

# Spotted Hyaena Ecology and Human Wildlife Conflict in the Caprivi Region of Namibia

## 2010 Research Report



*Photo: Anthony May*

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## **Acronyms**

AWT	African Wildlife Tracking
BNP	Bwabwata National Park
CGG	Community Game Guards
CVL	Central Veterinary Laboratory
FMD	Foot and Mouth Disease
GPS	Global Positioning System
GSM	Global System for Mobile Communications
HACCIS	Human Animal Conflict Community Insurance Scheme
HWC	Human Wildlife Conflict
ICEMA	Integrated Community- Based Ecosystem Management Project
IRDNC	Integrated Rural Development and Nature Conservation
KA	Kyaramacan Association
MET	Ministry of Environment and Tourism
MNC	Mudumu North Complex
MNP	Mudumu National Park
MSC	Mudumu South Complex
NACSO	Namibian Association of CBNRM Support Organisations
NEWS	Namibian Environmental and Wildlife Society
NGO	Non-Government Organisation
NNF	Namibia Nature Foundation
PA	Protected Area
PCT	Predator Conservation Trust
SPAN	Strengthening Protected Areas Network
TA	Traditional Authority
TFCA	Trans Frontier Conservation Area
VHF	Very High Frequency
WWF	World Wide Fund for Nature

## Background

Globally, many large carnivore populations are in decline. In most cases, the persistence of these species is linked to their relationship with humans (Lichtenfeld 2005). Large carnivores clash with the interests of humans to a greater extent than do many other groups of animals (Mills 1998). Some of these large carnivores prey upon livestock, causing economic damage and ill will (Hemson 2003).

Spotted hyaenas are the most abundant of all large carnivores in sub-Saharan Africa, occurring in a wide variety of habitats. However their range, especially in southern Africa, has become drastically reduced in this century (Kruuk 1972). This reduction in the number and distribution of spotted hyaenas has been accelerating as human population increases (Nowell & Jackson 1996), resulting in an increase in conflict with human development. This problem is accentuated in areas of high human density, such as the Caprivi and Kavango Regions.

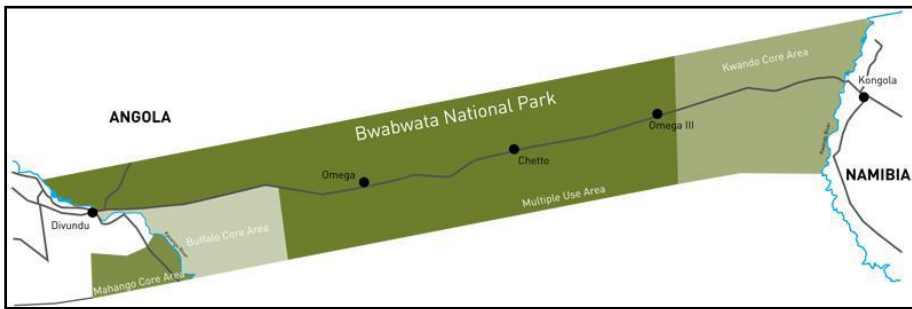
The future for spotted hyaenas outside protected areas remains precarious. It is difficult to reconcile the presence of spotted hyaenas in agricultural areas, and there is little point in attempting to do so (Mills, 1990). They are formidable livestock killers and are actively persecuted. Hyaena social structure is complex and the removal of a number of key individuals is likely to lead to the breakdown of the social group. Once a spotted hyaena social group has disappeared, it is difficult to repopulate the area (Kruuk, 1998). The spotted hyaena is unable to inhabit agricultural areas successfully and its future is tied to the long-term future of conservation areas (Mills 1990).

Most Namibians depend on the land for their subsistence, but the presence of many species of large mammals, combined with settlement patterns of people, leads to conflict between people and wildlife (Human Wildlife Conflict Management report). Large carnivores occur throughout the Caprivi and Kavango regions and frequently cross international borders. Their population dynamics, movements and conservation status are poorly understood despite ongoing conflict with local people. HWC is an issue of pressing conservation concern, particularly when it involves threatened species, and accurately identifying the causes of such conflict is fundamental to developing effective resolution strategies (Dickman, 2005). Long-term conservation of spotted hyaenas in the Caprivi and Kavango depends on their persistence in protected areas like Bwabwata National Park and in resolving human-wildlife conflict with the communities on the periphery.

Hyaenas are unique and vital components of most African ecosystems (Mills, 1998) and understanding the mechanisms that regulate or limit their population should be taken into consideration when developing management plans for protected areas. There is little data from the Namibian population including the Caprivi region.

Problem-causing animals are and always will remain a challenge in Africa wherever people and wildlife live together (Esterhuizen, 2004). Sound ecological data, such as reliable population estimates, distribution and population demography, are crucial in the implementation of conservation strategies and conflict resolution.

## Study Site



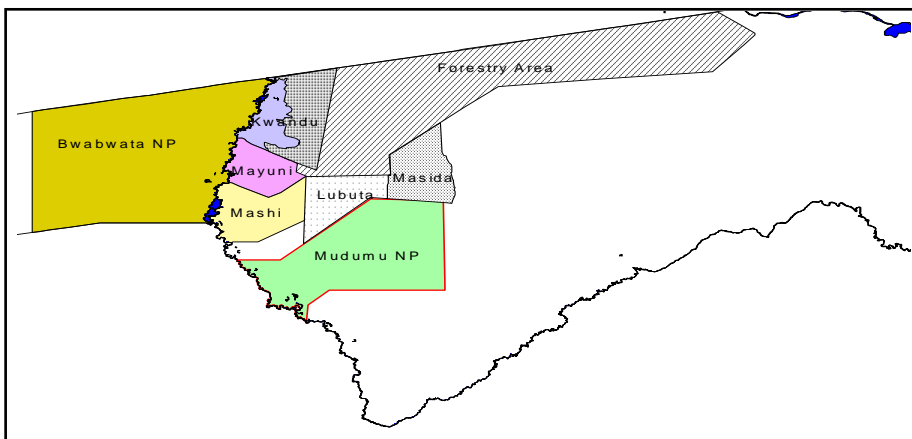
West Caprivi (Bwabwata National Park)

Source: [www.met.gov.na](http://www.met.gov.na)



The Caprivi Region relative to the rest of Namibia.

