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Protocol for the Monitoring of Fauna and Flora within Ngamiland, Botswana

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Southern Africa Regional Environmental Program

PROTOCOL FOR THE MONITORING OF FAUNA AND FLORA WITHIN NGAMILAND, BOTSWANA

May 2013

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ACRONYMS

AFIS	Advanced Fire Information System
CBD	Convention on Biological Diversity
CBNRM	Community-Based Natural Resources Management
CBO	Community-Based Organization
CEG	Community Escort Guide
DEA EIS	Department of Environmental Affairs Environment Information System
EOSDIS	Earth Observing System Data and Information System
DWNP	(Botswana) Department of Wildlife and National Parks
GDP	Gross Domestic Product
GIS	Geographic Information System
GPS	Global Positioning Device
HWC	Human-Wildlife Conflict
IDF	Institute for Forest Development (Angola)
IUCN	International Union for Conservation of Nature
MOMS	Management Orientated Monitoring System
NASA	National Aeronautics and Space Administration
NDVI	Normalized Differential Vegetation Index
PA	Protected Area
PAC	Problem Animal Control
PI	Photo Identification
SAREP	Southern Africa Regional Environmental Program
USAID	United States Agency for International Development
WMA	Wildlife Management Area

EXECUTIVE SUMMARY

During a wildlife expert workshop held at Maun Lodge, 26th & 27th January 2012, the Southern Africa Regional Environmental Program (SAREP) and the Department of Wildlife and National Parks (DWNP) co-hosted a seminar aimed at tackling the issue of the decline of wildlife in Botswana. This document details the outputs of this seminar, and the deliberations that took place follow its conclusion. These deliberations included several additional meetings between SAREP, DWNP and various experts, who subsequently the guidelines for the basic monitoring of flora and fauna within the Ngamiland concessions in Botswana. Designed to mesh seamlessly with the Management Orientated Monitoring System (MOMS), these monitoring data are collected by guides, under the responsibility of concessionaires, for the long-term trend assessment of flora and fauna and observation of wildlife population demographics in Ngamiland. The data collected from the protocol will be applicable at the local and national level. Predator densities and movements, as well as long-term herbivore population trends, will be obtained for management purposes; local game hotspots can be determined, rare species recorded and general dynamics (bush encroachment, stochastic local processes such as disease outbreaks etc.) can be observed and addressed fairly rapidly. The table below outlines wildlife monitoring activities that have been selected for standardised monitoring:

Wildlife Monitoring Activity	Timing
Rainfall (rain gauge)	Continuous
Flood level (meter gauges daily or weekly)	Continuous
Predator monthly summary (basic assessment of prides etc)	Continuous
Predation off-takes / selection (sightings of kills etc)	Continuous
Human Wildlife Conflict reports	Continuous
Poaching Incident reports (simple reports - not patrols)	Continuous
Presence of invasives and exotics	Continuous
Fire Occurrence (fire scars / presence / location - simple records)	Continuous
Unusual events (rare sightings)	Continuous
Specific focus on threatened spp. / indicator spp	Continuous
Bird nesting sites (key species - birdlife priorities) (GPS or grid)	Continuous
Wildlife Population Trends (Strip transects)	Bi-annual
Wildlife Population Structure (herbivore sex ratios & yearling rec.)	Bi-annual
Static Photo records (woody vegetation and seasonal floods)	Bi-annual

INTRODUCTION

Botswana has a wide range of ecosystems, driven by various levels of precipitation, geological and hydrological conditions, with a very distinct annual flooding cycle in the Okavango Delta (Mendelsohn *et al.*, 2010, Wolski and Murray-Hudson, 2006). The country has an extreme xeric as well as an extensive wetland fauna. Inevitably, this means many important faunal elements are present from the various ecosystems that stretch across southern Africa. Ecotourism supplies Botswana with 10% of its GDP and 16% of its non-mining GDP. In fact, tourism and the natural environment is so important that the Botswana government has set aside 17% of Botswana's land area as National Park or Game Reserve, and a further 22% as wildlife management areas, which form the basis for the most profitable Community-Based Natural Resource Management projects. Botswana has adopted and continues to adopt a number of policy frameworks on environmental management including the governance and management of protected areas and their surrounds, such as the Wildlife and Environment Act (1992) the Environmental Impact Assessment Act (2005) and the Wildlife Management Area Regulations of 2009 (Draft). These policy frameworks not only guide direct activities of various stakeholders in favour of conservation and protection but also adopt an adaptive approach to environmental management through evaluation of existing methods, criteria and indicators used to govern protected areas.

The DWNP and SAREP co-hosted a seminar in January 2012 (The future of Okavango's wildlife: "An urgent call to define an improved adaptive management and research strategy for the Delta", Maun Lodge, 26, 27 January 2012, SAREP & DWNP) to discuss the issue of declining wildlife within the borders of Botswana. One of the main recommendations of the workshop was to standardise monitoring throughout concessions in order to:

1. Improve our understanding of what regulates wildlife populations in the Ngamiland,
2. Develop data that can "flag" potential concerns or declines in wildlife populations,
3. Assess the threat and spread of alien and invasive species
4. Collect and analyse data on aspects of wildlife populations that aerial surveys cannot provide, including information on predator populations information and wildlife population dynamics.

Listed below are the main monitoring focal points that were suggested by the experts at the Maun Lodge workshop:

Wildlife Monitoring Activity

1	Wildlife population estimates
2	Rangeland Monitoring
3	Wildlife movement
4	Wildlife recruitment rates
5	Wildlife sex ratios
6	Poaching incident reports
7	Human wildlife conflict reports
8	Flood maps
9	GIS land use mapping
10	Fire maps
11	Poaching conviction rates
12	Wildlife body condition scores
13	Legal off take rates
14	Normalized Difference Vegetatio Index (NDVI) assessments
15	Trophy Quality

WHY MONITOR?

The verb "monitor" means to watch or to check, often for the purpose of detecting change. These are the reasons that we require monitoring to be done within Botswana:

- ***to describe or document current (normal) conditions (BASELINE MONITORING)***
- ***to describe or document abnormal or catastrophic events (such as disease outbreaks)***
- ***to confirm DWNP/ Research assessments***
- ***to investigate perceived problems (such as poaching, invasive species inundation)***
- ***to document the application or implementation of management practices (such as anti-poaching programs) (IMPLEMENTATION MONITORING)***
- ***to document the effectiveness of management practices (EFFECTIVENESS MONITORING)***

Following the guidelines by the IUCN and CBD requirements for protected area management, and the results of the above-mentioned workshop consistent monitoring of fauna and flora is essential. This is especially with regard to fluctuations in group dynamics including demographics, recruitment, mortality and movement and changes in ecosystem conditions including the encroachment of exotic or undesirable species is essential for making management decisions on the maintenance of ecosystems. Following the expert workshop, further discussions between the DWNP, SAREP and researchers were held in order to refine and prioritize monitoring activities (Table 1). These prioritized activities were then presented to concessionaires, who supported this initiative. **It will be the responsibility of the concessionaires to implement this protocol within their concessions.**

The following monitoring data was prioritized for each of the concessions in Ngamiland:

Table 1. Monitoring activities to be carried out in Ngamiland concessions by concessionaires.

Wildlife Monitoring Activity	Methodology	Data Entry Sheets
Rainfall (rain gauge)	Continuous daily data collection by camp manager, monthly compilation onto web-based database	flood levels
Predator monthly summary (basic assessment of prides etc)	Continuous daily data collection by guides, monthly compilation onto web-based database by camp manager or senior guide	predation off-takes
Bird nesting sites (key species - birdlife priorities) (GPS or grid)	Continuous daily data collection by guides, monthly compilation onto web-based database by camp manager or senior guide	event book sheet
Wildlife Pop Trends (ground transects)	Bi-annual survey (October & March)	*ground transects*
Poaching Incident reports (simple reports - not patrols)	Continuous data collection by guides, monthly compilation onto web-based database	event book sheet
Predation off-takes / selection (sightings of kills etc)	Continuous daily data collection by guides, monthly compilation onto web-based database by camp manager or senior guide	predator monthly summary
Presence of invasives and exotics	Continuous data collection by guides, monthly compilation onto web-based database by camp manager or senior guide	event book sheet
Flood level (meter gauges daily or weekly)	Continuous weekly data collection by camp manager, monthly compilation onto web-based database	rainfall
HWC reports	Continuous data collection by guides, monthly compilation onto web-based database by camp manager or senior guide	event book sheet
Fire Occurrence (fire scars / presence / location - simple records)	Continuous data collection by guides, monthly compilation onto web-based database by camp manager or senior guide	event book sheet
Static Photo records (woody vegetation and seasonal floods)	Bi-annual survey (October & March)	*ground transects*
Wildlife Population Structure (herbivore sex ratios & yearling rec.)	Bi-annual survey (October & March)	*ground transects*
Unusual events (rare sightings)	Continuous daily data collection by guides, monthly compilation onto web-based database by camp manager or senior guide	event book sheet

Table 1 (cont.)

