NATURAL RESOURCE MANAGEMENT TRAINING

Module 3.8:

WILDLIFE BIOLOGY/BEHAVIOUR

MILLENNIUM CHALLENGE ACCOUNT NAMIBIA

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NACSO

ACKNOWLEDGEMENTS

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GENERAL TRAINING TIPS

Preparation:

- Prepare each session in advance and ensure all necessary materials and visual aids are available (use visual aids wherever possible to enhance your training)
- Be aware of local customs – remember to open and close the training day with a prayer and give due recognition to any traditional leaders present
- Provide translation services where necessary (this will need to be arranged in advance – it may not be appropriate to ask a participant to translate)

General training and presentation guidelines:

- Use good time management to ensure every aspect of your training is completed – but take into account the possible need for translation and be prepared to slow down if necessary to ensure that all participants understand
- Maintain good eye contact with participants
- Speak clearly
- Keep your training language simple and appropriate to your audience
- Bridge one topic to the next
- Provide clear instructions for activities and check to see if your instructions are understood
- Where appropriate summarise each component of the module
- Avoid reading from this trainer's manual

Visual presentation:

- Write clearly and boldly if using flip charts
- Keep your visual aids clear – avoid blocking participants' view of visual aids

Involving the participants:

- Encourage questions and participation
- Ask questions to get participants thinking about the topic and key issues
- Keep the group focused on the task, but take breaks if participants are tired and losing concentration – be aware of body language
- Be patient and courteous with all participants
- Talk to your participants and not to the flipchart
- Acknowledge the comments and feedback from participants

NB: *Where we wish to indicate that text in this module refers to an activity that training participants are expected to undertake, we have employed this little icon.*

ABOUT MODULE 3.8: *WILDLIFE BIOLOGY/BEHAVIOUR*

OBJECTIVES: People who receive training in MODULE 3.8 will gain knowledge on:	1. What is meant by "wildlife biology" and "wildlife behaviour" and how these relate to wildlife management 2. The most important general wildlife management principles 3. The main habitat, food and water needs of key wildlife species 4. The population dynamics of wildlife species and how to make use of these data sets 5. Predator prey relationships 6. Wildlife behaviour
COMPETENCIES: People who receive training in MODULE 3.8 will be able to:	1. Understand how wildlife biology provides the science, information and tools to manage wildlife populations and habitats 2. Understand and explain the key wildlife management principles 3. Understand and explain the habitat, food and water needs of wildlife 4. Understand how population dynamics information is used to support planning and management of wildlife populations and utilization 5. Understand the basics of predator-prey relations
MODULE 3.8 is intended for:	Management Committee, Conservancy Manager and Community Game Guards
Duration of MODULE 3.8:	The training for this Module will usually last 3 days but this depends upon participants

To train this MODULE 3.8 you will need to have (enough for everyone):	**Check** ✓
Flipchart stand, sheets and different coloured marker pens ("cokies")	
Paper and pens for participants	
Handouts #1-#13	
Prepared Flipchart Sheets #1 and #2 if you prefer to use them (can be laminated for duplicate use)	
Paper and pens for participants	

The training of this MODULE 3.8 will generally follow this schedule:

Introduction	Introductions and explanations of what is meant by "wildlife biology" and "wildlife behaviour"
TOPIC 1:	Understanding general wildlife management principles
TOPIC 2:	The main habitat, food and water needs of key wildlife species
TOPIC 3:	Understanding and using population dynamics information
TOPIC 4:	Predator-prey relationship
TOPIC 5:	Wildlife behaviour
SELF-ASSESSMENT:	Assessing participants' understanding of this Module (Handout #13)

KEYWORDS and ACRONYMS for this MODULE

Wildlife	A collective term for indigenous wild animals and plants (though it is sometimes applied more narrowly to just indigenous wild vertebrates – i.e. animals with backbones such as mammals, birds, reptiles, fish)
Wildlife biology	The study and management of wild animals and their habitats
Wildlife management	Management that aims to balance the needs of wildlife with the needs of people using the best available science. Wildlife management can include game keeping, wildlife conservation and predator management. It involves the management of wildlife populations, the management of the relationship between wildlife populations and their habitats, and the management of wildlife populations and habitats to meet specific human goals
Wildlife behaviour	The scientific study of everything animals do. It involves investigating the relationship of animals to their physical environment as well as to other organisms (including humans), and includes such topics as how animals find and defend resources, avoid predators, choose mates and reproduce, and care for their young
Wildlife conservation	The wise, ethical and sustainable management and use of wildlife.
Indigenous	Species that are established and occur naturally in an area, having originated there, or been long settled without human intervention
Endemic	Species that are found naturally in a particular confined region and nowhere else in the world. Thus the Hartmann's Mountain Zebra is endemic to the arid escarpment and highland belt of south-western Africa (in Namibia and southern Angola). By contrast, the indigenous Burchell's Zebra is not endemic to Namibia, as it occurs widely across South Africa and up to East Africa
Ecosystem stability	The tendency and capacity of ecosystems to resist change
Ecosystem resilience	The measure of an ecosystem's ability to recover after a disturbance
Habitat	The area or natural environment in which an organism, population or species normally lives. A habitat is made up of physical factors such as soil, moisture, range of temperature, and availability of light as well as biotic factors such as the availability of food and the presence of predators
Herbivore	Animals whose diet is primarily composed of plant matter
Metabolism	The chemical processes that occur within a living organism in order to maintain life
Population dynamics	A term that describes the ways in which populations grow and shrink over time, as controlled by birth, death, and emigration or immigration.