Source: [www.met.gov.na](http://www.met.gov.na)



Mudumu North Complex in the East Caprivi (Adapted from Peggy Poncelet Report)

Source: [www.nnf.org.na](http://www.nnf.org.na)

The Caprivi Region lies in north east Namibia and stretches 450 km from east to west and ranges between 32 km and 100km in width from north to south and covers a surface area of approximately 20 000 km<sup>2</sup>. Its highest elevation in the west is 1100 metres which drops to 930 metres in the east. The landscape is shaped by thick deposits of Kalahari sands and perennial rivers with their associated floodplains.

The Caprivi has a mean annual rainfall of 550 mm (range 400 mm to 700 mm) which falls in the summer months from September to March. The majority of the area, i.e. the Mukwe district, the west Caprivi and the sandy plains of the east Caprivi consists of sand dunes which are dominated by Kalahari woodland vegetation type. This includes tree species like Burkea (*Burkea africana*), Leadwood (*Combretum imberbe*) Teak (*Baikiaea plurijuga*) Mopane (*Colophospermum mopane*), Camelthorn (*Acacia erioloba*), False Mopane (*Guibourtia coleospermia*) and Terminalia (*Terminalia sericea*). (Adapted from Mendelsohn and Roberts 1998)

The spotted hyaena study is taking place in the west Caprivi, which has been proclaimed as the BNP as well as the MNC bordering the Kwando River in the east Caprivi and adjacent to BNP. BNP is bordered by two perennial rivers, the Kavango in the west and Kwando in the east, by Angola in the north and Botswana to the south. Approximately 6500 people reside inside the park in multiple use areas focused around Chetto, Omega and Omega 3. Field work within BNP has been focused on one clan of spotted hyaenas within the Kwando Core Area.

The MNC consists of four conservancies, i.e. Mayuni, Mashi, Kwandu and Sobbe and borders BNP to the east along the Kwando River and MNP to the south. MNC falls adjacent to the international boundary with Zambia to the north. Approximately 13000 people and their livestock (*NACSO 2006*) reside in villages within the MNC. The study in the MNC has been focused on collecting baseline data on spotted hyaenas within livestock farming areas of the east Caprivi as well as examining the cause and extent of predator related HWC.

## **Spotted hyaena ecology**

### **Field activities**

Field activities took place between February and December 2010, with the majority of time (five months) spent attempting to capture, collar and monitor spotted hyaena presence and activity within the conservancies of the MNC. Approximately two months was spent in monitoring changes and activities of the original long-term study clan (Kwando Clan) within the Kwando Core area of BNP. Other activities involved assessing predator-related HWC through the Conservancy event book system for the MNC and BNP as well as monitoring livestock practices within the different conservancies of the MNC in the East Caprivi.

The systems of the east and west Caprivi are entirely different and cannot be dealt with as a single study site. Therefore the results of the field activities for 2010 are presented separately in this report.

### **Mudumu North Complex – East Caprivi**

Meat for baiting hyaenas in the east Caprivi was not subject to FMD quarantine restrictions which enabled it to be sourced locally. Goats were bought from farmers and haunches of beef were bought from roadside meat stalls where cattle are slaughtered locally. Approximately N\$5000 was spent within the MNC procuring meat for bait during 2010.

It was decided to follow the method of baiting used during 2009 in BNP, which involved identifying areas of known hyaena activity or assumed hyaena activity based on personal communication from communities and farmers or observation of spoor. As the study in the MNC is focused on HWC as well as the possibility of PA's being the source of problem predators, the baiting process was started as close to the boundary of MNP as possible. The aim was to study a clan that used both MNP and the livestock farming areas as part of their home range.

Bait was hung out of reach of hyaenas and other predators in a tree chosen for its accessibility by vehicle as well as visibility at night for the immobilization of study animals. Over a period of five months, five baiting sites were established (one site was used twice during the wet and dry season). Scent trails of between 50 metres and 10 km were run from the baiting site to an access road or outline where hyaenas were likely to traverse. The bait was monitored by an infra-red remote camera that was programmed to record time and date of visit as well as temperature and the phase of the moon. As one hyaena continued to attack cameras, eventually destroying one and badly damaging another, it was necessary to mount them in a metal housing for protection.

Photos were downloaded onto a laptop every 24 to 48 hours and occasionally cameras had to be removed to charge their batteries by solar power. Areas outside of camera range were monitored for predator activity by scanning the ground for spoor.

It is worth noting that the high density of people in the MNC proved a particular challenge to monitoring by camera. One camera was tampered with by removing it from its metal housing and then replacing it upside down so that the sensor was blocked. One camera belonging to ICEMA was stolen from the Njalingombe waterhole.

Unlike activities in BNP during 2009 where a hyaena clan was semi-habituated for capture and study, it was decided that this would be unethical in an area where hyaenas are persecuted and trophy hunted as it would make them easy targets. As it turns out, concern about habituation was unfounded as despite sitting for up to five hours a night over a period of approximately six weeks at one bait continuously, one hyaena was seen only briefly for a period of ten seconds before disappearing into the surrounding vegetation, even though they were regularly recorded on camera visiting the bait when the vehicle was not present.

Additional infra-red cameras belonging to ICEMA for the monitoring of the newly established Njalingombe and Lwazaze waterholes provided excellent non-invasive observations of hyaenas as well as other predators. Using natural markings and scars it was possible to identify individuals and group make up of an additional clan near the Zambian border that frequented the Lwazaze waterhole, but were not the focus of intensive study at the time.

Sound was used on only one occasion without success at the bait site adjacent to the northern outline of MNP. It was preferable to rather allow the hyaenas to discover the bait sites on their own through following the scent trails.

In order to monitor hyaena movements within the conservancies, GSM collars were purchased from AWT and preset to take a location every hour between 21h00 and 04h00. Ideally obtaining data over a 24 hour period would improve the quality of results, but the battery life severely limits the length of the collar's effectiveness. The present settings are the maximum that the battery life will allow for the collar to provide just over one year of data.