Wildlife Monitoring Activity	Methodology	Data Entry Sheets
Specific focus on threatened spp. / indicator spp	Species specific approach; Continuous daily data collection by guides, monthly compilation onto web-based database by camp manager or senior guide	event book sheet

MANAGEMENT ORIENTATED MONITORING SYSTEMS

The DWNP has been supporting the introduction of the Management Orientated Monitoring System (MOMS) into communities, while also using this system in the protected areas of Botswana. This system involves field staff and community members deciding what information is important for them to collect. They are then assisted in designing and undertaking the data collection, recording and analysing with minimal support from external or senior technicians. It is a simple and cost effective approach that was initially developed for community managed conservation areas that had limited long term funds and resources to conduct high-tech monitoring systems. The paper based system provides sufficient data to guide management decisions, build capacity of field staff, stimulate discussion amongst local resource users and encourage local participation. The MOMS process ensures that monitoring objectives are clear, that expectations and information needs are met, and that the end user of data is identified.

The MOMS system is designed to collect information on those natural resources, resource processes and events that are of significance to the user on an ongoing basis through events books. These data are captured monthly into monthly report cards called Field Events Cards (Yellow), which are transferred into an Occurrence Book. This is a monthly summary that can then be used to produce quarterly reports, and finally all information is updated annually (Red charts). During a recent MOMS workshop with the DWNP, feedback was obtained for the MOMS data collected in each of the protected areas in Botswana, and the usefulness of the system was self-evident in a management role. Managers obtain vital information from each of their stations, and this information can then be used in a constructive manner. The MOMS approach has been adopted with good results in the communal areas of Namibia and been expanded to other state protected areas in Namibia, Botswana, and Mozambique. The MOMS approach uses a geographical grid-based approach to identifying localities in the absence of GPS units. The grid system allows field operatives to develop spatial data, without the use of expensive equipment, within

their areas of operation. As a result of this accurate local information, a clear picture emerges over the entire region. This is because local knowledge of the conservation areas is very accurate and, given maps with geographic grids on them, individual localities can be plotted precisely by community escort guides (CEG's) and safari operators.

The standardised protocol, outlined in this report, is designed to mesh seamlessly with the MOMS approach, with the addition of a more scientifically rigid approach to the monitoring of fauna and flora in the concessions in the form of a bi-annual series of transects, in March and October, specifically undertaken in each concession and aimed at observing population demographic patterns of both herbivores and carnivores. These data will augment the continuous sightings and events data that is already collected by CEG's and Safari tour guides within the various concessions, and assist in providing a reliable and effective monitoring approach in order to answer the many questions surrounding the reduction of many species of wildlife in Botswana.

It must be understood that the information collected on a continuous basis and those collected during the bi-annual surveys are an invaluable source of information, not only to environmental managers and decision-makers, but also to the guides that are collecting this information. The information collected reflects, in a reliable manner, the circumstances locally and regionally. It allows guides to follow precisely the movements and habits of individual predators and give tourists an experience that has not been possible to date.

Concessionaires operating in wildlife areas within Botswana have an obligation, as per their lease agreement, to monitor all forms of wildlife in their concessions. In the past, this has been incompletely performed and in most instances monitoring is non-existent. In the case of obligatory monitoring within the Ngamiland concessions, expertise and resources (time, funding, staff, vehicles etc) may be limited, and it is for this reason that SAREP and the DWNP have drawn up a standardized monitoring protocol that is cost effective, efficient sustainable, and integrated with existing MOMS.

INTERACTIVE WEB-BASED DATABASE AND BASIC ANALYSING TOOL FOR CONCESSIONS

SAREP and DWNP are in the process of designing a web-based tool that will allow concessionaires to enter the data they collect in a standardised manner and undertake basic analyses of the data, helping to visualise the results in the form of maps and graphs. One of the problems identified from previous monitoring exercises was the lack of direct feedback on the results of the monitoring activities. The field personnel undertaking the monitoring lost enthusiasm for the activities as they were unable to see the benefit, or learn from the process. The objective for the website is to provide on-going feedback, that captures the data, visualises it and collates the data from all the concessionaires to give a picture, or status report on the state of fauna and flora within the WMAs of northern Botswana. It is hoped that the website will stimulate on-going enthusiasm of field personnel to undertake these activities.

In summary the website will:

1. Store the data for all of the concessions.
2. Provide analyses and visualise the data, for example; defining hotspots for game, assessing species-specific population trends, compiling poaching information, storing predator ID photographs (diagrams), updates on disease outbreaks and invasive aliens, and providing background scientific information etc.
3. Provide concessionaires with database security.

It is essential that the data collected are entered onto this database for this project to function properly. This will allow data from all of the concessions to be analysed simultaneously, a feat not achieved before in Botswana. It is the function of each concession manager to ensure that guides are motivated and equipped to carry out the survey work as outlined below. The camp manager or senior guide will be responsible for the data once it has been collected, whether it is entered on a monthly basis onto the web-based database from his/her camp, or from a head office.

MONITORING ACTIVITIES

There are two principal forms of monitoring activity; those data that are collected continuously during the normal activities of the camps and those that are collected through specified transects undertaken twice per year in every concession.

A. DATA TO BE COLLECTED CONTINUOUSLY

It is the objective of the continuous data collection to standardise and structure information which is currently collected by most camps in the Delta with their sightings book. Most guides already record information on predator sightings, kills, observations of rare and endangered species as well as rainfall and flood patterns etc. The standardised protocol aims to collate these data in a manner that can help with the management of the Delta's wildlife populations as a whole. Guides and CEGs will be able to benefit from everyone else's observations, helping guides to build a better picture of where their lion prides go when they leave the concession, or how diverse or similar prey selection is across areas...By sharing these data everyone benefits.

B. BI-ANNUAL DATA COLLECTION

It is the objective for the structured transects to collect information on aspects of wildlife populations that cannot be collected through aerial surveys. Information on the population dynamics of herbivore species can inform us of the status, health and viability of that population and what might be causing its decline. Gathering these data from across the region will inform us if species in some areas are more prone to predation or even poaching than in other areas and how changes in flood dynamics may affect these species.

A. DATA TO BE COLLECTED CONTINUOUSLY

The aim of this data collection is to have all of the information that is collected by the guides in the field, during game drives, recorded in a sightings book (a hard copy). Camp managers or senior guides are responsible for the monthly data compilation onto the web-based database that will act as a repository for the data, and allow concessionaires to produce current reports for their areas.

RAINFALL

Seasonality determines the timing of growth spurts of plants and breeding and recruitment of animals (See eg. Boyes and Perrin, 2009, Cheney, 2006, Merron and Bruton, 1995). The timing of the annual rains also regulates flooding events that characterize Ngamiland and the Okavango Delta. Annual variation in rainfall can cause large fluctuations in annual flood levels, reducing areas that are navigable and available to flora and fauna for the resources that they depend upon for survival. The onset of the wet season also triggers mass movement (migration) of animals such as elephant, zebra, and wildebeest, timed to make use of high quality wet-season foraging regions. Rainfall will be recorded daily (Table 3) and compiled monthly for analysis. The camp manager, senior guide or head CEG will be responsible for recording these data using a standard rainfall- gauge. A rain gauge should be positioned so that water cannot splash into it and all vertical objects (e.g. trees) must be four times their height away. Gauges are usually emptied at a fixed time every daily. If visited less regularly, a little oil can be added to reduce evaporation (Krebs, 1998).

FLOOD LEVELS

Flood levels will be recorded weekly using a meter gauge, placed at a standard location, ensuring that that level is measured from the flood-base level. The data will be recorded on the sheets provided (Table 4) and will then be entered on a monthly basis into the natural resource monitoring website database, either in camp or in Maun. When taking flood level measurements, ensure that safety is maintained – crocodiles and *Hippopotamus* abound in many of the permanent channels of the Okavango delta.