INTRODUCTION

WELCOME AND INTRODUCTION TO THE TRAINING COURSE

1 **Open the course by welcoming all participants; introduce yourself and any persons assisting you in providing the training.**

2 **Ask the participants to introduce themselves with a brief explanation of their position, organisation and roles.**

3 **Address any housekeeping/logistical issues.**

4 **Explain the objectives of Module 3.8**

USE: Flipchart to show the objectives contained in the table above. To save time you may prefer to have the flipchart Sheet #1 prepared in advance (or even laminate this one and others for duplicate use).

5 **Explain the competencies that participants will gain from Module 3.8**

USE: Flipchart to show the competencies to be gained as contained in the table above. To save time you may prefer to have the flipchart Sheet #2 prepared in advance

6 **Explain the anticipated schedule for training**

USE: Flipchart to show the anticipated schedule for the training, but emphasise that there is some flexibility depending on trainee's needs and responses

7 **Ask participants if they have any questions about the Module. Address any questions.**

NOTE: If participants are unfamiliar with the study of "wildlife biology" and "wildlife behaviour", you may wish to start the training by discussing in general terms what we mean by these terms and why they are relevant in a conservancy context.

ASK: What do we mean by 'wildlife biology'

8 **ASK:** *pairs to consider this question and then each pair will present their thoughts while the other pairs listen. Write the first few pairs' suggestions on the flipchart sheet under a title 'Wildlife Biology' and then ask other remaining pairs to add their contributions (add new thoughts to flipchart sheet).*

9 **EXPLAIN:** Wildlife biology is the study of wild animals and their habitats to better understand, inform and support wildlife management. As such it involves the following broad disciplines:

- wildlife habitats and ecosystems
- wildlife populations, their inter-relationships and life processes
- wildlife behaviour
- wildlife diseases
- predator-prey relationships
- relationships between people and wildlife
- wildlife conservation
- relationships between wildlife, land and water uses
- relationship between wildlife, markets and wise utilization

Modern wildlife biology requires a multi-disciplinary approach to the study and management of wild animals and their habitats. This includes:

- monitoring
- research
- recording
- mapping, including remote sensing
- planning
- decision-making
- adaptive management

ASK: What do we mean by 'wildlife behaviour'

10 *Ask pairs to consider this question, and then each pair will present their thoughts while the other pairs listen. Write the first few pairs' suggestions on the flipchart sheet under a title 'Wildlife behaviour' and then ask other remaining pairs to add their contributions (add new thoughts to flipchart sheet).*

11 **EXPLAIN:** Wildlife (or animal) behavior is the scientific study of everything animals do.
It involves an understanding of how:

- wildlife interacts with its physical environment
- wildlife species interact with other species
- individuals interact with other individuals of the same species
- different wildlife species find and defend resources
- individuals and populations of different wildlife species move, use the landscape, and set up and defend territories
- different wildlife species avoid predators
- different wildlife species choose mates, reproduce, and care for their young
- wildlife responds to and interacts with people

The functions of behavior include its immediate effects on animals and its adaptive value in helping animals to survive or reproduce successfully in a particular environment.

It is clear from the above that these two broad fields of science are directly related to the practice of wildlife management. These sciences provide wildlife managers with the information and tools they need to effectively understand, manage, utilize and monitor the different species of wildlife.

The purpose of this training module is to provide focused information on key aspects of wildlife biology and behaviour that are most pertinent to the management of wildlife in conservancies.

TOPIC 1: General wildlife management principles

Session 1: What are the general principles that conservancies must consider in managing their wildlife?

The aim of this session is to get participants involved in thinking about the fundamental principles of wildlife management in conservancies.

1 **EXPLAIN:** In order to get participants involved early on, start this first topic by initiating a discussion about the general wildlife management principles that conservancies would need to understand and apply in their conservancies.

ASK: What do you think are the main wildlife management principles that should be applied in your conservancy?

USE: Flip chart to record participants' responses under a title "Wildlife Management Principles"

2 **Wrap up the Session by presenting the following key messages:**

For wildlife management to be successful it must take place within the ecological limits of the area. This is no different to livestock management. If this overall condition is not met then serious long-term damage can be caused to (a) the productivity and resilience of the environment and (b) peoples' livelihoods, including income, jobs, food, other goods and services, and future options. The following key principles are important:

1) **Size and openness of area:** the larger and more open the area under wildlife management, the more productive and resilient it is likely to be, and the less intensive is the required level of management. Conservancies should thus:
   - have as large an area as feasible for their core wildlife zone
   - not fence in their wildlife zone, but manage open systems, and
   - work together with their neighbours (other conservancies, national parks, etc.) to co-manage larger landscapes

2) **Diversity of species:** the greater the number of indigenous species that occur in an area in reasonable abundance, the more stable and resilient is that ecosystem. The reason is related to the pathways of energy flow in ecosystems. All energy on earth comes from the sun. Plants capture this energy with the assistance of microscopic and near microscopic fungi. Herbivorous animals get their energy from plants. Predators get their energy from herbivores. Scavengers get their energy from dead animals (both herbivores and carnivores). And at the very end of the food chain all plant debris and animal remains are broken down by micro-organisms and the basic nutrients

are returned to the soil. At each stage in the food chain, only about 10-20% of the energy at any level is transferred to the next level (i.e. about 80-90% energy loss per level, mainly in the form of heat). However, in reality, energy flows are not simple chains but complex webs of interactions involving as many species as occur in an area. Many thousands of routes of energy flow are created, and this gives greater productivity, stability and resilience to natural systems. Conservancies should thus:

- try and maintain and, where appropriate, re-establish the full suite of indigenous biodiversity that historically occurred in that area (subject to socio-economic considerations), particularly the widest diversity of indigenous herbivores, and
- maintain the abundance of indigenous herbivores at optimal levels taking carrying capacity, veld condition, climatic factors and economic considerations into account.