Despite meat being laced with the sedative Midazolam (Dormicum, Roche) at a dose of 75 mg, which results in mild sedation and marked increase of tolerance of observers which increases success in immobilization, hyaenas continued to be extremely wary and would not approach the bait while the vehicle was present although they tended to remain in the area. On two occasions while noticeably sedated, they were observed running away from the approach of the vehicle. The male hyaena was immobilized while found walking in the track dazzled by the headlights. Tiletamine and Zolazepam (Zoletil, Virbac ) at a concentration of 5 mg/kg injected with a disposable 2 ml dart using a Pseudart rifle was used for immobilization. Recumbency took ten minutes. An additional 100 to 200 mg dose was hand injected intramuscularly within 20 minutes to half an hour after initial darting. A cloth was placed over the head of the immobilized hyaena to reduce external stimuli.

Samples were collected which included whole blood, blood smears, tissue and hair. Natural markings and scars were photographed and body and tooth measurements were recorded. Teeth wear and condition was recorded to establish age class and the general condition was assessed and the gender noted. Ear notching was used to visibly mark and number the hyaena. Body weight was estimated.

Capture work took place between 17h30 pm and 03h30 am and bait site and remote camera maintenance and servicing took place during daylight hours.

Scat was picked up incidentally to identify prey remains.

## Results

### Baiting

Despite copious servicing of bait sites through replenishing of bait and scent trails, only two spotted hyaenas were recorded on infra-red camera visiting one baiting site out of the five within the conservancy areas. This baiting site is approximately 20 km from MNP boundary. It is worth noting that three of the baiting sites had no hyaena response and two had no response from any predators at all despite being on the boundary of a national park. At these two sites, the bait rotted off the cable and remained untouched at the base of the tree. Baiting results are presented below.

Bait site	Period of baiting	Predator activity	Outcome
Mudumu northern boundary (10 km east of park entrance)	3 weeks	1 leopard for two nights 1 jackal all nights	Removed carcass remains
Mudumu northern boundary (25 km east of park entrance)	1 month	–	Carcass rotted off cable. Lay at base of tree.
Mudumu northern boundary (1 km west of park entrance)	8 days	–	Carcass left at base of tree.
Njalingombe (dry season)	6 weeks	1 leopard for two nights 2 spotted hyaenas most nights	Hyaena capture and collar
Njalingombe (wet season)	3 weeks	–	Carcass left at base of tree.

Table 1: Predator response at five baiting sites in the MNC

### Njalingombe

The waterhole at Njalingombe was chosen as a site for baiting after two attempts on the MNP boundary had already failed. Spotted hyaena spoor were regularly seen along the track leading to the water as well as at the waterhole itself. The bait site was established on the 20<sup>th</sup> August and was visited by a female hyaena at 23h14 on the same night. She stayed within the immediate vicinity of the bait for close to five and a half hours even though she was unable to reach the bait itself and departed at 04h37 in the morning.

Except for three nights (two of which the bait was visited by a leopard), she was the only hyaena photographed visiting the bait over a period of three weeks before being joined by a male hyaena on the 10<sup>th</sup> September.



A female hyaena at Njalingombe bait site in MNC



A male hyaena appears at the bait after 3 weeks.

After the 20<sup>th</sup> September, the female hyaena was not recorded visiting the bait site again. The male hyaena was immobilized and collared on the 1<sup>st</sup> October whereafter it was decided to dismantle the bait site until location data from the GSM collar would indicate a possible den site through high density of locations. A new bait site closer to the den would possibly improve capture success.

### Clan size and structure

Typically spotted hyaena clans contain multiple adult females, their offspring and one to several immigrant males that join the clan as adults (Boydston, 2003). Due to lack of response to baiting efforts it is impossible to assess with certainty whether spotted hyaenas exist in stable clans within the livestock farming areas of the MNC. Spotted hyaenas are trophy hunted within the MNC which is likely to damage the clan structure due to the unique population dynamics of the species. Much of the effort to trophy hunt spotted hyaena in the MNC was concentrated on the vicinity of Njalingombe waterhole, but without success during the 2010 season.

ID	Sex	Age	ID Method
Njalingombe 1	Female	Adult	Photo
CCC-7	Male	Adult (3 years)	Photo Ear notch Collar

Table 2: ID, sex and age of two hyaenas in the MNC

### Home Range

Unfortunately the GSM collar has not transmitted one data point since deployment despite cellphone towers at Kongola and Lizauli providing adequate network coverage.

After two months an attempt to recapture the male hyaena to remove the collar and download the stored location data failed as no hyaenas or other predators visited the re-established bait site at Njalingombe during the wet season.

With the assistance of MET's aircraft we were able to use the VHF facility on the collar to track the hyaena to approximately 8 km south of the northern cutline of MNP. Attempts at VHF tracking from the vehicle at night were unsuccessful, which is likely due to the undulating terrain. The ICEMA

camera at the Njalingombe waterhole subsequently photographed the collared hyaena drinking water.

Although it is not possible to identify a home range at this point due to lack of data, a number of conclusions can be drawn from the photographic evidence and tracking data. As the distance between point of capture and point of location through aerial tracking is approximately 30 km, it is unlikely that the hyaenas originate from MNP only making forays into livestock farming areas as is the general assumption among livestock farmers. Due to the frequency of visits by both the male and female hyaenas at the bait site at Njalingombe, it is likely that these spotted hyaenas spend a significant portion of their time outside the PA of MNP. As the den is an important part of hyaena society (Boydston, 2006) where females spend a significant portion of their time, it is as likely that dens occur within the conservancies as within PA's. Even though spotted hyaenas are capable of covering a distances of up to 70 km in a night (Mills, 1990), it is unlikely that MNC hyaenas would travel 60 km to and from MNP every 24 hours to visit the bait site and return to the den. Given the great distance covered (three conservancies and part of MNP) by one collared hyaena, it is likely that hyaena density is far lower than assumed and population numbers based on spoor frequency is overestimated.

It is common perception that spotted hyaenas within the conservancies of the MNC originate from PA's such as MNP and BNP, although collared hyaenas from BNP have not once crossed the Kwando River during two years of monitoring into the east Caprivi (Hanssen, unpubl data). It appears that conservancies within the east Caprivi are as likely a source of spotted hyaenas as MNP and are therefore potentially important habitat for the species.