PREDATOR SIGHTINGS AND IDENTIFICATION

Predators cannot be counted from the air as we do for herbivores. It is for this reason, and because of the importance of detailed knowledge of the status of the predator guild in any region (see below), that we pay special attention to the predators. Although there is predator research occurring in Botswana, this is localised and often very specific. This monitoring will be on a regional level and will allow stakeholders to assess the status of predators, including abundance and movement – even if these predators move into a different concession.

Predators greatly impact their environments, whether in an urban area or large wilderness complex. Animals that survive by preying on other organisms send ripples throughout the food web and regulate the effects that other animals have on that ecosystem. This process is called a "trophic cascade;" the progression of direct (predation-driven) and indirect (fear-driven) effects that predators have through lower trophic levels in a food chain (Predator Defense, 2013). Predators also have impacts throughout the predator guild through competition for resources, and dominant predators also kill and eat their competitors (intra-guild predation). Predators are important not only because they create biodiversity, but also because they indicate biodiversity. In addition to regulating natural systems as described above, predators (especially large predators) serve as a measure of the health of communities around them.

The health of the predator population is therefore an indicator of the health of an ecosystem, and the more information that can be gained over an ecosystem-wide scale, the deeper our understanding of the ecosystem is, the faster we are able to recognise a potential problem, and the more effectively we are able to manage the ecosystem.

In the absence of dedicated researchers to monitor predators, it falls upon the guides and community escort guides to perform this task within the concessions. The most simple and effective way to keep track of individual predators (as there are fewer predators than prey in healthy systems) is with the use of Photo Identification (PI). All individuals are physically unique in one way or another and by taking a digital photo of that unique feature we can identify the individual. As soon as an individual can be identified there is a wealth of data that can be obtained from it, such as movement patterns, home range size, inter-species relationships and population estimated (gained from resighting data), that were not available before identification.

The predators that we will focus on for the purposes of this data collection are wild dogs (*Lycaon pictus*), lion (*Panthera leo*), leopard (*Panthera pardus*), spotted hyaena (*Crocutta crocutta*) and cheetah (*Acinonyx jubatus*). A general rule for identification is that both sides of the focal area (ie. left/right flank, left/right face) are photographed where possible. This can take a few sightings of the individual to obtain, but once good quality photos exist, the individual can always be recognised and identified. The idea behind this process is to build up an **online predator ID database from which a current, printable booklet** can be produced for each concession so that guides can identify predators in the field and be able to give a history of the individuals to the guests while keeping track of the animals. The text box below illustrates what information is recorded when a predator is sighted and Table 6 is the form used.

DATA RECORDED ON EACH PREDATOR SIGHTING WILL INCLUDE THE FOLLOWING:

a) Date
b) Species
c) Initial count of individuals
d) Adult numbers (males and females)
e) Sub-Adult numbers (males and females)
f) Juvenile numbers (males and females)
g) Number of animals that are undetermined in terms of age and/or sex.
h) Locality (grid locality)
i) Vegetation type
j) Predator Activity (Sleeping, patrolling, hunting etc & Prey details (species, age, sex of prey)
k) ID picture obtained? (yes or no, what profile, flank or face, photo number)
l) Notes
m) Who recorded the data?

Wild Dogs (Lycaon pictus):

Wild dogs are on the IUCN red list as "endangered', and have disappeared from much of their former range. The species is virtually eradicated from West Africa, and greatly reduced in central Africa and north-east Africa. The largest populations remain in southern Africa (mainly Botswana) and the southern part of East Africa. Population densities in well-studied areas suggest that between 3,000–5,500 free-ranging wild dogs remain in Africa (< 2,500 of these are mature individuals) (IUCN/SSC Canid Specialist Group, 2008). Population size is continuing to decline as a result of ongoing human-animal conflict, infectious disease and habitat fragmentation and local populations therefore require careful monitoring.

Monitoring of Wild dogs

Wild dogs have a unique tail and body patterns and are easily recognisable given a bit of practise (Figure 1). They are territorial, social animals, and so can generally be grouped by region, pack, sex, age and then tail pattern. Flank patterns and ear-notch patterns can then be used to identify the individual. When taking photos of wild dogs, try to follow an individual (without causing undue stress to the individual) until both a left and right sides are photographed; this will save a lot of time when trying to match the photos to an individual subsequently. When a pack is encountered a count should be made of the number of adult males, adult males, yearlings and juveniles. Mortality rates in wild dogs are high, especially in the case of younger dogs, and so close observation should be kept on all packs within the area. During the denning season (which begins in April in Botswana), great care should be taken by operators to ensure that activity around the den is kept to a minimum, to avoid the pack having to move to a new den site due to a perceived threat. Such moves are very dangerous to the puppies. Once PI's have been taken of an individual, it is best practise to draw the patterns (on blank outlines – see Figure 2) and make notes on the distinctive markings for each individual. Soon the whole pack can be identified from booklets that will be carried by guides.

Figure 1. A right flank photo of an adult male wild dog. Flank patterns are immediately obvious, as well as conspicuous ear-notches on the left ear. Given a number of photos, identity diagrams can be drawn for each wild dog in a given pack. Dogs can be grouped initially by pack, sex, age and characteristic tail pattern, before a detailed pattern analysis is done.

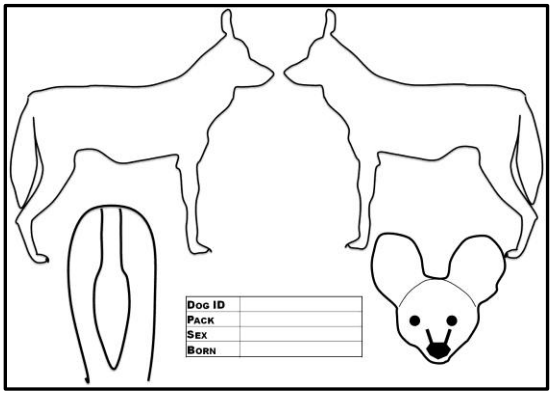

Figure 2. Blank diagram of wild dog on which ear notches, tail patterns and body patterns can be recorded along with individual's information.

Lions (Panthera leo):

While the lion is synonymous with wild Africa, few people realize that illegal killing, relentless habitat loss, and habitat fragmentation has left this species teetering on the brink of extinction. Nearly a century ago, there were as many as 200,000 lions living in the wild in Africa. Today, the most recent surveys estimate that there are fewer than 30,000 lions living in the wild in Africa today (Panthera, 2013). Lions are currently listed as "Vulnerable" on the International Union for the Conservation of Nature (IUCN)

Red List of Threatened Species; and in West and Central Africa, the species is now classified as "Endangered." Lions have vanished from over 80 percent of their historic range and currently exist in 28 countries in Africa and one country in Asia (India). They are extinct in 26 countries. Only 7 countries: Botswana, Ethiopia, Kenya, South Africa, Tanzania, Zambia and Zimbabwe are believed to each contain more than 1,000 lions.

Monitoring of lions

Lions have unique whisker spots on their muzzles that identify them as individuals. Once good left and right side photos are obtained for an individual, these can be plotted on a blank outline and carried by guides for identification in the following manner (Figure 3 and Figure 4).

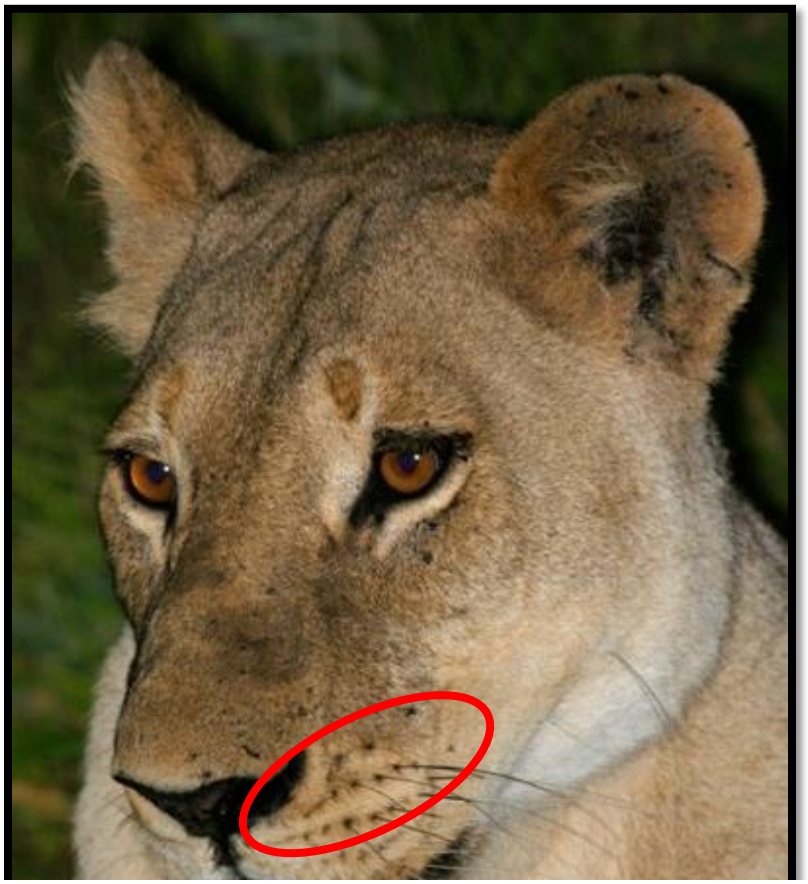

Figure 3. A left-face photograph of an adult female lioness, depicting the region where the identification whisker spots are located.

