1 Vaccination of domestic dog population in NNR

- If more than 70% of the domestic dogs in NNR were vaccinated annually, this could stop rabies and canine distemper outbreaks 95% of the time. However if there is a high population turnover of domestic dogs (i.e. 25% per annum) the vaccination coverage declines rapidly over time and vaccination will need to take place more frequently even if 70% coverage was achieved initially (Cleaveland *et. al.* 2006). Studies show that domestic dog numbers are frequently underestimated and that the 70% vaccination target is not reached.
- In NNR in 2006, only 49% of the total domestic dog population (determined from visual sightings) were vaccinated and even within the target areas, the 70% vaccination target was not reached even if the majority of dogs were vaccinated within the four target villages.
- Given the wide ranging activities of dogs, people and wild carnivores in NNR, it is not considered sufficient for just one village to receive full coverage, as there is likely to be substantial movement between villages that are in close proximity.
- Even if there were to be effective zoning of areas, with strict demarcation of "no dog" areas, it will be impossible to prevent interactions between the domestic dogs and carnivore populations, particularly with jackals, honey badgers, genets, mongooses, and leopards, which are regular visitors to villages and mashambas (Begg & Begg 2004). The contact rate between wild carnivores and domestic dogs is likely to be relatively high.
- Vaccination would need to take place every year as the benefits of vaccination are not long lasting and high levels of vaccination must therefore be continued annually otherwise all benefits are lost.
- In addition an effective registration process with distribution of certificates needs to be developed through agreement and collaboration with Veterinary authorities.
- One possibility for use inside NNR would be the use of IndentiPet microchips (injectable Transponders; Appendix 1). These are widely used for domestic pets as well as for wildlife and comprise a small transponder that is injected under the skin between the shoulder blades of each dog through a simple injection and lasts the dog's lifetime. Through use of a scanner individual dogs can be recognized and the last date of vaccination determined. Each transponder costs R60 ($8) with a scanner costing R3710 ($530). Sponsorship of two scanners and 50 transponders to this project has been offered by Indentipet, which could substantially reduce costs.

- The real costs of an annual vaccination program need to be calculated. These costs should include not only the actual costs for the vaccines, and registration, identification, and certification of the individual dogs but also the veterinary equipment, the travel and subsistence costs of vets, costs to Niassa residents to bring dogs in and the costs of monitoring dog populations to ensure that 70% of the population is vaccinated each year. In addition it needs to take into account likely increases in the number of domestic dogs in NNR over time, as a result of increasing human populations, increased veterinary care and simply through providing permission for domestic dogs in NNR.
- The potential for SRN to support a sustainable and effective vaccination campaign in NNR given its current time, financial and logistical constraints need to be assessed, and discussed in the context of regional vaccination programs. Who will be responsible for the vaccination program in NNR?
- While an effective, ongoing vaccination program will minimize the potential for a disease outbreak, it will be expensive, logistically challenging and does not address other negative consequences of domestic dogs being allowed in a protected area.

8.10.2 Removal of the domestic dogs from NNR

- In the medium to long term the removal of the relatively small population of domestic dogs in NNR in conjunction with a provincial vaccination campaign in neighbouring communities may be the most pragmatic solution (most cost and conservation effective) rather than potentially costly annual vaccination campaigns into perpetuity.
- This would also address the other potential problems of having a domestic dog population in NNR, particularly illegal subsistence hunting with nets and dogs.
- It would be relatively simple to monitor once in place, as any dog seen would be removed.
- Appropriate vaccination of domestic dog communities, particularly for rabies, in neighbouring communities would remain the responsibility of provincial and state veterinary authorities as part of national rabies eradication programs, possibly with support from SRN/ FFI as part of the Niassa Province projects.
- Considering that the Niassa's African Wild Dog population is one of Mozambique's greatest wildlife assets, we strongly support a phased removal of the current domestic dog population from NNR, beginning with the domestic dogs in the core area of NNR (Mecula district). This is a critical wildlife area where domestic dog populations are small and NNR presence high. The second phase could involve the more complicated Mavago-Msawize (Mavago district) at a later date (within 5 years).
- The removal of the current domestic dog populations will have to be done with the outmost care and only after extensive extension work by SRN community officers and consultations with

communities and traditional leaders. This will be particularly important in the Mavago-Msawize complex where the presence and influence of NNR/ SRN is low.