### **Lwazaze Clan**

The waterhole at Lwazaze which is situated approximately 20 km east of the Kwando River and five km south of the Zambian border in the forest areas of the MNC was monitored by infra-red remote camera for wildlife activity between the 1<sup>st</sup> September and the 16<sup>th</sup> December 2010. Lwazaze appears to be the centre of more predator activity than any other kind of wildlife, with spotted hyaenas, leopard and even wild dog being regularly photographed. Using markings, age class and group association of hyaena from photos (n = 211), it was possible to identify individuals and group make-up indicating the presence of a stable clan.

<b>ID</b>	<b>Sex</b>	<b>Age</b>	<b>ID Method</b>
Lwazaze 1	Female	Adult	Photo
Lwazaze 2	Female	Sub-adult	Photo
Lwazaze 3	n/a	Large cub	Photo
Lwazaze 4	n/a	Large cub	Photo

*Table 3: ID, Sex and Age Class of Lwazaze Clan*



A sub-adult female with eye injury



Same sub-adult female with large cub



Sub-adult female playing with cub



Two large cubs and sub-adult



Adult female with large cub



Large cub photographed seconds later

*Clan identified through infra-red remote photos showing individuals, groups and association.*

## Home Range

All observations of the Lwazaze clan were obtained indirectly through infra-red remote photography. As they were not the focus of the HWC study, none of these animals were collared and monitored. The remote camera was placed on the northern side of the waterhole facing south. All predators were photographed approaching the waterhole from the north passing closely in front of the camera, despite many game trails leading to the waterhole from all directions. This is a strong indication that they spend much time north of Lwazaze making the PA of Sioma Ngwezi in Zambia a likely part of their home range.

## Scat and Latrines

Latrines are found throughout spotted hyaena territory, often performing the function of territorial marking (*Kruuk, 1972*). Latrines are located along the boundaries of a clan territory, but some are found close to dens where they serve a social function. Latrines are a good indication of spotted hyaena presence and activity.

The entire network of tracks and roads throughout the conservancies of the MNC were driven by vehicle and many game trails were followed on foot attempting to locate hyaena latrines. Individuals taking part in the annual transect count were asked to look out for latrines within the conservancy areas. Despite active searching throughout the dry season, no latrines were located within the conservancies of the MNC.

Latrines are also a good source of scat. Although spotted hyaenas digest all organic material and excrete only inorganic material (*Kruuk, 1972*) it is still possible to identify some prey items through hair and small bone, hoof and horn fragments. In this study, scat samples consisting mostly of calcium with minimal hair were assumed to be the result of scavenging.

A total of nine scat samples were collected incidentally, mostly around the waterholes of Njalingombe and Lwazaze. Three were from spotted hyaena, five were from leopard and one was from wild dog. The remains of livestock were found in only one leopard scat. Prey items are presented below.

Species	Prey species	Calcium residue
Spotted hyaena	–	Scavenge
Leopard	Kudu Scrub Hare Impala Spring hare Bird	–
Wild dog	Duiker	–
Leopard	–	Scavenge
Leopard	Kudu Scrub Hare Steenbok	–
Leopard	Kudu Vervet monkey	–
Spotted hyaena	Springhare Bushbuck	–
Leopard	Goat	–
Spotted hyaena	Duiker	Scavenge

Table 4: Prey remains found in nine predator scat samples within the MNC

## **Bwabwata National Park (West Caprivi)**

Field activities in the Kwando Core Area have been focused on the Kwando Clan, of which one member was originally collared in April 2009. Additional clan members were captured, marked and collared with GSM collars through September and October 2009 and home range data over 6 weeks to 6 months were presented in the 2009 research report.

Unfortunately two collars stopped transmitting data during December 2009 and June 2010 respectively, leaving only one collar on CCC-3 (last data point was recorded on 24 November 2010) continuing to provide locations.

During 2009, three den sites were identified through the clumping of locations provided by the GSM collars. The area corresponding to the locations was explored on foot and the actual locations of the three dens were marked on GPS. During 2010, the dens were monitored for number and age of cubs as well as identifying and capturing unmarked clan members. As Caprivi hyaenas are particularly wary of people, monitoring den life through direct observation is too invasive. Den monitoring was achieved by approaching all three den sites on foot to identify which one was active. An infra-red remote camera was set up approximately four metres from what appeared to be the den entrance with the most activity. At this point I would like to express my gratitude to Dave Ward and Raymond Peters from WWF in Namibia for braving elephants, buffalo, lions, hornets and grass seeds in their shoes and for their expertise in contributing to this exercise.

One unmarked sub-adult female hyaena was identified and was later captured along with CCC-2 at the original bait site where all members of the Kwando clan were captured. Blood samples and blood smears were taken from both hyaenas and the female was ear notched. She was too small to collar safely. She was ID'ed as CCC-6 and her age was estimated from tooth eruption and wear, which was almost identical to that of CCC-2. Being larger than CCC-2 who is male, it is presumed that she is his sibling from the same litter.

Additional collar downloads provided more evidence of high density activity which were investigated for possible den sites, but none were found.

Three additional latrines were found and recorded on GPS by Dave Ward while carrying out field work for WWF. Dave collected scat samples for analysis. An additional nine scat samples were examined for prey remains bringing the total number of scat samples from the Kwando Core Area to 44.

## **Results**

### **Clan size and structure**

The Kwando Clan is made up of ten individuals. No additional adult males have been identified either through photos ( $n = 1120$ ) or direct observation leaving the Kwando Clan still with only one adult male. The additional sub-adult female that was captured and marked brings the number of sub-adults within the clan to two. Through photos obtained from remote cameras during April and May 2010, three small cubs of approximately 2 months old were identified.



A total of three cubs were photographed at the den CCC-1 and large unmarked female with cubs at den

CCC-3 has been observed suckling and interacting with the cubs identifying her as one of the mothers. The unmarked adult female appears to also be mother to one or more of the cubs based on time spent at the den and photographic evidence of her interacting with the cubs.

It is likely that CCC-2 will leave the clan during 2011 as most males born within the clan disperse shortly after puberty (East, *et al* 2001).

As the adult component of the clan remains unchanged, the sex ratio of males to females within the Kwando Clan is 1:4.

