

# BP Conservation Programme (CLP) 2005



*PROJECT NO. **103605** - GOLD AWARD WINNER*

## CONSERVATION OF AFRICAN WILD DOGS IN NORTHERN MOZAMBIQUE

### **FINAL REPORT**

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### ***Project executive summary***

Respectively eleven and nine packs of African wild dogs absent from former representations of the species distribution in Mozambique have been identified in the Cabo Delgado province and southern/western sectors of the Niassa National Reserve, together with assessment of home ranges and successive sightings description. Both preliminary demography and habitat preferences are deduced directly from such results while analysis of interferences with people reveals that accidental snaring would be the most immediate anthropogenic threat to both subpopulations. Much higher human population makes other non-conflict-related threats (habitat fragmentation, low prey densities driven by subsistence hunting...) more immediate in the Cabo Delgado province than in the Niassa NR, where conflicts on interactions with traditional/professional hunting are more likely risks despite higher wild herbivores densities.

Findings were recently submitted to the IUCN/SSC Canid Specialist Group, to the Museum of Natural History (MHN) in Maputo and to the Mozambican state authorities (DNAC), the two first for dissemination to the international/national scientific communities, the last for integration into practical measures and future policy-making towards the conservation of the species in focus.

MHN researchers supervised the project from institutional grounding to scientific analysis, university students developed new skills/abilities relevant to wildlife conservation and took part, together with DNAC field staff, hunting concessions personnel and research assistants locally recruited, to field surveys upon proper training. Local people were actively involved into fieldwork (interviews) and environmental education (species ecology and values for deterring negative views), but also considered further conservation implications (mitigating unintentional pressures) as data were collected for the socio-economic description of their activities and land uses in order to identify actual threats to be mitigated. Awareness-raising also focused on hunting safari operators and local NGO's within a wider national audience which future support is favoured by a strong linkage of the project into policy-making on the matter, DNAC having recently requested for its collaboration in the current elaboration of the official National Strategy for the conservation of African wild dogs in Mozambique, beside follow-up work on the most vulnerable subpopulation of the country (northern Sofala central province).

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# 1. INTRODUCTION

## 1.1. General Information

- **Project title:** Conservation of African wild dogs in northern Mozambique
- **Project dates:** April 2005 - April 2006
- **Award received:** USD 13,000 (notified on 24/03/05, 75% received on 27/04/05, 25% on 06/01/06)
- **Priority species:** *Lycaon pictus*, listed as Endangered on the 2006 IUCN Red List of Threatened Species
- **Project classification:** Terrestrial
- **Taxonomic group:** Mammal - large
- **Project location:** Longitude 35° 20' E - Latitude 12° 00' S
- **Project leader:** Jean-Marc André, awdogmoz@yahoo.fr
- **Number of team members:** 5 (4 students, 4 from the host country)

## 1.2. Scope of this report

There is no excuse for the over-extended time period between the "preliminary report" submitted on the 16<sup>th</sup> December 2005 ("within the first month after fieldwork is complete") and the present reporting step that the Organisers of the BP Conservation Programme (currently Conservation Leadership Programme) were expecting, according to the "Terms and Conditions for award winners", within 6 months after the abovementioned date.

A sporadic correspondence with the Programme Manager attempted to describe the circumstances having driven such an endless delay but this must not prevent in no way from formally presenting here to the five Organisers of the BP Conservation Programme 2005 the most sincere apologies for the like so created situation. For such precise purpose, a personal letter chronologically summarizing the events responsible for the referred delay has been attached to the present document and requested to be forwarded to the relevant persons at British Petroleum (BP), BirdLife International, Conservation International (CI), Fauna & Flora International (FFI) and The Wildlife Conservation Society (WCS).

It can only be humbly hoped today that the described succession of contexts having made that constructive work on reporting was impossible until very recently could encounter some comprehension, and much more importantly, some satisfaction from the proper content of these pages.

First recalling what the need for and urgency of this precursor work were, both addressing at the local level and contributing significantly to a global biodiversity conservation priority set by the international scientific community, the present document then reviews, more in depth than the former preliminary report already referred to, the level of achievement of each specific objective of the project as defined at application time. Methods applied and related activities performed towards the respective completions are also presented with more details before major findings are highlighted together with the other appropriate conservation outputs from the project.

Specific aspects including the involvement and collaboration of local/national stakeholders, the team experience and capacity development, the results dissemination locally/abroad and the evaluation of success are then treated specifically with a last one focusing on the potential exhibited by the results generated up to now for being built-on in the longer term, and on the ongoing conservation efforts that could therefore ensue from to address practical conservation issues raised by the original project. The last but not least financial aspect is finally dealt with in the ultimate pages.

Such slight modifications have been operated to the reporting format (compared to December 2005) for taking into consideration how the award granted formerly by the BP Conservation Programme evolved into the Future Conservationist Award now offered by the CLP, the latter scheme having been familiarized with through internet material currently available. But the most substantial change in this report is without a doubt that it comes, this time, conjointly with scientific results from the research component articulated on the analysis of the numerous sets of data collected during fieldwork for responding to the distinct key questions formulated within the project proposal, and therefore contributes to the conservation of the African wild dog in the respective areas.

One major outcome so far from this project is that these results have already been submitted recently (December 2007) not only to the relevant local/national institutions, including the competent state

authorities whose ensured report recognition and serious consideration of proposed management recommendations will be translated shortly in the conservation strategy for the species in Mozambique ("Estrategia nacional" currently elaborated by the referred governmental services in close collaboration with the project), but also to the most indicated entities of the international conservation community (African Wild Dog Working Group within the IUCN/SSC Canid Specialist Group) for being recorded in the relevant regional biodiversity databases and integrated to the most updated official maps of the status and distribution of the species in southern Africa that were drawn at the occasion of a workshop in Botswana where the BPCP project was represented by its leader.

The same research outputs to be presented hereafter of course mainly relate to the northern areas of the country where basic field data collection has been made possible through the funding support provided specifically by the BP Conservation Programme, namely the Cabo Delgado province (focusing on the Quirimbas National Park) and the western/southern portions of the Niassa National Reserve, but there is also mention of some findings (incl. anthropogenic threats ranking) from the North of the Sofala central province (lower Zambeze river right bank and estuary) although fieldwork had been conducted there in a project phase prior to this gold award won from the BPCP.

Indeed, project results for that region, coupled to recent findings from molecular genetic studies grounded in the existence of this project as well, revealed a highly vulnerable African wild dog local population of which crucial conservation value driven by its unexpected level of genetic differentiation, should evolve in the shortest delays into post-project conservation reinforcement. This will preferentially be combining field practical measures from the ones recommended to date by the project and an extended research component addressing more advanced issues raised by the original work, both of which are already detailed in further lines as well.

### **1.3. A high conservation priority: the African wild dog in Mozambique**

Distressing enough in the situation of the African wild dog (*Lycaon pictus*, Temminck, 1820) in Mozambique by the early 2000's was that, although recognized both nationally/internationally as a protected ("Legislação sobre a actividade da caça", 1978)/endangered (IUCN Red List) species and already focused on by specific conservation projects in all neighbouring countries but Malawi, a detailed information on its current status or distribution in the country was absent.

International publications by authoritative bodies recommended, already in 1997 (Woodroffe, R.B., J.R. Ginsberg and D.W. Macdonald (Eds.). 1997. The African wild dog: status survey and conservation action plan. IUCN, Gland, Switzerland) and further in 2004 (Woodroffe, R.B., McNutt, J.W. and M.G.L. Mills. 2004. African wild dog. In *Canids: foxes, wolves, jackals and dogs. Status Survey and Conservation Action Plan. 2<sup>nd</sup> edition*. C. Sillero-Zubiri, M. Hoffman and D.W. Macdonald, editors. pp. 174-183. IUCN, Gland, Switzerland), long-time needed specific surveys coupled to awareness work to finally be carried out in the country in order to establish the actual status of potentially important subpopulations of a species still listed today as Endangered on the IUCN Red List of Threatened Species, in category EN:C2a(i).

At the end of that same year 2004 a survey of carnivores species in the Niassa National Reserve had estimated African wild dogs number around 250 and an earlier phase of the project reported here, conducted in the northern Sofala province (central Mozambique) that year as well, had assessed that the size of the previously unrecorded small local population found there could have been up to 32. But these pieces of work were rather isolated and much more was still to be done in many more areas of the country. Conscious at that time of such a failure towards the conservation of the most threatened carnivore in sub-Saharan Africa, both national scientific institutions (Museum of Natural History and Department of Biological Sciences, Eduardo Mondlane University) and governmental authorities in matter of wildlife management (National Directorate of Conservation Areas, Ministry of Tourism, competent within the official conservation areas, and National Directorate of Land and Forest, Ministry of Agriculture, competent on communal lands), upon solicitation from their field staff in the respective areas, agreed on the urgent need for a detailed African wild dog survey. Necessary skills and means were also requested to replicate on their own similar work in such difficult conditions and remote areas of the country rarely, if ever, visited by professional scientists, towards the conservation of the same wildlife species and of others ones (potentially) threatened as well but still under-studied and therefore data-deficient.

Of course the already evoked publicity made to the African wild dogs in the other countries of the region was not innocent in the just referred national bodies to also consider the conservation of the species as a

high priority. They were reasonably expecting thereby a bit more of attention from the international conservation community for the wildlife areas of Mozambique where the species could occur and, by extension, to the other species inhabiting the same broader environments.

But additional obvious reasons related to its ecological characteristics also made appear clearly to the same local conservation actors that the African wild dog should be considered as a main concern for wildlife conservation in the country.

As many carnivores, this medium-size canid relies on a good prey-base for subsisting and its presence in an area thus depends on the populations of wildlife species that constitute the lower trophic levels (chiefly herbivores) being maintained at sufficient densities in the region, eventually requiring particular conservation efforts towards them in case of decline.

Moreover, the African wild dogs use to live in pack of 6 to 14 adults and yearlings that roam across very large home ranges (258.2 km<sup>2</sup> to 918.8 km<sup>2</sup>) in comparison to the extent of other carnivores' territories (making that the species always occurs at particularly low densities), and their conservation therefore ensures that vast areas of wilderness are preserved as well ("umbrella" species).

The species also suffers severely from interactions with human activities, whether intentionally (shooting, deliberate snaring, other trapping, spearing, poisoning, dens smoking-out...) or not (accidental snaring, road traffic accidents, infectious diseases transmission from domestic dogs, habitat fragmentation, loss of preys...), so that a stable local population of African wild dog then becomes the indicator of a low level of environmental disturbance by human factors which other wildlife in the concerned area must certainly also benefit from ("indicator" species).

Finally, the intensity of the social habits this animal exhibits (cooperative breeding, hunting, feeding, resting...), coupled to its characteristically non-aggressive behaviour towards human beings, easily turn it so much charismatic and attaching to the public in general, incl. local people, that the species can naturally served as a popular symbol for a wide range of wildlife conservation campaigns ("flagship" species).

## 2. SPECIFIC OBJECTIVES ACHIEVEMENT AND RELATED ACTIVITIES

### 2.1. ***"Gather baseline ecological information on wild dog distribution, habitat availability, prey, competitor species (lions & spotted hyenas), people attitudes to large carnivores, and determine the threats affecting wild dogs."***

#### 2.1.1. Level of achievement:

- For the first time ever, 8 individual groups of African wild dogs were identified and described within the Quirimbas National Park and adjacent Quiterajo area in the Cabo Delgado province (northern Mozambique) and their respective home range limits were assessed (see Annex A, Findings summary for the Cabo Delgado province).

The size of the local population was 59 individuals in total, when considering together the last sighting of each pack within 2004-2005, made of 49 adults and 10 yearlings, for an adults-to-juveniles ratio equal to 1:0.20 while only one pack out of the eight was last seen with juveniles (12.5%). The mean pack size at that time was 7.38 (6.13 adults + 1.25 yearlings).

- A particular research emphasis (see Annex B, Scientific report for the Cabo Delgado province) on the local African wild dog population in the Quirimbas National Park only (6 out of the 8 packs, 51 individuals made of 41 adults and 10 yearlings, adults-to-juveniles ratio 1:0.24, 16.7% of packs last seen with juveniles, mean pack size 8.50 = 6.83 adults + 1.67 yearlings) also enabled the preliminary assessment of some major demographic parameters, such as adult mortality (23-44%), yearling mortality (6-50%), pup mortality (52%), birth rate (19-37%), average litter size (8) and birth period (July-August), and the determination of the habitat types preferred by those 6 packs within the limits of the referred protected area, namely (in decreasing order of preference) bushland (miombo, acacia, "broad-leaved") and wooded grassland (palm, acacia, cashew).

- Although the relevant data-sets were actually collected in the field in order to study the ecological interactions of this African wild dog population (e.g. with preys and competitors), such useful baseline data are still awaiting proper treatment and results from their analysis have not been made available yet.

- Less detailed information (only 1 sighting per pack) at the level of the entire Cabo Delgado province however evolved in the identification of 3 potentially additional packs of African wild dogs (near Pemba, Nairoto & Palma, see Annex A) that would bring the total number of distinct groups up to min. 11 and the local population size up to min. 80 individuals in total (when considering together the last sighting of each

pack within 2004-2005) made of 70 adults and 10 yearlings, for an adults-to-juveniles ratio equal to 1:0.14 while only one out of the eleven packs was last seen with juveniles (9.1%). The mean pack size at that time was 7.27 (6.36 adults + 0.91 yearlings).

- Another 9 individual packs of African wild dogs were similarly identified and described within the western and southern sectors of the Niassa National Reserve, including 4 professional hunting concessions (out of the 6 found at the periphery of the reserve), namely "blocks" C, D2, D1 and E, and areas of the proper reserve on the Southwest of Mbatamila (headquarters) such as Matondovela, Catembe and Msawize (Namacambale) regions but not in the Northwest up to Chamba and Nkopoto, and their respective home range limits were assessed (see Annex C, Findings summary for the Niassa National Reserve).

The size of the local population was 101 individuals in total, when considering together the last sighting of each pack within 2004-2005, made of 66 adults, 28 yearlings and 7 pups, for an adults-to-juveniles ratio equal to 1:0.53 while six out of the nine identified groups were last seen with juveniles (66.7%). The mean pack size at that time was 11.22 (7.33 adults + 3.11 yearlings + 0.78 pups).

- Treatments of data having already informed for packs identification and description could be brought further according to methods identical to the ones built-up and applied on the African wild dog local population of the Quirimbas NP (see Annex B), and therefore similarly provide preliminary assessment of the same major demographic parameters (adult/yearling/pup mortality, birth rate, average litter size & birth period) such as results from habitat analysis (availability, use, preference, availability in most preferred, connectivity at larger scale).

The diverse circumstances having driven that such an exercise has not yet been practiced so far for the subpopulation identified in the Niassa NR are presented in details further in this report (see Section 6.2.), while the main reason for which, like for the Quirimbas NP population, the relevant data-sets actually collected in the field in order to study ecological interactions (e.g. with preys and competitors) are still awaiting proper treatment is nothing more than a shortage of time and the referred analysis and results can therefore be expected in the shortest delays.

