

Wild Dog Project

2008 Report

Namibian Nature Foundation

PO Box 245, Windhoek, Namibia.

Tel: 00264-61-248345, Fax: 00264-61-248344, Cell 00264-81-2772333,

e-mail: wilddog@mweb.com.na

http://www.nnf.org.na/NNF_pages/wilddogproject.htm



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Summary

This report brings together the most comprehensive metadata available on the African Wild Dog in Namibia from previous and current research, both nationally and with the conclusions drawn from International findings. While significant gaps exist in our knowledge of Wild Dog ecology and management in semi-arid rangelands the Wild Dog project continues to progress with important applied research. Nonetheless, based on current indicators, this project suggests the need for important and immediate management interventions that require support from the Ministry of Environment and Tourism.

STATUS ACROSS AFRICA..

98% population decline and 95% range reduction in past 100 years;
Comparable with any of Africa's most endangered large mammals;
Extinct from 24 of 39 countries in former range;
Only 8 countries now with *connected* populations >100 individuals;
Total population estimate of 3,000 – 5,000;
Conservation threats: Habitat loss and degradation, prey reduction
& human persecution.

..AND IN NAMIBIA

Formerly distributed throughout all of Namibia except true desert areas;
Now Namibia's most endangered large mammal - current population status reflects
conservation threats across Africa.

Latest population estimate: 160-259 adults and yearlings in <32 breeding packs;
Population declining around 10%pa;
Unlikely >4 breeding packs fully protected throughout lifecycle;
Annual human depredation rate exceeding recruitment, excluding natural mortalities.

Immense home ranges averaging >3000km²;
95% of population ranges outside protected areas;
Current protected area coverage ineffective to secure viable population;
Research and management limited to Wild Dog Project.

IMPORTANT MANAGEMENT DECISIONS ARE URGENTLY NEEDED AT GOVERNMENT LEVEL TO SECURE
A VIABLE POPULATION UNDER PROTECTED AREA COVERAGE
WHILE IMPROVING CONSERVATION STATUS OF CURRENT FREE-RANGING POPULATION.

Few large African mammals (>25kg) have experienced a decline in range and population comparable to the African Wild Dog. Extrapolation from known densities, habitat suitability and prey abundance suggests a 98% population decline and 95% reduction in range. Latest data indicates 8 countries contain *connected* populations >100 individuals, from a historical range extending throughout 39 sub-Saharan nations and across all habitats, except true deserts and the Congo basin rainforests.

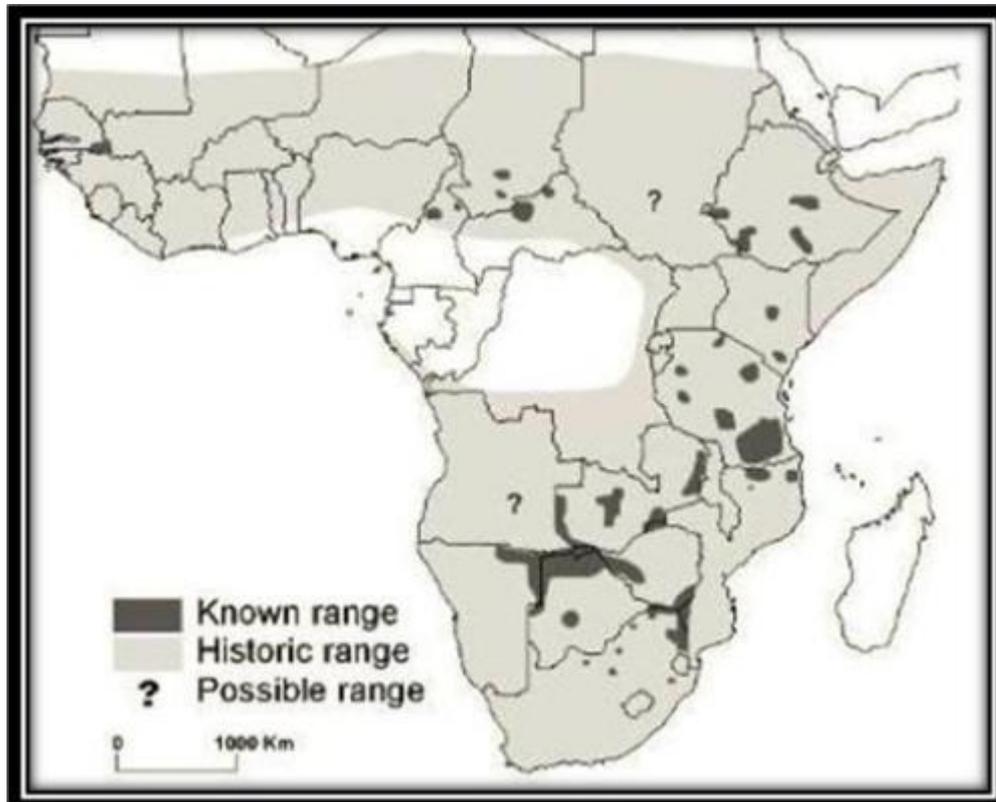


Figure 1: Known and historical range (CSG, 2004).

Namibia represents an important, but declining refuge for African Wild Dogs, currently containing 4-9% of the total free-ranging population of 3,000-5,000 individuals. But perhaps more importantly for Namibia are the unique conservation threats and opportunities. Best data suggests 95% of Namibia's African Wild Dog population live outside formally protected areas. Given their immense ranging ecology in semi-arid areas (range =1500-4200km²/pack, n=7 packs), it is unlikely that many packs are not threatened by human activities for some or all of their annual life cycle.

Free-ranging populations have gone extinct from almost every isolated protected area <1m ha in size, even where well managed, due to a combination of socioeconomic and ecological factors. Simple geometry dictates no point in a protected area of 1m ha can be >60km from the edge – hence during their yearly cycle most packs will move beyond park boundaries and into human-dominated environments where THEY are subject to widespread persecution. So viable populations need immense areas and require careful landscape-level management to survive.

In recent years has there been growing recognition that African Wild Dogs play an important role in balanced ecosystems and are a valuable tourist attraction, therefore representing a resource to be nurtured and conserved. Our understanding of their ecology and conservation needs is increasing. With wide open spaces, low human population density and a growing tourist industry centred on sustainable wildlife utilisation, Namibia is in a strong position to turn around the declining status of the African Wild Dog and introduce them to former range, with Etosha National Park being the conservation goal.

1.0 Study Area

(adapted from Mendelsohn & Obeid, 2002)

Environmental characteristics:

Otjozondjupa Region in the northeast of Namibia is situated at the western edge of the Kalahari Basin, an area covered by windblown sand and generally flat – varying between 1400m ASL in the southwest to 1000m ASL in the east. Drainage lines flow east towards the Okavango Delta 100km to the east of the Botswana border. Rain falls mainly in January and February varying from 350mm in the south to 450mm in the northern areas. Sporadic rainfall and high evaporation rates (up to 2,000mm annually) impact significantly on the vegetation types. Kalahari sands are dominated by woodlands, which are tall and broad-leaved in the higher rainfall areas, becoming progressively shorter and characterized more by shrubs and thorny species to the south. Dominant species include *Burkea africana*, *Commiphora africana*, *Terminalia sericea* and *Grewia spp.* Greatest plant diversity is matched by that of other phyla in areas of highest rainfall. Desertification, predominantly in the form of bush encroachment to the south and west, has occurred in many areas where grazing pressure from a poorly managed livestock farming industry is high.

The human element:

The total population in 2001 was 50,600, having grown by 2.6% pa since 1991. More than a third of all people live in towns. Almost half of the population is below 15 and the population density is extremely variable, with about 89% of the region being uninhabited. Approximately 7,000 San and 70,000 Herero people occupy this region.

Land and economy:

Land uses and the regions' economy are dominated by farming, especially ovaHerero cattle ranching where very large areas are fenced off as exclusive farms. Crop farming is seldom productive, and subsistence farming difficult. Livestock numbers consist of approximately 300,000 cattle and 180,000 sheep and goats combined. These livestock are restricted to areas where water is available. Livestock farming in the San areas (Tsumkwe District) is minimal with many of the inhabitants still relying on the vestiges of their hunter-gathering heritage together with seasonally available food aid. Income generated from wildlife dominates these areas but many of Namibia's poorest people live here.

Area 1: Okakarara District:

Prey depleted, established livestock production area.

Okakarara District (E17.50-190, S200-21.50) covers an area of 18,951km² and contains a population of c.21,000 people dominated by the livestock farming ovaHerero communities who settled the area in the past 150 yrs, displacing many of the earlier inhabitants. Language is uniform within this Herero community. The area is bordered to the northwest, west and southwest by fenced commercial land, utilised for both game and livestock farming. Conflict with predators is believed to be a significant factor affecting the viability of the Wild Dog population in this and adjacent areas. This site is also part of the National CBNRM programme and there are 4 registered communal conservancies within the boundaries of the district.

Tourism is very low in this area and the vast majority of income is generated from live sales of cattle. Wildlife populations are very low in areas close to human habitation (<0.2kg/ha) due to unsustainable harvesting for meat, although small ungulate species such as common duiker and steenbok are present in larger numbers (Lines, 2003a) and represent important prey species for Wild Dogs.

Area 2: Nyae Nyae Conservancy, Tsumkwe District:

Wildlife managed area, low/medium prey densities.

The second site centres around Nyae Nyae conservancy in the east of Tsumkwe District (E190-210, S18.50-200) covering an area of 8,900km² and containing a population of c.3,000 predominantly San bushmen of

the Ju'Hoansi group, but with a growing population of pastoralists from adjacent areas. Subsistence hunter-gathering remains the mainstay of local livelihoods with limited tourism income from sales of locally produced jewellery and camping fees. Significant revenue from safari hunting provides the community with means to fund small-scale development projects through the Conservancy management with the assistance of external NGOs. Wildlife utilisation is seen as the best option for long-term sustainable development. Livestock farming is on the increase but stocking rates remain low (<0.5kg/ha) and centred around a handful of semi-permanent villages and Tsumkwe town, the administrative centre with a population around 1,000 people. Game populations have stabilized in recent years and are now on the increase with good numbers of Kudu, Wildebeest, Springbok, Duiker and Steenbok – all suitable prey species for Wild Dogs. Nonetheless prey density is probably 10% of carrying capacity and <2kg/ha.

Area 3: Ondjou Conservancy, Gam District:
 Prey depleted, developing livestock production area.

The third, and most recent study area, is the newly proclaimed Ondjou Conservancy (E17-210, S200-21), to the south of Tsumkwe District. Ondjou covers an area of 8,729km² and the total population is estimated at 2,000, composed of recently resettled (since independence in 1990) ovaHerero livestock farmers from Botswana and San bushmen of the Ju'hoansi group who have inhabited the area for many thousands of years, historically living a semi-nomadic existence (see above). The majority of people live in and around the small settlement of Gam on the eastern fringes by the Botswana border where ephemeral rivers allow the extraction of water through boreholes. It is this water extraction that has facilitated the development of a livestock farming industry. But lack of control and management has resulted in dramatic changes to the fragile Kalahari savannah. Game numbers have been decimated in and around the scattered farming areas and overstocking/over grazing has resulted in desertification and bush encroachment. Predators have been significantly reduced in numbers throughout the farmed and adjacent rangelands.