- If it is agreed by SRN that domestic dogs should be removed, extensive meetings with stakeholders would need to take place to determine the best methods of removing the dogs with minimum disturbance to communities and a time scale agreed upon.
- A clear directive would need to be sent by SRN to prevent further confusion.
- During the rabies outbreak in 2005, more than 500 domestic dogs were destroyed in the Nipepe area over a period of two months with the full support of the Governor and district Administrator.
- We would suggest a less drastic approach in NNR. Given the low number of dogs currently in NNR, one could potentially identify (through transponders; IndentiPet) and sterilize all the current dogs in NNR and allow the current population to die out naturally over a two-five year period with no new dogs allowed into NNR.
- In the interim, vaccination of the domestic dogs currently within NNR particularly in Mavago-Msawize remains a possibility (as suggested by R. Branco). However care must be taken that it does not raise false expectations and that the ultimate goal of SRN (removal of the dogs) is clear.. Vaccination needs to be carefully managed so that it is not seen as an encouragement for more dogs to be allowed in NNR but is simply an interim measure.

8.10.3 Vaccination in neighbouring communities

- Whatever decision is made by SRN regarding the presence of domestic dogs in NNR, vaccination of domestic dogs in neighbouring communities will be important for decreasing disease risk to wildlife populations in NNR and for human health reasons.
- Meetings need to be held with provincial authorities of Niassa province to reach agreement on how this will occur and more detailed recommendations from veterinarians and experts in this field are needed to guide this process. The types of questions that need to be answered are:
    - Given that wild dog, lions, domestic dogs and humans are moving freely across the protected area boundary, how extensive would a " buffer area"" need to be to minimize disease risk for NNR carnivores, particularly wild dogs.
    - What is the current prevalence of rabies, canine distemper and canine parvovirus in the domestic dogs population bordering NNR?
    - What is the density of domestic dogs in the neighboring communities and the rate of growth?

9.0. Competition with lion & spotted hyaena

9.1 Relative density

- The Niassa Wild Dog project forms part of the Niassa Carnivore Project, which has specifically been investigating the status of lions and hyaenas in NNR.
- This is pertinent to wild dog conservation as wild dog numbers are negatively correlated with lion and hyaena densities across Africa. Competition between these predators may take the form of exploitation competition (eating the same prey) or interference competition (wild dogs chased off kills) as well as the killing of wild dog pups (Creel & Creel 2002).
- An extensive call-up survey of lion and spotted hyaena was completed in July 2005 with 97 call stations (at least 10 km apart) located throughout NR covering an area of 2221 –3120 km^2.
- During the survey 27 lion, 60 hyaena, 24 leopard, eight civet, two wild dog packs and one bushpig responded to the calls.
- Analysis of results suggests a density of 1-3 adult lions / 100 km^2 overall with a maximum of 700-800 lions predicted to be resident within NNR in 2005. The call-up survey will be repeated in 2008 using exactly the same techniques to monitor any changes.
- Both lion and hyaena densities in NR are relatively low compared to other protected areas, probably largely as a result of low prey densities. Creel & Creel (2002) suggest that when average lion densities are below 10 / 100 km^2, as is the case in NR, the threat to wild dog populations is low.
- If the population densities of lions, hyaenas and wild dogs are compared across different wooded habitats, it can be seen that in all cases, including NNR, hyaenas are the most abundant, lions are intermediate and wild dogs are least common (Table 9). However, in NNR the ratios are different due to the relatively low lion and hyaena densities.

Table 9: A comparison of lion, spotted hyaena and wild dog densities across different habitats (data on other areas from Creel & Creel 2002).

Study Site	Wild dogs (adults/100km^2	Lion (adults/100 km^2	Hyaena (adults/100 km^2	Ratio WD:L:HY
Kruger National Park, South Africa	1.7	10	13.5	1:6:8
Selous Game Reserve, Tanzania	4	32	11	1:3:8
Niassa National Reserve, Mozambique (mean estimate)	1	2	4	1:2:4