Hyaena ID	Sex	Age	Reproductive status	Marking method
CCC-1	Female	4 years (adult)	unknown	Collar Ear notch Photos
CCC-2 (Sibling of CCC6)	Male	2.5 years (sub-adult)	n/a	Ear notch Photos
CCC-3	Female	4 years (adult)	Mother of one of more cubs.	Collar Ear notch Photos
CCC-4	Male	4 years (adult)	n/a	Collar Ear notch Photos
CCC-5	Female	4 years (adult)	Unknown	Ear notch Large scar
No ID	Female	adult	Possible mother of one of more cubs	Photos

CCC-6 (Sibling of CCC-2)	Female	2.5 years (sub-adult)	n/a	Ear notch Photos
No ID	?	1 year (large cub)	n/a	Photo
No ID	?	1 year (large cub)	n/a	Photo
No ID	?	1 year (large cub)	n/a	Photo

Table 5: ID, sex and age structure of the Kwando clan.

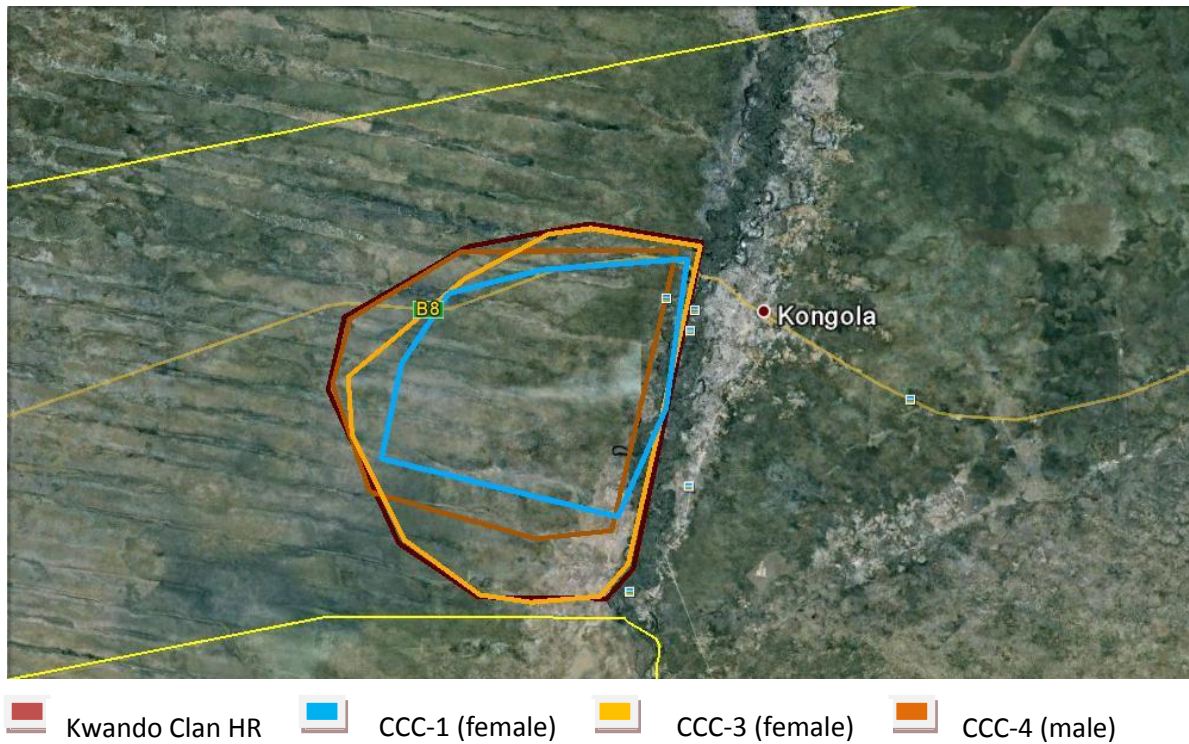
Although collared hyaenas have been observed several times with up to seven unmarked hyaenas within their home range (J. Koortzen, C. Kulobone, D. Stephens, pers comms) and once on the extreme edge of their home range (B. Zingola, pers comms.) it is likely that the unmarked hyaenas are from outside the Kwando Clan home range. All these observations took place when large food items, i.e. a dead hippo and dead elephant were available. Large food sources often attract spotted hyaenas from long distances that are not necessarily resident within that territory.

### Home range and trans-boundary movement

The approximate home range size for each collared hyaena as well as a collective home range for the clan are presented below. Over time the home range has almost doubled in size. CCC-3 has the largest range, but this is most likely due to the larger data set of locations. CCC-1's home range is the smallest, but minimal data has been transmitted from this collar with the last download taking place over a year ago. It is likely that the entire clan range is larger than the figure presented here as home range increases with the number of collars placed on hyaenas (*Gasaway, et al. 1989*). Once collar data has been retrieved, it is likely that the home range will increase even further. A number of locations were considered outliers and were not included in the calculations of CCC-3's home range. These included one occasion where she ventured approximately five km north of her usual home range and on two occasions she crossed the Botswana border venturing approximately 7 km south of her usual area.

Hyaena ID	Sex	Home range size in km <sup>2</sup>	Time period
CCC-1	Female	345	8 months
CCC-3	Female	600	14 months
CCC-4	Male	500	12.5 months
Kwando Clan		650	