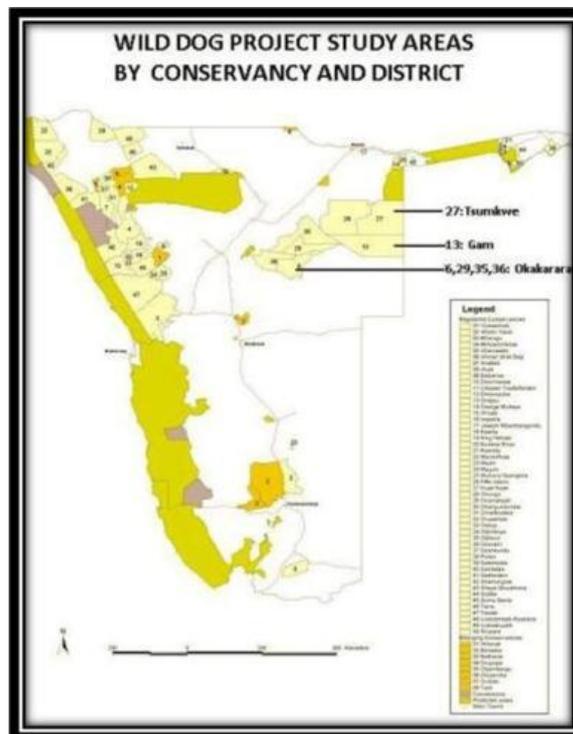


Figure 2: Namibia and Wild Dog Project study areas (NACSO, 2007)

2.0 Introduction to Ecology & Conservation

African Wild Dogs are cursorial predators. They can occupy a range of habitats from montane forest to semi-desert and hence were formerly distributed throughout sub-Saharan Africa excluding the Congo basin and true deserts. Wild Dogs are intensely social, hunting, breeding and even dispersing in close cooperation with other pack members. Hence packs, rather than individuals, are arguably the most appropriate measure by which to count Wild Dog populations. Through specialised cooperative hunting and killing strategies Wild Dogs can subdue prey far larger than their body size would indicate, but typically their dominant prey species is the most common small to medium sized antelope in the area e.g. Steenbok and Duiker, but also species as small as hares and as large as adult Kudu and Wildebeest.

Wild Dogs' decline reflects the expansion of human populations; they have persisted only in areas where human densities are low and have even disappeared from all but the very largest protected areas. Wild Dogs' vulnerability to local extinction appears to stem from their unusual ecology: they live at low population densities and each pack ranges vary widely, even where prey is abundant. Available data indicate that this wide ranging behaviour is a way of avoiding competition with larger carnivores, particularly lions, which reach high densities in prey-rich areas yet may kill Wild Dogs when they encounter them (Creel & Creel, 1996; Mills & Gorman, 1997). Low population densities mean that even Wild Dog populations occupying large areas comprise relatively few individuals, and large home ranges mean that even animals which spend much of their time in large protected areas are often exposed to – and threatened by – human activities on reserve borders. Hence, while the ultimate threat to Wild Dogs identified in the 1997 IUCN Canid Action Plan was destruction and fragmentation of habitat through human encroachment, this process generates proximate threats including deliberate killing by livestock and game farmers, accidental capture in snares, road accidents, and infectious diseases possibly transmitted from domestic dogs.

Wild Dogs have disappeared from much of West and Central Africa, and the largest remaining populations are in southern Africa and the southern parts of East Africa. Much of what is known about Wild Dog ecology comes from southern Africa, and from inside large protected areas. To date, there have been very few studies of Wild Dogs outside reserves or in semi-arid rangelands, and no intensive studies at all in West or Central Africa. This is largely due to the significant logistical and financial costs of effective monitoring and research in these areas in the long term. African Wild Dogs are renowned as a notoriously difficult study species, even under the most favourable circumstances.

Effective management requires robust data on population ecology, population status, conservation threats and opportunities. Namibia is in a precarious position with a single private sector initiative of Namibia Nature Foundation being the only project underway to address these shortcomings. The African Wild Dog has received the least research and conservation attention of all large carnivores in Namibia. Very little is known about their population status, ecology and impact of conservation threats in this vast semi-arid system of rangelands.

Critical conservation decisions are needed by Ministry of Environment and Tourism if Namibia's African Wild Dog population is not to decline to vagrant levels under pressure from changing land uses and insufficient protected area coverage and management.

3.0 Distribution, Density & Population Updates

Distribution: Namibia

African Wild Dog were a feature of the Namibian landscape for at least 2 million years until the arrival of pastoralist communities - Bantu groups from the north followed by settlers of European descent from the south. In the past 80 years Wild Dog range has been vastly reduced, with indications suggesting a correlation to the expansion of the human population, introduction of firearms, new diseases from domestic stock, depletion of wild prey and associated conversion of habitat into livestock farming. State sponsored eradication programmes compounded the decline.

Little rigorous data exists to provide a baseline for changes to distribution, density and population size over time with formal research restricted to a single short ecological study in the mid 1990's and the current Wild Dog Project. Table 1 indicates decline of the species from Southern Namibia throughout Central Regions and into the Northern areas.

Area/District	Last record
Orange River	1934
Keetmanshoop	1940's
Maltahöhe	1944
Karibib	1958
Windhoek	1959
Namib-Naukluft	1969-70
Kunene	1975
Etosha NP / N. Central ¹	Mid 1980's

Table 1: **Decline in Namibia** (mixed sources)

¹In the 1920's South West Africa's' Administrator estimated the Wild Dog population in the greater Etosha NP area at 2,000 individuals.

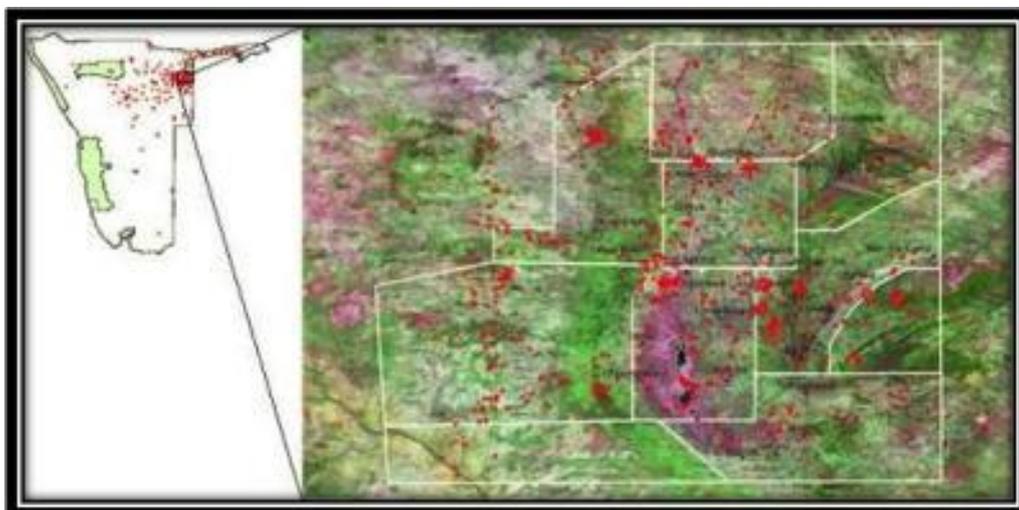


Figure 3: **Sightings in Namibia & Nyae Nyae Conservancy 2003/8, based on vegetation classes** (Stander & Hansen, 2005; Lines, unpublished data,)

Currently only the isolated northeast of the country contains a population that could be described as viable, although total range includes many commercial and communal farming areas in Omaheke, Otjozondjupa, Kavango and Caprivi that likely act as sink areas to the core population – drawing in animals that are

subsequently killed. Transboundary movement to Botswana, Angola, Zambia and Zimbabwe also occurs, indicating the importance of international collaboration e.g. the KAZA initiative.

Scattered sightings up to 500km away from core areas demonstrate the extraordinary dispersing ability of the species, but does not indicate resident range. By example a single Wild Dog was observed on a farm 60km SSE of Windhoek in December 2007 for the first time in nearly 50 years. The animal had probably dispersed from a resident population 300km to the east in Botswana, looking for mates to start a new pack. It was promptly shot. Sightings and monitoring information beyond Wild Dog Project database (and dated Carnivore Atlas) are sporadic, inconsistent and unreliable given the difficulties of observing the species and low priority in Government.

Distribution: Southern Africa

In December 2007 members of the IUCN Canid Specialist Group and other key range state stakeholders met in Botswana to attend a Regionwide Conservation Planning Workshop for the Africa Wild Dog. Figure 4 indicates the draft findings for Southern Africa. Namibian data supplied by Wild Dog Project database and additional sources, including Carnivore Atlas (Stander and Hansen, 2004).

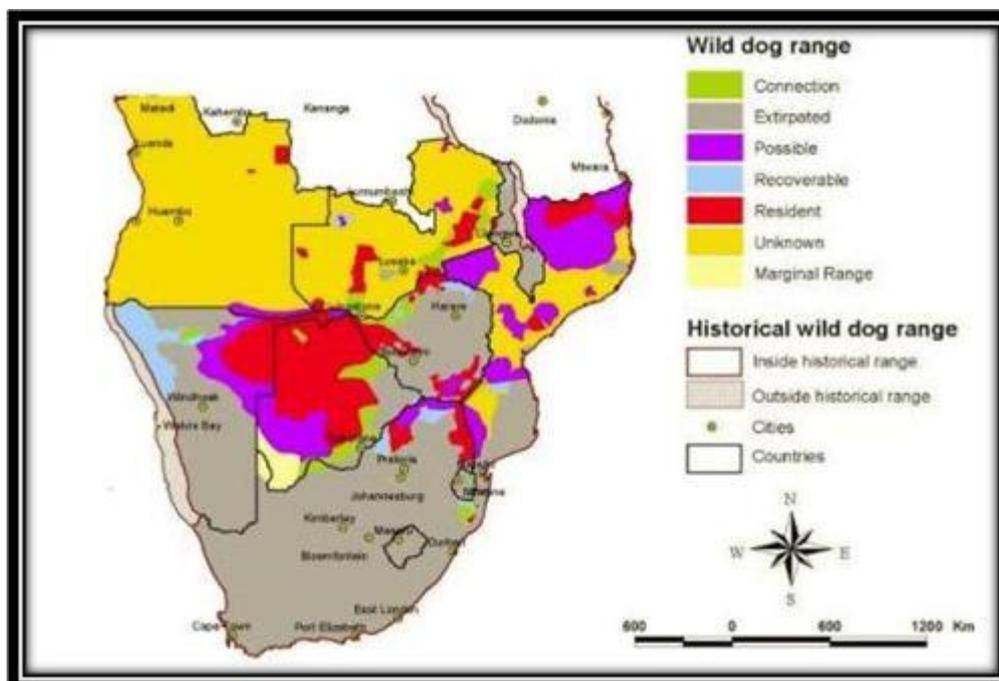


Figure 4: African Wild Dog status and distribution in Southern Africa (IUCN, 2007, unpublished).

While substantial gaps in our knowledge exist for Angola and Zambia in particular, but also for southern Mozambique, we can confidently say that viable populations likely occur in these countries given the precautionary approach of this analytical process together with an abundance of anecdotal sightings. Nonetheless it is clear that that backbone of Southern Africa's *known* population ranges throughout Botswana and NE Namibia with an important population in NW Zimbabwe around Hwange NP and Kruger NP in South Africa. The northern Mozambique population is concurrent with southern Tanzania where the largest continuous population of >1000 individuals exists.

It is intuitive from the map that connectivity between and within populations is critical to the survival of the species, insofar as transfer of genetic material ensures high individual heterozygosity and fitness.