9.2. Prey overlap

- Both lions and hyaenas showed lower densities in Miombo habitats compared to areas within 5 km of primary or secondary rivers, with 2-3 adult lions / 100 km^2 in habitats within 5 km of a primary or secondary river and a density of 0.8-1 adult lion / 100 km^2 in inland areas. These data are supported by a density of 3 adult lions / 100 km^2 within the intensive study area close to the Lugenda River. Spotted hyaena density is 3 – 5 hyaenas / 100 km^2 close to main rivers and 1-2 hyaenas / 100 km^2 in inland areas.
- These habitat related differences in lion and hyaena density are expected given the higher densities of prey recorded close to the major rivers (see section on prey availability).
- In other areas the diet of wild dogs overlaps substantially with the diets of lions and hyaenas. In NNR we do not have information on hyaena prey. However, the primary prey of NNR lions (based on 2004-2005 data) is buffalo, bushbuck, bushpig, kudu and waterbuck and the primary prey of wild dogs also includes bushbuck, kudu and waterbuck. Buffalo and bushpig have not been recorded as wild dog prey in NNR.
- There is some dietary overlap and potential prey competition in the larger carnivores. However, given the low densities of carnivores and increasing prey populations this is unlikely to be significant at present.

9.3. Direct competition at kills

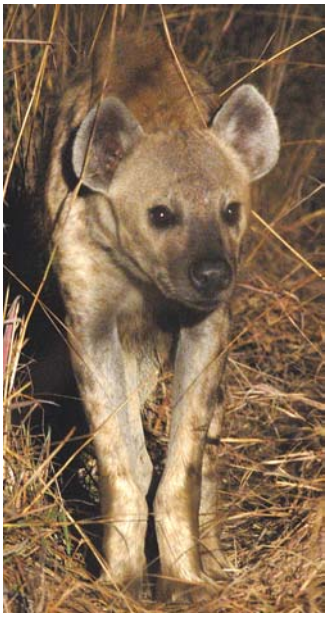
- In Savannah habitats hyaenas frequently eat at wild dog kills (Serengeti: 86% of wild dog kills; Ngonrongoro 60%) and spotted hyaenas can have a negative impact on wild dog foraging success.
- However, this is rare in more wooded habitats such as Selous G.R and Kruger N.P (Creel & Creel 2002) and has never been observed in NNR. In more wooded habitats kills are more difficult to locate for a would be scavenger (including humans), as the woodland limits line of sight, muffles the sound of dying prey and the calling of the wild dogs, and reduces the ability of vultures to locate kills (Creel & Creel; 2002).
- Given the relatively low density of hyaenas and lions in NNR as well as the extensive wooded habitat, interference competition by hyaenas at wild dog kills is likely to be negligible at present and unlikely to be having any negative effects on the wild dog population.

9.4. Killing of wild dogs by lions

- One professional hunter in Niassa has stated that when the wild dogs are in the area lions do not feed at baits, implying that the wild dogs are responsible for keeping the lions away. We would suggest that the reverse is true: it is because the lions are not in the area that the wild dogs are seen. Anecdotal data from the intensive study supports this, as on several occasion wild dogs were seen when we knew the radio-marked lions where not in the vicinity.
- Studies in the Kruger National Park (Mills & Gorman 1997) and Selous Game Reserve (Creel & Creel 2002) suggest that wild dogs actively avoid areas of high lion density but do not avoid hyaenas. This avoidance may come at a cost, as they avoid habitats (open woodland) with the highest densities of suitable prey (impala, wildebeest) when lions are present. Direct predation on wild dogs by lions is fairly common in other areas.
- The relatively low density of lions in NNR at present suggests that lions are unlikely to be having significant negative effects on wild dogs at present. However, if lion density increases as predicted, it may force wild dogs to spend less time in the more open habitats closest to the Lugenda River where prey densities are highest.
- Lion and hyaena group sizes are relatively small at present compared to wild dogs pack sizes and this may give them an advantage particularly in interactions with hyaenas. In lions, prides range in size from 2 - 6 individuals with the majority of sightings of two (n = 18 sightings) or three (n = 15) adult individuals, with lone females seen on 13 occasions. In males, coalitions of two lions are the most common (n = 21 sightings) with 14 sightings of lone males. No large clans of hyaenas have been located and individuals are most commonly seen alone or in pairs. In contrast, average pack size of wild dogs is seven ranging from 2-26 individuals.

9.5. Conclusions and Recommendations

- Lions and hyaenas are considered of minimal threat to wild dogs at present. However, the NNR lion population appears to be in a recovery phase driven largely by recovering prey populations.
- Given that this is a "natural" threat we would not support any interventions other than ongoing monitoring of lion and wild dog populations.