3) **Ecological capacity:** this refers to both the grazing and browsing capacity of an area. The ecological capacity is not fixed – it is changing all the time. This concept is very important because in the past the old Agricultural departments would give fixed carrying-capacity guidelines for different parts of Namibia. This incorrect approach led to a huge amount of environmental damage and loss of productivity. Some of the main factors that influence ecological capacity include habitat, climate – mainly rainfall, stocking levels – both wildlife and livestock together, and the area's history of use or abuse. The best way to remain within ecological capacity is to:
    - monitor wildlife and livestock numbers and range condition on a regular basis and to adjust accordingly, and
    - maintain a conservative approach to ecological capacity to manage firstly for good ecological productivity, because this is turn will lead to good wildlife (and livestock) productivity.
4) **Applying an ecosystem approach**: an ecosystem consists of all the living organisms and the non-living aspects such as soil, water, climate interacting with one another all the time in many millions of different ways. An ecosystem cannot be subdivided and managed in separate parts. It is all interconnected, and an action or impact in one part of the ecosystem will have implications in many other parts. It is also important to know that no precisely repeatable patterns or conditions exist in nature. Every day, every week and every year conditions will be different for any given area. Ecosystems are thus dynamic. Ecosystems in good condition are more productive, show greater stability and greater resilience. This means that they can both absorb greater shocks and recover better from such shocks (e.g. droughts). If ecosystems are mismanaged and damaged, their productivity goes down, they are less stable and they do not recover effectively from shocks. This in turn further lowers their productivity and

makes them even more vulnerable to shocks. Conservancies should thus:

- consider the whole, interrelated ecosystem when planning and making management decisions, and
- strive to manage ecosystems for their most productive, stable and resilient states – i.e. aim first and foremost to have healthy, diverse and productive ecosystems. If ecosystems are healthy, the chance is that so will be the wildlife, livestock and people.

5) **Animal population dynamics:** wildlife cannot be managed effectively without a basic knowledge of the population dynamics of the key species, specifically: growth, age and sex composition, numbers, movement and distribution, and its social organisation or behaviour. These aspects are all linked to the population's potential to increase, which in turn is linked to potential utilization and economic returns. Ongoing monitoring and understanding these key aspects of wildlife biology is essential for good management in conservancies. At the moment much of the expertise on population dynamics of different species is held outside of conservancies and supplied by service providers (e.g. NACSO's Natural Resources Working Group [NRWG]), but in the medium-term it is important that this information is transferred to conservancies. Conservancies should thus:

- ensure that they acquire a good level of knowledge on the relevant population dynamics parameters of the main wildlife species in their conservancy, and
- regularly monitor these parameters (e.g. numbers, distribution, age & sex ratios as well as trophy size trends) and use the information to make wise decisions for management and utilization.

TIP for Trainers: Try to link the messages to what the participants raised themselves in the discussion by referring to the flip chart.

3 **DISTRIBUTE:** *Handout #1, key principles for successful wildlife management.*

TOPIC 2: Understanding the habitat, food and water needs of key wildlife species

Session 1: What does the term "habitat" mean, and what are the preferred habitats of different wildlife species?

The aim of this session is to explain to participants what the term "habitat" means, and to discuss the habitat requirements of different species.

Start this session by defining and explaining the term "habitat" as follows:

1 **EXPLAIN:** A **habitat** is the area or natural environment in which an organism, population or species normally lives. A habitat is made up of physical factors such as soil, moisture, range of temperature, and availability of light as well as biotic factors such as the availability of food and the presence of predators. It is the place where plants and animals can get the food, water, shelter and space it needs to live.

Different species have evolved to require and be able to tolerate different environmental conditions. This means that different species will have different habitat requirements. In Namibia, for example, some species live in the wetland habitats of the large permanent river systems in Kavango and Caprivi, e.g. Hippo, Sitatunga and Red Lechwe. Other species live in the woodlands and adjacent grassland in the higher rainfall north-east, e.g. Roan and Sable Antelope and Tsessebe. Yet other species are adapted to the semi-arid savannas and Namib Desert, such as Springbok and Gemsbok. Some species occur across a very broad range of habitats, for example the African Elephant which is found from permanent floodplains through woodlands, savannas and into the desert.