Large areas of Southern Africa represent *extirpated range* but few areas are categorised as *recoverable range*, with the exception of Etosha NP and NW Namibia above the 200mm rainfall isocline. It is likely that low rainfall areas of western and southern Namibia can be categorised marginal range.

Density: Africa

African Wild Dogs appear to live at low densities, relative to other large carnivores, even in prey rich areas. Available data indicate that this wide ranging behaviour is a way of avoiding competition with larger carnivores, particularly lion and hyaena which reach high densities in prey-rich areas yet may kill Wild Dogs when they encounter them and steal food. Low population densities mean that even Wild Dog populations occupying large areas comprise relatively few individuals, and large home ranges mean that even animals which spend much of their time in large protected areas are often exposed to, and threatened by, human activities on reserve borders. Wild Dogs have gone extinct in areas where lion density approaches 15/100km² – approximately half the maximum attainable density recorded for the species, but a fraction of the density attainable by spotted hyaena which can exceed 100 individuals/km².

Place	Density	Reference
Northern Kafue National Park, Zambia	2.2	Calson <i>et al</i> , 2003
Kruger National Park, South Africa	1.7	Maddock & Mills, 1994
Selous National Park, Tanzania	4.0	Creel and Creel, 1995
Serengeti NP, Tanzania (1967-1979)	1.5	Frame <i>et al.</i> , 1979; Malcolm, 1979
Serengeti NP, Tanzania (1985-1991)	0.7	Burrows <i>et al.</i> , 1994; Laurenson <i>et al.</i> 1990
Hwange National Park, Zimbabwe	1.5	Childes, 1988 Ginsberg, 1993
Save Conservancy, Zimbabwe	4.2	Lindsay, 2002
Moremi National Park, Botswana	4.0	McNutt, 1995
Hluhluwe National Park, South Africa	3.3	Maddock, 1993
Tsumkwe East, Namibia ¹	1.2-0.5	Stander, 1997; Lines, 2008

Table 2: **Density ranges across Africa – dogs/100km²**¹median values taken**Density: Namibia**

The data from the recent Southern African Wild Dog workshop provides critically important directions in conservation planning, *but* the data does not form the basis for a prediction on density of population size in any range state.

To date accurate density data has only been gathered where significant resources for public and private sector research and monitoring have been invested in the long term. These studies are characterised by a focus on well managed protected areas with good road penetration in high prey density habitats with significant feedback on sightings from park staff, tour operators and visitors.

Limiting factors to reliable density estimates

The situation in Namibia is almost the other extreme, with Wild Dog range characterised by vast open areas in human dominated landscapes with little road penetration and almost no reliable sightings feedback in a timely manner. Prey densities are also very low, averaging 1-2kg/ha for the core area, and significantly lower elsewhere in adjacent livestock dominated communal farming areas. Further, widespread human persecution ensures Wild Dogs are extremely shy and elusive in most areas. These habitats and circumstances preclude the standard methods used elsewhere:

- Photographic ID surveys require large data sets, evenly distributed over space, for intense sampling periods, repeated annually;
- Spoor surveys are limited in low density areas by the prediction limits on the relationship between spoor counts and Wild Dog density being too wide, leaving substantial uncertainty about population size and trend. Sampling error is significant so prediction limits are typically a lot wider than confidence limits for relationships like this;
- Indirect genetic sampling methods through scat or hair analysis are in their infancy for free-ranging populations with little baseline data on heterozygosity for Wild Dogs;

- Relationships between Wild Dog packs size, prey density, density of competing predators and true Wild Dog density are inconclusive;

African Wild Dog population density is known to fluctuate widely over time, numbers increasing or decreasing by up to 50% within 3-4 years, so studies have to be long term to detect trends in population density, taking into account periodic fluctuations.

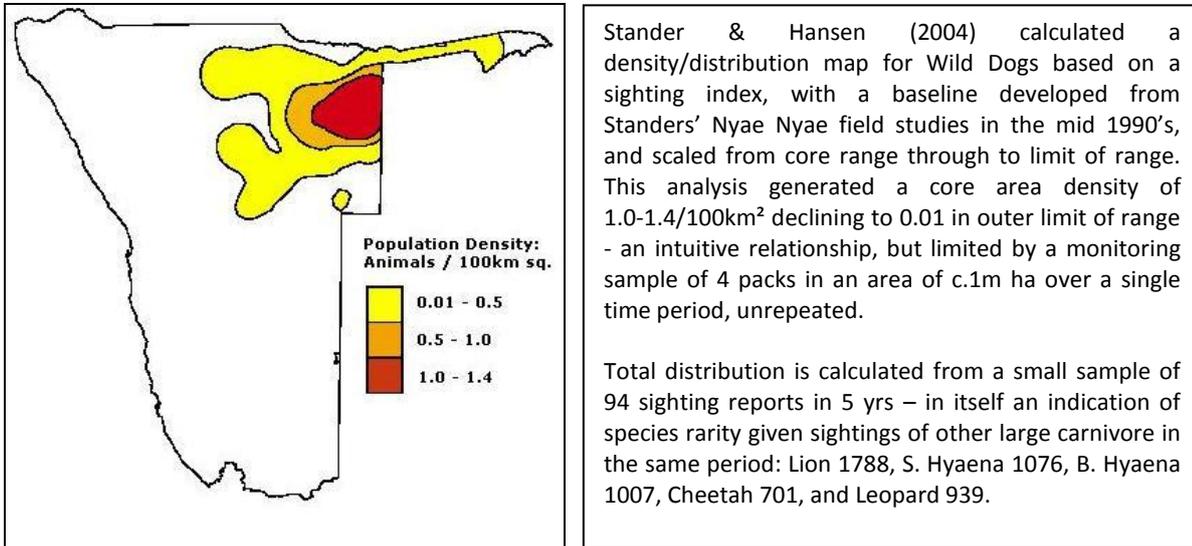


Figure 5: Carnivore Atlas density map (Stander & Hansen, 2004).

With an increase in livestock farming communities in rangelands surrounding the core Wild Dog area, we have observed increased rates of habitat alteration and fragmentation, reduction in wild prey and an increase in human-induced persecution of Wild Dogs in the decade since Stander's study. Consequently we use these indicators to hypothesise, with a strong degree of intuitive confidence, that the Wild Dog density is lower than a decade ago using Stander's analytical method.

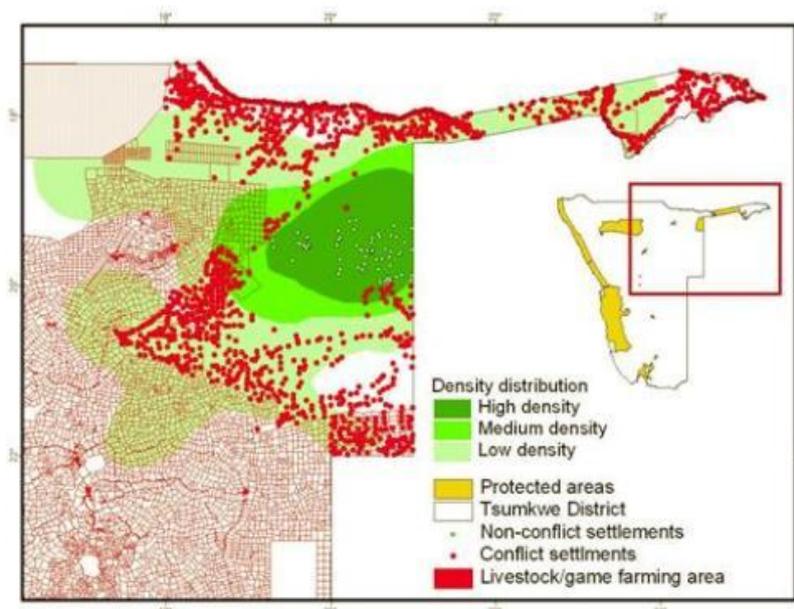


Figure 6: Wild Dog density and conflict settlements2 (Stander & Lines, unpublished)

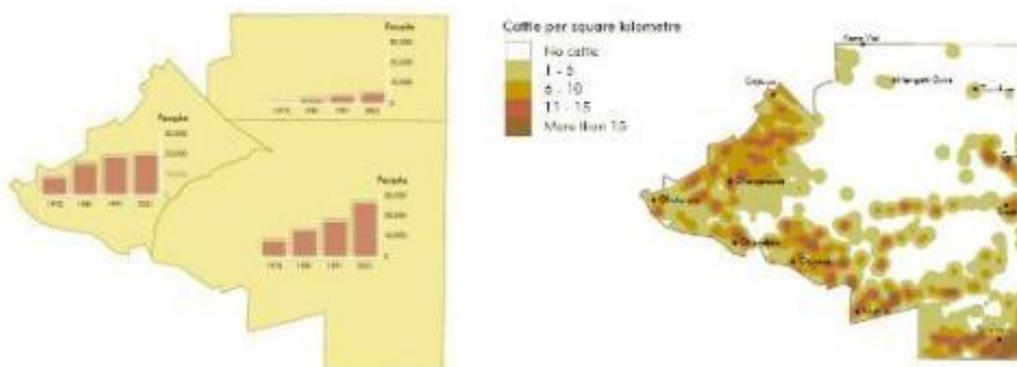


Figure 7: Increase in human and cattle density adjacent to core Wild Dog range (Mendelson & Obeid, 2002)

²Conflict settlement is broadly defined as a settlement where the predominant land use is livestock production. Wild prey is depleted and tolerance for large carnivores is low. Persecution is common and widespread. Much of Okakarara, Gam, Eiseb and E. Kavango are characterised by these settlements and can thus be further defined as Communal Conflict Settlements. This is in contrast to Commercial Conflict Settlements (or farms) where wild prey levels are generally higher but persecution of large carnivores, especially Wild Dogs, is more effective at localised eradication with widespread access to good communications, vehicles and firearms.

A second method utilised by the Wild Dog Project since field studies started in Nyae Nyae in 2003 involves analysis of direct observations of packs and groups within the boundary of the Conservancy, based on ground follow-ups of reports from project staff and experienced observers. This is the most reliable and robust technique for low density populations, but is time and resource intensive.

By the end of the 2007 denning season in October the following packs were known in Nyae Nyae:

Pack ID	Adults/Yearlings	Pups >3months old	Total
Djoxwhe* ¹	4	0	4
Tjeka* ²	7	0	7
Dorsland	5	5	10
Ag farm	3	7	10
Klein Dobe* ³	5	4	9
!Aoabace 1	6	5	11
!Aoabace 2	8	0	8
Average	5.4	3.0	7.0
Total	38	21	49

Table 3: Wild Dog density in Nyae Nyae, 2007⁴

* Radio/GPS collared

¹Pack split late 2006, did not breed by July 2007, alpha female died of old age late 2007

²Denning with pups, pack split soon afterwards, no sign of pups, 4/5 males together by end Oct.

³Collared male from Djoxwhe Pack found with new females and 4 pups 50km N from last sighting

⁴ Excludes dispersing and/or floating individuals

Thus a density of 0.43 dogs / 100km² is calculated for the core area, but should be considered a *minimum* figure with little or no data coming from large areas of (inaccessible) habitat representing c.50% of the Conservancy. A second consideration reducing the density estimate further is that none of the packs are restricted to Nyae Nyae. Total area on which to calculate density would include pack range in adjacent areas.

Population: Namibia

The 2004 Carnivore Atlas population estimate of 355-601 individuals, based largely on Standers' 1997 field study data (where core Wild Dog density was estimated at 1.0-1.4/100km²), can only be considered optimistic given changes to land use and increased threats to the existing Wild Dog population.