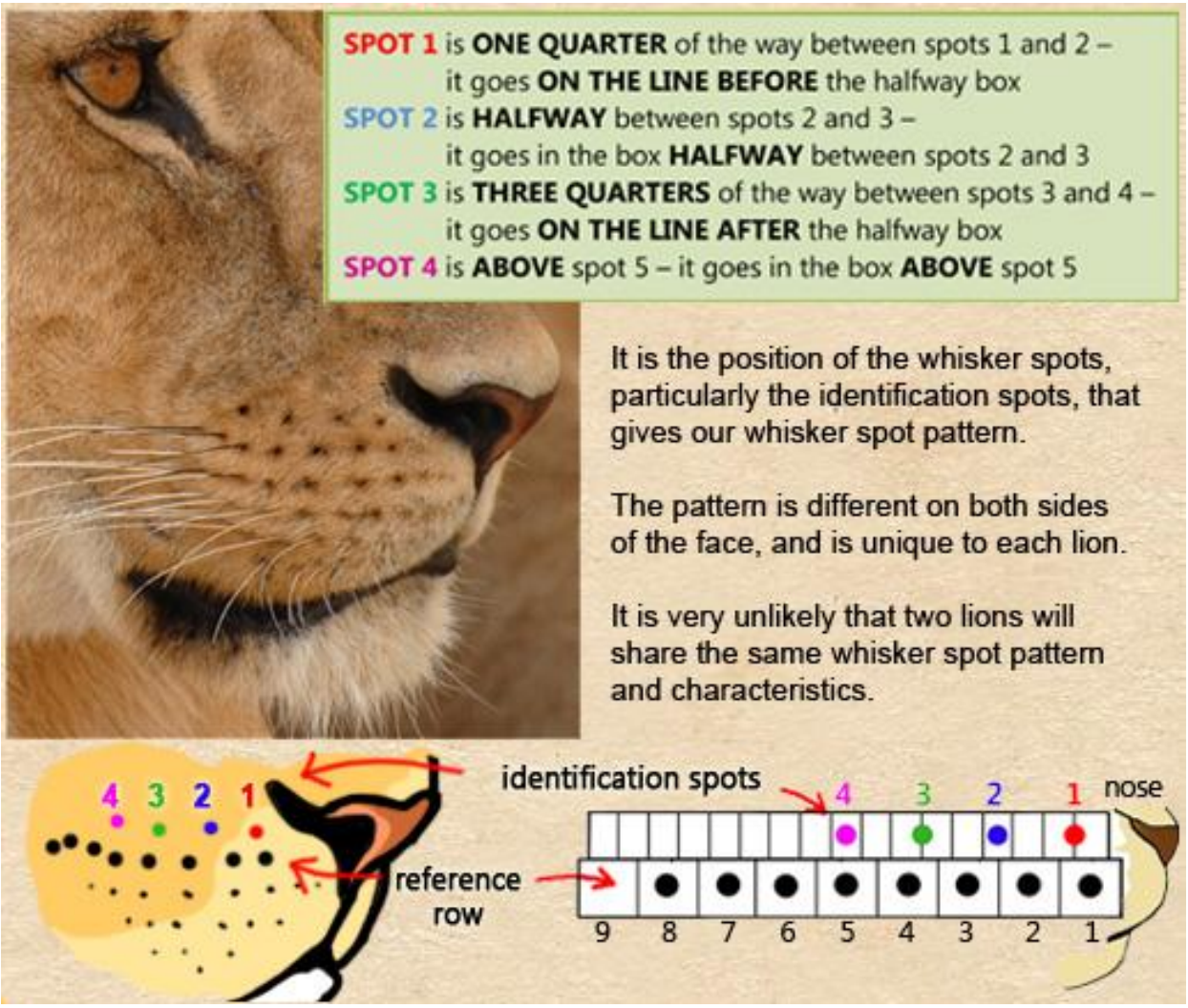

Figure 4. Two rows: the reference row and the identification spots. The reference row is the top complete row of whisker spots. The identification spots form an incomplete row above the reference row. There may be up to 5 spots **(Mara predator Project: Lion Database)**

In addition to the whisker pattern, unique scars, ear notches, sex, and pride can also be used to identify an individual, and these features can be plotted on the diagram below (Figure 5).

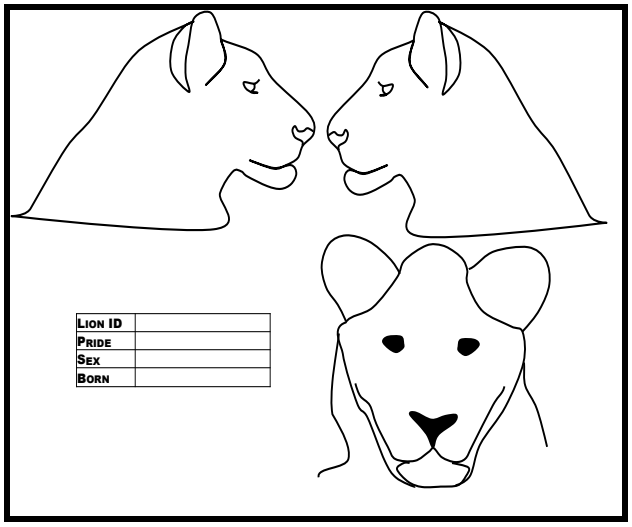

Figure 5. Lion "blank" diagram on which scars and ear notches must be drawn in order to recognise individuals.

Leopard (Panthera pardus):

Leopards are listed as 'Near Threatened' on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species. In 2008, the IUCN stated that leopards may soon move from a "Near Threatened" to a "Vulnerable" status.

Nine leopard subspecies have been recognized throughout the world. While leopards have the widest range of any big cat, they have vanished from almost 40% of their historic range in Africa and from over 50% of their historic range in Asia. In Africa, leopard populations are drastically declining due to the increasing demand among members of the Shembe Baptist Church for leopard skins, which are worn during religious celebrations. It is estimated that Africa is home to between five and eleven million Shembe followers. Other threats facing leopards in Africa and Asia include persecution resulting from human-leopard conflict situations, poorly managed trophy hunting regulations and direct hunting for the illegal wildlife market (Panthera, 2013).

Monitoring of leopards

Individuals can be recognised by the pattern of rosettes that adorn their bodies. Once again, good photographs of the face of a leopard (Figure 6) will enable guides to identify individuals, although there is always some level of perspective change if the photo is not taken from exactly the same angle in subsequent sightings. For this reason we use the facial patterns rather than the markings from other parts of the body. It is always advisable to keep a file of all clear photos of known individuals in order to be able to match photos.

Figure 6. Left side of the face of an adult female leopard. The pattern of spots on the body (and face) is unique, and the face is less prone to perspective change than other parts of the body. It is better to work with photos for leopard due to the complexity of the patterning.

Hyaenas *(Crocutta crocutta):*

Spotted hyaenas are by far the most abundant large carnivores on the African continent, and they are keystone predators in most of the ecosystems in which they occur. A keystone predator is any animal feeding at the highest trophic level in a particular ecosystem, whose removal from that ecosystem results in a cascade of deleterious events at multiple trophic levels that lead ultimately to habitat destruction. Spotted hyaenas appear to be the large carnivores in Africa with the greatest behavioral plasticity, and they are relatively easy to monitor. Spotted hyaenas offer us a very conservative indicator of ecosystem

health because they can survive under conditions no other large carnivore can tolerate. Therefore their disappearance from an ecosystem indicates that the habitat has become very severely degraded, perhaps irreversibly. However, in areas where these hyaenas still occur, their behaviour and demography can be monitored to reveal warning indications of negative trends. If such trends can be identified and quantified, they can potentially be halted or reversed.