10.0 Human-wild dog conflict

10.1 Domestic livestock and wild dogs

- People perceive carnivores to be a threat because they have the potential to kill people, eat domestic livestock, spread disease and compete with people for food (meat, fish, honey). As a result people tend to persecute carnivores regardless of their density, numbers or actual threat to the person or livestock (Ginsberg, 2001; Sillero-Zubiri & Switzer 2004).
- African wild dogs pose no threat to humans, however they do take livestock in some areas and wild dogs can become a severe problem for sheep and goats with multiple animals killed in a single attack (Woodroffe *et al* 2004).
- NNR is unusual in that it supports considerable wildlife as well as 25 000 people spread amongst more than 40 villages inside the protected area boundary. Cattle are absent due to tsetse fly (*Glossina spp*.), the vector for the disease *trypanosomiasis,* but smaller livestock, primarily goats, turkeys, ducks and chickens are present in some of the larger villages, particularly Mecula and Mavago (the same villages which have domestic dogs) and it is predicted that the tstetse load is lower in these areas due to extensive bush clearing.
- In terms of the SRN community policy (2005) "SRN do not consider the eradication of tsetse fly to be in the best interests of the Reserve, and will work with local, provincial and national authorities to ensure that the Reserve is omitted from any tsetse fly eradication programmes"
- This policy will limit domestic livestock in NNR and is positive for wild dog conservation as it means that conflict between wild dogs and domestic livestock are likely to be minimal into the foreseeable future.
- Records of interactions between people and wild dogs in NNR were collected on an opportunistic basis and through a simple survey on carnivore conflict completed by Oscar Muemedi . During 2006, the MOMS system of monitoring was initiated and one of the modules is human-wildlife conflict. This has helped standardize collection of human-carnivore conflict data and will become even more effective as the system of community scouts is extended to more villages throughout NNR.
- Sampling in the main village of Mecula in 2005 suggested that as many as 65 % of households currently keep goats with an average of 9 goats per household (3 – 22). However this is a fluid population as many goats get sick and die, possibly because of trypanosomiasis infection. In addition this was an unusually high population as more than 100 goats were given to the village as a gift from the Government. In 2006, the numbers of goats in Mecula showed a dramatic decrease. Few goats are found in the smaller villages.

- No records of conflict with wild dogs have been recorded in Mecula despite other problems with spotted hyaena, jackal, leopard and honey badger during 2005. Wild dogs were also not identified as problem animals in a detailed community study done in the Negomana district (Cunliffe, 2005).
- In four years only one report of wild dogs being a "problem" has been recorded. In 2004 a pack of eight wild dogs chased and caught chickens (and removed cooking pots) on two occasions at a scout post (Matondevela) in 2004.
- Local communities within NR generally do not perceive wild dogs as "problem animals" at present.
- There is also no evidence that wild dogs are utilised in any way by the communities (traditional medicine) and direct persecution by communities is therefore not considered a threat.

10.2. Interference competition and perceptions

- In November 2005, a fisherman was found to have chased a pack of five wild dogs off an impala kill and retrieved almost all the fresh meat. He had obtained meat in this way on three occasions in the last year. Further conversations and observations in 2005 and 2006 revealed that this is a widely known and relatively common opportunistic method of obtaining meat in NR, and it was not considered poaching, as the animal was already dead (Fig. 21).
- More recently, a pack of 16 wild dogs killed an ungulate on the airstrip at Reserve Headquarters (Mbatamila) and the scouts chased the dogs off the kill to retrieve the meat. The bushmeat was then taken to the village to sell (S. Rhodes, pers. com).
- While leopard are also chased off kills on occasion it is considered, in most instances, to be too dangerous to chase lion off their kills.
- Interference competition by humans in NNR is currently unlikely to be having a significant negative effect on the wild dogs due to low human density, wooded habitat and the opportunistic nature of wild dog sightings. A local hunter has to be in close proximity (+-500m) to a wild dog kill to be able to chase dogs off and still obtain sufficient meat due to the extremely rapid consumption of prey by a pack. However, this may change if the human population within NR were to increase dramatically and should be monitored.
- At present wild dogs are perceived in a positive light by local hunters as they provide a means of obtaining fresh meat and are not considered dangerous or pose a threat to domestic stock. This is in stark contrast to their opinion of most other carnivores.
- The value of this positive relationship between humans and wild dogs should not be underestimated and we caution against making a specific rule against this practice. However, the sale of the bushmeat is a more complicated issue that will need to be addressed by SRN. At present it is impossible to distinguish between bushmeat legitimately obtained through

community hunting quotas, problem animal control and bushmeat obtained through active snaring and poisoning.