2 **DISTRIBUTE:** *Handout #2, habitats of different wildlife species. Discuss this handout with the participants. The participants should then focus on the wildlife that occurs in their conservancy.*

ASK: List the main wildlife species that occur in your conservancy, and describe their preferred habitats

USE: Flip chart to list the main wildlife species in one column and in the adjacent column record the participants' descriptions of the preferred habitat per species

3 Wrap up the session by opening the floor to any comments from the participants, giving feedback on the habitat descriptions and by presenting the following key messages:

1. The term "habitat" refers to the broad environment in which an animal, population or species lives. Within this broad habitat there are many "micro-habitats". For example, Roan Antelope, Sable Antelope and Tsessebe all live in open grassy woodland habitat. They are all grazers. However their "micro-habitats" differ as follows:

Roan Antelope	Sable Antelope	Tsessebe
Lightly wooded areas with open patches of medium to tall grass (e.g. vleis), grass up to 1.5 m, tolerant to low bushy scrub up to 1.5 m provided it is open and patchy.	Depends on cover. Prefers open woodland adjacent to vleis or grasslands with medium to high stands of grass.	Woodlands with open stands of healthy short grasslands with easy access to shelter (trees and shrubs) scattered within the grassland.
Avoids closed canopy woodland, thick bushy areas and areas with short grass. Spends little time on burns even when green flush occurs; prefers taller stands of grass.	Avoids dense woodland and short grass especially when overused by other species. Not particularly attracted to burns.	Avoids habitats where plant height exceeds 2 m. Prefers burnt areas and readily concentrates on burned areas when green flush appears.
Highly selective feeder – selects climax green grass species with high nutrient content or high leaf:stem ratio – usually feeds above 8 cm above ground level.	Highly selective feeder – prefers medium height green grasses and has a narrow range of acceptable grass species.	Highly selective feeder – strong preference for young green grass shoots up to 60 cm tall. Selects for stage of grass growth rather than species of grass.

2. No two species have exactly the same habitat or micro-habitat, eat exactly the same food and have exactly the same types of behaviour. There would be direct competition between these species. One of the species would be more successful than the other, either causing the other to shift or go extinct. Thus all species have different habitats or micro-habitats, eat different types or combinations of food, and have different behaviour patterns. In other words each species uses the environment in different ways to all other species. This is called "niche separation". A "niche" is a term describing the relational position of a species or population in its ecosystem to other populations of species. It encompasses the species' habitat, as well as all the other parameters (food, breeding, behaviour, movements, etc.) that define and make a species unique.

Bridge to next session:

The next two sections looks at the diets and water needs of wildlife.

Session 2: How do the diets of wildlife species differ?

The aim of this session is to understand the different food preferences of wildlife in Namibia.

1 **Start this session by explaining the following:**

1. Wildlife managers need to have a good knowledge of the natural diet of all wildlife species, because it has a direct effect on the growth, breeding and survival of animals.
2. The three main factors that influence the feeding behaviour of herbivores are:
    - Food availability – particularly during the dry season and during droughts;
    - Food selection – based on palatability and preference; and
    - Chemical components in food, e.g. protein content, various essential elements as well as toxic and deterrent chemicals.
3. Herbivores are usually classified into the following three groups:
    - Grazers (grass and herbs)
    - Browsers (woody plants) and
    - Mixed feeders (both grazers and browsers)

    In addition, many species of wildlife, both grazers and browsers, also eat wild fruit when available, ranging from *Ziziphus* (buffalo-thorn or blinkblaarwag-'n-bietjie) to *Acacia* pods to tsamma melon, gemsbok cucumber and !nara fruit. Fruit provides not only protein and other nutrients, but some fruit (e.g. tsamma) also provide moisture which is particularly important in arid areas.

2 **DISTRIBUTE:** *Participants to Handout #3, habitat and food selection by wildlife in Namibia. This handout shows the main habitats, food and feeding spectrum (or selectivity) of the main wildlife species in Namibia. Discuss this handout with the participants. The participants should then focus on the wildlife that occurs in their conservancy.*

ASK: List the main wildlife species that occur in your conservancy, and describe their food preferences.

USE: Flip chart to list the main wildlife species in one column. In the adjacent column record the participants' descriptions of the food preferences of each species. Decide whether a species is mainly a grazer, a mixed feeder or mainly a browser.

3 **DISTRIBUTE:** *Participants to Handout #4, diet of different wildlife species. Discuss this handout in relation to the participants' views.*

Wrap up the session by presenting the following key messages:

1. A few species of wildlife remain very restricted to their diet throughout the year, e.g. Burchell's Zebra, Hartmann's Mountain Zebra and White Rhinoceros, which feed almost 100% on grasses and herbs.
2. However, the majority of species are much more flexible. After the rains wildlife tends to favour the new green growth of grasses and herbs, which have about 80-100% more protein and are more digestible than the same grasses in the dry season. Even species which are mainly browsers (e.g. Kudu) will feed on some green grass after the rains. During the dry season, mixed feeders such as Eland tend to reduce the amount of grazing and shift towards browse.
3. In the dry season and in drought years, the amount of moist fruits in the diet of semi-arid and arid species increases, particularly when animals do not have access to open water, e.g. Gemsboks. Also, species such as Springbok may move away from grassy plains into hilly and rocky terrain where they feed on more succulent herbs and forbs.
4. The moisture content of food is an important factor in dry areas. If Impala eat food with moisture content of above about 33%, they do not need to drink. If Springbok have access to food with a moisture content of about 10% or more, they do not need to drink.
5. The food eaten by most wildlife species is thus fairly flexible and dynamic within the broad diet categories, taking account of food availability, palatability, digestibility, energy content, protein and other nutrient levels, the presence of deterrent chemicals and food moisture levels. Wildlife needs to be very mobile to ensure that it obtains the right combinations of foods to achieve all these requirements to stay healthy and to ensure optimal growth and reproduction.