Although lions have historically represented the primary source of mortality for hyaenas, this situation is rapidly changing as human population density increases near remaining wilderness areas. In many parts of Africa, humans now kill more hyaenas than any other mortality source. They do this by means that are both intentional and unintentional. In many parts of Africa, both local pastoral farmers and commercial ranchers alike commonly retaliate for the loss of livestock, with the use of snares, poison bate and active hunting with rifles the most common reaction.

Monitoring of Hyaena

Spotted Hyaena are the most abundant hyaena species in Northern Botswana, and each have a unique spotting pattern on the body (Figure 7). Hyaenas have a matriarchal society, with females generally growing bigger than males and being very difficult to sex due to the presence of a cliteropenis. Right and left flank pictures can be used for identification in conjunction with ear notches and scars and, eventually, clan affiliation. Photos may be taken opportunistically in the field or at den sites. Unfortunately most encounters occur at night or in weak light, and this makes it difficult to obtain decent identification pictures.

Figure 7. Spotted Hyaena flank photographs taken with an SLR camera (left), and a camera trap (right). Hyaena are difficult to identify because they are nocturnal and thus a camera trap at a den site (or two for left/right flank photographs) may be a good option.

Spotted hyaenas have a highly developed social structure utilising dens as a centre of activity, to safeguard their cubs and renew social bonds so that the clan remains cohesive. Too much activity around a den site causes them to move it, at great risk to young animals and it is advised that these sites, when discovered, are treated with caution. Camera traps may be used to obtain photos of clan members and growing cubs. However, if these traps are placed within reach of an adult or a cub, they will be discovered and chewed to pieces.

Cheetah (Acinonyx jubatus)

The known cheetah population is approximately 7,500 adults. Additional areas where cheetah status is poorly known are unlikely to raise the total to over 10,000. Given an estimate of 15,000 cheetahs in Africa in the 1970s, a decline of at least 30% is suspected over the past 18 years (3 generations). The decline is primarily due to habitat loss and fragmentation, as well as killing and capture of cheetahs as livestock depredators, primarily, as well as for trade (IUCN Cats Red List Workshop 2007). Historically cheetahs were found throughout Africa and Asia from South Africa to India. They are now confined to parts of eastern, central and southwestern Africa and a small portion of Iran.

Monitoring of Cheetah

Cheetah can be individually identified by spot patterns – again, left and right face photos can be used to identify individuals (Figure 8).

Figure 8. Two photos taken of one individual female cheetah at different times. Note the same spot pattern of this individual.

PREDATION OFF-TAKES/ SELECTION (SIGHTINGS OF KILLS ETC)

There is a general paucity of data regarding the amount and types of prey that are taken by the various predators. While we know that certain predators favour certain prey species, it may be important to quantify this, especially in areas where prey species may be low or declining in order to manage this appropriately. This information can be collected and recorded easily by guides on the predator sighting forms (**Table 6. Predator sightings/Kills datasheet**Table 6).

HUMAN-WILDLIFE CONFLICT REPORTS

Human-animal conflict is possibly one of the most important factors regarding the future of Botswana's wildlife. Elephants, followed by buffaloes have been most involved in the conflict especially within the Kasane/Kazungula development area (http://flowhoorc .blogspot.com/2010/12 /humanwildlife-conflict-in-botswana.html, accessed 03/04/2013). Elephants go into the townships at night and feed on the

people's fruits and plants and end up being shot and killed by Kasane residents. A DWNP report July 2010 indicates that 23 elephants were killed within the first half of 2010 in defence of property or human lives. Other species killed were buffalo (21), lion (3), leopard (2), hippo (3), warthog (4) and baboon (3). The collection of data on HWC in those areas that have settlements bordering them will give us an idea of the frequency and nature of HWC's. Hotspots can then be identified and targeted for mitigation procedures. The following information needs to be collected when a problem animal or HWC incident is reported, on the PAC form (Table 7):

a) **Date**
b) **Locality (grid)**
c) **Species**
d) **Extent of Loss – cattle, Sheep & Goats, Fields & Gardens, Human, Other.**
e) **Complainant**
f) **Action Taken**
g) **Who reported?**

POACHING INCIDENT REPORTS

The actual extent of poaching in Botswana is not known, nor is the extent to which poaching has contributed to the decrease in Botswana's animal populations. Poaching is, however, a huge problem. Anti-poaching efforts within Botswana are piece-meal and ineffective; they are not centralized or directed. When poachers are apprehended, they are, for the most part, not convicted. We suggest that poaching incidents are reported through this forum and uploaded onto the website. We can then identify those areas most in need of protection from poachers and react accordingly. The information that is required when a poaching incident is reported or observed, to be recorded on the illegal harvesting form (Table 8).

b) Date

c) Locality (grid)

d) Species

e) Complainant

f) Action Taken

g) Who reported?

PRESENCE OF INVASIVE/EXOTIC PLANTS

We have added a list of potential specific plant threats to Ngamiland and the Okavango Delta. This list will soon be combined, in a booklet form, with identification criteria for each species so that these plants can be identified in the field.

******Acanthospermum hispidum***,	Khonkhorose, Setlhabakolobe, Sephalane, Ikunkubo, Ikungubo, Upright starbur, Bristly starbur. Spreading fast around North Gate. Tall with broad leaves displacing grazing and shelter for anim
******Datura stramonium/ferox/innoxia***	Have not finally identified as these three are very similar. Occurring in huge stands on Lake Nga with broad leaves displacing grazing and shelter for animals.
******Alternanthera pungens***	Sepodise, Paper thorn, Burweed, Khaki weed.
(Guilleminea densa?)	Very similar *A.pungens* but not spreading quite so fast
Flaveria bidentis	Smelter's bush, Afrikaans: Smelterbossie
******Xanthium strumerium***	Donkey burr, Motabakolobe. Tall with broad leaves displacing grazing and shelter for animals.
Oxalis corniculata	Tswaitswai, Oxalis, Jimson weed, Wood sorrel, Creeping lady's sorrel, Creeping oxalis, Yellow s Creeping sorrel. Poisonous to grazing animals.
Ricinus communis	Mokhure, Moono, Mono, Mfuthe, Castor oil plant, Castor bean, Castor-oil bush.
Pseudoconysa viscosa	A recent introduction spreading fast
Amaranthus viridis	Waterleaf
Bidens biternata	Black jack, Moonyana, Mmonyana, Setlhabakolobe, Mokwelenyane (Very similar *B. pilosa*)
Bidens pilosa	Blackjack, Beggar sticks, Bur marigold, Spanish needles, Sweethearts, Black fellows, Blanket-st Setlhabakolobe, Moonyane, Sina, San: Xarexo, Guexwe, Kalanga: Sina, Kgalagadi: Nthokamosa Afrikaans: Knapsekerel, Ovambenderu: Omupapaku, Subiya: Monyana.
******Conyza bonariensis***	Flax-leaf fleabane, Horseweed, Moromoswane, Afrikaans: Kleinskraalhans. Displacing grazing a shelter for animals
Helichrysum argyrosphaerum	Everlasting weed, Wild everlasting, Masupegane, Afrikaans: Poprosie. Seen a lot in Maun and ot towns but so far occasionally in the Delta
Alectra picta	
Cyperus rotundus	Nutsedge, Nutgrass, Purple nutsedge, Afrikaans: Rooiuintjie. [known as the world's worst weed! known as a weed in 90 countries! It is difficult to eradicate because of its tuberous rhizomous roo system, which will regenerate from small broken pieces. It can become a pest in crops. (Is it an a the Delta or is it indigenous?)]
Physalis sp.	Chinese gooseberry. Appears as an escapee from fruit bowls in camps in the Delta. Picked up by squirrels and birds and then dropped in the wild.
Ipomoea sp.	Morning Glory. Showy blue flowers, narcotic. Between Xaxanaka and Khwai.
Achyranthes aspera var. ***pubescens***	a non-native new-comer replacing the two indigenous varieties. Spreading rapidly around North and in the Linyanti.
******Blainvillea gayana***	a native of West Africa spreading very rapidly through the Delta. Already becoming a problem ir Australia. Tall with broad leaves displacing grazing and shelter for animals.

When one of these plants are encountered, the date, grid reference, species, recorder and extent of invasion must be recorded.