Using an updated *minimum* figure of 0.43/100km² as baseline for the core population density, but maintaining the Carnivore Atlas methods for population calculation, multiplying minimum density by a factor of 1.4 to attain maximum density, we derive the following population size:

Area (km ²)	Animals / 100km ²		
	Low Density (0.01-0.22)	Medium Density (0.22-0.43)	Highest Density (0.43-0.60)
117,321	12-26	-	-
20,602	-	45-89	-
24,046	-	-	103-144
Total = 161,969	Minimum 160, Maximum 259		

Table 4: Revised population estimate

Calculations provide an updated population estimate of 160-259 adults and yearlings, excluding pups. Given average pack size of 8 adults and yearlings this population* estimate indicates 20-32 breeding packs in Namibia.

* Average pack size for all sightings Namibia, 2002/8, adults and yearlings.

Area/District	Status	Density (dogs/100km ²)	Trend	Likely threats
Kaudom GR	Present	0.22 - 0.43	Decreasing?	Conflict & persecution adjacent to park boundaries
Tsumkwe	Present	0.43 - 1.0	Stable?	Conflict & persecution in bordering areas, road kills
Tsumeb	Vagrant	n/a	n/a	Conflict & persecution
Outjo	Vagrant	n/a	n/a	Conflict & persecution
Grootfontein	Uncommon	0.01 – 0.22	Unknown	Conflict & persecution, road kills
Otjiwarongo	Uncommon	0.01 – 0.22	Unknown	Conflict & persecution, road kills
Okakarara	Present	0.01 – 0.22	Decreasing?	Prey reduction, conflict & persecution, road kills
Gam/Eiseb/Talismanis	Present	0.01 – 0.22	Decreasing?	Prey reduction, conflict & persecution, road kills
Gobabis	Vagrant	n/a	n/a	Conflict & persecution, road kills
W. Kavango	Uncommon	0.01 – 0.22	Unknown	Prey reduction, conflict & persecution, road kills
E. Kavango	Present	0.22 – 0.43	Decreasing?	Prey reduction, conflict & persecution, road kills
Babwata NP	Present	0.22 – 0.43	Unknown	Road kills & persecution
E. Caprivi	Uncommon	0.01 – 0.22	Unknown	Prey reduction, conflict & persecution, road kills

Table 5: Population density, trend and threats by area

It is important to stress again that the decline reflects the increasing encroachment of human populations into the Wild Dogs' largely unprotected habitat, resulting in the destruction and fragmentation of habitat generating proximate threats including deliberate killing by farmers, reduction of wild prey, accidental capture in snares, road kills, and infectious diseases possibly transmitted from domestic dogs.

4.0 Ecological Monitoring

Limitations:

In section 2.0 reference was made to the challenges involved with studying elusive, low density, wide ranging species in remote, poorly developed communal areas. Timely feedback of Wild Dog sightings from Government staff, tour operators, the local community and tourists is minimal. Air support, at least twice monthly and preferably weekly, is critical for efficient population monitoring, but logistical and financial restraints of bringing in aircraft more than once a month is a major limiting factor. While in the field one must be largely self-sufficient of external support, maintaining water, power and all equipment 300km from the nearest town. Most supplies must be driven in from 800km away. This is very time consuming. Given these considerations population monitoring is a necessarily slow process requiring patience and dedication. Nevertheless effective conservation of any species depends upon correctly identifying the threatening processes which cause decline or hinder recovery. Only by identifying these threats can the most appropriate conservation activities be determined (Caughley, 1994).

Methods:

The fieldwork season centres on the natural breeding season of the Wild Dogs. In the case of Namibia, as with much of Southern Africa, this coincides with the dry winter season between May and October/November. Packs are restricted to a core area in their range where the pups are born in an underground den, raised and weaned for around 3 months until able to move freely with the rest of the pack, at which point non-denning ranging patterns resume. During the denning period it becomes feasible to locate new packs, follow and capture individuals in order to attach telemetry, either VHF, or GPS, thus facilitating further monitoring of basic ecological parameters during and outside the denning season.

Capture is facilitated by immobilising individuals with a mixture of Ketamine (2-4mg/kg) and Xylazine (1- 2mg/kg) delivered IM via a Pnuedart system, usually at 20-35m range. Recumbence takes 8-15 minutes. A qualified and registered vet is present to oversee all immobilisations and anaesthesia. This drug combination is considered very safe and has been used widely for over a decade with limited complications. No mortalities or long term injuries have been registered from 22 immobilisation in 5 years.

Standard biomedical samples (blood, skin, hair, faeces, and extoparasites) and physiological data (weight, body size, teeth measurements along with body/tooth condition) are collected. Sample individuals, characterised by Alpha status or a prime dispersal age of c.2 years, are collared with VHF transmitters with a range of 2-3km on ground and up to 30km from aircraft, and increasingly with GPS-based units that incorporate VHF transmitters. Both units weigh a maximum of 2% bodyweight as prescribed by international guidelines for medium to large carnivores (IUCN, 2004). The procedure typically takes 45mins and the dog is reversed from the anaesthesia with Yohambine (0.125mg/kg) IV. The dog is usually standing within 5 minutes.

Pack sizes, composition (age, sex), feeding ecology and ranging ecology are monitored through intensive ground follows of 3-7 days, usually off-road through the bush, rough camping nightly close to where the dogs rest for the night, starting again pre-dawn when the dogs commence hunting. Natality, mortality and interspecific competition with other predators is also monitored where possible.

Data collection from outside Nyae Nyae is sporadic and opportunistic, focusing on individual reports together with Conservancy Event and MET Incident Book data, and generally limited to pack sightings, conflict incidents and mortality reports.

Data on captive populations is updated periodically through direct communication with captive facilities, although anecdotal reports indicate a number of illegal captive facilities exist on commercial farms.

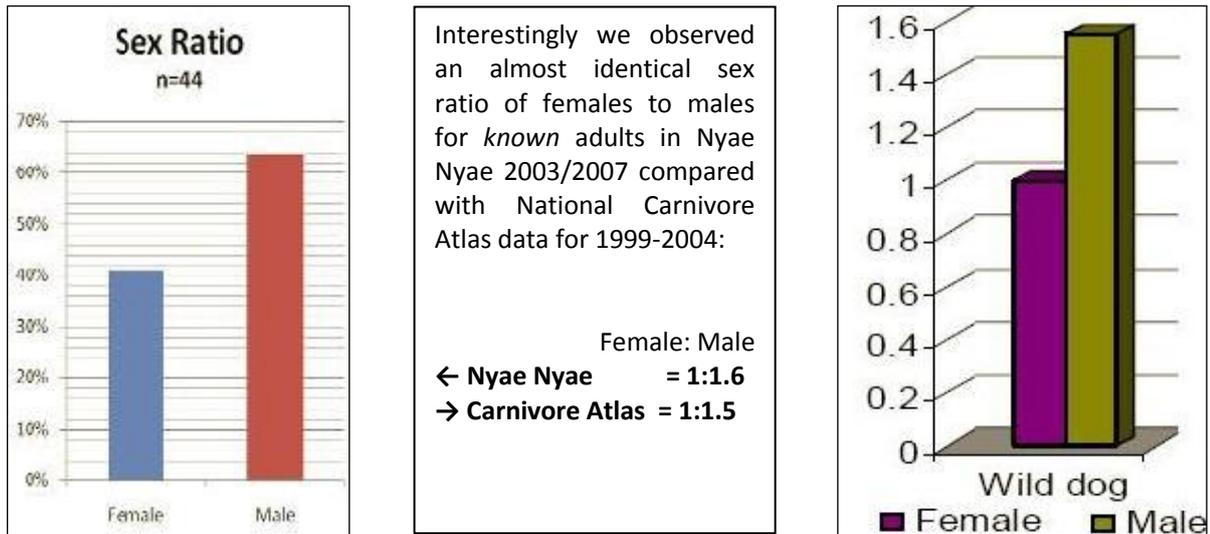


Figure 8: Sex structure in Nyae Nyae 2007 & Carnivore Atlas 2004
 (Lines, unpublished; Stander & Hansen, 2004)

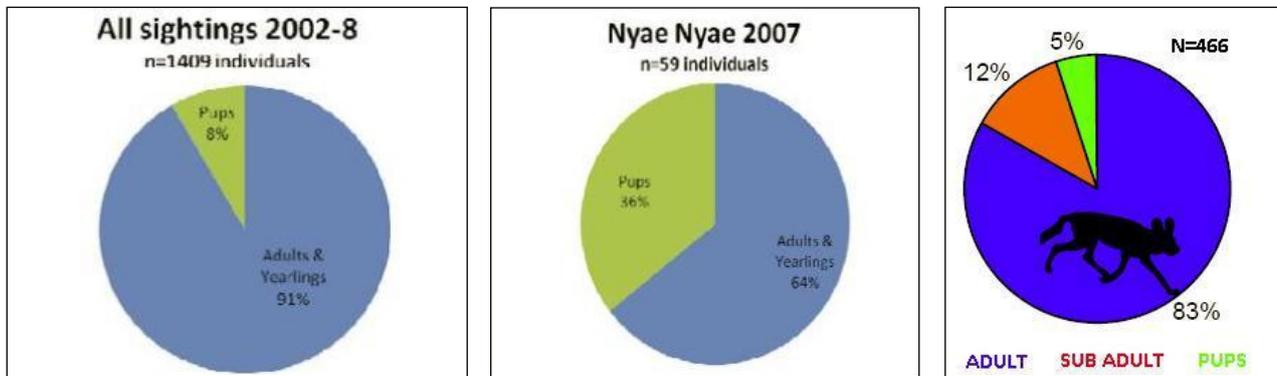


Figure 9: Age structure, all sightings (2002-2008) & Nyae Nyae (2007) & Carnivore Atlas 2004

Carnivore Atlas data for 1999-2004 indicates 95% adults/yearlings and 5% pups in 466 individual reports. The Nyae Nyae population in 2007 exhibits a significantly higher ration of pups to adults but much of this discrepancy can likely be explained by observer and sampling bias. Wild Dog Project sightings are confirmed by experienced observers working intensively on the ground, whereas many Carnivore Atlas sightings are opportunistic from a variety of sources. Packs are also inclined to hide their pups so will be harder to observe and record opportunistically.

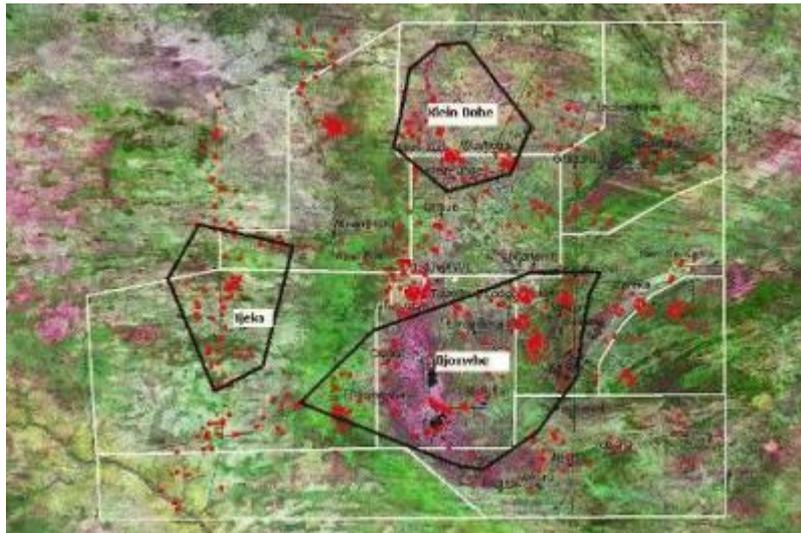
Ranging ecology:

Figure 9: Preliminary dry season home range data, Nyae Nyae Conservancy (Lines, unpublished data).