- Regarding to local communities attitudes and induced threats on *Lycaon pictus* and sympatric carnivores, the general perception seems to be that the local people are rather indifferent to African wild dogs from the fact that these are neither seen frequently nor aggressive towards human beings the few times they are seen, and that reported attacks on domestic livestock unequivocally incriminating the species are very scarce in the respective surveyed regions.

Spotted hyaenas (*Crocuta crocuta*) and lions (*Panthera leo*), most often responsible for the conflicts just evoked although not currently intense in the project areas but still very much (lethal attacks on people) until recently (2000-2001, northern Quirimbas NP), are much less appreciated by local residents who many times clearly claimed their negative attitudes ("dislike") towards these two species and that are persecuted in consequence, but with very limited means only (no firearms and no direct confrontation unless when unintentionally caught in snares).

- The characteristically low human density in Niassa National Reserve and periphery makes that non-conflict-related threats, potentially generated by every-day-life activities and land uses (habitat fragmentation due to shifting subsistence agriculture and uncontrolled bushfires, infectious diseases transmission from domestic dogs...) are not so much immediate but maybe the ones evolving from the professional/traditional hunting activities practiced in the area. Indeed, while appreciably high wild herbivore densities turn it unlikely that the African wild dogs suffer from loss of prey items to the referred hunting practices, the only risk for the population in question (fortunately maintained to a very low level up to now thanks to appropriate conservation management), would be that conflicts eventually erupt from interferences with the referred practices and give raise to direct persecution from local subsistence hunters and/or professional safari operators. The former are already probably representing the major current pressure faced by the resident African wild dog population in the form of accidental snaring and more casualties caused by other non-selective traditional hunting techniques. No fear for wildlife in Niassa NR.

- Potential threats to the Quirimbas NP population present a clearly different pattern although the just mentioned non-selective subsistence hunting techniques (arch & arrows being used only in the Mueda region, further North) seems to be the main factor of risk as well, but this time combined to all the other threats usually induced by continuous human population expansion and natural environments exploitation (habitat fragmentation by shifting agriculture and bushfires, loss of preys to traditional hunting activities, direct persecution in response to conflicts risen from perceived interferences with subsistence hunting, from unfounded general fears and from interactions with domestic dogs but only very exceptionally as a majority of people in the area are Muslims and do not use to keep such kind of animal at home), as human

density appears much higher in this newly created (2002) protected area. There is no developed safari hunting/game farming in or around the Quirimbas NP.

#### 2.1.2. Methods & Related activities:

- The Field interviews Survey was performed in the Quirimbas NP and Niassa NR near respectively 20 and 19 human settlements, out of the 132 (15%, see 2.2.2.1 in Annex B) and 48 (40%, see Annex D) preliminarily identified within the given areas, semi-randomly selected and as much as possible equally divided between the habitat types represented in the areas. Another few individuals, not necessarily resident in the field but with sufficient knowledge of the areas and associated wildlife acquired through their activities (conservation staff members in official areas, safari operators and staff, hunters, logging concession operators, tourists...), were also interviewed.

- Aided when relevant by a translator in the locally spoken language ("Kimwane", "Makuwa" and "Swahili" in the Cabo Delgado province, "Makuwa" and "Jawa" in the Niassa NR), a standard questionnaire especially set up for that purpose (see Annex 4 of Scientific report, Annex B) was used together with a pictures-book showing African wild dogs with various fur patterns and postures, at different ages (with always at least two of the age classes, among adult, yearling & pup, represented simultaneously to allow for comparison of body size) and in diverse numbers (pack sizes), the other large carnivores (lion, spotted hyaena, leopard - *Panthera pardus*, cheetah - *Acinonyx jubatus*), 23 potential prey species from suni (*Neotragus moschatus*) to buffalo (*Syncerus caffer*) and the 4 broad vegetation types (Woodland, Open woodland, Wooded grassland, Grassland) known or supposed to be found in the areas.

Respondents were asked to report all African wild dog sightings they remembered sufficiently including details such as date, time of the day, exact location (GPS fix whenever possible), vegetation type, pack size and age composition (discriminating pups, yearlings & adults), activity when observed etc. (see 2.1.3.1 & 2.1.3.2 in Annex B).

They were also requested to comment on the long-term trends in sightings and to assess the relative abundance (on a scale from 0, "absent", to 4, "abundant") of potential prey and competitor species whether at sighting point (best) or around the village of residence (when no sighting or not remembered for sighting point).

- The entire process yielded a total of 65 interviews in the Quirimbas NP, of which 53 (82%) contain the report of a direct sighting of the species, 49 with exact location and 43 also with additional descriptive information, and a total of 101 interviews in the western/southern regions of the Niassa NR, of which 88 (87%) with a sighting report, 82 with exact coordinates of sighting point and 79 also with additional detailed data on the observation.

- The treatment of the data from this only survey (eventually coupled to Signs of presence Survey, see below) suffices for the identification of the African wild dog packs of both areas through reconstitution on the basis of potentially redundant successive sightings combination (Sighting redundancy analysis and geographical preliminaries, see 2.1.3.3 in Annex B for principles and 2.2.2.3/Annex 2 of same Annex B for practical application) such as for their respective description (home range and successive sightings details, see Annex A & C), including the habitat they were seen in (habitat type at sighting location was informed both directly from interview respondent and indirectly from plotting the respective geographical coordinates onto the relevant GIS layer), and for the determination of the estimators presented above for the local populations they constitute when considered conjointly (population size & age composition, adults-to-juveniles ratio, proportion of observations with juveniles, mean pack size & age composition).

Preliminary demographic parameters can be deduced directly from these results and habitat analysis can be run on their basis, whether for each pack taken individually or for the entire local populations they represent (see methods and applications to the Quirimbas NP packs in Annex B, 2.2.2.4 for demography and 2.1.4/2.2.3 for habitat analysis).

Finally, the Field interview Survey is also pivotal in the investigation of people's interactions with wildlife (see below) and details of sightings reported but not entering into pack identification (non-redundant) are still valuable however (see Section 3.).

- Assessment of herbivore species (potential preys of the African wild dog) densities through Distance sampling Survey was conducted in the early mornings and late afternoons along 139 km of secondary roads and tracks within the Quirimbas NP limits, divided into 10 distinct transects mostly in open to semi-open habitat to allow visual detection, making then impossible to sample equally (same total distance) each habitat type as initially stated, and along 505 km in the Niassa NR, divided into 29 individual transect-lines.



- With the assistance of 1 or 2 local counterparts (for sampling 1 or both 2 sides of the vehicle in addition to driving it), any direct herbivore observation was geo-referenced by GPS, species were identified, groups were counted, habitat type was recorded and perpendicular distance to the transect-line was assessed while the total distance of each transect (to be divided thereafter into the elementary distances covered across each habitat type found along the line) was noted down as well.

- At a same number of exact locations (a total of 30 in the Quirimbas NP, 34 in the Niassa NR) within each of the habitat types represented respectively in the two survey areas, sounds known to attract spotted hyaenas and lions (potential competitors of the African wild dog) were played-back through horn-speakers at night and according to a well-defined protocol (Call-in stations Survey).

- The distance from each station within which sounds were supposedly audible to the target species (the radius of the area actually surveyed around each point) is assessed depending on field conditions (vegetation density, wind...) and a simple count of the individuals attracted to the emitting station then gives a punctual density for each species. Any station was sufficiently distant from any other apart (straight-line distance superior to the sum of the two respective radius, confirmed through GPS positioning) to avoid double-counting of a same animal during the same night of work.

- During the hottest hours of the day (not suitable for any other wildlife survey), or along transfer rides between local settlements that were visited for interviews, an additional component to fieldwork was conducted: the Signs of presence Survey (see 2.1.2 in Annex B).

The research team systematically stopped the trip in course (of variable total distance each) at a repeated same distance interval (2 or 3 km according to conditions but maintaining a constant distance interval during a same trip), GPS position was taken, habitat type was recorded and conspicuous signs of presence (footprints and faeces mainly) of any wildlife species were searched for in a rectangular strip of (3x100) m<sup>2</sup> in front of the vehicle till the exact number of single individuals of each represented species "having recently crossed the strip" was determined and recorded.

The calibration of such population indices was of course impossible (as requiring reliable estimates of the related populations size), and therefore so was their translation along the sampling lines into actual population density estimate for the species detected in the successive punctual strips, but these indices can however be used as indicators of relative abundance in the referred species (incl. African wild dog) within/across study sites and allow for comparison between areas, habitats or other sampling conditions.

- This exercise was practiced along 17 km (by foot) in the Quirimbas NP (permanent sampling along the walked line, no successive sampling strips, see 2.2.1 in Annex B) and along 401 km (4x4 vehicle) in the Niassa NR (22 lines, 201 strips). It was attempted to sample along a same distance within each habitat type represented in the respective areas but a similar penetration index (km of line sampled per km<sup>2</sup> of area) is more likely to have been maintained across them as depending on the road/track network (supposedly designed randomly in regard to habitat type, longer distances of roads/tracks then being naturally encountered in more represented habitat types).

Stratification of such kind of sampling is much more complex anyway as it must also take into consideration and tend to annihilate (or integrate) the factors other than population density affecting intensity of production of a given sign of presence (activity & behaviour, habitats, seasons, soils...) by the animals.

- People's attitudes towards African wild dogs and carnivores in general were investigated through a specific set of questions in the already mentioned standard questionnaire used for the Field interviews Survey. This was to identify the local residents perception of the origins of eventual conflicts (attacks to people, livestock depredation, interferences with traditional/safari hunting, interactions with domestic dogs, unfounded general fears...) with, and possible consequent threats (measures, tending to direct persecution the most often, taken by the people to resolve the conflict to their advantage) faced by carnivore species, the African wild dog in particular.

- Other potential human threats, not conflict-related but ensuing from every-day-life activities and land uses (accidental snaring and other non-selective traditional hunting techniques, habitat fragmentation by shifting agriculture and bushfires, low prey densities driven by traditional/professional hunting, infectious diseases transmission from reservoir domestic dogs...), have been deduced from the analysis of distinct data-sets systematically collected in the field towards the socio-economic description of both interviewed rural communities (incl. population, main activities, area of influence around settlement/activity, domestic dogs survey, subsistence hunting techniques and rate of use, wildlife species traditionally hunted and assessment of removal rate for each... ) and visited safari concessions (incl. wildlife species hunted for trophy, annual quotas/species, animals actually shot along the 5 previous years...).

- However, the treatment of these data towards the deduction of actual, and not only potential, anthropogenic threats, both conflict-related (direct persecution) or not, to the African wild dog populations surveyed through this project still being in course, the interpretation made in this report of the results available so far from such analysis should not be considered yet as more than preliminary.

## **2.2. "Using a spatial model to determine the extent and connectivity of suitable dog habitat at a regional level (Mozambique, Tanzania, Zambia, Zimbabwe and NE South Africa)."**

### 2.2.1. Level of achievement:

- An operational Geographic Information System (GIS) has been built all through the project by adding all geo-referenced new locations generated by fieldwork activities (smallest human settlements, new/narrow roads and tracks, safari concessions limits, African wild dog sighting locations, position of sampling strips wherein signs of presence were counted and of distance sampling transect-lines, call-in stations exact coordinates...) to existing layers of the most recent and reliable digital geographic information (IGN-France & DINAGECA-Mozambique, 1997) acquired from the competent public services in the country (largest human settlements, main roads, limits of conservation areas, rivers, lakes, habitat types...).

- What has been done so far is a simple determination of vegetation types preference (ratio use/availability) for each individual pack identified within the Qurimbas NP (see 2.2.3.3- Section A in Annex B) vegetation type preference (ratio use/availability), followed by the deduction of a common scale of preferred types at the level of the specific local population made of these packs (see 2.2.3.3- Sections B & C and 2.2.3.4 in Annex B) and a final projection of the distribution at a wider geographic level (the entire Cabo Delgado province, see 2.2.3.5 in Annex B) of those elementary areas (GIS polygons) covered with the vegetation types revealed as the most preferred (first & second) by the specific population in question. The total extent of such areas taken conjointly and connectivity between them could then be determined. But the definition of suitability for African wild dogs of a given habitat must not be limited to their level of preference for the types of vegetation found within and more factors such as human presence, activities and land uses, existing prey-base, potential for interspecific/intraspecific competition, and others known to affect density and distribution of the species or to potentially represent a threat to it (e.g. road network), should also be taken into consideration.

- In a conceptually similar approach than for determining vegetation type preference, the observed intensity of these factors on the individual packs identified by the project taken individually, and to be formulated thereafter in common for the local population these packs constitute, will be quantitatively measured with specific variables and measures actually obtained will then be considered as the standard of suitability for the referred population (since animals were actually seen in such conditions).

The principle applied by the spatial model, when activated to search on such basis for the most suitable African wild dog habitats at the scale of any given area, is to calculate the same variables in any single point located within the referred area and extract the ones that offer habitat conditions resulting from factors of which intensity corresponds sharply to the standard one (same measure of the associated specific variable) which the reference packs/population of the Qurimbas NP were submitted to.

### 2.2.2. Methods & Related activities:

- Recording of GPS positions during fieldwork provided most of the new geo-referenced locations but some also came from paper maps scanning and/or images geo-referencing.

The GIS tool has been used on every steps of the project so far, from planning and implementation of fieldwork (identification and selection, at least in part in function of the vegetation type they fall within, of local communities to be interviewed, of strips to be sampled for counting wildlife signs of presence, of transect-lines for herbivores sampling and of locations for calling-in carnivores...) to data analysis (African wild dog sighting points, vegetation type at various locations, distance between sightings, habitats repartition within areas, buffering, measure of various distances/areas...) and results presentation (geographical representations of country, study areas, identified packs polygon/circle home ranges, availability in preferred vegetation types...).

- While the expression of some of the factors to be integrated into the spatial model because supposedly affecting density and distribution of African wild dogs (e.g. vegetation) is obvious according to existing categorization (e.g. vegetation types), translating the intensity of others into measurable variables follows

no stated rules and is mostly guided by the nature and amount of data at disposal to inform quantitatively on each of the referred factors.

According to the data actually available to this project, the spatial model in course of elaboration will consider the following variables:

- \* Preferred vegetation types (quantitative measure = index of preference for each type)
- \* Distance between geometrical centre of pack home range representation (polygon or circle) and nearest human settlements (or sum of distances to the 5 nearest human settlements)
- \* Cumulated human population of the 5 nearest settlements
- \* Cumulated number of goats/sheeps in the 5 nearest settlements
- \* Cumulated number of domestic dogs in the 5 nearest human settlements
- \* Cumulated number of traditional hunters in the 5 nearest human settlements
- \* Cumulated number of professional hunters (per year) in the 2 nearest hunting concessions
- \* Wild herbivores density (biomass/km<sup>2</sup>) within pack home range geographical representation
- \* Wild carnivores density (biomass/km<sup>2</sup>) within pack home range geographical representation
- \* Distance to the nearest other African wild dog pack and rate of home range overlaps
- \* Total distance of road sections within pack home range geographical representation.