FIRE OCCURRENCE

Fire and herbivory are two of the main determinants of savanna ecosystems (Masunga *et al.* 2013). The occurrence of fire can be monitored using the Okavango Research Institute's website (Okavango research Institute: Fire, 2012) and downloading the relevant maps. For example, during the seven days preceding 03/05/13, there were four fires recorded on NASA's EOSDIS website (with a link on the ORC website). The fires were downloaded as shapefiles and imported to ArcGIS (Figure 9). It is interesting to note, just from these fires, that three of the fires, recorded on 28 February 2013 in NG 27 B, are along a road, indicating the possibility of man-made fires. While these data can be collected on the internet, it is important that it is ground-truthed by guides, using their event books to record locality, date and extent of fire; the area burnt, a hot or cold fire, and the damage caused. SAREP is also supporting the introduction of AFIS to all of the concessions.

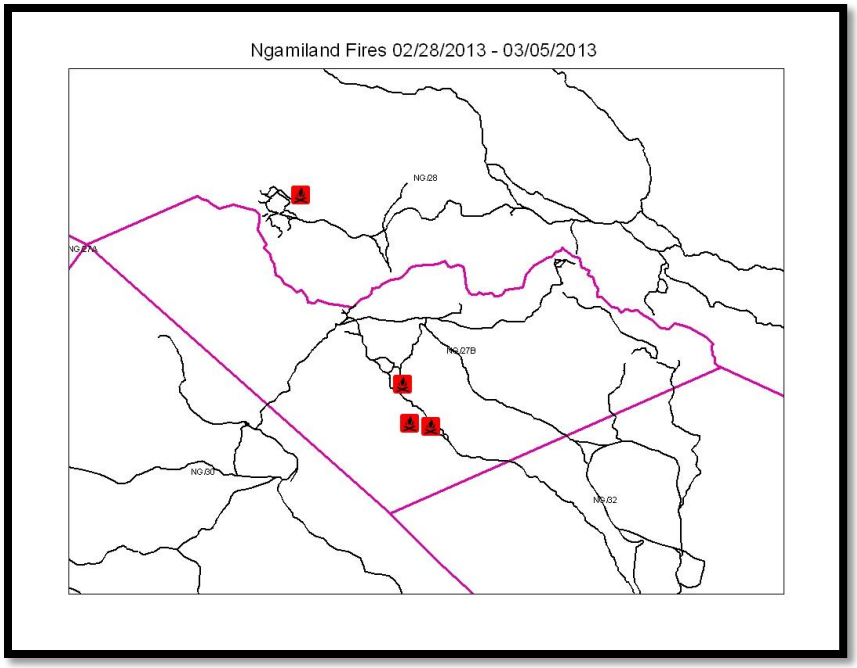

Figure 9. Fire occurrence map for the period 02/28/13 to 03/05/13 for NG 27B and NG 28.

RARE/ENDANGERED ANIMAL SIGHTINGS

Opportunistic sightings of rare or endangered animals need to be recorded by guides in the field, in case there is a hotspot for these animals that requires attention.

DATA RECORDED ON EACH RARE OR ENDANGERED ANIMAL SIGHTING WILL INCLUDE THE FOLLOWING:

a) Date
b) Species
c) Initial count of individuals
d) Adult numbers (males and females)
e) Sub-Adult numbers (males and females)
f) Juvenile numbers (males and females)
g) Number of animals that are undetermined in terms of age and/or sex
h) Locality (grid locality, south and north)
i) Vegetation type
j) Notes
k) Who recorded the data?

SPECIFIC FOCUS ON THREATENED/INDICATOR SPECIES

Monitoring Birds of concern

BirdLife Botswana has compiled a list of 20 Birds of Conservation Concern – species which are potentially or actually threatened based on our current state of knowledge. Some of these species are recognised as being globally threatened, but others have undergone declines within the Southern African region and may be under threat in Botswana. We have selected seven of these species to be monitored, based on their threat levels (Table 2).

Table 2. Birds of conservation concern within Botswana.

Birds of Conservation Concern	
Cape Vulture	*Gyps coprotheres*
Hooded Vulture	*Necrosyrtes monachus*
White-headed Vulture	*Trigonoceps occipitalis*
Lappet-faced Vulture	*Torgos tracheliotos*
White-backed Vulture	*Gyps africanus*
African Skimmer	*Rhynchops flavirostris*
Southern Ground-Hornbill	*Bucorvus leadbeateri*

When one of these birds is encountered, the information listed in the text box (below) must be collected and recorded on the bird sighting form (Table 9). The data must be collated and entered into the web-based database on a monthly basis.

DATA RECORDED ON EACH BIRD SIGHTING WILL INCLUDE THE FOLLOWING:

a) Date
b) Species
c) Nest?
d) Initial count of individuals
e) Adult numbers (males and females)
f) Sub-Adult numbers (males and females)
g) Juvenile numbers (males and females)
h) Number of animals that are undetermined in terms of age and/or sex.
i) Locality (grid locality, south and north)
j) Vegetation type
k) Notes
l) Who recorded the data?

B. BI-ANNUAL DATA COLLECTION

WILDLIFE POPULATION TRENDS (GROUND TRANSECTS) AND WILDLIFE POPULATION DEMOGRAPHICS

Population estimates and density distribution patterns are currently generated from the aerial surveys conducted by the Department of Wildlife and National Parks (DWNP). Over a long period of time, successive surveys conducted using the same methodology provide important information about long-term changes in population estimates. Across large, remote and often inaccessible terrain, aerial surveys become invaluable and can often, as is the case in Botswana, provide the only evidence of potential population changes. However, the data presented on herbivore populations from these surveys must be viewed in light of the limitations of aerial census. Aerial census do not provide information on the structure of the population, with data restricted to estimates of numbers for each species. Without an understanding of the population structure from each species it is hard to understand the cause of a populations increase or decline.

If a population is increasing you would expect to find an abundance of foals / calves and yearlings within the population, providing evidence of a healthy population structure. If these results are not evident, the increase could be attributed to immigration from other areas. Likewise if a population is declining you might expect to find a low rate of recruitment of yearlings, expressed as the number of yearlings per 100 adult females, which could indicate that the population is resource restricted due to droughts for example. But if a declining population has a high recruitment rate, then the cause may be an unusually high loss of adults, from either predation of human related off-take.

The data that could be collected from these standardised protocols will not provide all the answers, but the information will provide clarity and help improve the adaptive management of the system.

Distance sampling: Bi-annual surveys (October and March)

Strip Transects

The distance sampling method makes use of the available road network in a concession, along which transects are placed. Transects are preferred to other methods because it is not possible in most instances to obtain accurate total counts for animals, especially those that are smaller, cryptic, nocturnal, or prefer denser vegetation types. The advantage of using the transect method is that all habitat types can be represented, and more of the area can be sampled than using the point-count method (Krebs, 1991). The likelihood of encountering rare, endangered, cryptic or shy species, and the accuracy of the analyses increases with increasing distance travelled. As mentioned earlier, this method, while able to estimate abundance will not be used primarily for this purpose as government-funded aerial surveys already perform this function. Rather, it will be used for observing population dynamics, including demographics, recruitment, and mortality rates. Over time long-term population trends will emerge for each of the concessions.