Home range data for Wild Dogs varies across ecosystems and land uses, typically varying between 400- 1500km² per pack (n=7 studies), but can reach >4,000km² (Stander, 1997). Range overlap is extensive, excluding the core breeding area which covers c.10% of total pack home range for 3 months of the year. Little is known about what factors positively correlate to density, even under the best of monitoring conditions.

Stander (1997) estimated average home range for 4 packs in Tsumkwe at 3,300km². VHF telemetry data from 2005/8 has revealed dry season home ranges between 690-1450km²(minimum convex polygon, n=3 packs), but restricted air support and dispersal of GPS collared individuals/collar failure has not permitted data acquisition to reflect 12 month ranging cycles, which are expected to extend home range significantly in response to dispersal of prey populations. Further deployment of GPS-based telemetry collars will continue in 2008/9.

Feeding ecology:

Wild Dogs rely almost exclusively on mammalian prey that they have killed for themselves. They hunt prey as small as hares (1-2kg), and as large as adult Zebra or juvenile Buffalo and Eland (200kg), but concentrate on prey between 10 and 120kg, with larger packs taking larger prey (Creel, 2002). Impala and Wildebeest are important prey items in most ecosystems but in Nyae Nyae Kudu, Duiker and Steenbok are the most common antelope and make up 90% of Wild Dogs' known diet (Lines, 2008). Although little direct evidence exists of Wild Dogs preying on Warthog, Springbok, Hartebeest, Wildebeest and the calves of Roan, Oryx and Eland, they certainly represent suitable prey species and are likely taken - as has been observed by the presence of hair of these species in Wild Dog scats. In Kaudom NP a local abundance of juvenile Roan antelope and Eland may provide a plentiful food source but records are based on spoor presence at old kills and not direct sightings, so must be interpreted cautiously.

Interestingly the only record of Wild Dogs attacking livestock in Nyae Nyae 2003/7 is as an isolated case of herders driving a group of calves into a resting pack of Wild Dogs that had not hunted successfully since the previous night.

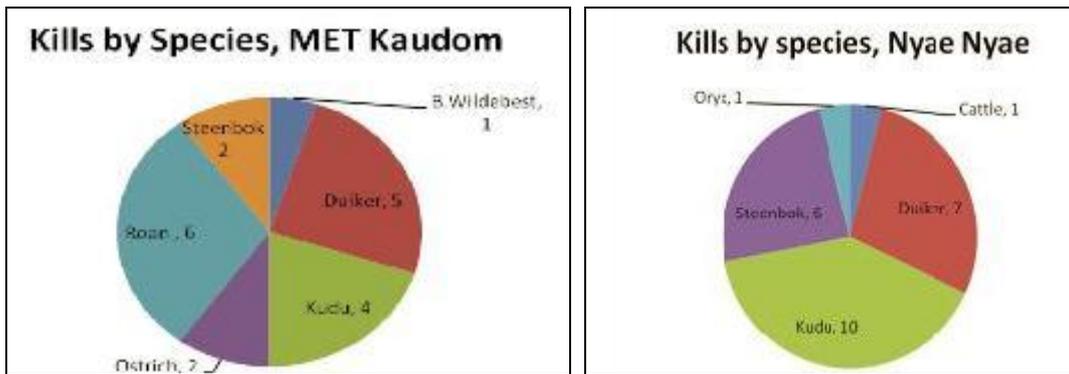


Figure 11: Kills by species, MET Kaudom and Wild Dog Project data 2002/7

Species ¹	Numbers	%age kills	%age diet ²
Kudu	10	40	66%
Steenbok	6	24	9%
Duiker	7	28	16%
Cattle/calves	1	4	1%
Oryx	1	4	8%
Ostrich	0	0	-
Roan	0	0	-
Warthog	0	0	-
Wildebeest	0	0	-
R. Hartebeest	0	0	-
Eland	0	0	-
Springbok	0	0	-
Sheep/Goats	0	0	-
Total	25	100	100

Table 6: **Confirmed kills from suitable prey species, Nyae Nyae 2003/7**

¹Smaller prey e.g. hares are not included in calculation, although provide valuable food sources.

²Based on mean weight / carcass / pack size of un-scavenged remains

Interspecific Competition:

Early studies of African Wild Dogs and Spotted Hyaena noted that interference competition between the two species was common (Estes & Goddard, 1967) and that at higher densities hyaena might restrict Wild Dog numbers and distribution by out-competition and scavenging at Wild Dog kills, especially in open areas where kills could be quickly located. In many cases Spotted Hyaena were actively seen following Wild Dog hunts. Spotted hyaena are also known to predate on Wild Dog pups and sub-adults, thus interfering in breeding. Recent research indicates Lions may also limit Wild Dog numbers, either through competitive exclusion from areas of high prey density or by direct persecution. Habitat selection suggests Wild Dogs avoid areas of highest Lion density in both Selous GR and Kruger NP (Creel & Creel, 1995; Maddock & Mills, 1994). Although pack living may help Wild Dogs defend their kills or avoid predation, this benefit is equivocal because Lion and Spotted Hyaena also live in group (Creel & Creel, 2002). Wild Dogs have gone extinct in all protected areas where Lion density exceeds 15 individuals/100km² and Spotted Hyaena density exceeds 100 individuals/km².

There are no free-ranging areas in Namibia, protected or otherwise, where either Lion or Spotted Hyaena density exceeds the densities suggested to limit Wild Dog populations. In the farmlands where Wild Dogs still exist at very low densities Spotted Hyaena exist at similarly low densities and lion have been largely exterminated. Interference competition will thus be negligible.

Lion - Nyae Nyae & Kaudom NP:

Lion were largely exterminated from Nyae Nyae in the mid-1990's by local communities and Government in a response to predation on newly introduced livestock roaming free and unattended in the area. In recent years sightings of nomadic males have increased as has sightings of pride forays into the area from Kaudom GR to the north. In addition sightings indicate that 2-3 small prides might have set up home ranges in the area, suggesting a recolonisation. Nonetheless density is very low, < 0.5/100km².

Kaudom GR, adjacent to the north, holds a small population of lion under threat of persecution on the park boundaries, and likely numbering fewer than 50 individuals in 380,000ha – a density of $\leq 1.3/100\text{km}^2$. Dedicated predator research has not been conducted in a decade and community outreach to mitigate human-wildlife conflict is sporadic in places and non-existent elsewhere.

Spotted Hyaena - Nyae Nyae & Kaudom NP:

Spotted hyaena are undoubtedly the dominant large carnivore in Nyae Nyae but exist at low densities in relation to other wildlife areas in Africa, as would be expected by the low prey densities. Spotted hyaena sightings are restricted to small group sizes and low numbers present at carcasses. While no extensive survey has been conducted, limited use of acoustic playbacks (Mills & Briggs, 1993) in the highest prey areas around Nyae Nyae Pans have indicated localised densities of 5.5/100km².

While Spotted Hyaena likely outnumber Wild Dogs by a ratio of at least 10:1 there is very little indication that they have a significant impact on Wild Dog through interference competition. Less than 5% of Wild Dog kills exhibit fresh signs of Spotted Hyaena presence and fighting – well below any threshold likely to limit Wild Dog numbers.

Mortality Causes:

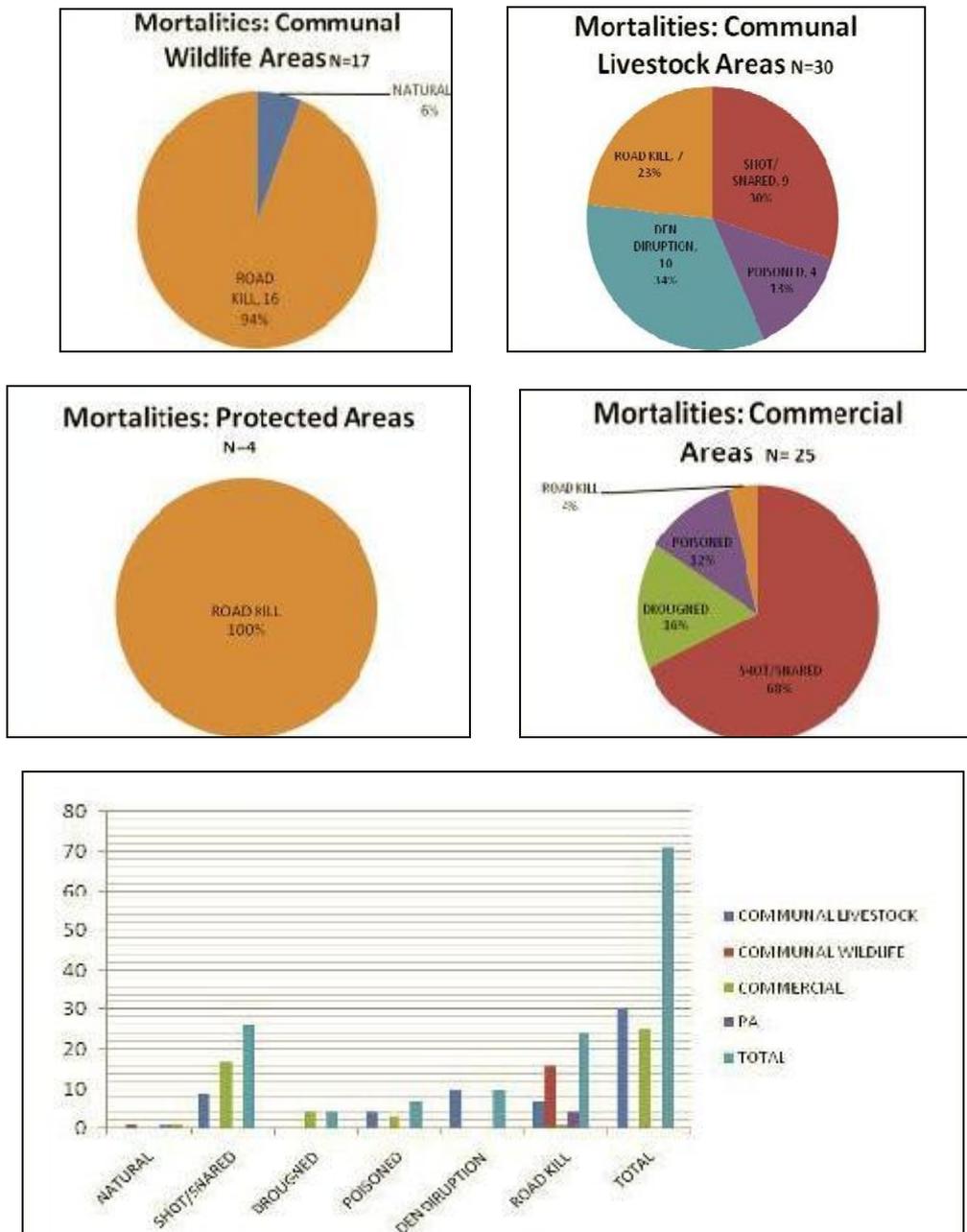
Mortality causes in free-ranging Wild Dogs are subject to significant reporting bias - skewed to areas close to human habitation and roads. Human-caused mortality appears to increase as the intensity of monitoring declines, with a high proportion of non study animals apparently killed by people, but a far smaller proportion of radio-collared dogs dying in this way. Preliminary examination of data across 8 study sites (Table 7) would suggest that human causes are the most important contributor to Wild Dog mortality. However, substantial differences between causes of mortality subjected to different levels of monitoring suggest that this simplistic conclusion may be influenced by reporting bias (Woodroffe *et al*, 2004). Nonetheless with 95% of Namibia's Wild Dog living outside of any formal protection human caused mortalities are expected to be significantly higher (Figure 8).