- In contrast wild dogs are negatively perceived by several of the professional hunters (PHs) working in the hunting concessions as wild dog prey on many of the antelope that are trophy species, but unlike lion and leopard are not a trophy species. In particular PHs complain that wild dogs are to blame for low numbers of bushbuck. However, direct persecution by PHs is considered unlikely.

Fig 21: Fishermen cutting meat off a bushbuck killed by wild dogs moments before in the Lugenda River bed

10.3. Snaring - indirect persecution

- Use of wire and rope snares by local communities to catch small to medium sized ungulates is widespread and relatively common in certain areas of NR, particularly around villages. 180 snares were removed during anti-poaching patrols along the Luatize river valley (Block D2) and 84 nylon rope snares were removed along the Lussanyando River in 2006 (D1).
- In 2004 & 2005 there were also several reports of poisons used to kill fish in pools and poison baits used to kill buffalo. The main poison used is "Ntofilo", a pesticide used in the cotton industry.
- Wild dogs rarely scavenge and are therefore at less risk from snares and poison baits than other carnivores. However in other countries areas high levels of commercial snaring are a problem for wild dogs (Zimbabwe, P. Lindsay pers. com) and poisoned water sources are a potential problem for all carnivores.

- In 2004 we observed a pack of wild dogs kill a waterbuck, which was chased to a snare line close to a fishing camp (Fig 22). Several set snares were in close proximity along the same snare line and the wild dogs were at considerable risk of getting caught.
- However, no records of wild dogs killed or injured by snares or poison have been recorded to date (in contrast three lions hunted in 2004 had snare wounds). The threat to wild dogs from snaring and poison is therefore considered moderate and requires monitoring.
- It is expected that as law enforcement in the reserve improves this will decrease the risk from snaring and poisoning.

Fig 22: Lipumbulu pack with a waterbuck they killed and ate while it was caught in a snare

11.0 Roads

- In some area, wild dogs are frequently killed on roads. While wild dogs are frequently seen along the dirt roads in NNR, at present no high speed roads are currently present and car traffic is relatively low. No wild dogs have been reported killed on roads in NNR to date.
- Road rehabilitation is occurring and there have been dramatic improvements in road conditions over the last 3 years, particularly along the two main access routes into NNR (through Mavago, and through Mussoma) along with increasing vehicle traffic.
- Of particular concern is the Freedom Bridge being built over the Rovuma in the north eastern section of NNR,which will link Tanzania with Mozambique and will involved building a major road through at least a portion of the NNR with a concomitant increase in traffic (Fig. 23).

- In addition, just south of NNR, tarred roads have been completed between Marrupa and Lichinga and are due to be constructed between Balama and Marrupa. These roads run outside the NNR, but we know wild dogs are present in these areas and roads may have an increasing impact.
- Wild dog mortality due to vehicles is considered an insignificant threat at present, but should be monitored and may increae.

Fig 23: Construction of Freedom bridge over the Rovuma River in north-eastern NNR which will link Tanzania and Mozambique –Nov 2006

Section D: 2007 Goals for "Nkuli Team" (Project leader C. Begg)

12.0 2007 Goals

1. To continue to provide an annual report for SRN collating all sightings provided by MOMS, other observers and ourselves
2. To assist and support the SRN MOMS representative with further development of the community scouts with the goal of identifying and training of 5-6 new MOMS community scouts in 2007 (Phase 2).
3. To continue to mentor, train and guide Oscar Muemedi.
4. To continue to assess the status of lions and hyaenas in NNR, through radiomarking and individual identification in the intensive study area.
5. To collect blood samples from carnivores in NNR for assessment of disease risk (lion, leopard, civet, genet and other) and to address previous logistical difficulties in storing and analyzing these samples effectively.
6. If possible, to model the NNR wild dog population and disease risk in collaboration with R. Woodroffe, S. Cleaveland and others to provide a clearer picture of these issues and benefits of vaccination (see Vial *et al* 2006).
7. To attend SRN meetings, provide advice, mentoring and where feasible assistance to SRN on all issues relating to wild dog conservation when needed.
8. To continue to liaise with and expand the network of professional hunters, and operators to collect their wild dog sightings.
9. To attend the Wild Dog Priority Setting Workshop to be held in September in Botswana to ensure this population is included in regional conservation strategies.
10. To publish a paper in a peer reviewed journal on the status of the Niassa Wild dog population based on the data collected between 2003 and 2006 to ensure this information is available to the wider scientific community.