- Once each of these variables will have been measured for all the known packs, and translated into a single common expression (of each variable) at the population level (e.g. the variable "Cumulated human population of the 5 nearest settlements" ranges between 137 and 982 people for the 6 packs identified within Quirimbas NP limits; a common expression of the same variable at the population level could possibly be that no pack has been found to be surrounded by more than 982 human souls distributed in the 5 nearest settlements), the extrapolation to a larger scale of such ecological/anthropogenic parameters associated to African wild dog presence is then made possible through manipulation of the spatial model. For that purpose, a computerized request is entered for identifying by multiple calculations and joining on a same GIS layer all point locations of a given area (the one which availability in most suitable habitats for African wild dogs is looked for) at which the measures of the respective variables correspond to the standard of suitability revealed by the study population (e.g. GIS tool isolates elementary areas where any point is surrounded by less than 982 people within the 5 nearest settlements, and such points/areas are the most "suitable" for African wild dogs regarding to the human population factor considered here).

- Any variable (any factor which intensity is expressed by the measure of this variable) could be analysed independently (to assess suitability towards this only factor), but the ultimate goal of the exercise is to finally overlap resulting layers and find the elementary areas where any point location is suitable for African wild dogs regarding to as many factors as possible (i.e. same point present on as many layers as possible, each layer representing suitability according to one distinct variable/factor), defining like so the definitely most suitable habitats within any perimeter.

### **2.3. "Provide training to Mozambican conservation staff, students, researchers and selected community members (outside protected areas) in field methods and complementary skills for data analysis."**

#### 2.3.1. Level of achievement:

- Up to 3 conservation staff members in the Quirimbas NP (Alfredo GONÇALVEZ, Evaristo ABDALA & Casimiro NOMICO) and minimum 1 management scout in each private hunting concession visited around the Niassa NR ("Blocks" C, D2, D1 & E) took part to the fieldwork within the respective areas and were then trained in specific field methods for Field interviews, Signs of presence, Distance sampling and Call-in stations Surveys.

- Mozambican scientists at the Museum of Natural History (MHN), at the Department of Biological Sciences and at the Faculty of Veterinary Sciences, all within the Eduardo Mondlane University (UEM), were familiarized with the project in its earliest steps (pilot field identification mission in 2000) and some have accompanied the progress up to now, having been frequently updated on the subject including with the most recent results. MHN researchers particularly, in their quality of prime recipients of the scientific deliverables, have always been provided in priority with new findings from the project, conjointly with detailed explanations on the analytical steps that led to them.

- Through such exchanges, new skills have been hopefully transmitted as much on the institutional side of launching from nothing (incl. fund raising) and then leading a project like this one, than on adapted

planning and practical implementation of fieldwork activities and ultimately on the scientific analysis of data coming from such field activities for producing the expected results.

- The 2 students of the Department of Biological Sciences (UEM) counting among the project team members and who successively took part to fieldwork during one month in the Quirimbas NP (Osvaldo CHACATE & Eliseu ARMANDO) learnt for that purpose not only the methodology for local communities interviews on wildlife presence and abundance and for proper wildlife surveys (sometimes together with conservation staff members of the protected area in question, invariably creating like so natural collaborative links in the field), but were also trained thereafter in the necessary skills, including the use of GIS software, for analysing the data they had been collecting and then for interpreting the related results.

- For fieldwork in the Niassa NR western and southern sectors, 3 members of local communities were recruited to also join the team when their respective areas of residence were visited and 2 of them (Magendo CHAIBO & João SANDAR) were actually trained in the same specific field methods than conservation staff/students. These people made spectacular progress within the 1 month term along which they brought to the fieldwork their very precious local knowledge of the area/wildlife species and exhibited unconditional commitment.

### 2.3.2. Methods & Related activities:

- Fieldwork activities in areas of the region with specific wildlife management status (official conservation or private safari hunting, both under authority of the same governmental body, National Directorate of Conservation Areas, "DNAC" in Portuguese) always started with a visit to the head of the field structure in charge of such management. Once project background and objectives of presence in the area in question had been exposed, it was requested (when not spontaneously proposed by the responsible person) for at least 1 of the staff member to take part actively to data collection after having received a specific training in the methods to be applied and in related field techniques to be used for that purpose (leading interview on basis of questionnaire and pictures-book, counting wildlife signs in sampling strips, detecting animals for distance sampling, counting groups and assessing perpendicular distance to herbivores along transect-lines, GPS fixes recording, nocturnal bush driving, horn-speakers, amplifier and tape-player manipulation at call-in stations according to existing protocol...).

- It was then underlined that such new skills, or at least part of them, could later serve the management body for own-needed surveys (on wildlife species of particular interest to them) and for ongoing African wild dogs monitoring, in the hope that the personnel member(s) the most capable and motivated regarding to the briefly described field practices was (were) preferentially appointed.

- Periodical updates to the relevant national researchers were many times made through written work submission (identification documents, project proposals, models of application for funding, fieldwork reports, scientific analysis of data and result reports...) but also through official meetings (for discussing on the last pieces of written work provided, especially data analysis) and informal conversations.

- Respectively 7 and 12 interviews of local people were conducted by the two students having joined the field team. Some of the questionnaires filled in like so were including African wild dog sighting reports which the students thus treated details of according to the existing methods until final contribution to the identification of the individual packs. They also accompanied other aspects of the research they had participated to during fieldwork and were most of the time present when intermediary results were presented to the entitled researchers at the Museum of Natural History who had initially put them in contact with the project.

- Within communities where the local research assistants were recruited, the project leader always spent at least 4 days living and sharing moments with all the members without distinction. The contact person was always the traditional chief. The project tent was settled down in his property and he often called a council of the elders and most influent people of the community to participate to the conversations. Without pinpointing immediately the real reasons for such a presence among them, in order not to modify usual behaviour of the people, their habits, attitudes towards wildlife, and activities (and associated land uses) with potential effects on surrounding wildlife species including the African wild dogs, were observed. In a second time, the interviews were conducted but with no proposal yet of any active participation in the project and no transmission yet of any conservation message. This was to better assess intrinsic value of each future candidate for the work and thus avoid biased pre-selection by traditional authorities.

By the end, the most indicated individuals (best knowledge of the wildlife species and their signs of presence, basic practice of the Portuguese language, minimum writing ability...) were approached with the opportunity to take part to the process.

The only person finally selected in that way (and accepting the duty) was familiarized with the problematic/objectives of the work and trained in the specific techniques already evoked, that were then put immediately into practice for the next month or so of fieldwork.

#### **2.4. "Establish constructive and long-lasting relationships with local communities to better understand their attitudes towards wild dogs (and wildlife in general) and secure their active participation in conservation activities."**

##### 2.4.1. Level of achievement:

- The African wild dog is now more familiar to the local communities settled in the areas that were surveyed as the project dedicated, beside conducting field research, substantial conservation educational efforts for an improved perception of the species intrinsic values, such as for a better understanding of its ecology and interactions with other wildlife and human beings.

Upon demonstration that the risk of potential conflicts in the respective areas was very low (especially in the Niassa NR, unless maybe some interferences with professional/traditional hunting under particular conditions), negative views on the species were deterred and it was searched to dissuade from engaging in direct persecution.

- Further, there are very good prospects for implication of the local population into practical conservation actions for the African wild dog and wildlife in general, whether directly (continued recording of new sightings details, zero-level persecution, minimum disturbance to occupied dens when located, ongoing campaigning for the conservation of the species...) or indirectly for reducing anthropogenic pressures due to local activities and land uses (to favour the use of selective techniques for traditional hunting and ban the one of poison for any purpose, to get the agriculture more sedentary, to avoid uncontrolled bushfires, to practice traditional hunting only for domestic purpose, to prevent domestic dogs from free roaming...).

##### 2.4.2. Methods & Related activities:

- The conservation message and objectives of the project were always very well perceived by the local people, many times evolving in spontaneous offer for strong support and frank participation to any activity to be proposed. This was attained by simply respecting a few key steps in the procedure for gaining their engagement and actual recruitment to continue long-term conservation activities.

When visiting a human settlement, the contact was naturally initiated through the Field interviews Survey (amplified when a fieldwork assistant was to be recruited) and then completed with conversations and explanations, mainly to the traditional chiefs who were requested to forward to the entire community the message for the conservation of the African wild dogs. In most of the cases, the representatives of the traditional authority received the project team after having convoked a council composed of the people with the most authority/influence in the place regarding to the issue (traditional hunters, bush doctors, elders...), what also favoured a wider effect of the action.

- This entire education (most relevant individualities with good perception of wildlife) and awareness process (all members of the community) took place with the didactic support of books, pictures, posters, brochures, drawings, craftwork items (small wood statues made and sold by local people around Hwange NP in Zimbabwe), vocalizations of the species on tape etc. Such material illustrated the ecology of the African wild dog and was exposed to the most indicated members of the community (with sufficient knowledge of wildlife and level of recognition by the others) in the perspective of influencing positively the environmental knowledge, attitudes and behaviour of these local stakeholders and of enhancing a long-term effect of the conservation message like so transmitted to them.

- Allusions were made to arch/arrows and spear as techniques to be envisaged for traditional hunting, searching for references in cultural memories. Dangers of poison manipulation were evoked.

- The reasons for the practice of shifting agriculture were investigated, and rural development alternatives were suggested in function (terrain selection, irrigation & drainage, animal traction, culture rotation, cultivation practices including timing in cycle and adapted techniques, seeds quality improvement, organic inputs, agro-forestry...).

- It was also remembered that traditional hunting on communal areas is authorized in Mozambique only according to numerous conditions, and that being strictly for domestic use (no trade) and practiced during a well-defined time period of the year (April to September) are only two of those.
- The risk of infectious diseases, transmitted from domestic dogs with erratic behaviour in the bush once back to domestic livestock and human beings concentrated in settlements, was also highlighted in the optic of owners preventing their dogs from such free ranging movements.

**2.5. "Develop a public awareness campaign, including NGO's, cooperation agencies, international organisations and the private sector to gain support for conservation actions."**

2.5.1. Level of achievement:

- The proper workshop, to be organized in collaboration with both national competent authorities (DNAC) and research institutions (MHN, UEM), in order to present final research results (incl. management suggestions), but also to hopefully increase awareness of the most likely interested participants and to set up between them links resulting in the continuation of the conservation efforts post-project, has not been held yet but is still planned.
- Wider public awareness campaigning has already been addressed anyway through different other means and directed to a larger target audience of potential stakeholders, but necessarily including the most relevant ones referred to here (NGO's, cooperation agencies, international organizations, private sector...).

2.5.2. Methods & Related activities:

- Public presentations (including slide show) of implementation issues and preliminary results from the project have already taken place on 4 occasions, successively in late October 2004 at a workshop on conservation of the African wild dogs in Kruger NP, South Africa (in English), at the French cultural centre in Maputo by late February 2005 (in French), at the BP Conservation Programme 2005 workshop held in late June 2005 by the Smithsonian Institution in Virginia, USA (in English again but an extended version) and a last time (in Portuguese) at the Museum of Natural History in Maputo on 22<sup>nd</sup> September 2006 (see Annex E).

The potential participants to the still programmed national workshop were already identified through relevant sectorised databases (from MHN, compiled by this project, through the NGO Consortium and the Ministry of Foreign Affairs & Cooperation in Maputo...) and invited the two times the presentation was made in Mozambique.

- Furthermore, another database with the contacts of potential respondents to a "National Enquiry Process" at distance (phone calls or post/electronic mailing of an information/questions brochure edited both in English and Portuguese languages) to collect information on African wild dog sighting reports from all over Mozambique for status survey purpose has been patiently built up along the project course.

Should that process be started properly again, awareness of any individual contacted for the national enquiry would implicitly be raised. The database referred to includes:

- \* competent authorities (DNAC, National Directorate of Conservation Areas & DNTF, National Directorate of Land and Forest) both at central and local levels (province, district, administrative post, locality...), incl. field administration and staff of the official conservation areas
- \* private safari operators, managers and staff in professional hunting concessions
- \* timber concessions owners and workers
- \* field personnel of socio-economic development projects (NGO's, cooperation agencies, international organizations)
- \* field personnel of industrial and large infrastructure construction/maintenance projects (railways, roads and bridges, sugar cane exploitation, semi-precious stones extraction and other mining...)
- \* national hunters under official licence regime
- \* field scientists...

**2.6. "Submit results and conservation recommendations to the authorities and research institutions responsible for wildlife management in Mozambique such as to national conservation policy-makers, regional biodiversity databases and the international scientific community"**

2.6.1. Level of achievement:

- Upon further data treatments, all potential threats (extended to extrinsic ecological factors in addition to direct persecution in response to conflicts, indirect anthropogenic threats caused by local activities and land uses whether traditional or professional, as reviewed so far) to the African wild dog population identified in the respective conservation areas will be determined together with their complete demographical characteristics. It is only upon confrontation of these two main deliverables from the project (potential threats & advanced demography) that actual threats faced by the local population referred to will be identified, which sound science management recommendations for mitigation could then be ensued from.

- A close partnership with the relevant state authorities has been maintained up to now in the perspective of keeping them posted on the progress of the project until such suggestions of practical options for the conservation of the species in the areas will be submitted to their services.

- This final report is the first one from the project presenting explicitly the implementation of fieldwork in the Cabo Delgado and Niassa provinces together with every related final specific outcomes, scientific or not.

- In Mozambique, all the institutional partners to the project mentioned in the description of this specific objective have been updated recently (December 2007) with the scientific report and findings summaries.

- The only mention to the project in a published scientific document so far is referenced as "André, J.-M. 2004. African wild dogs in Mozambique. In *Tools for the conservation of African wild dogs. Do we know enough? What more do we need to know? Report of a workshop on research for conservation of the African wild dog, Kruger National Park, South Africa – 25<sup>th</sup>-29<sup>th</sup> October 2004*. R.B. Woodroffe, editor. pp. 65-66. WCS and IUCN/SSC Canid Specialist Group".

- Please see hereafter (Section 3.) how last results from the scientific research component were recently submitted on a single occasion both to regional biodiversity databases (linkage into established reporting systems) and to the international scientific community (linkage into officially published action plans).

2.6.2. Methods & Related activities:

- At DNAC, Ministry of Tourism, both the Deputy National Director of Conservation Areas and the official agent entitled with the monitoring of the project since formal support was granted in late 2003, were recently (December 2007) provided as well with the most up-to-date results from the project and informed on remaining steps before actual recommendations for African wild dog conservation in the area can be produced. They will however ensure immediate dissemination of the recent documents among all state bodies susceptible to influence policy-making in matter of wildlife management and species conservation, including outside the conservation areas network ("multiple-use areas", Wildlife Repartition Services, DNTF, Ministry of Agriculture), as the only distribution and density results found inside so far are already much needed for that purpose.

- The submission of result reports and numerous other interactions with national research institutions having developed a strong partnership with the project (MHN, UEM, Veterinary Sciences...) have already been described in previous lines, and will be in further ones as well.