Table 5: Home range sizes of the Kwando Clan of spotted hyaenas



*Home Range boundaries of the Kwando Clan*

### **Hyaena density in the Core Area**

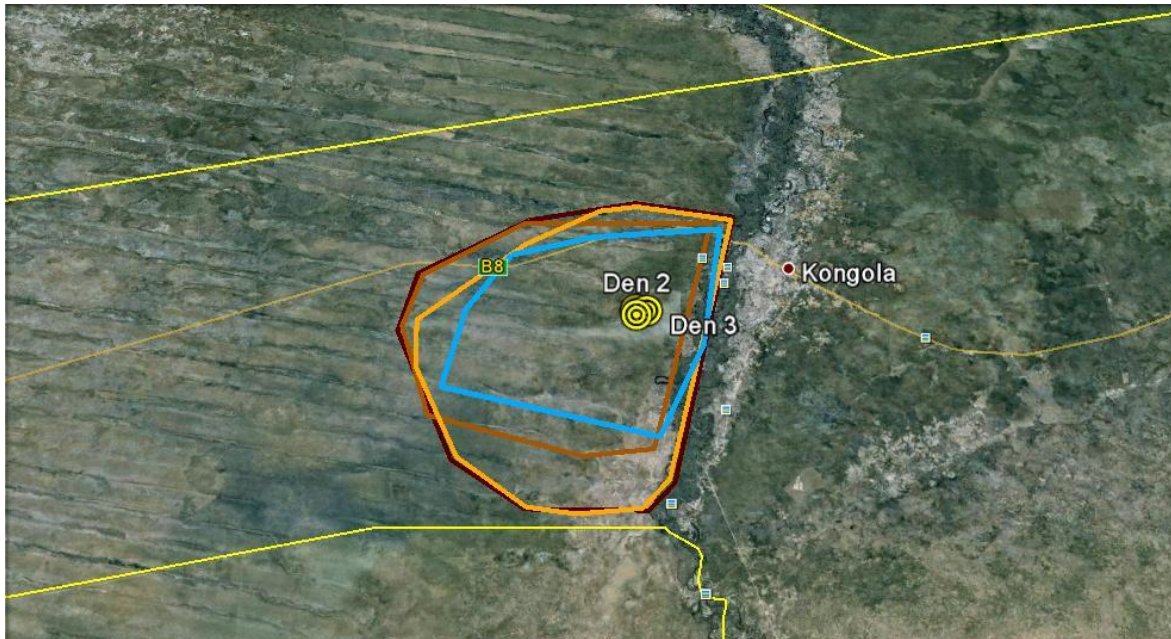
The density of spotted hyaenas within the Kwando Core Area was calculated at approximately 0.8 hyaenas per 100 km<sup>2</sup>. This figure was based on five adult hyaenas in a home range of 650 km<sup>2</sup>. Over time it is likely that the density will increase as the female sub-adult matures and if the cubs survive to adulthood. This figure will be recalculated once all the present GSM collars have been removed and the data downloaded. It is possible that with additional data, the home range will increase thus lowering the density.

### **Dens**

The number of den sites within the Kwando Clan home range remains three. No additional dens were discovered during 2010. Monitoring of den sites will continue as occasionally dens are re-established after years of absence ( *Boydston, et al; 2006*). Caprivi hyaenas move dens and refurbish dilapidated ones. Unfortunately there is not sufficient data on which to base a time period of den occupation. To date the Kwando Clan have been observed at den 2 and den 3 out of the three identified den sites.

Two of the den sites (one and two) are located among Mopane scrub with very little shade and den three is situated high on a dune surrounded by large mature and shady trees. Den three is 830 m and 840 m respectively from den one and den two. The entire denning area is approximately 4.5 km from the permanent water source of the Kwando River.

The highest density of locations of all collared hyaenas are found within the vicinity of the dens.



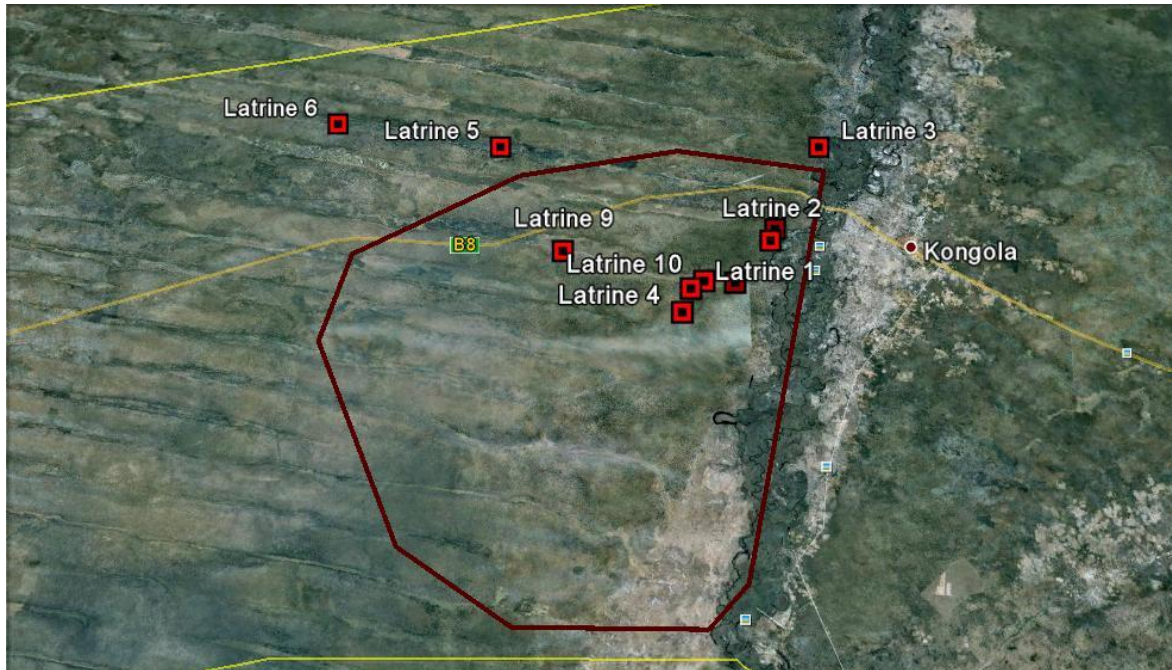
*Three dens of the Kwando Clan in relation to the home range boundaries.*

### **Latrines and scat**

A total of 10 latrines have been found within the Kwando Core Area. Latrines 3,5 and 6 fall outside of the home range boundary of the Kwando Clan and are likely to fall within the area of neighbouring clan/s. Rather than demarcating the home range boundary, the latrines that have been identified are more representative of areas with highest frequency of use by clan members.

The additional scat samples were examined for prey remains. The majority of them consisted mostly of calcium powder indicating scavenging. Springhare was the only new species identified as part of prey selection by the Kwando Clan.

Food items identified include the following: Impala, Kudu, Elephant, Hippo, Buffalo, Warthog, Scrub hare, Springhare, Baboon, Tortoise and elephant and buffalo dung. Other items include bird feathers, insect pupa casings, insect carapaces, tooth fragments, bone fragments, seed casings, wax wrap and brown glass.