Session 3: What are the different water needs of wildlife?

The aim of this session is to understand the different water needs of wildlife in Namibia.

Start this section by asking the participants to think about the drinking habits of the wildlife species that occur in their conservancies

ASK: What species in your conservancy:
a) drink frequently, i.e. every day or every second day?
b) drink occasionally?
c) never drink?

USE: Flip chart to record participants' responses under a title "Wildlife Drinking habits". Discuss with the participants whether there are any seasonal differences.

1 **DISTRIBUTE:** *Participants to Handout #5, water dependence of different wildlife species, and discuss in relation to participants responses on the flipchart. Ask the participants if there are any differences in the times that different species drink.*

2 **EXPLAIN:** the key messages:

1. Water in one form or another – as free water, or as moisture in food, or bound in other chemical molecules, is used or produced by the chemical processes that occur in animals to maintain life (called "metabolism").
2. The way different animals make use of water differs from species to species. Also, the way that an animal makes use of water may differ from wet to dry season.
3. Each species has its own water requirements. These are influenced by the following factors:
    - **The amount of dry matter in the food:** the more the dry matter in the food, the more the animal will need to drink. There is not a standard relationship between dry matter and drinking for all species. Some species have evolved mechanisms to deal with lower water needs. For example, Impala need to drink when the moisture content of their food drops below about 33%. Springbok need to drink when the moisture content drops below about 10%. This is clearly an adaptation to dry environments.
    - **The composition of vegetation:** When the protein or salt contents of vegetation increases, the animal needs to drink more.

- **Type of animal:** Grazers are generally water dependent (i.e. they need regular access to open water of reasonable quality) while mixed feeders and browsers are often water independent or only require access to water occasionally. Mixed feeders may make use of succulent vegetation or fruits to acquire the moisture they need in their diet. Water independent species will drink if water is readily available, and even these species are forced to drink in times of drought when food becomes a limiting factor.
- **Pregnancy:** There is some evidence that water intake increases in some wildlife species during pregnancy (as it does in domestic stock), but this has not been well studied.
- **Environmental temperature:** Temperature has a marked impact on water use in some wildlife species. For example, at 22° C a waterbuck uses 40% more water than an Eland and 300% more than a Gemsbok. Many species have special physiological and behavioural adaptations for coping with temperature and saving water. For example, the Gemsbok can allow its body temperature to rise while keeping its brain at a constant temperature. Many species orientate themselves to the sun to placing as much of their body in their own shade during the hottest times of the day, or take shelter from the sun under trees or cliffs, while others take mud baths (e.g. Warthog, rhinos, Buffalo and Elephant).
- **Age and physical condition:** Young, fast growing animals need more water that mature animals.

4. Different species drink at different times of the day and night. In Etosha, for example, the following drinking pattern was found:

Preferred drinking time	Species
Morning	Eland Kudu Red Hartebeest
Afternoon	Burchell's Zebra Warthog
Throughout the day	Blue Wildebeest Gemsbok Ostrich
Night	Black Rhinoceros Elephant Jackal Lion Hyaena
Throughout the day & night	Giraffe

Drinking patterns can be strongly influences by disturbance, predation and persecution. Drinking patterns may be different in different regions and different climatic zones.

5. Wildlife needs water of acceptable quality and quantity to survive and prosper. Water management and water point management are often given insufficient attention in conservancies. The following key aspects should be remembered:

- Water should be of an acceptable and safe quality. Water quality changes from time to time, particularly in arid areas between periods of good rainfall and droughts. Water quality should be monitored from time to time.
- There should always be sufficient water provided, particularly in the dry season when veld water has dried up or is very limited.
- The design of water points should be suitable to the drinking habits of all the wildlife species that are likely to need to make use of such water.
- Water points should be located in open areas where the wildlife feels safe from predators. Some shade is of benefit, as animals may rest there after drinking, or wait in the shade for other animals to finish drinking.
- Water points should not be placed in areas which are prone to soil erosion.
- Because wildlife is able to move further between water and grazing, it is not necessary to have water points closer than about 30 km apart.
- Water points should be managed for minimum human disturbance, during both the day and night.
- Water points should be cleaned out at least once a month and the holding tanks should be cleaned out at least once per year.

TOPIC 3: Understanding and using population dynamics information

Session 1: What is meant by the term "population dynamics"?

The aim of this session is to get participants familiar with the concept of "population dynamics" and with some population dynamics information for key wildlife species.

1 **Start this session by defining what is meant by the term "population dynamics":**

Population dynamics is a term that describes the ways in which populations grow and shrink over time, as controlled by birth, death, and emigration or immigration. It includes all the parameters that may contribute to population changes, such as breeding rates and life expectancy.

2 **DISTRIBUTE:** *Participants to Handout #6, population dynamics parameters of wildlife in Namibia. As such it is a source of reference. Explain each column of information to the participants and then give them time to study the table.*

ASK: Do you think that this information is a true reflection of what you see in your conservancy? Discuss ...