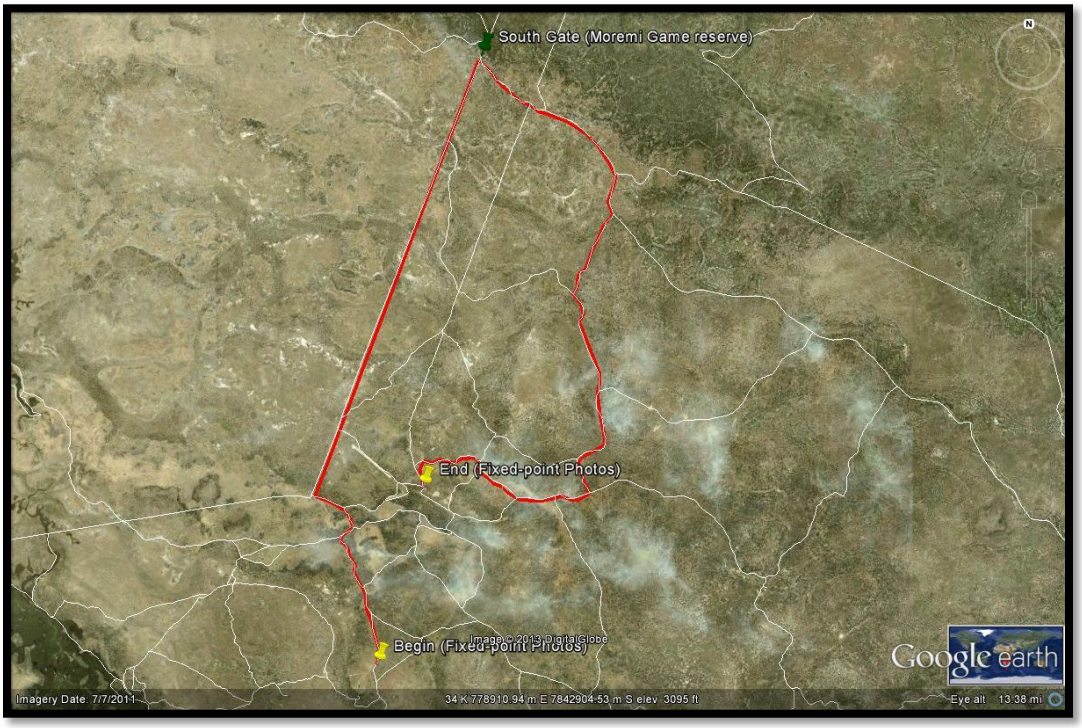

Figure 10. An example of a bi-annual herbivore transect in NG 33, encompassing Riverine woodland, Former floodplain (Savannah), Acacia woodland, and Mophane woodland. This transect takes 3.5 hours to complete.

Transects will be placed along roads in all concessions that will be decided upon as part of a consultative process with the concessionaires. It is expected that each road transect will be repeated three times in March and again in October, and these transects will take an average of 3.5 hours to complete. When an

animal is encountered, it is identified to the species level, aged and sexed (Table 10). Ages are recorded as either adult (older than 2 yr), yearling (1yr to 2yr) and calve / foal (new born to 1 yr). The habitat in which it is recorded, the distance along the transect and its perpendicular distance to the road is then recorded; In the case of a group of individuals (herd, pride etc), the average distance from the road is recorded along with group demographics and these data recorded onto the mammal survey form (Table 10). Transects should be carried out at a standardised speed, in the region of 10 $km.hr^{-1}$ in order to reduce the possibility of double counting an individual (too slow) or missing the animal entirely (too fast). Transects should be started at first light in order to avoid the heat of the day, when most animals are resting in shade and are therefore less visible.

Perpendicular distance is recorded from the road in order to calculate a detectability function – the relationship between the probability of detection and the distance of the animal from the observer. Obviously, this function is important when estimating abundance because animals in thickets are going to be less detectable than those in open floodplain. Distance should ideally be estimated using a range-finder, although a practiced observer can be fairly accurate and consistent. If an animal moves then its original position is recorded.

FIXED-POINT PHOTOGRAPHY FOR VEGETATION TRANSITION AND CHANGES

Photo monitoring is a valuable tool for documenting environmental management as well as conditions or events that affect management. While photographs cannot tell the entire story about an environment, much information can be gathered by comparing photographs taken of the same scene over a number of years. When you establish a photographic collection to monitor landscape conditions, you do not generate the large amounts of data often associated with monitoring projects. Still, photo-monitoring may surpass other forms of monitoring because it is simple, inexpensive, accurate and rapid. Fixed point photography is one of the most effective and robust method of monitoring vegetation change. This is especially true in a system such as the Okavango, where habitat succession through the encroachment of floodplains by Acacia trees and sage bushes or the reversal of this process with flood events and the emergence of sedges is an on-going process.

In order to successfully use this method, each site must be permanently and clearly marked. Finding old sites is extremely difficult and this often takes up most of the field time. The use of a GPS alone is not

sufficient and it is strongly recommend that a GPS be used as an addition to detailed direction / location descriptions. If the exact point cannot be found years later then it is pointless photographing the site. Photographs will be taken by standing at the plot marker, at the beginning and end of each mammal transects, and taking photographs at the eight standard compass points (N, NE, E, SE, S, SW, W, NW) in March and October.

BIRDS

General

Bird population monitoring is a suggested, but voluntary, activity that can be done in February and November. We outline the background and methodology below, from Birdlife Botswana, 2008.

"In 2008, there were 25 globally threatened bird species in Botswana, and a further eight species regarded as nationally threatened, or Birds of Conservation Concern in Botswana. This is an increase from 2000, when just 11 Botswana species were listed in Threatened Birds of the World (BirdLife International, 2000). This is not due to a deterioration of the status of birds in Botswana; rather it is due to additional species being listed as globally threatened following declines elsewhere in the world. Indeed, many globally threatened birds are vagrants to Botswana, and little can be done within the country to improve their status. Nevertheless this represents an overall decline in the status of globally threatened birds in Botswana. Some species however, such as the Wattled Crane and Slaty Egret have their core populations in Botswana, and Botswana has a special responsibility for their well-being. They have been the subject of research and conservation action since BirdLife Botswana joined the BirdLife family and their populations appear relatively secure e.g. the Okavango Delta has the largest, single population of Wattled Cranes remaining, and the population is currently stable. It is also significant that Botswana has no Critically Endangered bird species. There are only two Endangered species (both vagrants), nine Vulnerable and 14 Near Threatened species. On the whole, the status of birds throughout the country is relatively good; however, there is no room for complacency."

Table 3. List of endangered, Vulnerable and Near Threatened Species that occur in Botswana.

Endangered species	These are species which face a very high risk of extinction in the wild in the near futu status of globally and nationally threatened birds in Botswana, 2008.
Egyptian Vulture	*Neophron percnopterus*
Basra Reed-warbler	*Acrocephalus griseldis*
Vulnerable species	These are species which face a high risk of extinction in the wild in the medium-term.
Slaty Egret	*Egretta vinaceigula*
Wattled Crane	*Grus carunculatus*
Lesser Kestrel	*Falco naumanni*
Cape Vulture	*Gyps coprotheres*
Lappet-faced Vulture	*Torgos tracheliotos*
Corn Crake	*Crex crex*
Black Harrier	*Circus maurus*
White-headed Vulture	*Trigonoceps occipitalis*
Blue Crane	*Anthropoides paradiseus*
Near Threatened	These are species, which are close to qualifying for Vulnerable status.
Lesser Flamingo	*Phoenicopterus minor*
Pallid Harrier	*Circus macrourus*
Denham's Bustard	*Neotis denhami*
White-backed Vulture	*Gyps africanus*
African Skimmer	*Rhynchops flavirostris*
Black-winged Pratincole	*Glareola nordmanni*
Great Snipe	*Gallinago media*
Latakoo (Melodious) Lark	*Mirafra cheniana*
Maccoa Duck	*Oxyura maccoa*
Chestnut-banded Plover	*Charadrius pallidus*
European Roller	*Coracias garrulous*
Red-footed Falcon	*Falco vespertinus*
Black-tailed Godwit	*Limosa limosa*
Eurasian Curlew	*Numenius arquata*

None of the birds of Botswana are endemic.

Bird Population Monitoring

BirdLife Botswana has introduced a highly successful monitoring program in Botswana; **this event will be voluntary for concessions.**

The objectives of the project are:

1. To develop a Wild Bird Index for Botswana showing bird population trends over time and to use these trends to set conservation priorities, report on biodiversity changes/state of the environment in Botswana (and to contribute to African/global efforts – Convention on Biological Diversity (CBD), Department of Environmental Affairs Environment Information System (DEA EIS);
2. To show that changes in the overall condition of ecosystems can be used by decision-makers to influence politicians to find suitable biodiversity management solutions
3. To increase levels of community participation through building the appropriate capacity in bird identification and awareness.

Methods

Point Counts

Random transects are chosen within each concession. Each transect has 11 points, each point being 200m from the next (for guidance and help in estimating distances, 200m is the length of two football pitches). On arrival at each point, start counting birds immediately, recording and identifying all birds that you see or hear for a set period of 5 minutes. Record all of the birds you see or hear at each point. If you are working in a team of two or more, ideally, only one observer should record birds whilst the other is completing the Field Recording Sheet. Birds that are flushed as you approach a point may be recorded in the totals for that point, but do not record birds whilst moving the 200m between points. On arrival at each point, bring the vehicle to a standstill, switch off the engine and start recording birds immediately. Where possible, please stand outside your vehicle to carry out your count – you need not move away from the vehicle, but you may see and hear birds more clearly if you do.