### **3. CONSERVATION IMPACT & OUTPUTS**

At the moment, the main outcome from far of the project is to have made a significant contribution to priorities set by the international conservation community through identifying the presence of respectively 11 and 9 individual groups of African wild dogs in the Cabo Delgado province and western/southern sectors of the Niassa NR, many of which had not been described by anybody in the past.

The grounds of such major new findings to science (exact location of respectively 49 and 82 African wild dog sightings in the areas over 20 years, 1985-2005) have subsequently been delivered to the bodies entitled by the same scientific community with the record of such information into specific regional biodiversity database (African Wild Dog Working Group within the IUCN/SSC CSG) at the Southern Africa

Regional Workshop on "Rangewide Conservation Planning for Cheetahs and African wild dogs" (Jwana Game Park - Botswana, 4<sup>th</sup>-8<sup>th</sup> December 2007, IUCN/SSC Cat & Canid Specialist Groups - WCS - ZSL). As the distribution and status maps for African wild dogs were revised at the occasion of that meeting (see agenda, Annex F), the most substantial change resulting from the project will thus be the new limits of the species range on the updated distribution map for Mozambique to be published shortly (?), where data for the specified regions of Mozambique come almost exclusively (>80% of all sightings reported for these areas by any scientist in the last 30 years) from fieldwork carried out through the present initiative, which the BP Conservation Programme 2005 funding support was crucial to.

Project contribution could also be extended considering that only 19 detailed direct sightings from 2004-2005 in the Quirimbas NP (out of the 49 which geographical coordinates were passed on at the Botswana meeting, 27 within 2004-2005), and only 32 in the Niassa NR (out of 82 passed on in Botswana, 64 made during 2004-2005), were actually isolated by analysis out of the entire pool (see 2.1.3.3- Sections B.2.1 to B.2.4, in Annex B) in order to identify and describe a total of twenty individual packs resident in the referred regions of Mozambique (see Annex A & C). This means that respectively 30 (49-19) and 50 (82-32) similarly detailed visual observations reported to the project remain available for further analysis and could therefore eventually bring additional findings on the dynamics of the newly identified African wild dog local populations or on threats the same are actually facing.

Demographic parameters that were assessed from the only 19 detailed sightings in the Quirimbas NP according to the existing methods (see 2.2.2.4, in Annex B), and that could be determined on the basis of the only 32 in the Niassa NR, should not be considered as more than "Preliminary" until the entire pool of reported sightings (49+82=131 instead of the only 51 looked at with scrutiny so far) will have been analysed in the same perspective.

But the most significant impact of the project is still to come when, upon management recommendations to be submitted ultimately by the project to the competent state authorities, practical conservation measures to mitigate identified actual threats will be taken in the field and long-term national strategic planning for the conservation of the African wild dogs in Mozambique will be properly translated into further policy-making in the matter.

Unfortunately, the constitution guided by sound scientific principles of the necessary basis to reflect on such concrete propositions for the areas surveyed by this project in the North of the country seems quite remote yet. Indeed, this should highlight actual threats to the population and thus be built on the determination of the pressures the species is potentially facing in the area conjointly with the most complete demographic description possible of the local population in question, what still must pass successively through:

- possible repeated identification and description of individual packs according to eventually reviewed methodology (upon scientific feed-back, see Section 6.2.),
- deducing (a second time for the Quirimbas NP if methodology is altered, firstly for the Niassa NR) demographic parameters and running Habitat analysis according to existing or reviewed methods (whether only from the sightings used to identify packs or from the entire pool of sightings, whether for each pack taken individually or for the entire local population),
- setting-up of adequate data treatment methodologies (today whether still embryonic or more advanced but not complete yet) and subsequent application to the related data-sets already collected for the study:
  - \* of ecological interactions (Distance sampling Survey of herbivores, carnivores Call-in stations Survey, preys/competitors relative abundance assessed from Field interviews Surveys, from Signs of presence Survey and from records for management purposes put at disposal by the official conservation/private hunting areas managers) and possible threats to the African wild dog that could ensue from, such as unsuitable prey base (whether in terms of species composition or respective densities), intra-guild competition whether directly by interference (incl. kleptoparasitism by spotted hyaena and direct predation by lion) or indirectly by exploitation (if competition actually rises from a reduced availability in a same resource not sufficiently present), and natural transmission of diseases within wildlife of which mechanisms are not very well understood yet but most likely to be amplified by physical contacts between animals during competition interactions (whether with other carnivore species or within each of these, incl. intraspecific competition between African wild dog packs).
  - \* and of potential interferences with humans, whether direct persecution (conflicts and attitudes data from Field interviews Survey) or indirect consequences of traditional/professional human activities and land uses (personal details of respondents to the Field interviews Survey, socio-economic parameters collected on interviewed rural communities incl. number of inhabitants, 1<sup>st</sup> & 2<sup>nd</sup> main activities, area of influence around settlement/activity, domestic dogs survey, traditional hunting techniques used and rate of use,



wildlife species traditionally hunted and assessment of removal rate for each etc., and on visited safari hunting concessions incl. wildlife species hunted for trophy, annual quotas/species, animals actually shot along the 5 previous hunting seasons...).

Although such management recommendations are not available yet at the national level, the preliminary identification performed here so far (see Section 2.1.1.) of potential threats to these 2 local populations of African wild dogs, and consequent proposal of possible ongoing practical conservation actions whether by (see Section 2.4.1.) or towards (see Section 2.4.2.) the local people and other stakeholders (e.g. safari operators, see Sections 4. & 5.), also represents a significant outcome from this project to date.

#### **4. LESSONS & CONSTRAINTS**

Initial planning of the project expected the total extent of both Cabo Delgado and Niassa province to be surveyed within only one year but fieldwork was finally limited to much more restricted areas in the referred provinces by the end of the fieldwork season (late November 2005).

Such a time constraint surged from various circumstances.

- First the entire extent to survey in the North of Mozambique, made by 2 whole provinces (around 200,000 km<sup>2</sup> in total), was maybe not realistically appraised when planning fieldwork at the office, such as the difficult field conditions to be encountered there, in areas all remote but a few.
- Then, preliminary data on local settlements required for their selection to the Field interviews Survey in the area were sometimes available only from the settlement itself or from the nearest larger one. Much time was thus lost for gathering such information, as it was a compulsory step towards the proper semi-random stratified selection of local communities to be visited for interview.
- Finally, the unexpected and irremediable decision by an additional sponsor to the 2005 fieldwork season to cancel for unjustified reasons its financial support during project course (September 2005) also shortened time in the field by 1 or 2 months. Incoherencies between the preliminary report submitted by 16<sup>th</sup> December 2005 and the present document, not only in terms of actually surveyed areas but also for other aspects of the project (finally 2 students only instead of 3 actually took part to fieldwork and only 2 and not 3 or even 4 local residents were recruited in the Niassa NR to be trained as research assistants), are mainly driven by the referred shortage in funds as project expenditures had been planned as a whole on the basis of the two cumulated budgets.

Other lessons concern:

- 1°- logistical issues, with vehicle ownership revealed more advantageous from far than occasional rental from national particulars, maybe not for financial reasons but mainly to prevent the field researcher from losing precious time and energy (prospecting, negotiating, contracting, stuck in the bush because unknown vehicle revealed not fit for the difficult fieldwork conditions, repairing prior to devolution, arguing with dishonest owners on the act of devolution, dealing with dishonest owner post-devolution attempts of intimidation...),
- 2°- the importance to learn the local vernacular language, or at least the name of all wildlife species dealt with through the Field interviews Survey and the sufficient basic vocabulary/grammatical notions to lead such survey on its own in the shortest delays (no doubt on translator reliability, better perception of answers to questionnaire, larger impact of conservation campaigning/environmental education...),
- 3°- the partner relationships that should be established as much as can be with the safari operators managing hunting concessions overlapping with African wild dog (potential) areas. Firstly because wildlife densities are many times higher (thus potentially favouring the species in focus as far as herbivore species are concerned rather than competing predators) in the sectors under their responsibility (efficient anti-poaching, lower human densities...), with ecological data sometimes available (counts, quotas, licences actually sold...), but also because their logistic support is always the most welcome in the isolated areas they manage, and finally for the reason that their strong implication in the conservation of the species should always be looked for once their degree of interest for the cause is investigated and assessed (from subtle allusions to the African wild dog national protection status prohibiting direct persecution to the much more positive and lucrative evocation of possible alternative ecotourism circuits, in search for experiencing a first direct sighting of such an emblematic endangered species, and to be charged in extra to the non-hunter members of the clients groups that otherwise wait unproductively for ages at the main safari camp, or even to external non-hunter visitors...).

## 5. LOCAL INVOLVEMENT & COLLABORATION

Beside being involved through scientists frequently updated on the progress and results of the project, like so participating to its successive phases (as already mentioned in previous sections), from pilot field identification to final data treatment (direct supervision) and results interpretation through fieldwork planning and implementation, the Eduardo Mondlane University, its Department of Biological Sciences and the Museum of Natural History (MHN) in particular also provided the project with unconditional support of both institutional (see Annex G, request for governmental agreement of the project on behalf of the MHN, 07<sup>th</sup> November 2003) and administrative (see Annex H, request for visa clearance of the field researcher on behalf of the MHN, 01<sup>st</sup> December 2006) natures, completed by assistance on numerous logistic issues from the early beginnings up to nowadays.

When the research team is not busy conducting fieldwork in any part of the country (as it is currently the case), the scientific equipment serving for field surveys (project wildlife picture-book, ordinary wildlife field-guides, binoculars, 12-220V inverter, amplifier, horn-speakers, spotlights, compass, scanner...) is let at the disposal of the Museum of Natural History for possible use in own research activities, hopefully towards African wild dog conservation.

To be remembered here is that the MHN is in Mozambique the legally entitled scientific advisor, to any governmental executive authority, for decisions susceptible to affect the natural resources of the country. Please feel free to confirm this near Dr. Almeida GUISSAMULO (Tel.: +258 21 491145, Fax: +258 21 490879, Cel.: +258 82 4965700, Email: [mhni@zebra.uem.mz](mailto:mhni@zebra.uem.mz) or [almeida2409@hotmail.com](mailto:almeida2409@hotmail.com)), Head Investigator (and BP project team member), Museum of Natural History (UEM), Maputo.

Similarly, the state authorities competent in matter of wildlife management always ensured the project a full dedication from their representatives in the field, with conservation areas administrators invariably attaching members of their staff to the project team when working within areas under their authority (as described already). After having first identified the project as locally needed (see Section 1.3.), they were then translating like so its formal approval and pledge of cooperation manifested at the central level of the referred authorities (see Annex I, National Directorate of Conservation Areas letter of support to the project, 13<sup>th</sup> November 2003).

According to the most recent interactions with the same governmental services at the time they were provided with the updated results reports (early December 2007), it can be considered with certainty that the institutional support once formally granted is still secured today. The final management recommendations from the project are more than ever strongly needed (see Section 2.6.) and its collaboration in the current elaboration of the official National Strategy for the conservation of the African wild dogs in Mozambique has already been requested by the competent services.

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Beside the transfer of appreciable know-how on wildlife survey techniques (incl. field interviews) and analytical skills for treating data collected in the field until expected results are obtained (see Section 2.3.), the 2 university students who participated to fieldwork also benefited like so from a practical framework so that they can take the lead on wildlife conservation upon graduation.

They indeed became more familiar with the numerous wildlife species surveyed (African wild dog but also potential preys and competitors) and with the main issues related to their conservation and management. They both went home with the satisfaction of having been put in direct contact with practical field methods and thereafter took part actively in data treatment and results interpretation for which they actually developed the required abilities, demonstrating like such true commitment to and leadership potential in biodiversity conservation.

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The partnership with the national NGO called "Fórum Natureza em Perigo" as stipulated in the early application was unfortunately revealed not strong enough and collapsed when the director of this

organization took his (long) distances with the project at the time of the already evoked funding cancellation by a national sponsor. This sponsor was indeed supporting financially numerous other projects also implemented (at least in part) by the same NGO...

It had been planned firstly that this partner could have acted significantly in project results dissemination (including methods for local people implication) and public awareness campaign for the conservation of the African wild dog in Mozambique. Such duties have consequently not been properly fulfilled yet so far.

Fortunately, another national NGO called "Justiça Ambiental" ("Environmental Justice" in English) recently expressed to the project leader its wish to occupy, hopefully with much more efficiency, the position left vacant by the FNP amongst the project national partners and to therefore reach similar purposes at the country level through diverse communication channels (incl. one quarterly informative leaflet on wildlife conservation and 4 monthly pages for articles on the same topic in the daily newspaper "O País").

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The Field interviews Survey already represents on its own a first level of local communities involvement, especially through the questions investigating on conflicts with and attitudes to the African wild dogs and other wildlife species, the large predators in particular but not only (many problem animals are not carnivorous, actually). For this process to evolve into environmental education on the species ecology, in dissuasion from persecuting and even into securing possible further implication of the local people in practical conservation actions/habits (see Section 2.4.) , the project first needed to work at a better perception of the species values and why it thus should be preserved.

The discourse used for such a purpose was passed on to the people through the traditional authorities and was articulated on the following elements.

- The African wild dog is declining in the world (on the continent) but Mozambique, and in particular the region where the community is settled, has the privilege to still possess some representatives of this charismatic wildlife species.
- The fact of being so rare nowadays creates an interest from tourists (national and foreigner) who may want to come to have the chance to sight the emblematic endangered species in question (potential ecotourism benefits highlighted, in particular direct employments and various services to tourists).
- The African wild dog does not represent a threat in terms of attack to people and domestic livestock (confirmed through interviews) so there is obviously no reason for direct persecution.
- The African wild dog presence corresponds in many cases to low densities of lions and spotted hyenas of which prejudicial behaviours (to people and livestock) are well known, making understand that a pack of a reasonable size could suffice to maintain such conflict carnivores at respectable distance (conceptual).
- Several species of herbivores causing damages to the local agriculture (bushpig - *Potamochoerus larvatus*, bushbuck - *Tragelaphus scriptus*, warthog - *Phacochoerus africanus*, common duiker - *Sylvicapra grimmia*, kudu - *Tragelaphus strepsiceros*, and eland - *Taurotragus oryx*, in decreasing order of problems induced) enter into the alimentary diet of the African wild dog that thus contributes to the natural control of such "problematic" herbivore species.
- Finally, it was sometimes referred to the few reports (through interviews) of local people taking opportunistically advantage of the prey the African wild dogs have just killed, in reference to the way these animals can be easily fled away from the product of their hunt so that people can make use of the meat.
- But such a practice was immediately dissuaded from through lastly evoking that the African wild dogs are also precious because they kill most often the less fit prey items (and thus maybe sick, making therefore the meat inconsumable...), what keeps the local population of the related species (medium-size antelopes corresponding most of the time to the species also harvested in traditional hunting) healthy.