*The positions of ten latrines identified in the Kwando Core Area*

## **Human-Wildlife Conflict**

### **Field activities**

Data on livestock predation was obtained from the event book archives from the conservancies of the MNC, i.e. Kwandu, Mashi, Mayuni and Sobbe. Data on livestock losses within BNP were obtained from Event Books at KA office of Omega 3, Chetto and at the Buffalo Ranger Station. Although all data from when conservancies were first established was collected, only 2008 and 2009 results are presented as time constraints prevented me from entering the sheer volume of records that are available. Records for 2010 were still in the possession of CGG and were recently audited in January 2011, when I had already left the field.

My thanks go to the Conservancy Game Guards and various individuals who shared information on incidences of HWC with me and thank you to the Conservancy Management teams and the Natural Resource Monitoring Group for access to the Event Book data, which is an incredible resource.

Bennety Busihu from IRDNC and the Co-ordinator for HACCIS, kindly shared the programme's data with me. Although many losses are recorded in the event books, HACCIS only reimburses for loss if correct livestock management practices are adhered to.

Livestock owner vigilance as a contributing factor to HWC was measured by counting the number of livestock left outside kraals and unattended after dark thereby calculating the livestock actually made available to predators for food.

The MNC was divided into transects, which were driven between one hour after sunset until after ten at night. Only livestock seen on the gravel road or within ten metres on either side were counted. Livestock was divided into different classes representing different mass. These were

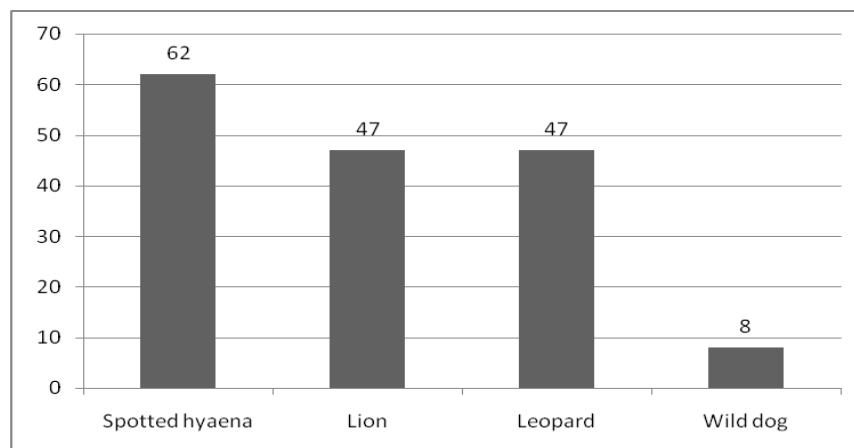
goats, small calves, yearlings, cows and bulls. The position of the livestock was marked on a GPS for possible correlation with predation hotspots.

As this exercise only started towards the end of the field season, there is very little data, but enough to demonstrate that lack of farmer vigilance contributes substantially to predation on livestock.

## Results

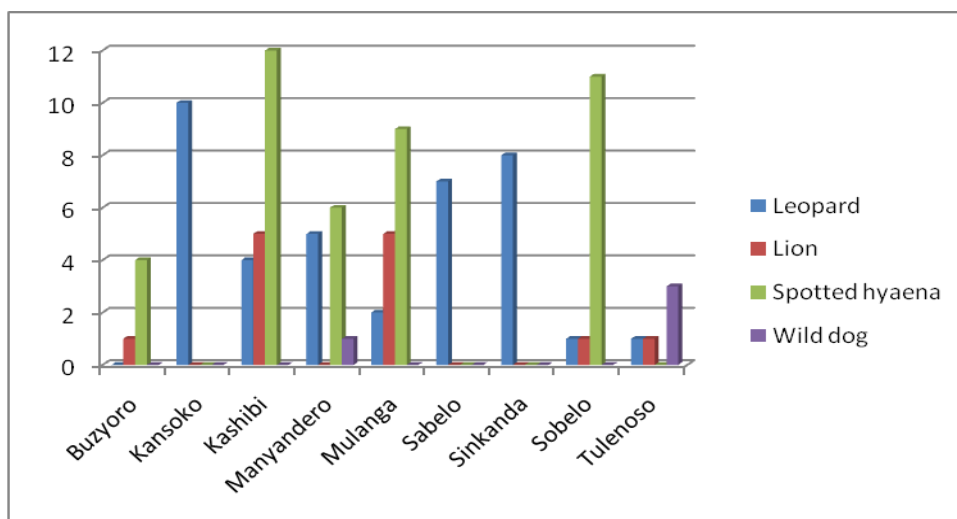
### Event book records

In 2008 and 2009, 64 cattle and 73 goats were killed by large carnivores in the MNC. Two cases of leopard attacks on people were recorded during the same period for both MNC and BNP. Spotted hyaenas took similar numbers of goats and cattle with 62 head of livestock killed in 49 incidences. Lions were responsible for killing mainly cattle with 47 head of livestock killed in 30 incidences. Leopard killed mainly goats with 47 head of livestock lost in 24 incidences and Wild dogs were responsible for killing 8 head of livestock in 8 incidences.



*No of livestock lost to large carnivores in the MNC*

Livestock losses occurred in 41 villages in the MNC and four villages in BNP during 2008 and 2009. Of these only nine villages in MNC had over 4 (5 – 18) losses per village per year and only two villages had losses of 4 head of livestock for both 2008 and 2009. Sobelo Village in Sobbe Conservancy lost 8 head of livestock in 2008 and 5 in 2009 and Kashibi Village in Mashi Conservancy lost 11 head of livestock in 2008 and 9 in 2009. Chetto in the west Caprivi lost 17 goats and 1 donkey all to leopard in 2009.



*MNC Villages with high numbers of livestock losses to species of large carnivore*

The highest number of incidences during 2008 and 2009 were reported from Mashi Conservancy followed by Sobbe Conservancy, which both border on MNP. Mashi Conservancy also borders on BNP separated by the Kwando River and is in close proximity to both Wildlife Corridors.

#### **Cattle transects**

A total of six transects have been driven over six nights in order to count unguarded and unkraaled livestock. The transects are listed below.