3 **Emphasise the following:**

1. The information contained on this sheet is generalised information. Some parameters are fairly fixed, e.g. pregnancy period, weaning age, age of sexual maturity in males & females, age of first mating and first birth, and weight of infant at birth – these are mainly species-specific parameters and are largely independent of geographic location and climatic zone.
2. A number of parameters are rather variable and site specific, such as mating season and time of year when young are born. These parameters are influenced by climatic patterns which in turn determine food availability and nutritional levels. Springbok in parts of the summer rainfall area may produce most of their young from September to January. In the winter rainfall area they lamb mainly from August to October.
3. At specific places, mating and the birth of young animals may be even more synchronised. In Etosha, for example, most Springbok lambs are born in December and January, and most Blue Wildebeest

calves are born in January and February. The timing of these events has evolved to coincide times of greatest resource needs with resource availability, whereas the synchronisation (i.e. all animals lambing or calving in a narrow window of time) is to reduce overall levels of predation on vulnerable young plains game.

4. In semi-arid and arid environments climatic events are highly unpredictable. Many arid-adapted species are not locked into a specific time for giving birth, but retain a measure of flexibility and respond to climatic events. Thus the lambing and calving times of some species may vary from year to year, depending on how the rains have fallen.
5. There is a third set of parameters which are influenced by a large number of factors, such as the numbers of females per male at adulthood and population growth rates. These factors may be influenced by habitat type and condition, predator pressure, climatic conditions, competition with other species, etc.
6. It is important to understand the conditions in your conservancy, and to fine-tune the information in Handout 6 – particularly those parameters which are influenced by local climatic and other conditions. You are encouraged to produce your own table of seasons.

Bridge to next session:

The next section looks at how population dynamics information is used for wildlife management.

Session 2: Using population information for management

The aim of this session is to help participants make use of population information for improved management.

1 **This session will look at a number of different sets of population dynamics information and explores how they can be used for management purposes.**

2 **DISTRIBUTE:** *Participants to Handout #7, the average mass of adult wildlife.*

A. Average mass (weight) of animals

1. Knowing the approximate weights of different wildlife species helps in estimating meat production and planning for meat distribution. A "dressed" carcass is one with the head, legs below the knees and hocks, the tail, the skin and most of the viscera removed. Dressed carcasses typically weigh about 55% (just more than half) the weight of the live animal. The lean meat (red meat) yield of wildlife is typically about 41-45% of the weight of the live animal, compared to cattle which seldom reach 30%.
2. However, from a rangeland management perspective, the most important use of the weight of different wildlife species is to determine the biomass of animals that are being supported, and to compare this on an ongoing basis with the condition of the veld and whether there will be enough grazing for all the animals, plus some reserve, until the next growth of grass. An average weight per species is calculated based on the sex ratio of females to males. The proportion of the diet of each species that comes from grazing (versus browsing) is applied. This figure is then multiplied by the numbers of animals of each species estimated for the area from the most recent game count. Finally, this figure is divided by the area over which the animals are managed to give the kg per hectare (ha) biomass of grazers. It is important to include both domestic stock and wildlife in these calculations. See table below as an example, assuming the size of the conservancy is 450,000 ha:

Category	Species	Sex ratio F:M	Mean weight (kg)	Proportion grazer (%)	Number	Biomass (kg) per hectare
Wildlife	Gemsbok	1.2:1	224	65	2,350	0.76
	Springbok	1.3:1	34	60	11,540	0.52
	Mountain Zebra	1.5:1	289	100	450	0.29
	Steenbok	1:1	11.1	25	870	0.01
	Giraffe	2:1	945	5	46	0.00
Domestic stock	Cattle	-	750	90	2,680	4.02
	Sheep	-	65	70	490	0.50
	Goats	-	90	30	12,980	0.78
Sub-total: wildlife						1.58
Sub-total domestic stock						5.30
Grand total						**6.88**

This shows that there is in total 1.58 kg of wildlife that is grazing on the grasses and herbs per hectare, and 5.30 kg of domestic stock grazing per ha, in total 6.88 kg/ha. This does not include the animals that browse on the trees and shrubs. This type of analysis allows conservancies to:

(a) see where their grazing is going, and to look at this critically to assess whether there is actually much competition between wildlife and domestic stock. For example, domestic stock rarely graze in the same hilly places as Mountain Zebra. And Gemsbok and Springbok are not water dependent and can use grazing in areas far from water points that cannot be accessed by domestic stock;

(b) assess the economic returns that conservancies and their members get from different uses of the grazing. If wildlife were to earn more than domestic stock, then the conservancy may wish to consider reducing domestic stock numbers and increasing wildlife numbers. For example, for every 10 cows removed, an additional 300 Springbok could be carried. This means that 6 additional trophy Springbok could be sold and 70 additional animals could be harvested for meat at a combined annual value of about N$34,400, excluding tourism values. How does this compare to the economic productive capacity of 10 cows?; and

(c) assess the changing animal biomass to grazing carrying capacity. The Ministry of Agriculture, Water and Forestry has developed a very generalised Ago-Ecological Zonation map for the country which has indicative levels of carrying capacity in kg/ha. These are just broad guidelines, they are not meant to be followed blindly. They need to be adjusted at the local level by farmers and wildlife managers on an ongoing basis, based on local rainfall and veld condition. By doing this, conservancies can ensure that they manage their rangeland carefully and sustainably for high production, ecosystem stability and resilience.

ASK: Do you think that you could set up biomass tables for your conservancy, including wildlife and livestock, to help you make decisions about stocking rates? For those conservancies who would like to do this, they can contact the Natural Resources Working Group for assistance.