Maybe solutions to potential future problems with African wild dogs (inspired from experiences elsewhere in similar conditions), such as domestic livestock depredation or interferences with traditional hunting, could have been presented. But they were not, for not unwittingly giving rise to such conflicts that were not spontaneously mentioned as such by local respondents to the field interviews.

Involving, as an additional local stakeholder to the project, the hunting safari companies operating around the Niassa NR (definitely representing another group of people influenced by and having overlapping interests with the issues involved in this project) has been greatly facilitated by the relatively high density of wild herbivores in the area, making that competing conflicts with the resident African wild dogs on size and availability of the referred herbivore populations had not been experienced yet.

In a longer term perspective for the conservation of the species in the respective hunting concessions, the managers were actualized on its ecological characteristics, especially the wide ranging behaviour, highlighting that spatial avoidance should suffice to surpass such conflicts if they were to occur. Contact details have been exchanged so that effective communication on a potentially emerging problem with African wild dogs will hopefully favour moderate and scientifically driven concerted solutions in the field instead of heading straight to the more radical direct persecution. Additionally, it will also be possible to communicate on trends in African wild dog sightings that the safari field responsible persons have many times promised to keep on recording with caution.

## **6. POST-PROJECT FOLLOW-UP**

### **6.1. Dissemination of results**

At the national level, the most advanced results from the project were recently put at the disposal of the most relevant national research institutions and of the authorities competent for wildlife management (as presented in previous sections). The first are responsible for forwarding such results to the national scientific and conservation communities, the second for transmitting them to their field representatives and for deciding, once concerted, on the best local measures and major enlightenments for further policy-making towards the conservation of the African wild dogs and associated wildlife species in the field. Other Mozambican institutions (Ministry for the Co-ordination of Environmental Affairs, UEM Faculty of Veterinary Sciences...) and conservation-orientated organizations (WWF-Mozambique, IUCN-Mozambique, EWT-Mozambique...), whether occasionally supporting the project or simply familiarized with, were also provided at the time of their punctual participation with intermediary results and/or feed-back on fieldwork implementation.

The two public presentations in Maputo of project progress (see Section 2.5.2.) aimed at awareness campaigning towards a wider public including public/private sector, NGO's, cooperation agencies and international organizations represented in the country, to whom results available at that time were also presented.

Internationally, the project managed to maintain endorsement from the IUCN/Species Survival Commission Canid Specialist Group (CSG) along its course, what enabled the field researcher to take part to the recent Botswana workshop already referred to (see Section 3.). The ultimate scientific results from the project were presented there to that same body who had repeatedly recommended survey/awareness work towards the conservation of the species through the successive publications (1997 & 2004) of the previously mentioned specific status survey and conservation action plans (see Section 1.3.).

A first international workshop held in late 2004 on "Research for the conservation of the African wild dogs" (Kruger National Park - South Africa, 25<sup>th</sup>-29<sup>th</sup> October 2004, IUCN/SSC CSG - WCS) already counted with the presence of both project supervisor (Dr. C. Sillero, currently Chair of the IUCN/SSC CSG) and field researcher (see agenda, Annex J) and preliminary results on African wild dog conservation status in the northern Sofala province (surveyed during 2004) had already been presented on that occasion to the represented scientific community (see pp. 65-66 in workshop report, Annex K).

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It is strongly hoped that the project could benefit from continuous support from the same authoritative entity so that the associated various communication channels could be used for disseminating the results from still numerous forthcoming data treatments execution or improvement (prey-predator relationships, competition with other large carnivores, intraspecific interactions, direct conflicts with people/indirect consequences of human activities and land uses, ecological/anthropogenic pressures potentially faced by the population, advanced demography to help discriminate most actual threats etc. till final management recommendations). Another associated expectation inveterately maintained up to now is that the most relevant research deliverables and methods will be presented in a concise, precise and technical style through the publication of scientific papers in appropriate journals (including Oryx, Frontlines, Wildlife Conservation, relevant BP publications...).

The present reporting process to the BP Conservation Programme 2005, although the name has now changed to Conservation Leadership Programme, is also hoped to evolve in the vast dissemination of

information on and results from the project which the Organisers once signified they would be committed to, at the condition, of course, that the standard of the work was actually sufficient for doing so...

## **6.2. Success evaluation**

Such a vast dissemination of pieces of information previously unknown to the international scientific community and resulting from the project might already be taken into consideration for the assessment of its success. Other indicators could include the possible future implementation of consequent management measures towards African wild dog active conservation in the field, the expected impact of the project on future national policy-making in the matter, the number and diversity of national/local stakeholders actually involved in the project as in continuing conservation efforts, and finally the intended ongoing activities combining research and action to be grounded in the most recent evolutions (see next Section). In a longer term vision, the stability or growth (better) of the newly identified local populations would represent the final evidence that the present initiative will have reached its ultimate goal.

Nevertheless, for a more immediate and pragmatic evaluation of success based on technical merit alone, the methods used for field data collection such as the ones applied for the scientific analysis of same data and interpretation of results from, are described in details in the scientific document (Annex B, section 2). The Quirimbas National Park (without the islands) actually covers 7.5% of the entire Cabo Delgado province extent, and the Niassa National Reserve 34.4% of the province with same name, so that the two areas taken conjointly represent about 6.0% of the total Mozambican national territory. Other quantified parameters that could inform on the level of success of specific project components such as the proportion of actual respondents to field interviews within the total population of the area, the number of national/local counterparts having benefited from awareness/education/training programmes or frequency of public talks on project work and results can also be deduced from the text above, under the respective specific components related sections.

The only breach is that, although the most recent results from the project have already been largely diffused (as detailed in the above lines & sections), the methodologies used to identify and describe the individual packs from basic field data (Redundancy analysis and geographical preliminaries, see 2.1.3.3- Sections B.2.1 to B.2.4, in Annex B) and therefore the interpretation of such a grouping pattern in terms of habitat preference (results of Habitat analysis, see 2.2.3.1 to 2.2.3.5 in Annex B) and packs/local population first demographic characteristics (Preliminary demography, see 2.2.2.4- Sections A to C in Annex B), have not been scientifically validated yet.

The very short term (December 2007) since authoritative scientific references have been actually approached with a request of that nature, and provided with the related documents to comment on, is the only reason to be put forward to justify such a situation.

Any stakeholder having received project results so far, and potentially interested in using them judiciously, was informed upon submission of such a still pending confirmation that sound scientific principles have been respected at every step of the work that furnished the referred deliverables.

As such authorized comments and recommendations for improvement of the "pilot" scientific report prepared only for the Cabo Delgado province so far (Annex B) have not been emitted yet, it would have appeared a bit precipitated to already run analysis further than individual packs identification for the other surveyed region (western/southern sectors of the Niassa NR), should the methods set-up so far for doing so and for any existing analysis (incl. Habitat analysis and Preliminary demography) change radically according to the scientific feed-back to come.

For similar reasons, it was also found delicate to already turn public the details of all the African wild dog direct sightings (82) in the Niassa NR (while provided in the scientific report for the Cabo Delgado province although same restriction is also applicable), but only of the ones serving for the identification of individual packs as practiced so far (32 sightings, see Annex C), as it would not be fair such an exercise to be conducted differently on more adequate science principles, without having given first the opportunity to people now involved in the project for up to 7 years (field identification mission in 2000) to get educated on such principles and methodologies inspired from.

### 6.3. Possible post-project conservation actions

A "National Enquiry Process" to investigate at distance (telephone, post/electronic mailing) the status of the African wild dog at the scale of the country is planned for a long time (see Section 2.5.2.), and didactic material is ready while the database of potential recipients is today well provided after having been completed and updated continuously during the last years.

This operation could even be launched and conducted from outside Mozambique, and requires only limited time and means (but post mail, very exceptionally used).

Both for pursuing locally the long-term African wild dog conservation achievements this project was grounded into and for addressing practical issues actually raised upon its field implementation, the most appropriate ongoing conservation actions would certainly be the continuation and intensification of relevant local stakeholders (chiefly rural communities and safari operators) environmental education and awareness-raising, in view to mitigate the anthropogenic threats that have now been identified and ranked (see Table 1) for each area where surveys actually took place (incl. northern Sofala province in 2003/2004).

Table 1: Potential anthropogenic threats to 3 African wild dog populations in Mozambique and ranking of intensity on each of the 3

Potential anthropogenic threats	RANKING		
	Quirimbas NP	Niassa NR	North of Sofala
Conflicts on attacks to people	10	12	12
Conflicts on livestock depredation	8	10	10
Conflicts on interferences with traditional hunting	4	2	3
Conflicts on interferences with professional hunting	-	3	5
Conflicts on interactions with domestic dogs	9	9	7
Conflicts based on unfounded general fears	5	11	6
Accidental snaring (& other non-selective practices)	1	1	2
Habitat fragmentation (agriculture, bushfires...)	2	6	8
Low prey densities driven by traditional hunting	3	4	9
Low prey densities driven by professional hunting	-	5	11
Infectious diseases transmitted from domestic dogs	7	7	4
Road traffic accident	6	8	1

While already launched by the project team when working in the field (see Sections 2.3., 2.4., 4. & 5.), the referred campaigns would now benefit from a better tailored design, approaching individually local communities and other actors with conservation discourses/activities more specifically adapted to the nature and level of threat they actually represent for the African wild dogs of their own region, and could thus be expected to reach a much higher efficiency. Indeed, the respective individual packs description and home range limits assessment are now at disposal so that local people the most determinant for the conservation of each pack can be deduced from the location of the human settlements each pack in question is surrounded by.

Once the most important locally settled stakeholders would have been like so identified, it would also be possible to then conduct an extension work towards them much more orientated to the actual threats each is the most likely to generate through the conjunction of its attitudes, activities & land uses.

Priority would then be given to threats to be mitigated (local stakeholder groups to be approached) through local conservation efforts according to the single ranking of all the potential anthropogenic pressures that has now been determined specifically at the level of each of the African wild dog studied populations (see Table 1).

As far as research is concerned, especially in terms of fieldwork to continue collecting useful up-to-date baseline data (whether to identify new subpopulations or to monitor the already described ones as "sentinels" to depict new emerging threats) informing on conservation status of the African wild dog in Mozambique, the state authorities recently confirmed their interest for similar surveys to finally be carried out in the Gilé National Reserve (Zambezia province), as it was already advised to the project in late 2003 (see Annex I), and in other key-areas for the conservation of the species in the country (northern & western Gaza province making part of the Great Limpopo Transfrontier Park - GLTP - such as Banhine and Zinave National Parks, with contiguous Coutadas 4 & 5 respectively in northern Inhambane and southern Sofala provinces, the area South of the Cahora Bassa dam in Tete province, from western Niassa NR to Lake Malawi, the upper North Cabo Delgado province eastern to Niassa hunting blocks A & B). Their perspective is the completion of the national status survey preliminary to the elaboration of a national conservation strategy which the project has recently be invited to contribute to by DNAC representatives

who attended the same workshop in Botswana (December 2007). But this will also enable explaining better connectivity between the Mozambican subpopulations among themselves and/or with other populations in neighbouring countries (Kruger NP in South Africa, Gonarezhou NP and Mana Pools NP regions respectively in Southeast and northern Zimbabwe, Lower Zambezi NP in Zambia and Selous GR in Tanzania).

----- **Confidentiality starts here. Thank you.** -----

#### **6.4. Proposed follow-up work**

But for truly being built-up on the results from the project reported here and demonstrating long-term benefits actually contributing to ongoing local conservation priorities it originally raised, follow-up work should not take into account only the output constituted by the reviewed and ranked potential anthropogenic threats to each identified population as presented above (see Table 1), evolving in the possible application of conservation measures among the ones proposed so far (environmental education programme, awareness raising campaign, rural development, law enforcement...). Indeed, such future work should better also consider results from the original project research component itself which informs, through the demographic and ecological aspects it tackles, on the actual vulnerability of each of these populations to the potential threats just referred to, any of which could then be revealed as rather immediate and thus not only "potential" anymore.

This because the damages a given threat can cause to a population of African wild dogs do not depend only on the intensity with which the threat affects the local population in question but also on the capacity of the latter to endure, according to balancing mechanisms, specific behaviour and other intrinsic factors, the prejudicial effects of the former. Some populations, of the least capable to endure, could thus appear in (much) more perilous status than others and should therefore concentrate the efforts of any further practical conservation action in the field focused on of the endangered African wild dog in Mozambique.

While in the North of the country the relevance of the potential ongoing conservation efforts just underlined can of course not be contested, such as the related conservation benefits for the species that will ensue from, the truth is that there is in Mozambique another African wild dog local population currently in a much more critical situation and therefore more urgently requiring serious conservation reinforcement:

##### 6.4.1. The northern Sofala province African wild dog population

If the Niassa NR is the only area of Mozambique where African wild dog sightings never actually stopped, even during the 1976-1992 civil war period (Lobão Tello 1986), and were reported with enough details for being scientifically recorded again since 1995 (with some more intensity in the last year before this project but in the western/southern sectors it actually surveyed), while sightings were also sporadically reported since 2002 from the Cabo Delgado province although not sufficiently detailed to allow any scientific record prior to this project, the local population identified through its 2004 component in the northern Sofala province was, on the other hand, absolutely unknown to the international conservation community. The data from the referred field survey (and interpretation of the results provided by their analysis) thus constitute the most significant new finding the project has delivered to science so far, and the recent updating of the status/distribution map of African wild dogs for the referred region of Mozambique (9 northern districts of the Sofala central province incl. 2 official conservation areas and 6 safari hunting concessions) was conducted at the December 2007 workshop (Botswana) on no data other than these.

##### *6.4.1.1. Demographic characteristics typical of a small population*

Similar field surveys (but Signs of presence Survey, see Section 2.1.2) than in the Cabo Delgado province and the Niassa NR were conducted in the northern Sofala province, namely

\* a total of 222 interviews in 71 local communities (out of the 197 identified within the area, see Annex O), of which 107 (48%) with an African wild dog sighting report, 96 with exact location and 91 also with

additional description information that were passed on to the IUCN/SSC CSG at the Botswana workshop, together with individual pack reconstitution and assessment of home ranges (Field interviews Survey),  
\* 274km of secondary roads and tracks (divided into 14 distinct transect-lines) were driven for assessing densities of the herbivore species that were directly observed (Distance sampling Survey),  
\* and 32 exact locations where spotted hyaenas and lions were attracted to at night with specific sounds played-back according to the same particular protocol than the one followed in northern Mozambique incl. semi-random stratification per vegetation types (Call-in stations Survey).

As a result, one previously unrecorded African wild dog population was revealed as actually resident in the area through methods of data treatments similar to the ones defined for the identification and description of the individual packs found within the Quirimbas NP (see Annex B).

This was made of 4 individual packs only (as the one in the Gorongosa NP should be considered as doubtful and was discarded) that were identified and described with the assessment of their respective home range limits (see Annex P, Findings summary for the northern Sofala province).

The size of the local population was 46 individuals in total, when considering together the last sighting of each pack within 2003/2004, made of 27 adults, 16 yearlings and 03 pups, for an adults-to-juveniles ratio equal to 1:0.70 while three packs out of the four were last seen with juveniles (75.0%). The mean pack size at that time was 11.50 (6.75 adults + 4.00 yearlings + 0.75 pups).