Record the time that the count started at each point in the space provided on the recording forms. Do not exceed 5 minutes because you are sure a certain ‘good bird’ is there but not yet recorded. Remember to

scan for birds flying overhead and include these in the count. Record all the birds you see and hear on the Field Recording Sheet in the appropriate point columns 1-11. Space is provided on the recording form to allow you to record different individuals of each species seen for each point. Try not to record the same individual bird twice, e.g. an individual that can be heard singing from several points should be recorded once, at the point where it was first detected. If you observe a bird during the point count but do not identify it, it is OK to spend time after the end of the 5-minute period working on the id, recording the individual as being in the count at that point. Do not use any method of coaxing birds during the count – it is important that all counts are done consistently to produce reliable results. Please note the starting time of each 5-minute count period using a 24-hour clock, e.g. 0730 for 7:30am, 1300 for 1pm. As a guide, an average visit should last around 2 hours.

We would strongly encourage observers to use standard species names (e.g. that used in current field guides for the region). These should be written in the appropriate space on the Field Recording Sheet (Table 11).

The number of transects done per concession should be approximately 2 per 100 km^2, and an attempt should be made to incorporate as many habitat types as possible.

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TABLES

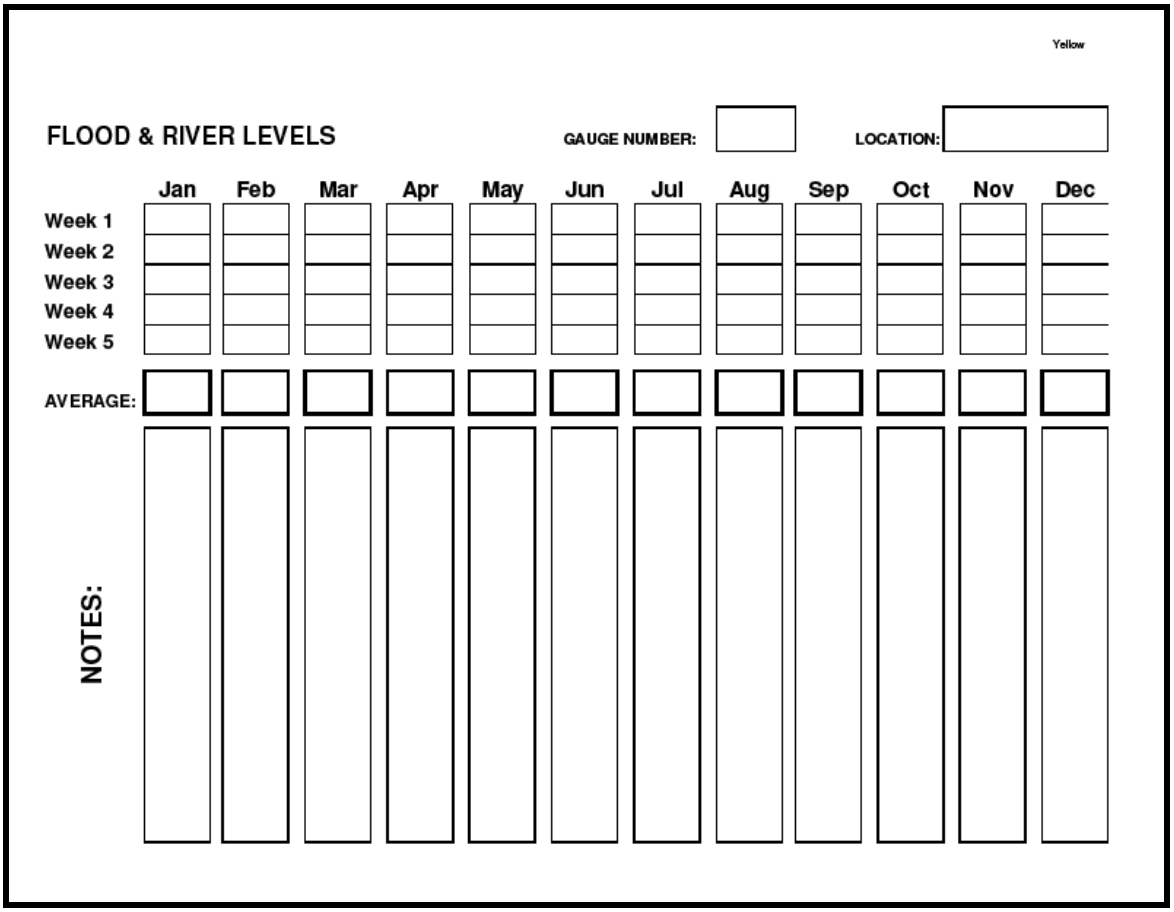
Table 4. Rainfall datasheet

Yellow

RAINFALL RAIN-GAUGE NUMBER: ______ LOCATION: ______________

January		February		March		April		May		June		July		August		September		October		November		December	
Day	Rainfall	Day	Rainfall	Day	Rainfall	Day	Rainfall	Day	Rainfall	Day	Rainfall	Day	Rainfall	Day	Rainfall	Day	Rainfall	Day	Rainfall	Day	Rainfall	Day	Rainfall

Table 5. Flood datasheet



Yellow

FLOOD & RIVER LEVELS

GAUGE NUMBER:

LOCATION:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Week 1												
Week 2												
Week 3												
Week 4												
Week 5												
AVERAGE:												

NOTES:

Table 6. Predator sightings/Kills datasheet

Predator Data Sheet													
Date	Species	Count	Adults	Sub-Adults	Juveniles	Undetermined	Location (S)	Location (E)	Vegetation	Activity /Kill (Prey Sp)	PI?	Notes	Recorded by
			M F ?	M F ?	M F ?						L R		

Table 7. Human-Animal conflict datasheet

Yellow

PROBLEM ANIMALS

		GPS/Grid Cell			Extent of loss							
Date	Place	S	E	Species	Cattle	Sheep & Goats	Fields & Gardens	Human	Other	Complainant	Action Taken	Who reported?

Table 8. Poaching/Illegal activity datasheet

Yellow

ILLEGAL ACTIVITY

Date	Describe incident: Species/number poached, Type of illegal activity, Off road driving; night driving; poaching etc	GPS/Grid Cell		Items Recovered			Number of people	Fines (Pula)	Origin of Transgressors (Village, Region or Country)	WHO REPORTED ?
		S	E	Snares & Traps	Fire arms	Other (specify)				

At end of each month, leave TWO lines:

Table 9. Bird datasheet

Bird Data Sheet											
Date	Species	Count	Adults	Sub-Adults	Juveniles	Undetermined	Location (S)	Location (E)	Vegetation	Notes	Recorded by
			M F ?	*M F ?*	*M F ?*						

Table 10. Bi-annual herbivore transect datasheet

Herbivore survey **Month:** **Year:**

Transect: .... Date: .... Habitat: .... Start point GPS: S 19` End point GPS: S 19`

Observers: 1.................. 2........................... Start point GPS: E 23` End point GPS: E 23`

Driver: .... Car: .... Start odometer: End odometer:

Weather: .... Cloud: .... Start time: End time:

Species	Initial count	Adult			Sub-adult			Juvenile			Undet.	Perp. Distance	Angle from N	Odometer reading	Location (South)	Location (East)	Vegetation
		M	F	?	M	F	?	M	F	?							
															19.	23.	
															19.	23.	
															19.	23.	
															19.	23.	
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Notes:

Date entered: Person entering data:

Table 11. Voluntary bi-annual Bird life Botswana datasheet

BIRD POPULATION MONITORING

FIELD RECORDING SHEET

Name of compiler		Number of observers	
Site name/habitat type		Names of others involved in count	
Quarter degree square (eg 2124A2)			
Coordinates of the start point			
Coordinates of the end point			
Visit date (DD:MM:YY)			

Weather (1,2 or 3)	Cloud	Rain	Wind	Visibility	Tel.	
					Email:	

Time each point count started (24h clock)										
Point 1	Point 2	Point	Point	Point	Point	Point 7	Point 8	Point 9	Point	Point 11

	Species name	Number of individuals at each point											Total count
		1	2	3	4	5	6	7	8	9	10	11	
1													
2													
3													
4													
5													
6													
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What threats to or problems at the site are you aware of?
Use your local knowledge of the site (i.e. not just that observed on the day of the count) to provide the following information on the state of the landscape around your transect. Please use codes as described in the instruction to assess Timing, Scope & Severity

Threat	Habitat and/or population affected	Timing	Scope	Severity

PLEASE RETURN ALL FORMS TO YOUR REGIONAL ORGANISER OR TO BIRDLIFE BOTSWANA (education@birdlifebotswana.org.bw)