B. Breeding related information

1. Breeding places extra stress on animals. The time of greatest stress in the breeding cycle of different species usually coincides with the

time of best food availability. The time of best food availability is linked to the climate. In semi-arid and arid regions, rainfall is the main driver. Climate is also often a trigger for the initiation of breeding. As climatic events are different in different parts of southern Africa and Namibia, it should be expected that the breeding seasons will differ.

2. In semi-arid and arid areas not only is rainfall low, but it is also highly variable. In some years the most rain may fall in January, the next year in February, and the following year in March. Arid adapted species have learned to cope with this unpredictability by keeping their breeding seasons flexible. However, this makes the task of the wildlife manager more difficult, particularly when it comes to utilization.
3. When harvesting wildlife, it is wise to do so in a manner and at a time of year that has least effect on reproduction. The rules for wildlife are essentially the same as those generally used by farmers for their domestic stock:
    - Keep disturbance to a minimum, as stress to animals during the mating season can lead to embryo resorption; disruption during the lambing or calving season may lead to abortion; and disruption during early lactation may result in the separation of mothers and their young, possibly leading to starvation or predation.
    - Avoid harvesting at the times of year when animals are clearly pregnant, or when animals are suckling young.
    - Because the reproductive cycles of most species, from mating, pregnancy, birth to weaning cover a large part of the year or more than one year, (see examples below), and because the exact timing of the reproductive cycle is variable depending on climatic conditions, it is difficult or impossible to avoid harvesting at some time in the breeding cycle:

Species	Pregnancy (days)	To weaning (days)	Total breeding cycle (days)
Springbok	170	120	290
Gemsbok	268	105	372
Mountain Zebra	363	300	663

3 **DISTRIBUTE:** *Participants to Handout #8, the length of pregnancy and weaning age for different wildlife species.*

4. To further complicate the matter, different species have different breeding seasons, and produce young at different peak periods of the year. In a particular area the peak time of birth may be more

restricted than shown in this figure. For example, Springbok births in Etosha peak in December and January.

5. **4** **DISTRIBUTE:** *Handout #9, the birth seasons and peaks per category of wildlife in Namibia.* 

6. For practical purposes, harvesting should be avoided a few months before and a few months after the peak birth periods. This is set out as an example for plains game in Handout 10. This figure should be modified to reflect the more specific seasons in each conservancy or cluster of conservancies.

7. **5** **DISTRIBUTE:** *Handout #10, the peak pregnancy, birth and suckling periods for plains game.* 

8. And finally, conservancies should apply an adaptive management approach, responding to shifts in breeding seasons and improving their methods as they learn from experience. The ultimate goal is to harvest while causing minimal disturbance and achieving maximum reproductive output of all the wildlife species in your conservancy.

C. Percentage population increases

1. The rate at which a population increases is related to its breeding rate, survival and longevity (the average number of years that the species lives) on the one hand, and its mortality rate on the other. Factors that influence these parameters are: habitat condition (which in turn is usually related to rainfall and stocking rates), secure water provision, sex ratios, population numbers and the presence or absence of predators.
2. It is important for wildlife managers and conservancies to have good information of the approximate annual increase in different species on their land, because this is one of the pieces of information that is used to determine levels of utilization.
3. **6** **DISTRIBUTE:** *Handout #11,* indicative annual percentage increases for different species of wildlife living with and without predators. 

4. It is important to understand that these figures are broad averages. In good rainfall years with good veld conditions and few predators the rate of increase may be greater than shown, while in dry years, with poor veld conditions the rate of increase may be less, and populations may even show no growth or decline.

5. In open systems it is also important to realise that, while a population may increase overall, there may actually be fewer animals on your land in some years because part of the population has moved onto neighbouring land. In the longer term this is not a problem because they are likely to return when conditions improve. A return of animals may give the impression that there has been a huge increase in the population. In fact, the population has simply changed its distribution. To fully understand the dynamics of populations they should be monitored over as large a landscape as possible – that is why game counts involving large clusters of conservancies are carried out so that we can understand the "bigger wildlife picture". That is also why working in partnership with neighbours using a "co-managed landscape" approach is a good idea.
6. Let us take an example of a conservancy making use of population increase information. Conservancy x has 6,000 Springbok on 250,000 ha. The conservancy would like to build up its Springbok population to about 12,000 animals, but it also needs to earn an income. The conservancy has decided that it should try and reach its target in 5 years. How can it utilise its Springbok resource while building the population?

Year	2011	2012	2013	2014	2015	2016
Natural population increase at 25%	6,000	7,500	9,375	11,719	14,648	18,311
Effect of 10% quota	6,000	6,900	7,935	9,125	10,494	12,068
No. animals on quota		600	690	794	913	1,049
Allocate 2% to trophy (no. animals)		120	138	159	183	210
Allocate 8% to meat harvest (no. animals)		480	552	635	730	840
Approximate income (N$)		289,920	333,408	383,840	441,520	507,360

From 2017 the conservancy can increase its quota to on average 25% per year to hold the population at around its target of 12,000 Springbok. This would mean that it would have a quota of about 3,000 Springbok per year of which 240 would be trophy animals and 2,760 would be harvested for meat and sold commercially. The approximate annual income would be N$1,127,000. Similar calculations can be made for all the other wildlife species in the conservancy to help set populations targets (taking into account biomass carrying capacity of the area as discussed earlier) while also utilising the wildlife and earning an income.