#### *6.4.2.2. Multiplicity of recent and current potential anthropogenic threats*

- Because the region is also characterized by low human density and extended areas under the responsibility of private hunting concessions managers (note that home ranges of all 4 packs, whether represented by a polygon or by a larger circle, are almost entirely contained within the same 1,500 km<sup>2</sup> or so of a single hunting reserve, the "Coutada nr. 12", see Annex P), the potential anthropogenic threats to the African wild dogs of the northern Sofala province could have been thought to be scaled in a similar order than for the Niassa NR, regarding to apparently comparable environmental conditions.

- But unexpectedly, and although (as for Niassa) the threats potentially evolving from traditional and/or professional hunting activities in the area effectively appear high ranked (see Table 1) on the respective scale built-up for the northern Sofala province (non-selective subsistence hunting techniques or interferences with traditional/professional hunting practices, but not low prey densities driven by these regarding to the exceptionally high prey biomass supported by the limited area the entire population focused on seems confined to), road traffic accident emerged as the most actual threat to the referred population.

Indeed, the research team directly observed 5 carcasses of African wild dogs dead from such cause between 2003 and 2005, while within the 96 direct sighting reports already mentioned as having been collated from interviews in the area, not less than 14 (15.6%) over a 10-years time period (1994-2004) were of individuals found to have died from a vehicle collision along not more than the only 130 km of practicable secondary roads and 40 km of a short tarred section crossing the region.

- Non-conflict-related threats mostly ensuing from every-day-life activities and land uses (habitat fragmentation by shifting agriculture & bushfires, conflicts on livestock depredation...) are made no so much immediate by the very low number of people actually living in/around the already underlined small area the African wild dog packs were located into. But other particularities are that, although only a few, all the local residents in question are keeping domestic dogs (recent information came that 5 or 6 dogs of one same logging concession owner in the area successively died during the last 2 years from a heart infestation by a parasitic worm known to be transmissible to *Lycaon pictus*), thus making the related threats (infectious diseases transmission from and conflicts on interactions with domestic dogs) more probable, and that astonishingly unfounded fears mainly based on pure ignorance (not really from the local people, having sometimes already been put involuntarily in close contact with the species without for all that having suffered any damage, but rather from regional travellers simply crossing the area on the road) are likely to have already caused the death of some individuals as well (one interviewee reported having deliberately killed "some" African wild dogs with his car when driving on the already referred short road network, only because he did not know what those animals were when he saw them and got "scared").

- Of course these potential human threats were identified, and their respective intensity classified like such (Table 1), on the basis of data that had been collected in 2004 so that changing environment conditions in the between time (4 years) could have turned the once most immediate pressures whether not topical anymore or more accentuated either, while other ones could have had emerged. Along these years, the



project has thus frequently gathered information from the area in order to remain updated towards this particular conservation issue and it must be said that prospects for the African wild dog population living in there have not evolved positively at all, even turning worse than in 2004.

- Firstly, it seems that more and more people are coming to settle along the road that crosses the African wild dog restricted area (the traditional chief in one of the only few human settlements in 2004 had indeed manifested his intentions of "expansion" when interviewed at that time). This is likely to increase rates of both subsistence hunting (most probably with non-selective hunting techniques as practice of selective ones is absent at a larger scale), of interactions with domestic livestock/dogs and of deforestation for agriculture purposes in the region, the latter (and the first) intensified by the recent opening of several new logging concessions (and residence of workers) in this fairly dense woodland vegetation (another particular feature of this African wild dog population since the species uses to favour semi-open habitats).

- Also, "Sena Sugar Estate" company re-started functioning completely in 2005 and is constantly expanding sugar cane exploitation in the Zambeze river estuary (right bank, Marromeu). Although the production is mainly transported by boat/train far from the area looked at here, the increasing human activities (and densities) driven in the entire subregion by such an industrial complex has already provoked a significant intensification of the traffic on the only road linking Marromeu to the rest of Mozambique, the one on which African wild dogs dead from road traffic accident were already found so often.

The finalisation in a very close future of the road bridge over the Zambezi river in Caia (Northeast of the area in focus) will certainly bring rapid vehicles traffic intensity to the highest possible levels on the already referred small tarred section (40 km South to Caia) these African wild dogs are concerned with ("Estrada Nacional no. 1", crossing all Mozambique on a North-South axis from Maputo to Pemba, and therefore supporting a large majority of the national goods/persons transit).

- Moreover, the collaboration of each of the respective managers of the 6 safaris hunting concessions of the area that had been raised by the project during the 2004 fieldwork season, evolving in the proposal of some to participate to further monitoring of the species, and in the promise from all to first refer to this project (contact details had been exchanged for such purpose) before engaging into direct persecution with the African wild dogs (in case these would have started to interfere anyhow with their commercial activities), is much likely to need renewal. Indeed, most of those persons have now been replaced by new managing teams, while additional hunting concessions were also created, and there is no idea at the moment neither of the level of awareness of these supplementary stakeholders towards the issue of conserving the local African wild dog population nor of the degree of collaboration from their part that could be gained thereafter (or of the risk such new local actors might actually represent...).

- Finally, the possible ecological impacts of the recent (2006-2008) massive restocking of wild herbivores in the nearby Gorongosa National Park (which increase in supported biomass could finally make the African wild dogs enter into) must also be kept in mind as some eventually prejudicial environmental responses (e.g. higher density of spotted hyaena and lion populations), especially in areas where the species in focus would also be attracted by a better prey-base but then competed by larger carnivores (or facing new additional threats making that benefits global balance of having moved is finally negative, sink effect), can not be excluded.

If now considering preliminary demography of the concerned population, although only a few estimators have been made available so far by this project (see previous Section), in the context of the now reviewed potential threats to it as identified in 2004 and of the possible amplification/diversification of the same (whether having already occurred along the last 4 years and still to come in a close future), it then becomes obvious that its vulnerability is of the most exacerbated.

#### *6.4.2.3. Factors amplifying actual impact of the identified threats*

- The two particular features exhibited by the northern Sofala province African wild dog population the most relevant for its conservation are, its unusual small size, totalizing only 27 adults when lastly assessed (see Annex P), and its extreme geographical isolation, the closest place where African wild dogs presence is confirmed being not less than 420 km away (Save Conservancy in eastern Zimbabwe), with the first official conservation area inhabited by the species at a distance of 540 km (Gonarezhou NP, Northeast of Zimbabwe), and of 660 km for such an area to be in Mozambique as well (Niassa NR).

The conjunction of these conditions makes that the options left to the population in question for balancing variability due, at least in part, to chance and random events (stochasticity) become notably scarce.

- Especially when a population is so much reduced in number, the natural variations in birth/death rates (demographic stochasticity, factor intrinsic to each individual of a population), eventually coupled in the case of African wild dogs to an "Allee effect" (compatible breeding males and females never encounter because of low density, like a dispersal in African wild dogs that fails because the 2 sufficiently unrelated groups of same-sex siblings never join to create a new pack), are more susceptible to bring, by their only effects, the population down to much smaller sizes. So small that its vulnerability to other ecological factors, whether intrinsic as well (like genetic stochasticity) or extrinsic (like environmental stochasticity: food, competition, predation, parasites, diseases... incl. climate and natural catastrophes), of which effects are normally endured without significant decline by large and healthy populations, can dramatically increase and precipitate the population into complete extinction under the effects of the combination of these only random ecological factors (whatever the chronological order they act in, extinction vortex).

- For the extrinsic ones in particular, which affect population as a whole and not individually like when intrinsic (chiefly demography & genetics), the limited extent of the sector wherein the 4 packs of the northern Sofala province seem to have established their home ranges is likely to represent an aggravating factor, as such an unusually concentrated packs grouping pattern makes that the all population could be affected seriously by a single random event in only one time (e.g. an infectious disease outbreak), even if the scale which the referred event would act at was very local.

- Now if the same population comes to be isolated as well, like the African wild dogs in the northern Sofala province are, the loss of genetic variability emerges as an additional intrinsic factor which, if not remedied by migrations/movements of its members (gene flow), is also capable to greatly affect its viability. Indeed, the intensity of the accelerated genetic drift is then inversely proportional to effective population size ( $\Delta F = 1/2N_e$ , where  $\Delta F$  is the expected loss in heterozygosity per generation in a small an isolated population and  $N_e$  the number of breeding adults within the population that actually take part to reproduction, Wright 1931) and frequency of alleles can then change, from a generation to another, on the single effect of chance. In addition, any occasional severe reduction in number of an already small population can also lead to the definitive loss of rare but dominant alleles (genetic bottleneck), making then possible for depreciator recessive ones to be expressed, all the more likely than risks of inbreeding depression are once alternatives of reproduction mates remain only a few and homozygosity level is high.

- Although it is true that a comprehensive molecular genetics study (Girman et al. 2001, see Annex Q), including the analysis of microsatellite allele loci (to measure allelic variability and heterozygosity level) among 280 African wild dog genetic samples from 7 different areas/populations, demonstrated that levels of genetic variability were similar within each population and that recent overall decline in African wild dogs number did not seem to have caused (yet) a dramatic reduction in genetic diversity within each of the same, the issue however remains significant to the conservation of the small and isolated population which is focused on here.

- First because the individual populations concerned by Girman's conclusions on genetic variability observed within were large and stable ones, what is not the case in the northern Sofala province. But also, and most importantly, because such appreciable levels of genetic polymorphism are the most surprising, even for healthy populations (African wild dog historically small population sizes should have inevitably led to genetic drift and loss of associated variability, from  $\Delta F = 1/2N_e$ ), and scientifically explained so far for these only by behavioural responses (migration somehow but mainly strong inbreeding avoidance) that are made very difficult to adopt by the individuals of the population looked at here due to the conjunction of its three unusual characteristics highlighted so far (small, confined & isolated); dispersing within the population leads sooner or later to inbreeding risks (4 packs, 2 breeding adults per pack,  $N_e = 8$ ) and dispersing outside inevitably implies long dispersal distances.

- It would then be fascinating that genetic drift had not been acting yet within the northern Sofala province African wild dog population (regular mutations being the only alternative left for this not to be), and questioning whether or not loss of genetic variability is currently occurring within appears the most relevant. This should therefore be urgently responded to through appropriate investigation of current heterozygosity level, as of trends in recent changes and possible future ones, with results eventually translated into immediate conservation measures according to the very next findings on the matter.

- But isolation of a population is generally also expected to also lead to its genetic differentiation and African wild dogs, although being highly mobile like many wild canids and long distance dispersers for which such differentiation between populations should thus be minimum (gene flow being max.), actually presented a high level of genetic distinction between the 7 populations of the same 2001 study, most likely to be due to their actual physical isolation one from another through habitat loss, hunting, diseases...

- Genetic distinction of a population clearly increased its conservation value and can be assessed through the number of haplotypes and microsatellite alleles unique to it, or through the degree of distinctiveness between the genotype(s) exhibited by its members and the one(s) found among individuals of other (surrounding) populations of the same species.

In his 280 samples study, Girman found (2001) a total of 8 mitochondrial DNA control region genotypes (=haplotypes, see Annex Q), some of them shared by many populations (not unique to any) and plenty of samples (e.g. haplotype S2 shared by 4 populations out of 7, namely Etosha, Moremi, Hwange & Kruger, and by 118 samples out of the 280), but others unique to a single location/population and much more rare in terms of individuals samples were taken from (e.g. haplotype E3, unique to Serengeti + Masai Mara, only 09 samples out of 280), then conferring to the related population the conservation value just referred to.

#### 6.4.2.4. *Recently revealed outstanding conservation value*

- Genetic differentiation is precisely the level of consideration of conservation relevance at which the African wild dog population identified and described by the project in the northern Sofala province should unequivocally retain unanimous and urgent support from the international conservation community.

- Indeed, opportunistic events made that genetic samples were taken from 3 individuals of this population when found on one single occasion in October 2004, after they died from vehicle collision (see Annex R, Necropsy Report), and the material was recently analysed for the purposes of a currently running comprehensive molecular genetics study of *Lycaon pictus* all over its range.

- Results are incredibly interesting as a new mtDNA control region genotype (in addition to the 8 previously identified through analysis of 280 samples) has been found (December 2007) for the species in the only 3 samples the project submitted to the specialists who named it **M1** (M for Mozambique).

- This means that the new M1 genotype is, from one part, unique (until other individuals with same genotype are found elsewhere) to the northern Sofala province African wild dog minuscule population (making that the newly found genetic type is thus represented today by only 46 animals in the wild, or possibly less as it is not even known yet if M1 is shared by all the 46, or only by some of them as it was by the 3 found dead).

If now compared to the eight previously identified haplotypes, whether as unique to a single area/population as well (respectively S1 in Kruger NP with 39 samples and S3 in Selous GR with 24 samples) or not (S2, Z1, Z2, E1, E2, & E3), the M1 genotype is from far the one represented by the smallest number of individuals having been analysed for such purpose (only 3 samples out of 283), what makes it the rarest.

Uniqueness and rarity are not the only 2 features of the new M1 genotype coming to highlight the conservation priority that should be attributed to this local African wild dog population. Others such as its degree of distinctiveness (expressed by the number of substitutions across nucleotide sites on the mtDNA control region specific sequences) with the genotypes found in the other populations, surrounding or not, and its belonging to 1 of the 2 distinct and highly divergent control region sequence clades (eastern/southern Africa ecotypes) in which Girman had grouped his 8 haplotypes (depending on a number of sequence divergences low enough with other genetic types found in the same clade, and simultaneously high enough with the genotypes found in the other clade, according to the author's definitions), are the most unexpected as well and question connectivity much further, but the scientists team currently in charge of the referred research has requested strict confidentiality on these specific aspects until related results are officially published (Head: Clare Marsden, Molecular Ecology Group, Division of Environmental & Evolutionary Biology, University of Glasgow, Tel.: +44 141 330 6625, <c.marsden.1@research.gla.ac.uk>).

#### 6.4.2.5. *Ultimate justification as a high conservation priority*

According to the now detailed multiplicity of potential threats the northern Sofala province African wild dog population is (will be) confronted to, of which effects on are likely to be amplified by particular demographic characteristics such as its small size, restricted ranging area and geographic isolation from other African wild dogs, the status of this population should be today considered of the most perilous. Considering furthermore that are found among its few members, but in unknown proportion, the only representatives of the rarest mtDNA genotype recently found in African wild dogs, what moreover makes it unique to this only area/population in, it then becomes impossible not to realize that planning of conservation reinforcement for the referred population count among the highest priorities.

## 6.4.2. Aims, objectives & methods

### **A- First aim (Action)**

To urgently implement in the field practical measures for the conservation of the northern Sofala province (central Mozambique) African wild dog population as recommended by the original project to mitigate the anthropogenic threats to it then identified, and possibly emerging in the meantime, in strengthened collaboration with all local/national stakeholders still involved in the issue and relevant additional ones.