13.0 Financial reports

13.1. Expenditure 2006

Funds are administered by The Ratel Trust (Trustees: C. Begg , K. Begg, S. Clarke) and copies of all receipts are available on request.

Funding Received

Fair Play Foundation/FFI **$13 500**

Expenditure

Item	Budgeted	Expenditure (US $)
Running costs		
Fuel & maintenance -motorbike	1 750*	1750*
Salary & food for Research Scout	1 300	973
Landrover servicing & maintenance	2 000	2070
Fuel -Diesel	1 200*	1200*
Food and camping supplies - Researchers	1 000	801
Subsistence and travel-State Veterinary staff	1 250*	1250*
Blood samples		
Immobilization drugs & veterinary supplies	100	0
Small 12 V freezer for blood samples for vets	800	750
Blood sample analysis	500	0
Audiovisual equipment	0	600*
Other supplies		
Miscellaneous (notebooks, maps, datasheets)	300	295
Batteries	300	235
Communications (Bushmail)-portion	500	500
Other		
Poster production and printing	1 000	850
Report writing, analysis, supervision (C.Begg	1 500	1500
Bank Charges	0	210
TOTAL	**13 500**	**12 984****

*Funds deposited directly into SRN account for items shown
** Credit to be used in 2007/2008 for contingency items - $516

13.2: 2007-2008: Budget proposal

Funds administered by the Ratel Trust (Trustees – C. Begg, K. Begg & S. Clark). Some of these costs might be carried over into 2008 given the short 2007 field season.

Item	Cost (US $)
Salaries	
Dr. C. Begg (Project leader)	3 000
Mr K. Begg	800
Salary & subsistence- Research Scout –Oscar Muemedi	1 000
Salary and subsistence- research assistant (E. Waiti)	750
Subtotal	**5550**
Running costs -Research	
Fuel & maintenance -motorbike	1 750
Landrover servicing & maintenance (portion)	1 000
Fuel –Diesel (4 drums)	800
Food, rations and camping supplies (portion)	1 000
Subtotal	**4550**
MOMS community scouts	
Training workshop in Namibia for SRN representative	2445
Salary - Community Scout	1800
Diesel to collect scouts	200
Community scout uniform (cap, bag, t-shirt)	220
Reporting supplies-datasheets etc	500
Subtotal	**5 165**
Blood samples from carnivores	
Veterinary supplies –immobilization drugs	400
Small 12 V deepfreeze	700
Portable generator for power (portion of costs)	750
Analysis of samples	1 000
Subtotal	**2 850**
Research equipment	
Research assistants tents	900
Assistants food and uniforms	400
GPS / cybertracker for research assistant	700
Subtotal	**2000**
Other	
Auditing fees of Ratel Trust	350
Miscellaneous (notebooks, maps, datasheets)	200
Batteries	300
Email Communications (portion of costs)	500
Office-ink, paper, email	250
Subtotal	**1 600**
Grand Total	**21 715**
Contingency (2006 credit)	**516**

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Appendix 1: Identipet Transponders

Identipet

Injectable Transponder TX1400L

12mm Microchip with BioBond® Anti-Migration Cap

Product Number: TX1400L

Brand Name: Small (12mm) microchip with BioBond® Anti-Migration Cap

Product Description:

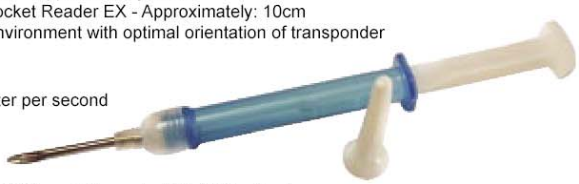
The Injectable Identipet™ Transponder is a passive radio-frequency identification tag, designed to work in conjunction with a compatible radio-frequency ID reading system. The transponder consists of an electromagnetic coil, tuning capacitor, and microchip sealed in a cylindrical glass capsule. The chip is pre-programmed with a unique ID code that cannot be altered; over 34 billion individual code numbers are contained in the production series. When the transponder is activated by a low-frequency radio signal, it transmits the ID code to the scanner reading system.