Cause	Number of deaths recorded			Total
	collared	not collared	not study animal	
natural causes				
natural injury	9 (8%)	9 (9%)	1 (2%)	19 (7%)
other Wild Dogs	12 (11%)	1 (1%)	0 (0%)	13 (5%)
predator	14 (13%)	7 (7%)	4 (8%)	25 (10%)
disease	5 (5%)	2 (2%)	3 (6%)	10 (4%)
human causes				
road/train accident	6 (5%)	4 (4%)	18 (34%)	28 (11%)
shot/speared	10 (9%)	18 (18%)	2 (4%)	30 (11%)
poisoned	1 (1%)	7 (7%)	14 (26%)	22 (8%)
snared	18 (17%)	29 (29%)	4 (8%)	51 (19%)
unknown	33 (31%)	24 (24%)	7 (13%)	64 (24%)
TOTAL	108	101	53	262

Table 7: Causes of mortality recorded in eight studies (Woodroffe *et al*, 2004)

It seems likely that various forms of mortality may be over or under-reported in dogs that are not systematically located. In particular, road traffic accidents account for a far higher proportion of deaths recorded among non-study animals than those in monitored packs. This is almost certainly because Wild Dogs killed on roads are conspicuous and hence likely to be reported. In contrast, shooting and snaring may be under-reported as comparatively few deaths of non-study animals are attributed to these causes.

Wild Dogs that are radio-collared can be, and usually are, located when they die irrespective of the cause or location of the mortality. Hence data from these animals probably provide the least biased estimate of mortality causes. It has been indicated that radio collars may provide some protection against snaring and hence might underestimate the importance of this mortality cause. Given the high probability of biases in the data from uncollared dogs, and the substantially smaller probability of bias in data gathered from collared animals, analysis of mortality rates and causes should ideally be restricted to radio-collared animals (Woodroffe *et al*, 2004).



Figures 12-17: Mortality causes in Namibia by area 1999-2008 (Lines, unpublished)

Of 71 mortality reports only 1 has been reported as natural (1%). This report was also the only radio collared individual in the population to have died to date.

Nonetheless it is once again somewhat intuitive that Namibia will experience a higher proportion of human-induced mortality causes with 95% of the Wild Dog population living outside protected areas.

With MET and Wild Dog Project records indicating the annual human depredation rate around 50 individuals (in excess of natural mortalities), it is highly probable that the annual mortality rate exceeds population recruitment in Namibia, irrespective of short term population fluctuations.

Human-Wild Dog conflict:

Given the long tradition of Wild Dog persecution, it is important to ask what the reasons are behind human-Wild Dog conflict. Although in recent times public perception of Wild Dogs has improved, historically the majority of people held negative views towards them, handing these views down through generations and via migrations (Sillero-Zubiri & Switzer 2004). Interestingly many perceptions in local communities support Wild Dog conservation. Wild Dog kills are seen as a useful source of meat for the Shona communities in Zimbabwe (Rasmussen, *pers comms*) and the San communities in Namibia (Lines, *pers obs*). The Masai of East Africa regard them as assets as prey on wildebeest which compete for grazing with their cattle (Sillero-Zubiri & Switzer 2004).

Although myths, folklore and legends profess tales of Wild Dogs killing people there are no confirmed records of such incidents, either in Namibia or elsewhere. Where attacks have happened it is likely to be a rabid individual in 'furious' phase, attacking people repeatedly during the short period that they survive. With the reduction of rabies these rare incidents have dropped dramatically and are now seldom ever reported (Linnell *et al.*, 2000).

Ever since the earliest periods of herding livestock many carnivores have been persecuted for their role as predators of domesticated livestock. Policies to reduce Wild Dog populations in an attempt to safeguard livestock or game populations existed within our generation but expenditure on such policies often outstripped the cost of depredation. While depredation is nearly always overstated (Pringle, 1977; Rasmussen, 1997; Lines, 2003), predation of livestock and valuable farmed game is nonetheless a reality, often spread out unevenly throughout the farming community, with a few individuals bearing the brunt of the financial damage. Deliberate killing of Wild Dogs – often illegal – is an important cause of mortality, especially outside protected areas. One reason for this lethal control is that in many areas Wild Dogs are perceived to be serious predators of valuable livestock and game species and are killed either in response to depredation or with the intention of preventing it. It was partly for this reason that colonial governments often considered Wild Dogs to be 'vermin' and sponsored their eradication from many areas (Fanshawe *et al.*, 1991).

Livestock and game farming, both for commerce and subsistence, is the major land use across much of Africa and livestock often share the landscape with wildlife or occupy areas immediately adjoining reserves. This has two implications for Wild Dog conservation. First, it may mean that Wild Dogs inhabiting protected areas become involved in conflicts with neighbouring farmers, risk being shot, snared or poisoned as predators (or perceived predators) of livestock and game, and potentially undermining population viability. Second, it may mean that, if conflicts can be resolved, large areas of land dedicated to commercial or subsistence livestock farming have the potential to support globally important populations of Wild Dogs in the long term. Hence, resolving conflicts with farmers is a high priority for Wild Dog conservation (IUCN, 2004).

Results: Okakarara District - Prey depleted, established livestock production area
(Summarized from Lines, 2003a)

Historical record keeping at both community and MET level is inconsistent and sporadic so an extensive Communal Farm Survey was conducted to investigate human-predator conflict. The findings broadly concurred with a number of other studies from farmlands and rangelands indicating losses to Wild Dog are overstated compared with other predators and losses to predators were overstated compared to other causes of loss. Key results are summarized below:

Livestock Predation:

- Predation by Wild Dog accounted for 2% of cattle losses and 0.6% of small stock losses;
- For every cow loss to Wild Dogs 30 were stolen;
- Losses to Wild Dogs were spatially skewed to disproportionately effect a few farmers;
- Stock theft, poisonous plants, birthing problems and veld injuries are all more significant loss causes to livestock than are all predators combined;

	Total Livestock Numbers	Average Herd Size/ Homestead	Total Losses All causes	Average Losses / Homestead	Average lost to Predators	Average losses to Wild Dogs
Small stock	5757	68.5	1823	21.7	5.6 (26%)*	0.03 (<1%)
Large stock	6842	81.5	1053	12.5 2	.0 (16%)*	0.3 (2%)

Table 8: Livestock Numbers & Losses at Homestead Level, Okakarara 2002/3 (Lines, 2003).
*all predators combined

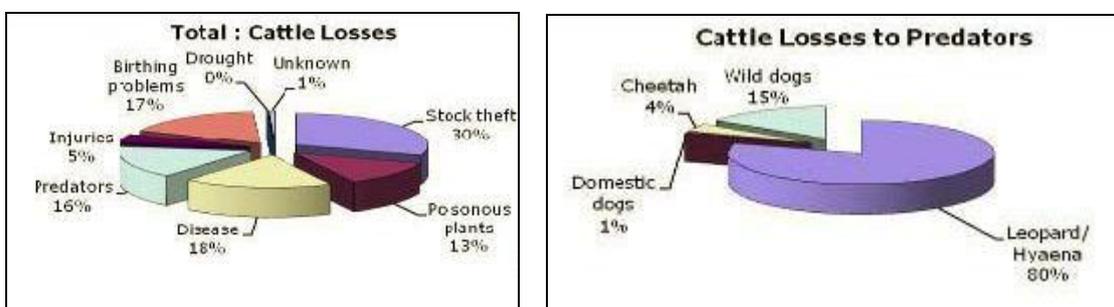


Figure 18: Mortality causes in cattle, Okakarara 2002/3 (Lines, 2003).

Community attitudes and perceptions:

- >80% of community want Wild Dog populations to decline;
- Attention on most conspicuous predator, not most damaging;
- Wild Dogs (and all predators) believed to have larger impact on livestock than reality.

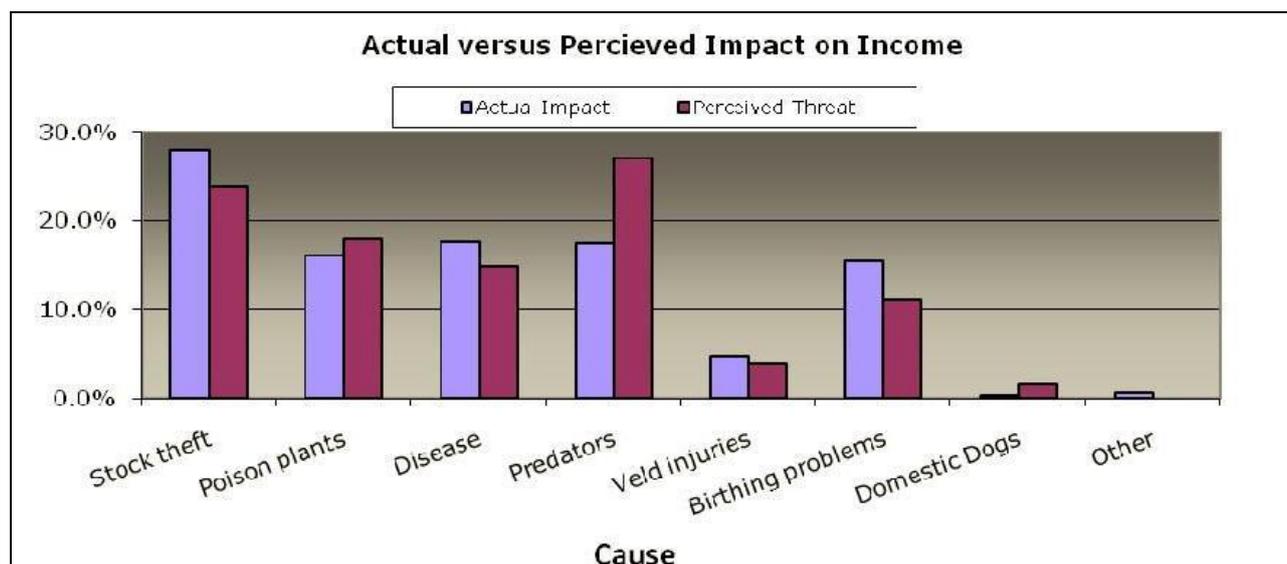


Figure 19: Discrepancy in livestock losses, Okakarara 2002/3 (Lines, 2003).

Human depredation of Wild Dogs very hard to collect but:

- Outside denning periods little success killing Wild Dogs which become very illusive if harassed, even semi-nocturnal;
- Area characteristics (large remote, road less areas, limited transport, communications and firearms) restrict localised eradication;
- Shooting, snaring, poisoning and burning out dens most common form of persecution at the most sensitive time in their life cycle when pack recruitment occurs;
- Two recorded incidents of deliberate road kills (6 deaths);
- Six known incidents of zero recruitment to breeding packs with dens excavated/smoked out, water sources poisoned and gin traps snaring breeding adults;
- In the most recent incident a breeding female was gin trapped and her 9 pups excavated – all subsequently died. Second female gin trapped and chased for 33km with trap on foot before captured. Died of injuries.