#### A.1- First specific objective (**Action**)

To reduce road traffic accident mortality by implementing, with auspices of the relevant state authorities competent both in matter of wildlife (DNAC, DNFT) and transport/communication (ANE), practical measures that whether slow the traffic down on the sections revealed the most critical through the research component or facilitate the animals to avoid vehicle hazards, but always include strong educational efforts.

#### *Methods*

- Data from the original project (see Figure 1) provide road locations where African wild dogs were seen, whether alive or dead from road traffic accidents. Comparison in the field of these sites one with another, eventually coupled to results to be progressively provided by the advanced research component described hereafter (more accurate assessment of home ranges/movements/habitat preferences and possible behavioural observations of packs on roads), will enable to locate the most appropriate places for limiters of vehicle speed (rumble stripes, speed bumps, other physical barriers...) such as for specific road signalisation, the latter for warning motorists to reduce and the former for forcing them to do so.
- Official approval for these placements will be gained by establishing links between the state authorities competent for wildlife matters in the area (DNAC, DNFT), possibly relayed by the safari operators (under DNAC responsibility) whose private concessions would contain any of the determined location, and the ones habilitated for matters of road network management in Mozambique (ANE, "Administração Nacional das Estradas", Ministry of Transport & Communication) where the project already approached some decision-makers with the issue. The Museum of Natural History (Eduardo Mondlane University) will certainly, in his already mentioned position of legally official advisor near any governmental body, contribute to increase networking towards the same purposes. Technical aspects such as design and dimension of the equipment, material to be used and proper placement will need to be discussed with the same stakeholders to whom the project will offer to conduct the proper implementation.

In the optic of also facilitating animals eventually on the road to be alerted of an approaching vehicle so that they can evacuate and therefore avoid the collision, fitting cars and trucks crossing the area with a special device acting for such purpose will be experienced. Aspects to be mastered are the proper nature of the element (most likely an ultrasonic whistle provoking sounds uncomfortable to the African wild dogs), the way to fix it on vehicles and whether this is done for being permanent (device "given" to the owner of the vehicle) or only temporary (between check-points at the extremes of critical road sections where the item would be fixed/removed by project collaborators), and the number of devices (and fitting kits) consequently required from the manufacturer upon selection (the most locally settled as possible).

A common advantage of the two just reviewed measures to reduce road mortality is their high visibility and that the needed equipment can therefore serve as education materials as well, starting point of an associated conservation outreach component. Indeed, as road kills have been demonstrated to sometimes be intentional, specific groups of professional drivers usually working on these roads (public transport, vehicles of private companies operating in the region for timber extraction, fishing, hunting, sugar production, agriculture, infrastructure building...) will be targeted by a specific education programme. Reasons for persecution will be investigated, and invalidated thereafter, whether from drivers passing through check-points (distribution of leaflets informing on purposes of road signs/speed limiters/acoustic device campaigns and familiarizing with the species, its value and status) or approaching motorists where they potentially congregate (village centres, offices/garages of employing companies, gas stations...).

## A.2- Second specific objective (**Action**)

To mitigate threats linked to bushmeat poaching (accidental catch, conflicts, low prey densities...) in areas identified of high risk through existing data, less on an anti-poaching approach than by rather generating alternative sources of incomes for local communities, and to diminish the same threats where hunting is legal (safari concessions, communal lands...) by adding a component of education/awareness on specific adaptations to its practice (locations, techniques, target species, intensity...) in order to overlap the least with local requirements of the species as informed by research work.

### *Methods*

First the areas exhibiting the highest levels of threats driven by interferences with hunting, whether traditional (proximity of human settlements, communal areas renowned for such practice, surroundings of logging concessions...) and/or professional (safari concessions limits, subareas within these where managed harvesting of wild ungulates is the most intense, especially of herbivore species counting among the potential prey items for the African wild dog...), will be identified on the basis of home range and habitat preference results from the former research, most probably completed by further enlightenments on mechanisms of ranging and habitat uses to be provided by the conjointly conducted scientific work.

- For the areas of these where the referred hunting activity will be occurring illegally (professional hunters outside the delimited private concessions, local subsistence hunters inside these same concessions or within other areas with restricted wildlife exploitation status...), conservation measures for the African wild dogs will consist in signifying to the stakeholders their contradiction with the law. The related official text and eventual credentials will be in possess of the field team, translated in the language the most familiar to the targeted groups of people and accompanied by other education materials for explaining to subsistence hunters the restrictions of the legislation towards their activity in terms of zoning (practice prohibited or allowed but with conditions), authorized hunting techniques (only "traditional" ones), pursued purposes (strictly for domestic use, no trade), wildlife species legally protected (which hunting is strictly forbidden in the country whatever the conditions) and seasons (hunting season open from April to September). The possible damages to an endangered species like the one in focus here, whether direct like accidental snaring or rather primarily affecting its prey base, will also be highlighted. This will give raise to an intensification of the environmental education/awareness process launched through the original project (see Section 2.4.2), but now better focused on the most relevant local actors.

- Further than anti-poaching and repression or denunciation, this project will favour the investigation near the concerned parties of the reasons for such departures from the rule and consensual solutions will be searched for.

The strong collaboration to be hopefully (re)built with safari operators will help to sort this out with them quite easily, as numerous other interconnections will be existing between their activities and this initiative. Regarding to the traditional hunters, the best way out definitely being the diversification of local sources of incomes, all will be done to truly find realistic alternatives to their subsistence practices. As this is addressed the best by finding a stable employment, a strong support in this perspective will be provided to them (integration into local development programmes for alphabetisation and education, personalized framing in the search for job vacancies through project networking and communication...), preferentially for finding professional positions valuing the best the capabilities they developed through the traditional activity it is looked to be put an end to here.

It could like so be envisaged, in partnership with the hunting reserves managers for this to take place on their land and thus also benefit to them, that the project launches sight-seeing touristic circuits, eventually orientated to African wild dog direct observation and thus serving additional outreach purposes, where knowledge of the area and tracking skills of the referred local traditional hunters then acting as field staff members (contracted) would be the best reconverted (tracking, detecting wildlife by sight, guiding...). Additionally, the meat made available through the professional hunting activities running in the region could benefit to more local people than to the only respective safari staff members' communities as presently, simply by organizing better its transport and preservation (cold chain) from the hunters camps to the enlarged pool of potential consumers. This would prevent tons of meat to be rotted away along the professional hunting season while additional wild animals are killed a little bit further for the same purpose.

- Discourses for requesting in the soft way to local people authorized to practice subsistence hunting activities to pay a particular attention to African wild dogs conservation has been improved through the

former fieldwork sessions (see Sections 2.4.1., 2.4.2. & 5.) and will now be held to the most relevant (according to African wild dogs distribution) northern Sofala province groups of residents found to be in such situation. Although they will also be approached with the same proposals than to the bushmeat poachers as just mentioned, it should be kept in mind that these might not arouse their interest while mitigating accidental snaring (to which *Lycaon pictus* is particularly sensible, especially the alpha-individuals, due to its itinerant habits and large home ranges in remote areas) and other detrimental effects of same activity (authorized subsistence hunting) absolutely needs to be addressed.

- To help on this matter, advanced data on prey selection and alimentary diet of African wild dogs will be collected through the conjointly led research efforts based on individual packs intensified observation (see hereafter), will serve to investigate the aspects of the traditional hunting practice (areas, techniques, species...) that make it the most in concurrence with or directly prejudicial to the studied animals.

Shifting in caught species (or enlarging the range of these), and/or in areas where traditional hunts are actually practiced, could eventually be managed from local hunters but it will soon be necessary to assume the responsibility to admit that programmes of practical training in hunting techniques more selective than snaring/blind hole/blind net (currently in use in the area) should be planned as the threat risen from the uses of the latter is the second most imminent (after road traffic accidents) to this population. Trainees would be subsistence hunters from regions of Mozambique where such more selective practices (arch/arrows, spear, baiting, visual netting...) are in course (Gaza, Tete, Cabo Delgado provinces) and the driver to the adoption of such new practices by the trainees would be a kind of inter-regional competition spirit (ensuring a success more than likely according to what the project has learnt so far...).

- The same advanced research results (prey selection and alimentary diet coupled to habitat use when hunting) will also serve to approach the managers of safari concessions with a similar request for their professional activities to be planned in a way of being the less disturbing to African wild dogs as possible (at least until this remains commercially acceptable). This will be the most likely achieved by requesting lower quotas for hunting the ungulate species to be shown as preferred by the studied packs, by maintaining herds of these species around the size that the most fits the packs requirements, by making the best use of spatial avoidance for interferences with African wild dogs to be the fewest...

### A.3- Third specific objective (**Action**)

To liaise with NGO's and national/international organizations acting locally in rural development and other relevant socio-economic areas for their implemental programmes to take into account considerations on African wild dog conservation, towards long-term mitigation of the threats to the species not to be directly dealt with by this project (habitat fragmentation, conflicts on livestock depredation, or on unfounded general fears...), at the exception of an emphasis on the domestic dogs problematic (infectious diseases transmission and conflict on interactions with) that it will also address.

#### *Methods*

Programmes of the numerous stakeholders (state authorities, local/national/international NGO's, bilateral/multilateral/international cooperation agencies...) active in the socio-economic development of the northern Sofala province local people will be reviewed, and the most dedicated to restriction of shifting agriculture, banishment of bushfire practices and introduction of adapted livestock husbandry (eventually already coupled to wild herbivores conservation as this helps preventing from domestic cattle depredation by wild carnivores) will be selected.

The field implementers will then be approached with a suggestion of the local communities where the application of their programmes will serve the best the conservation of the African wild dog population resident in the region, as determined through past and upcoming scientific fieldwork. Awareness-raising of the referred agencies would thus be attained at the same time and will hopefully result in these actually integrating the rural settlements proposed by the project into their action plan. If not, a request will be submitted to the same bodies for providing the means so that the project team can conduct there an extension work based on a similar approach than theirs (if expertise is sufficient).

The practical conservation issue of preventing domestic dogs from free roaming in order to avoid transmission of infectious diseases from the reservoirs they constitute to the African wild dogs, and also to reduce the risks of conflict on interactions between the 2 species, will be addressed by this follow-up project according to three main steps.

- First, the education effort already started by the original project on the subject, through highlighting the risks to bring into villages additional diseases that free ranging domestic dogs back from rides in the bush can represent, will be intensified towards the most relevant local communities (proximity to African wild dog areas and possession of domestic dogs). Advantages of keeping their dogs tied-up, or at least at eyesight, will be evoked with the owners (dogs always present, better guarding/cleaning, prevent livestock depredation by keeping wild predators away, no worries for damages they eventually cause while roaming...) and reasons for them not naturally doing so will be investigated further.
- Secondly, and only if the local perception of such a proposition is promising, basic equipment made of collars and leashes would be provided by the project to a pool of owners listed for their serious consideration of the matter. This will not only aim at turning more popular such a way of keeping dogs but also to facilitate it in the acts.
- Finally, an alternative or complement to the latter action is the possible setting-up of dog training programme through which owners and their domestic animals could learn the automatisms necessary to make that the 4-legged individuals obey when prohibited from going in the bush, even when not tied-up. Trainers would be recruited the most locally as possible to ensure better communication with the trainees such as sharing of similar conceptions on domestic dogs keeping, what would furthermore play for sure (precursor effect, like for many of the conservation measures proposed so far) an additional role in raising local awareness on the project and the endangered wild canid species it focuses on.

## **B- Second aim (Research)**

To collect additional demographic, ecological and behavioural data during repeated and longer-lasting direct observations of the few packs constituting the African wild dog population focused on in the northern Sofala province, so that specific results deduced from advanced research, made possible only along with fieldwork of such nature, will inform further both on refining conservation measures in course of implementation and on designing longer-term ones.

### **B.1- First specific objective (Research)**

To establish visual contacts with the individual packs inhabiting the study area and to maintain these for the longest time possible on each occasion so that data on directly observed daily activities will be collected to advance research on specific aspects (ranging, habitat use/activity, hunting, sociality...) that serve to refine running conservation actions in addition to results from previous scientific work of the project.

#### *Methods*

- As it appears clearly through the location of direct sightings reported to the original project (see Annex P), a specific road section already referred to above (see Figure 1) shows a significantly higher rate of frequentation by the African wild dogs of the region. Visual contacts with the respective packs are expected to be established repeatedly through cruising intensively on this particular section.
- Maintaining the established visual contacts (up to 3 days max. regarding to field team autonomy incl. food and water) will be achieved through the combination of traditional foot tracking, with the contribution of the most capable local trackers to be recruited according to their skills in interpreting wildlife tracks (African wild dogs, other carnivores, all herbivore species represented), and of acoustic simulations of the African wild dog "Hoo" (long-distance) call using playbacks and megaphones, this conservation tool having proven to provoke actual approach of the animals in 84% of the cases, at the double condition that these are active when called-in and within a distance at which sounds are audible to them (around 2 km according to the audio equipment used in the documented methodology).
- Whatever the duration of the direct observation, the identification of individual African wild dog will be based on photographic records of any single animal given to be seen, in the most postures as possible, so that the description of each fur coat pattern (and other individual characteristics of the anatomy) is made.
- The conjunction of these techniques has demonstrated particular suitability to attain the related purposes in studied regions where road networks are limited, and where dense vegetation does not prevent only from off-road driving but also from the use of classical telemetry techniques which rely greatly on the same favourable conditions (off-road practicability and open to semi-open habitats) that definitely do not characterize this region of the northern Sofala province. Furthermore, risks associated with immobilizing

and handling African wild dogs for radio-collaring purposes have already risen past concerns and are still considered nowadays as non-zero.

- Detailed information (GPS fixes) on the movements of the packs in relation to crossed habitat types, covered distances per time unit or succession of resting points, and repeated observations of the same packs along the fieldwork period, will continuously increase the accuracy of the assessment made so far of their home ranges/habitat preferences and will allow a deeper insight in the respective driving mechanisms.
- To be noted here is that such repetition in observations of packs which members will have been individually identified during their first sighting will also enable to monitor over time size of the groups and age composition fluctuations much more accurately than through the original research (see Section 2.1.), and better estimations of survival rate for each age category will thus be made possible.

Hunting activity in African wild dogs uses to be divided in two daily peaks (early morning & late afternoon) so that it is highly expected that related scenes could actually be observed during the successive long-lasting visual contacts to be managed with the packs. Number of chases, whether ending with a kill or not, will be recorded together with particular features of alimentary diet and prey selection in each case such as exact coordinates, prey item species, prey herd size, habitat type, distance covered for chasing, adopted hunting/killing techniques, other environmental conditions...).

The last observations that should also be experienced with an appreciable certainty due to daily practices of the African wild dogs (like moving and hunting) are the ones of intra-pack social interactions. The behaviour of each individual animal one with another while playing, hunting, feeding, resting or moving will underline internal social hierarchy of which main interest resides in the related effects on reproduction and breeding success.