Patented BioBond® Anti-Migration Cap: A porous polypropylene polymer sheath is pressure fitted to the microchip to prevent migration of the device within animal tissue. This BioBond® anti-migration cap results in increased retention, by promoting the development of fibrocytes and collagen fibres around the implant. The cellular response inhibits movement of the microchip, enabling it to be easily and quickly located and read at the original implant site.

Although specifically designed for injecting into animals, this transponder can be used for other applications requiring a micro-sized identification tag.

Specifications:

Compliance:	ISO 11785 Annex A
Dimensions:	12mm by 2.1mm
Housing:	Bio-compatible glass Manufactured in an ISO 9002 approved facility
Anti-Migration:	Patented BioBond® Anti-Migration Cap (see product description)
Average Weight:	0.06 g
Read Range:	HS5105L MPR Reader - Approximately: 20cm Pocket Reader or Pocket Reader EX - Approximately: 10cm (In a benign noise environment with optimal orientation of transponder and scanner.)
Read Speed:	Approximately 1 meter per second
Temperature Range:	-40°C to 70°C
Vibration:	Sinusoidal: 1.5mm (0.06") peak-to-peak, 10 to 80Hz, 3 axis Sinusoidal: 10g peak-to-peak, 80Hz to 2kHz, 3 axis
Operating Frequency:	125kHz
Power:	Passive device energized using an ISO compliant reader



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www.identipet.com e-mail: info@identipet.com

Identipet

Identipet

Reg No: 99 / 25765 / 07

Price List

Jan 2007

Needle Assembly 12mm in FDX-A or FDX-B

BioThermo™ in FDX-A or FDX-B

MPR Reader

Pocket Reader EX

Pocket Reader

	% Discount	ZAR (ex VAT)	ZAR (incl VAT)
▪Needle Assembly Microchip (12mm)			
Price per unit below 100	-	59.58	67.92
Price per unit from 100 and below 500	5%	56.60	64.52
Price per unit from 500 and below 1000	7.5%	55.11	62.83
Price per unit exceeding 1000 microchips	10%	53.62	61.13
▪BioThermo™ Microchip (12mm)			
Price per unit below 100	-	75.00	85.50
Price per unit from 100 and below 500	5%	71.25	81.23
Price per unit from 500 and below 1000	7.5%	69.38	79.09
Price per unit exceeding 1000 microchips	10%	67.50	76.95
▪Unpackaged / Ralogun® Microchip (12mm)			
Price per unit below 100	-	45.94	52.37
Price per unit from 100 and below 500	5%	43.64	49.75
Price per unit from 500 and below 1000	7.5%	42.49	48.44
Price per unit exceeding 1000 microchips	10%	41.35	47.14
▪Industrial Microchip (22.5mm)			
Price per unit below 100	-	48.75	55.56
Price per unit from 100 and below 500	5%	46.31	52.80
Price per unit from 500 and below 1000	7.5%	45.09	51.41
Price per unit exceeding 1000 microchips	10%	43.88	50.02
▪Ralogun® Implant Gun	-	693.00	790.02
▪e.TAG™ (incl Stud)			
Price per unit below 100	-	26.73	30.47
Price per unit from 100 and below 500	5%	25.39	28.95
Price per unit from 500 and below 1000	7.5%	24.73	28.19
Price per unit exceeding 1000 microchips	10%	24.06	27.42
Extra Studs for e.TAG™	-	3.51	4.00
e.TAG™ Applicator	-	301.40	343.60
▪Readers			
MPR Reader™	-	4612.50	5258.25
Pocket Reader EX™	-	3832.50	4369.05
Pocket Reader™	-	3255.00	3710.70
▪Proprietary Microchips (Nature Conservation)			
Price per unit below 100	-	40.25	45.89
Price per unit from 100 and below 500	5%	36.80	41.95

Banking Details
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FNB - Fourways
Branch # 251-655
Acc # 6210 465 8531

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