Results: Tsumkwe & Gam Districts combined

Incident book data, gathered by MET staff, based on local reports, and kindly offered for analysis, provides a valuable insight into the costs of human-wildlife conflict in the vast expanses of NE Otjozondjupa Region according to differing land uses, settlement characteristics and wildlife density. See *Study Area* section for reference. Data has been standardised with the removal of costs relating to human injuries and government fencing/water point maintenance, which would increase financial costs significantly if data was available. As such figures should be considered *minimum* estimates.

Interestingly, data is only available for losses incurred due to wildlife and not other loss causes. If data from the Okararara study is any guideline, we can reasonable expect a significant percentage of financial losses to livestock as a consequence of stock theft, birthing problems, injuries, ingestion of poisons and disease. When a drought occurs, as is periodically the case in Southern Africa, massive financial losses will occur. These losses are somewhat underrepresented in these data sets given long term climatic trends and impacts on livelihoods.

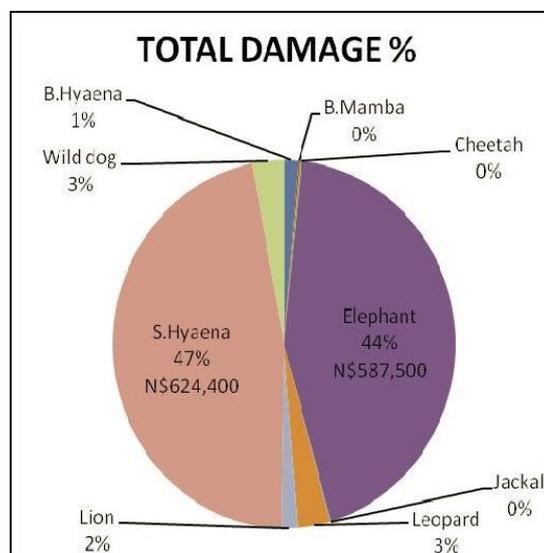


Figure 20: Financial implications of human-wildlife conflict, Tsumkwe/Gam 2000/8*1 (MET Incident Book Tsumkwe/Gam*2 2000/8)

*1 excludes small stock losses and other livestock loss causes

*2 includes data from Kaudom GR and Buffalo Camp

Tsumkwe District: Unfenced established wildlife area, limited livestock farming or human-wildlife conflict

Species	Incidents	Total cost N\$	Cost/incident N\$	% cost
B. Hyaena	14	17,500	1,250	11%
B. Mamba	1	500	500	0%
Elephant	24	101,000	4,208	61%
Leopard	44	21,150	481	13%
Lion	2	1,000	500	1%
S. Hyaena	45	20,250	450	12%
Wild Dog	1	3,500	3,500	2%
Total	131	164,900	1,259	100%

Table 9: Human-wildlife conflict breakdown, Tsumkwe 2000/8
(MET Incident Book, Tsumkwe 2000/8)

As might be reasonable expected in an area where the dominant species is a resource hungry megaherbivore, elephants represent the most significant cost, both overall and per incident. A single incident of Wild Dog predation on livestock in 8 years is reflected in the meagre 2% financial impact on livelihoods, *judged on wildlife only costs*. As with most livestock losses to predators, the causes are largely preventable through adaptive management and improved livestock husbandry, which currently is at a very low level. Livestock are left to roam unattended in the bush for long periods, sometimes many days, and rarely protected in suitable kraals at vulnerable times between dusk and dawn when the predators feed, and during birthing/calving periods.

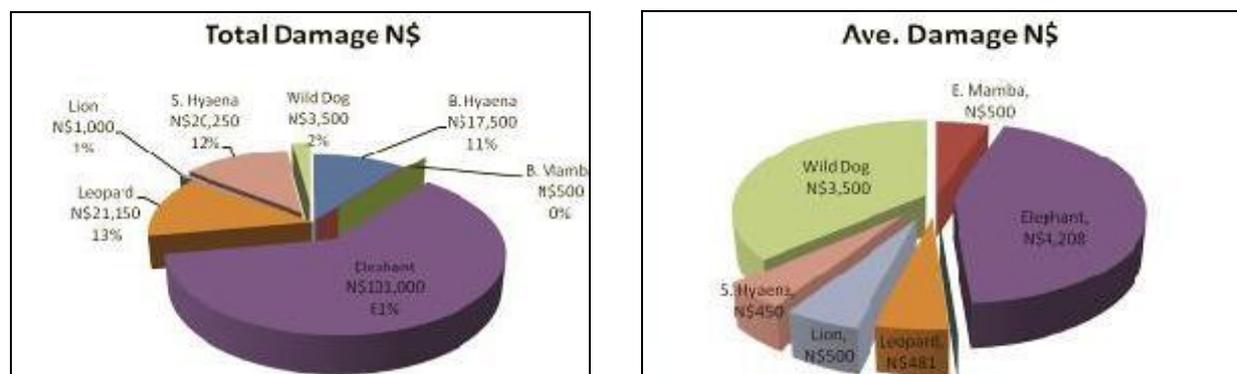


Table 10: Human-wildlife conflict breakdown, Tsumkwe Agricultural farm 2000/8
(MET Incident Book, Tsumkwe 2000/8)

Interestingly Wild Dogs have bred in and around the farm for the past 3 years without any incidents of livestock predation, and at a time in the dogs’ life cycle that predation on livestock is predictable when prey numbers are reduced through intensive localised hunting. An investigation of 20yr records for the farm reveals only 3 incidents of Wild Dog depredation on livestock.

Once again elephant damage to fences and unprotected water points is the major financial cost.



Figures 23&24: Financial implications of human-wildlife conflict, Tsumkwe Agricultural farm 2000/8* (MET Incident Book, Tsumkwe 2000/8)

*excludes small stock losses and other livestock loss causes

Gam District: Growing pastoralist community, Developing livestock area; Prey depleted though intense, unsustainable harvesting; High level of human-Wild Dog conflict.

- Area represents significant *sink population* to the *source population* in Tsumkwe District;
- Results based on preliminary data;
- Additional human-wildlife conflict research in relation to other livelihood impacts required.
-

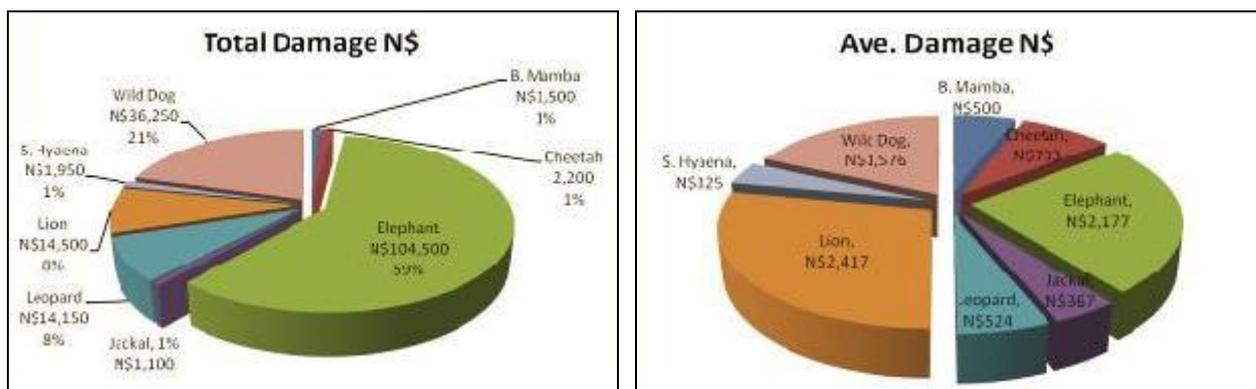


Figure 25&26: Financial implications of human-wildlife conflict, Gam 2000/8 (MET Incident Book, Tsumkwe 2000/8)

*excludes small stock losses and other livestock loss causes

Once again elephant represent the largest financial cost due to human-wildlife conflict, accounting for nearly 60% of losses. In contrast to Okakarara District (an area with many similar land use characteristics) losses to predators vary significantly. Wild Dogs appear to be responsible for around half of losses to predators. But considerable research is required to investigate these preliminary results in more detail given natural prey has been effectively eliminated around most of the farmed areas to the east.

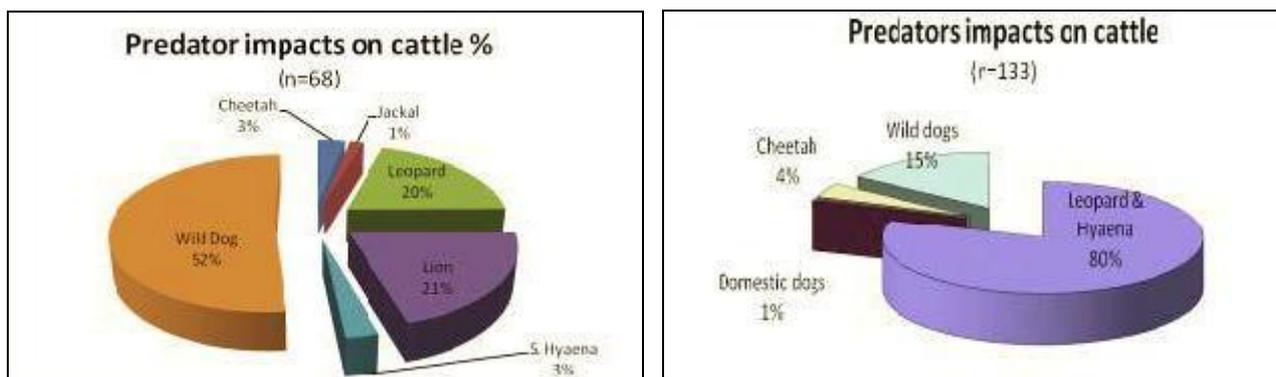


Figure 27&28: Predator impact on cattle, Gam & Okakarara
(MET Incident Book, 2000/8; Lines, 2003)

Implication of disease for the viability of Wild Dogs in Namibia:

Disease has potentially a significant impact on the viability of Wild Dog populations. Wild Dogs are known to be susceptible to a number of infectious diseases and their social behaviour facilitates the transmission of infectious pathogens among individuals (Laurenson *et al.*, 2004). The infection of one pack member may therefore rapidly affect the whole pack and may thus result in catastrophic losses. It is confirmed that an outbreak of infectious disease has contributed to the extinction of at least one Wild Dog population in East Africa (Kat *et al.*, 1995; Woodroffe *et al.*, 2004). Likewise, although there are so far no data on disease outbreaks and associated mortalities in Wild Dogs, apart from some historical records (Gaerdes, 1976), disease could potentially also have a significant impact on the Wild Dog population in this country. Wild Dog-pathogenic diseases like Rabies, CDV and PDV infection readily occur in Namibia (Schneider, 1994) and also a study conducted 8 years ago in the Tsumkwe District provided evidence that the sympatric Wild Dog populations has indeed been exposed to disease (Laurenson *et al.*, 1997). To investigate and monitor the occurrence and dynamics of Wild Dog-relevant diseases in Namibia is therefore of great significance for the long-term conservation of the species in this country. An important first step in this context is to look at and monitor the local domestic dog population in Namibia's core Wild Dog area. Since Wild Dogs always occur at low densities the persistence of highly pathogenic diseases in the Wild Dog population alone is very unlikely (Laurenson *et al.*, 1997). Instead, the existence of a reservoir in another species and the occurrence of spill-over infections from those reservoir hosts are necessary. One very likely reservoir is domestic dogs (e.g. Kat *et al.*, 1995; Van Heerden *et al.*, 1995). In a serological survey of local domestic dogs and Wild Dogs conducted in 1993/94 in Tsumkwe District (Laurenson *et al.*, 1997), antibodies against a number of infectious diseases was found in the domestic dog population, three of which also occurred in the sampled Wild Dogs. Domestic dogs are very popular in rural Africa and hence dog numbers are steadily increasing with the growing human population, which simultaneously also increases the risk of transmission of pathogens from sick domestic dogs to Wild Dogs.