<b>Transect</b>	<b>Approximate length</b>	<b>No of times driven</b>
Sijwa turnoff to Mudumu boundary	20 km	4
Sijwa turnoff to Kongola	8 km	3
Kongola to Sinai	2 km	2
Sinai to Singalamwe	15 km	2
Sobbe conservancy office to Kongola	40 km	1
Mashi conservancy office to Sachona	12 km	1

*Table 6: Cattle transects in MNC*

A total of 190 km was driven over 6 nights during which 141 head of livestock left unkraaled and unguarded were counted. These were made up of 1 bull, 109 cows, 13 yearlings, 8 calves and 18 goats.

It is interesting to note that conservancies with the greatest livestock losses, i.e. Mashi and Sobbe are the same as those with the highest numbers of unattended livestock.

Conservancy	Average number of livestock available as prey per night	Range	Number of transects
Kwandu	2	0 - 4	2
Mashi	24.3	12-28	3
Mayuni	1.34	0 - 4	3
Sobbe	42	0-42	1

Table 7: Unguarded livestock per conservancy

When questioned, farmers within Kwandu Conservancy adhere as strictly as possible to the HACCIS criteria and are actively reminded at community meetings. Many farmers in Mashi Conservancy leave cattle to graze for weeks in the veld unguarded during the wet season due to the availability of water and the green grass (D. Chelezo; F. Tetuka; pers.comm). HACCIS claims also reflect the extent of predation on well managed livestock, where only four claims for spotted hyaena damage and seven claims for lion damage were paid out over a period of three and a half years.

Further transect counts will be conducted intensively throughout the wet and dry season within the MNC to assess the extent of farmer vigilance in HWC mitigation. These results are important as many wildlife management decisions are based on the perception of wildlife as problem animals.

### **Additional monitoring within MNC**

Two infra-red remote cameras provided by ICEMA were established at the waterholes of Njalingombe and Lwazaze for the monitoring of reintroduced species of wildlife by MET as well as value of the waterholes for wildlife. The waterhole monitoring is an ICEMA project although the cameras were serviced and maintained during field work for the hyaena study. Vehicle running costs were funded by IRDNC. Photos were regularly downloaded and distributed to ICEMA, IRDNC, MET, SPAN and WWF. Species recorded on camera include: elephant, kudu, eland, wildebeest, leopard, spotted hyaena, wild dogs, bush pigs, warthog and giraffe. Waterhole monitoring will continue when field work commences for 2011.

### **Training**

Most community training took place while setting up bait sites and waterhole cameras. Kwandu Game Guards (Vincent Kakuwe, Bargrey Tubawene, Luscious Mushandami, Kebby Likando) were involved in setting up the remote camera as well as downloading photographs every one to two weeks as part of the monitoring at Lwazaze. All photos were shared with Kwandu Conservancy management.

Mashi Game Guards and members of the GMU (Davies Chelezo, Forster Tetuka, Zorrick Musole) received training on setting up bait sites and remote cameras in order to capture predators.

Nicolaas Buys, the state vet from Katima Mulilo received training in field techniques in the capture and handling of large carnivores for field studies.

## **Collaborations**

Hyaena data has been shared with MET and WWF in Namibia and Robin Naidoo (WWF-US) for the ongoing monitoring of trans-boundary movement of mammals. Hyaena serum from blood taken in the field has been deposited with the CVL in Windhoek as part of a collaborative study on anthrax. Blood smears are being stored for a blood parasite taxonomy study by Onderstepoort. All samples collected in the field have been made available to studies undertaken at UNAM through Prof. Percy Chimwamurombe.

## **Awareness and Publicity**

Project results were presented at a Trans-boundary Natural Resource Management Workshop held by IRDNC in Katima Mulilo, which also involved common HWC issues across international borders.

Articles on spotted hyaenas in the Caprivi were written for Roan News (NEWS), 2010 Caprivi Magazine and two issues of Zambezi Traveller. Additional articles appeared in Africa Geographic Magazine and Travel News Namibia.

Regular reports with project developments and data analysis were produced throughout 2010. Reports were posted on the PCT ([www.predatorconservation.com](http://www.predatorconservation.com)) and WildiZe Foundation ([www.wildize.com](http://www.wildize.com)) websites. Hard copies of the reports were distributed within the east and west Caprivi.

## **Accommodation**

IRDNC kindly allowed me to establish myself at their field training base of Sijwa at Kapako Village in the east Caprivi. Sijwa is approximately 10 km from Kongola and is ideal for access to both the west and east Caprivi for field work.

## **Conclusion**

Spotted hyaena clans in both the Kwando Core area of BNP and in the forest in north MNC are stable and exist at low density. It appears that the spotted hyaena population around human habitation areas of MNC is fragmented and unstable and this is likely due to persecution and trophy hunting, which under most conditions cannot be practiced sustainably with this species due to their population dynamics. It is likely that trophy hunting of spotted hyaenas in conservancies is impacting on clan structure within the protected area of MNP. The density of spotted hyaena throughout the Caprivi Region appears to be far lower than originally calculated. Present management practices like trophy hunting of spotted hyaenas should not be conducted within the boundaries of PA's, particularly BNP, which is the only stable habitat for the long-term conservation of spotted hyaenas in the entire Caprivi Region. Spotted hyaenas have been largely ignored in conservation circles despite their valuable role in healthy ecosystems. The present method used by NGO's of setting trophy hunting quotas per conservancy for fair distribution of benefits rather than the sustainability of off-take should be reassessed for the spotted hyaena. There no scientific bases or justification for the present off take, which is presently driven by community pressure and negative perception and is likely to be extremely damaging to the species.

Research efforts for 2011 will focus on areas adjacent to the core conservation areas of BNP to examine the impact of continued trophy hunting of spotted hyaenas within BNP as well as in the vicinity of human settlement areas to assess the extent of HWC. Additional clans using the Kwando Core Area will be identified to collect baseline data as per the Kwando Clan. The Kwando Clan will

continue to be monitored with the ongoing marking and collaring of the growing clan. HWC in the MNC will be ongoing throughout 2011 while much effort will be put into capturing CCC-7 to download the east Caprivi hyaena data. It will be necessary to extend the study site to include MNP and MSC in order to provide the necessary information on HWC. Members of KA and MET will be involved in all activities within BNP and the GMU and CGG will continue to take part in research in MNC.

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