Not properly looked at in this component of the research, unlike in the former one, faeces of the animals under study will however be collected along fieldwork, and durably preserved, as advanced molecular genetics techniques now make possible that these serve for DNA analysis. The samples will be sent to the research team currently investigating further genetic variability both between and within African wild dog populations across the species range.

## B.2- Second specific objective (**Research**)

To gather additional data from pack long-lasting observations that, once analysed, will inform again on the improvement of the conservation options applied to the population focused on and will also contribute to increase scientific knowledge on the species at large, but collection of which first depends on particular events in the life of the pack that will not be visually recorded on a basis other than opportunistic (reproduction, denning, birth, death, presence on roads, dispersal, physical interactions...).

### *Methods*

- If reproduction acts are directly observed within a pack, the implicated members will be recorded for contributing further to the description of social structure but also to assess the related success and to determine the one of breeding, the litter size or at least the number of emerging pups (and subsequent mortality within such age category if the pack comes to be observed again after pups are seen for the first time), at the only condition that the same pack is also encountered when denning thereafter.
- It will then be possible to also characterize the site of the referred den in terms of location, habitat types and other features, so that other areas offering similar propitious conditions could be identified and better preserved. The project will also benefit on such occasion from the longest possible observation periods of a same pack facilitated by the species habit to be much more sedentary around its occupied den than during the rest of the year (3 months/year, likely to be from June to August in the northern Sofala province). Number, ranking and individual identification of helpers, whether guarding the den or regurgitating to other helpers/mother/pups when back from hunting, will be noted down as well.
- Causes and consequences of death events will also be opportunistically recorded, in order to contribute to continuous updating of the major threats to the population in focus and to ensure this to be translated into more sharply adapted conservation measures.



- Dispersal events will hopefully be observed as well on the same opportunistic basis. The respective causes and consequences will then be also highlighted while the related movements will be geographically referenced in terms of distance, direction and possible influencing factors so that underlying mechanisms could be enlightened further, including how the group to disperse got formed within its home pack and why rates of mortality among dispersers are so high.

- Finally, and at the same condition that this takes place while the field team will be directly observing the pack(s), the behaviour of individuals implicated into physical interactions whether with other carnivore species, with members of another African wild dog pack entered in contact with or even with local people, will also be noted down. This will indeed provide a significant impulsion to the study already in course of the referred aspects of the species ecology (interspecific/intraspecific competition) as of its interferences (and possible conflicts) with human beings, and will eventually allow a better tailoring of practical conservation measures potentially influenced by these.

- In a similar perspective, it is particularly hoped that packs will be frequently observed when using roads (resting, travel corridors). Behavioural observations and more data both on nature, causes, duration, reaction to approaching vehicles, habitat conditions and other characteristics of such a notable habit will be collated and hopefully serve a more adapted design of the practical conservation measures devoted to reduce road traffic accidents on African wild dogs in the region.

----- **Confidentiality stops here. Thank you.** -----

## **7. FINANCIAL SECTION**

### **7.1. Amount received**

The USD 13,000 total award was received in Mozambique in two times.

On 27<sup>th</sup> April 2005, the equivalent of USD 9,679.49 was credited to an account in EURO (the only bank account in foreign currency actually accessible to the project at that time).

Amount received was EUR 7,533.00 (Exchange rate = 1.28494) as no commission was charged by the Mozambican (see bank credit official document, Annex L).

The remaining USD 3,320.51 were sent on 06<sup>th</sup> January 2006 and credited directly in USD (although exchange rate to EURO, 1.20802, was still mentioned on the related bank credit official document, see Annex M) as the project had acquired an account in such currency in the meantime.

### **7.2. Period covered by the report**

As notification of the award was sent to the field researcher by 24<sup>th</sup> March 2005, first month of fieldwork covered by the grant is April 2005 and funds were spent until June 2006.

### **7.3. Exchange rates**

The change in national currency (Metical, MZM) for EUR 1.00 oscillated between MZM 28,500 in early May 2005 and MZM 28,285.76 in early January 2006 but however averaged MZM 28,855.25 on the same period due to a slight increase in August. The average exchange rate in USD for the same EUR 1.00 was 1.24648 over the same reference period. The exchange rate in MZM for USD 1.00 to be used in this financial breakdown was thus set to MZM 23,149.39 (28,855.25/1.24648).

## 7.4. Expenditures

Date	Item details	MZM	USD
<b>1- PRE-PROJECT EXPENSES</b>			
<b>ADMINISTRATIVE</b>			
<b>1.1- Communication (tel, fax, internet, postage)</b>			
10/09/05 to 16/06/06	Telephone: landline + mobile (various receipts)	3,775,500	
05/10/05	Satellite phone SIM card and air time		207.09
23/04/05 to 19/06/06	Internet & computer facilities (various receipts)	3,795,000	
TOTAL Communication (MZM)		7,570,500	327.03
TOTAL Communication (USD)		-	<b>534.12</b>
SUBTOTAL (USD)			<b>534.12</b>
<b>1.2- Administrative regularization (Visas &amp; Permits)</b>			
10/11/05 to 10/04/06	BP project leader visa clearance	5,429,680	
TOTAL Administrative regularization (MZM)		5,429,680	234.55
TOTAL Administrative regularization (USD)		-	<b>234.55</b>
SUBTOTAL (USD)			<b>768.67</b>
<b>1.3- Travel insurance &amp; National flights</b>			
03/05/05	Travel insurance student 1 (Osvaldo CHACATE)	354,726	
15/06/05	Air ticket Pemba-Maputo (Osvaldo CHACATE)	3,799,000	
19/07/08	Travel insurance student 2 (Eliseu ARMANDO)	270,000	
07/08/05	Air ticket Pemba-Maputo (Eliseu ARMANDO)	4,199,000	
20/09/05	Air ticket Lichinga-Maputo (project leader)	4,379,000	
06/10/05	Air ticket Maputo-Lichinga (project leader)	3,879,000	
TOTAL Travel insurance & National flights (MZM)		16,880,726	729.21
TOTAL Travel insurance & National flights (USD)		-	<b>729.21</b>
TOTAL "Administrative" (USD)			<b>1497.88</b>
SUBTOTAL (USD)			<b>1497.88</b>
<b>EQUIPMENT</b>			
<b>1.4- Autonomous camping equipment</b>			
27/05/05	Collapsible beds (2), chairs (2), table (1)...	4,499,400	
28/05/05	Water carrier (2x20l), backpacks (3), sleeping bags (3)...	6,119,920	
TOTAL Autonomous camping equipment (MZM)		10,619,320	458.73
TOTAL Autonomous camping equipment (USD)		-	<b>458.73</b>
SUBTOTAL (USD)			<b>1,956.61</b>
<b>1.5- Scientific equipment</b>			
21/04/05 & 28/09/05	Computer supplies (floppy & USB Flash drive 256 Mb)	1,210,000	
15/05/05	Scientific calculator	279,800	
27/05/05	Rechargeable spotlights (Call-in stations) & lantern	6,319,200	
27/05/05	200W car power inverter (12/220V) - out of order SEP 05	1,060,000	
28/05/05	Electric plug standard adapter (for power inverter)	50,000	
26/09/05	300W car power inverter (12/220V)	4,309,200	
30/10/05	Audio-tape player (Call-in stations)	200,000	
TOTAL Scientific equipment (MZM)		13,428,200	580.07
TOTAL Scientific equipment (USD)		-	<b>580.07</b>
SUBTOTAL (USD)			<b>2,536.68</b>
<b>1.6- Medical supplies &amp; Health</b>			
20/04/05	Hospital consultation (dental care)	1,095,000	
30/04/05 to 10/01/06	Pharmacy (various receipts)	675,000	
15/06/05	Hospital consultation (emergency general care)	1,035,238	
TOTAL Medical supplies & Health (MZM)		2,805,238	121.18
TOTAL Medical supplies & Health (USD)		-	<b>121.18</b>
SUBTOTAL (USD)			<b>2,657.86</b>
<b>1.7- Consumables (photo rolls, batteries for GPS...)</b>			
31/05/05 to 29/11/05	Rolls & batteries (various receipts)	1,849,000	
TOTAL Consumables (MZM)		1,849,000	79.87
TOTAL Consumables (USD)		-	<b>79.87</b>
TOTAL "Equipment" (USD)			<b>1,239.85</b>
TOTAL "Pre-project expenses" (USD)			<b>2,737.73</b>
SUBTOTAL			<b>2,737.73</b>
<b>2- FIELD EXPENSES</b>			
<b>2.1- Vehicle (Land Rover Defender 130 Tdi): use, fuel &amp; maintenance</b>			

<b>2.1.1- Vehicle equipment</b>			
15/05/05	Hand pump & Siphon	259,800	
28/05/05	Pulling cable	1,580,000	
28/05/05	Mounting 4 new tyres BF Goodwrich All-terrain	24,000,040	
28/05/05	2 batteries	4,800,400	
28/05/05	Jerry cans (3x20l) & Sand trax rubber	3,696,000	
30/05/05	Canopy	10,001,169	
27/10/05	1 air chamber	300,000	
22/12/05	Glass sweepers	200,000	
TOTAL vehicle equipment (MZM)		44,837,409	1,936.87
TOTAL vehicle equipment (USD)		-	<b>1,936.87</b>
SUBTOTAL (USD)			<b>4,674.60</b>
<b>2.1.2- Spare parts and fitting BEFORE fieldwork</b>			
21/05/05	Master clutch & Clutch plate	6,816,200	
28/05/05	Various spare parts incl. Belt drive, Timing, Pressure plate...	22,376,000	
TOTAL Spare parts and fitting before fieldwork (MZM)		29,192,200	1,261.04
TOTAL Spare parts and fitting before fieldwork (USD)		-	<b>1,261.04</b>
SUBTOTAL (USD)			<b>5,935.64</b>
<b>2.1.3- Fuel, oil &amp; other services DURING fieldwork</b>			
05/05	Fuel (Maputo-Nelspruit-Maputo)	3,070,000	
08/07/05	Fuel paid to SRN Niassa		130.00
08/10/05	Transmission oil	600,000	
08/10/05	Motor oil	700,000	
28/11/05 to 21/12/05	Security parking in Lichinga (airport)	4,100,000	
22/12/05	Fixing secondary clutch pump	350,000	
31/12/05	Crossing Zambeze river	100,000	
04/06/05 to 23/01/06	Fuel for fieldwork (Maputo-Pemba-Lichinga-Pemba-Maputo)	28,213,306	
TOTAL Fuel, oil & other services DURING fieldwork (MZM)		37,133,306	1,604.07
TOTAL Fuel, oil & other services DURING fieldwork (USD)		-	<b>1,734.07</b>
SUBTOTAL (USD)			<b>7,669.71</b>
<b>2.1.4- Spare parts and repairing AFTER fieldwork</b>			
01/06/06	Motor oil	80,000	
02/06/06	Battery recharge	200,000	
02/06/06	White paint	75,000	
08/06/06	Cylinder head rectification	1,053,000	
12/06/06	Crankshaft (2 <sup>nd</sup> hand spare part)		400.00
13/06/06	Cylinder head join	900,000	
17/06/06	Mounting cylinder head join & crankshaft	9,000,000	
31/01/06 to 30/06/06	Fuel (various receipts)	3,000,000	
TOTAL Spare parts and repairing after fieldwork (MZM)		14,308,000	618.07
TOTAL Spare parts and repairing after fieldwork (USD)		-	<b>1,018.07</b>
TOTAL "Vehicle: use, fuel & maintenance"			<b>5,950.05</b>
SUBTOTAL (USD)			<b>8,687.78</b>
<b>2.2- Stipends local counterparts</b>			
15/07/05	Oswaldo CHACATE (student)		200.00
11/08/05	Eliseu ARMANDO (student)	4,000,000	
17/09/05	Magendo CHAIBO (locally recruited research assistant)	2,960,000	
23/10/05	João SANDAR (locally recruited research assistant)	1,420,000	
06/05 to 11/05	Gratification for interview (MZM 30,344/int.; 166 interviews)	5,037,104	
24/02/06	Eliseu ARMANDO (student)		100.00
TOTAL Stipends local counterparts (MZM)		13,417,104	579.59
TOTAL Stipends local counterparts (USD)		-	<b>879.59</b>
SUBTOTAL (USD)			<b>9,567.37</b>
<b>2.3- Transportation other than with project vehicle</b>			
23/09/05 to 27/09/05	Car rental (coordination mission in Maputo/Nelspruit)		202.80
23/09/05 to 27/09/05	Toll gate (Maputo-Nelspruit-Maputo)	410,000	
20/12/05	Air ticket Maputo-Lichinga (back from funds disposal trip)	5,379,000	
11/01/06	Bus ticket Inhambane-Maputo-Inhambane (car breakdown)	270,000	
TOTAL Transportation other than with project vehicle (MZM)		6,059,000	261.73
TOTAL Transportation other than with project vehicle (USD)		-	<b>464.53</b>
SUBTOTAL (USD)			<b>10,031.90</b>
<b>2.4- Accommodation for team members</b>			
12/04/05 to 23/05/05	Accommodation in Maputo (41 nights at USD 11.72/night)		480.60

06/07/05 to 08/07/05	Accommodation in Maputo (2 nights at USD 22.50/night)		45.00
10/07/05 to 05/08/05	Accommodation in Pemba (11 nights at USD 14.18/night)	3,610,000	
08/09/05 to 27/10/05	Accommodation in Lichinga (8 nights at USD 21.06/night)	3,901,000	
23/09/05 to 27/09/05	Accommodation in Nelspruit (4 nights at USD 24.19/night)	2,240,000	
28/11/05 to 19/12/05	Accommodation in Maputo (11 nights at USD 11.60/night)	2,955,000	
22/12/05 to 28/01/06	Accom. trip Lichinga-Maputo (36 nights at USD 19.36/night)	16,135,000	
28/01/06 to 31/05/06	Accommodation in Maputo (123 nights a USD 1.62/night)	4,600,000	
06/06	Private room monthly rent in Maputo (USD 5.76/night)	4,000,000	
TOTAL Accommodation for team members (MZM)		37,441,000	1,617.36
TOTAL Accommodation for team members (USD)		-	<b>2,142.96</b>
SUBTOTAL (USD)			<b>12,174.86</b>
<b>2.5- Food for team members</b>			
19/07/05 to 31/12/05	USD 2.25/day during 160 days	8,330,000	
01/01/06 to 30/06/06	USD 2.25/day during 180 days		404.82
TOTAL Food for team members (MZM)		8,330,000	359.84
TOTAL Food for team members (USD)		-	<b>764.66</b>
TOTAL "Field expenses" (USD)			10,201.79
SUBTOTAL (USD)			<b>12,939.52</b>
<b>3- POST-PROJECT EXPENSES</b>			
<b>3.1- Report production</b>			
08/06/06	USB Flash drive 256 Mb	850,005	
20/04/05 to 22/05/06	Photocopies	550,000	
TOTAL Report production (MZM)		1,400,005	60.48
TOTAL Report production (USD)		-	<b>60.48</b>
TOTAL "Post-project expenses"			<b>60.48</b>
<b>TOTAL</b>			<b>13,000</b>