While in 1993/94 the local domestic dog population in Tsumkwe District was only around 137 dogs: 107 dogs in 28 villages plus an estimated 30 dogs in Tsumkwe town (≈ 3.64 dogs/village (Laurenson *et al.*, 1997), a village survey conducted by the Wild Dog project staff in October/November 2005 now revealed a domestic dog population of around 190 individuals in 31 inhabited villages (≈ 6.13 dogs/village). The number of domestic dogs in Tsumkwe town is estimated to have increased by up to an order of magnitude since 1993/94. Therefore the increase in the local domestic dog population is dramatic. Similar to the situation 10 years ago, the population is still skewed towards younger animals (median age = 1.5 years ($n=67$)) and the turnover-rate (percentage of animals under 1 year) is very high (44.3%). According to the dog owners, pup mortality, as well as mortality among adult dogs is high, the causes of death being mostly unknown. Since veterinary care is virtually non-existent in the area, apart from an annual Rabies vaccination program conducted by Veterinary Services since 1994, it seems likely that at least part of those mortalities is attributed to infectious diseases. In order to verify this assumption, to monitor the occurrence and long-term dynamics of infectious diseases within the local dog population and to assess the effectiveness of the annual Rabies-vaccination, blood samples survey from 67 domestic dogs (1-4 dogs/village) were collected during the village survey and will be screened for relevant diseases.

5.0 Management Options

Conflict on farmlands:

In reality little scope exists for Namibia to control the high levels of Wild Dog persecution on farmlands to a sustainable level in the short-medium term without a significant injection of money and resources, similar to those directed at rhino and elephant conservation since independence.

Under current trends of land conversion and persecution the existing Wild Dog population can be expected to decline to a maximum of c.150 individuals within 5-7 years. A century of inherited prejudice has wiped out the African Wild Dog from much of its former range and continues to be the major limiting factor effecting current range.

A paradigm shift in attitude and behaviour across vast commercial and communal livestock and game farming areas would be required in order to secure a viable population of 500 individuals given a single breeding unit of Wild Dogs might require up to 300,000ha. Even with significant range overlap a population of 500 individuals (in 50-65 packs) may require 5m ha of wildlife managed friendly habitat which is unlikely to ever be the case without reintroduction to Etosha and NW Namibia.

As a consequence it may be practical to assume that conservation efforts be focused on areas where the dogs are not persecuted and might be reintroduced or translocated to safely, perhaps utilising individuals that are captured on farmlands and would otherwise be killed, combined with surplus captive stock of the same genotype. It is simply not feasible to try and remove all Wild Dog packs from farmlands where they are persecuted and become immensely illusive, nor is it ecologically advisable when a few pack members might survive a persecution incident to breed in subsequent years, augmenting the remaining population.

Nonetheless selective capture and translocation of packs might be considered in exceptional circumstances. But it should be noted that this is a very problematic and difficult operation and only achievable if the denning area is located and the local farming community agrees to leave the pack unmolested while they can become semi-habituated to human presence. A capture attempt using multiple safe snares around the den area can then be attempted. But successful whole pack capture is far from guaranteed even under the most favourable circumstances and individuals might well move back into the empty territory in subsequent years. This is far from a long term solution.

Expanded and formalised environmental education initiatives in areas adjacent to core populations are critical to try and mitigate the edge effects that draw out packs from core areas and expose them to persecution. Farming communities must be informed about the need to preserve prey populations and drastically improve livestock husbandry. A growing body of work indicates that where prey populations are maintained and simple effective husbandry measures are implemented, very little livestock is lost to Wild Dogs – well within tolerable limits compared to the impacts of stock theft, ingestion of poisonous plants, birthing injuries, disease and drought.

Augmenting core population:

With edge effects reducing the core population to below carry capacity a strategy to assist core population maintenance could entail soft release of bonded individuals into the core area, composed of a combination of wild caught and captive bred animals. Post release monitoring using VHF/GPS telemetry would be essential to establish survivorship and other baseline ecological factors. Nyae Nyae Conservancy in Tsumkwe District would be an ideal location due to low conflict, increasing prey populations, existing community support for Wild Dogs and established Wild Dog research in the area. This initiative could be run in parallel to plans for an Etosha release and provide an additional release site for animals caught on farmlands and otherwise killed. Funding to initiate this project is available immediately from the Wild Dog Project.

Protected Area reintroductions – Etosha NP:

Developing a second viable population inside a suitable protected area is the single most important conservation intervention for the African Wild Dog in Namibia.

Etosha NP represents the largest NP in all of Africa, within former Wild Dog core range, to be considered recoverable range. With linkages to the growing wildlife areas in NW Namibia and bordering private nature reserves, conservative estimate suggest that a doubling of the current population is achievable within 5-7 years utilizing a method of staggered soft release of multiple packs composing the same bonded pack technique mentioned above. While early pioneering attempts at reintroductions failed in Etosha NP there have been very significant developments in release techniques since then and over 25 sub-populations have been established in smaller game reserves in South Africa alone and have provided a significant tourism boost while ensuring local survival of the species. Funding to initiate this project is available immediately from the Wild Dog Project.

Metapopulation management:

A more intensive management option, that could run in parallel to the previous conservation interventions, would be to set up a *population of sub-populations*, managed for genetic viability, across a number of large fenced reserves, in a similar vein to Namibia's successful black rhino custodianship programme.

Significant oversight to ensure high levels of adherence to management objectives and guidelines would be necessary (Lines, 2003). To a degree this has started to occur in Namibia with Erindi GR bringing in 2 packs from South Africa in the past 18 months and further private reserves showing interest, some of which have captive stock awaiting release. But to date this has been done on an *ad hoc* basis, neglecting strategic management of the species in accordance with internationally recognisable guidelines (IUCN, 2004).

A significant benefit of this approach would be to promote tourism of the species and develop its economic value in Namibia, as would be the case for reintroductions to Etosha NP, although utilising private sector resources.

6.0 Community Support

Education & awareness initiatives to reduce conflict:

The Wild Dog project continues with local education and awareness projects focusing on both farming communities and other stakeholder groups. A summary of 2008 activities follows:

Activity:	Training workshops on Integrated Predator and Livestock Management
Area:	Tsumkwe
Stakeholder Group:	Communal farmers, conservancy members and game guards
Frequency:	5 Day courses
Exposure:	25 participants
Partner:	Cheetah Conservation Fund, IRDNC, MET.

Activity:	WILD DOG FLYING KILOMETER race
Area:	Tsumkwe
Stakeholder Group:	All community, including school children
Frequency:	1 annually
Exposure:	65 runners, 3 age groups, 250 spectators
Partner:	Nyae Nyae Conservancy

Activity:	Environmental Education (EE) radio show in local Ju\`Hoansi language
Area:	Tsumkwe town, Nyae Nyae
Stakeholder Group:	All members of the community, focusing on youths
Frequency:	Bi-weekly
Partner:	Namibia Broadcasting Corporation

Activity:	Radio interviews in OtjiHerero, English, Afrikaans, Ju\`Hoansi and German on Wild Dog conservation and integrated predator and livestock management
Area:	Windhoek, Okakarara, Otjiwarongo, Grootfontein and Tsumkwe Districts
Stakeholder Group:	All members of the community
Frequency:	19 interviews in 5 years
Partner:	Namibia Broadcasting Corporation/Kudu FM

Activity:	Articles on Wild Dog conservation in press
Area:	Local, National and International press
Stakeholder Group:	General public
Partner:	Magazines: Conservation, Forum, AgriForum, Flamingo (all Namibia).
Newspapers:	New era, Die Republikein, The Namibian (all Namibian)
Newsletters:	Peoples Trust for Endangered Species, TUSK Trust, Kennel Club, Rufford Conservation (all UK).

Activity:	Publications on Wild Dog conservation: <i>Predators on Livestock Farms</i> , Integrated Predator and Livestock Management (content supplied), <i>Truth About Wild Dogs</i> (poster and pamphlet).
Area:	Across communal and commercial farming sector
Stakeholder Group:	Farmers, youth groups and MET staff
Partner:	CCF, Communal Conservancies in Otjozondjupa, Namibia Development Trust, NARREC, MET

Community benefits from Wild Dog Project:

Low game numbers, poor infrastructure and a homogenous livestock dominated (largely fenced) farming landscape precludes much opportunity for wildlife and Wild Dog tourism in Okakarara and Gam Districts in the short or medium term.

In contrast there is vast scope for low impact/high income enterprises in Nyae Nyae Conservancy where the Wild Dog aren't harassed and persecuted by local community members. Since June 2004 the WDP has hosted 6 EE groups at Klein Dobe EE Centre, trialling various experimental packages with a focus on interpretive hunting / gathering walks with the local San community, photographic trips and Wild Dog tracking. Traditional skills are being promoted and training offered to community members.

Total accrued community benefits from these zero profit initiatives 2004/7 exceed N\$30,000. This is a small fraction, perhaps 10%, of what could be earned from commercial exploitation of the species on purely nonconsumptive sustainable utilisation.

In addition the following benefits flowed to the local community from Wild Dog Project presence 2007/8:

Category	Total N\$
Employment*1	10,710
Community bonuses	1,280
Camping fees to NNC	2,175
NNC entrance fees	300
Dance fees	930
Educational support*2	9,950
Craft purchase	2,500
Total	27,845

Table 12: **Wild Dog Project Support to Nyae Nyae Conservancy members, 2007/8**

*1 Average daily rate, inclusive of food but excluding clothing and camping equipment was N\$47/person/day.

*2 TEEP educational programme, NNC meetings/training, Wild Dog Flying kilometre

Conclusions

Mounting evidence indicates that the African Wild Dog is rapidly approaching vagrant status in Namibia with perhaps only 1-2 areas where sightings occur with any regularity (Tsumkwe East & West Caprivi). Little doubt can exist that the species is Namibia's most endangered large mammal - probably outnumbered 3:1 by lion, 5:1 by black rhino, 15:1 by cheetah and 100:1 by elephant. The population trend is downwards, irrespective of short term fluctuations, and is probably declining at a rate of $\approx 10\%$ pa. Establishing a second viable population under protected area status is critical for the survival of the species in Namibia.

Latest estimates suggest <300 adults and yearlings with annual human-induced depredation rates exceeding annual recruitment, notwithstanding additional natural mortalities impacting on the population further. Wild Dogs in Namibia appear less robust to changing land uses in comparison to leopard, jackal and cheetah which have persisted on farmlands under pressure from significant human-induced depredation for generations, and even increased in numbers with the decrease in interspecific competition from larger predators.

It is also very unlikely that more than a handful of breeding packs, perhaps totalling 30-45 individuals from the entire population, are safe from one or another form of human-induced persecution for their entire annual life cycle. This should be a major cause for concern with totally insufficient protected area coverage to secure the population.

Data suggests that African Wild Dogs can exist across an extensive range of habitats wherever suitable prey density exceeds 1-2kg/ha without extensive livestock depredation occurring, even where livestock husbandry is almost non-existent. This is encouraging for reintroductions both in state protected areas bordering farmlands and large private reserves.

Further research is required to understand the impact of the connected populations in Botswana, Angola, Zambia and Zimbabwe on the viability of our population.

A reintroduction to Etosha National Park is essential to secure a second viable population under protected area coverage.

References

A comprehensive list of references is available on request.

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