7. Finally, it is extremely important to constantly monitor wildlife numbers and adaptively manage quotas based on local conditions and changing population figures. Theory is really only

useful in providing guidelines and a starting point. Thereafter, monitoring and applying adaptive management on an ongoing basis is what separates good wildlife managers from bad managers. And good wildlife managers have better veld, healthier animals and make more money than bad wildlife managers!

ASK: Do you think that you could set up population tables for the key wildlife in your conservancy, with targets and time frames to help you make decisions about quotas? For those conservancies who would like to do this, they can contact the Natural Resources Working Group for assistance.

TOPIC 4: Predator-prey relationships

Session 1: What is meant by the term "predator-prey relationship" and what are the most important things to know?

The aim of this session is to get participants familiar with the broad concepts of predator-prey relationships. Specific courses on predator management linked to wildlife, livestock and rangeland management are planned within the Human-Wildlife Conflict Management Plans of most conservancies, to be provided at regional level to Trainer of Trainers and cascaded down to farmers.

1 **Start this session by defining what is meant by the term "predator-prey relationship":**

A predator-prey relationship is simply an interaction between two organisms of unlike species in which one of them acts as predator that captures and feeds on the other organism that serves as the prey.

The words "predator" and "prey" are almost always used to mean only animals that eat animals, e.g. lion and zebra, jackal and hare, but the same concept also applies to plants: Kudu and bush, zebra and grass, grasshopper and leaf.

Predators and prey evolved together and are in a constant struggle to be more effective predators and more evasive prey. This applies also to plants which, for example, grow longer and stronger thorns and produce toxic chemicals to avoid predation, while the browsing animals evolve tough, leather mouths to handle thorns and mechanisms to deal with toxic chemicals, e.g. Black Rhinos and *Euphorbia*.

The main problem experienced from large predators is that they eat meat and compete with man. However, these predators also have high ecological, tourism and utilization value. To date we have not been very innovative in turning these values into economic benefits to offset the costs. This is the next challenge facing everyone working in the conservancy programme.

2 **Present the following key messages:**

1. A group of predators usually has a demarcated territory which is scent-marked and into which no other animals of the same species are allowed. In semi-arid and arid areas these territories may be very large.

2. This territorial behaviour maintains a constant and fairly stable population of predators in an area, provided that there is a sufficient prey base.
3. When predators are removed from an area, new often young animals move in.
4. A predator population requires a minimum prey biomass (prey base) to survive. For example a leopard needs 3-5 kg of meat per day on average, though it may not eat every day. Whether the prey consists of small or large animals is irrelevant.
5. Under natural conditions predators do not normally kill more food than they need. Predators do not usually waste food. In unnatural settings, e.g. when a predator gets into a livestock kraal or wildlife boma, they may occasionally cause extensive damage. This is instinctive behaviour and is called "surplus killing".
6. Predators generally do not have a detrimental effect on the numbers of large-herd ungulates. However, when population numbers are low, e.g. when a small number of animals are reintroduced to an area, then predators can have a significant impact, slowing growth rates or even eliminating the species.
7. Most predators are opportunistic hunters. They will try to kill the first prey they encounter. This means that common species are taken far more often than rare species, and common species thus provide a "predator buffer" for rare species. Healthy wildlife populations also provide a buffer for domestic stock, especially where stock is managed wisely, e.g. animals kraaled at night, held near homesteads during and after lambing and calving, etc.
8. Predators are often blamed for reducing wildlife numbers. In fact, the causes are usually food shortages (often nutritional bottlenecks towards the end of the dry season), habitat change, climatic events or management actions (opening up new water points) rather than predators.
9. Predators tend to prey on sick and injured prey when available as well as on less fit individuals, thereby removing them from the gene pool.

TOPIC 5: Wildlife behaviour

Session 1: What aspects of wildlife behaviour are relevant to wildlife management?

The aim of this session is to get participants familiar with the broad concepts of wildlife behaviour and to highlight those aspects that are most relevant to wildlife management.

1 **Start this session by reminding participants of what we mean by "wildlife behaviour"**

Wildlife behaviour is everything that animals do.

We have already discussed the habitat choices, feeding, drinking, population dynamics, including breeding seasons, and predator-prey relationships.

2 **DISTRIBUTE:** *Handout #12, Species fact sheet. Refer participants to selected species fact sheets (relevant to the conservancies from which the participants come). Divide the participants into small groups of 2-4, each group to reviewing a species. After about 15 minutes, ask a representative from each group to give a short presentation to the participants on the most important information on the fact sheet for their conservancies. Then ask the participants to add any other information that is important, including local knowledge, first hand experiences, etc. that was not covered by the fact sheet.*

USE: Flip chart to record participants' additional information per species.

3 Drawn participant's attention specifically to sections on Human-Wildlife Conflict, Ecological value, Economic value and Management objectives if these aspects were not covered by the group presenter, and link these where relevant to material presented earlier in this training module.

Bridge to next session:

We have now finished the training course on wildlife biology / behaviour. The next session will provide a chance for any last comments or questions and provides an opportunity to assess participants' understanding of the training module.

SELF-ASSESSMENT: Assessing participants' understanding of this Module

Handout #13 comprises a set of questions based on this Module and designed to evaluate the knowledge and skills that participants receiving this training have acquired. It is not intended as a formal test but is meant to help participants assess areas where they have sound knowledge and strong skills, and areas that require further work.

You can either use the questions as the basis of a plenary session with all the participants, or – if more suitable – ask them to write their answers out on some paper that you will provide for the purpose.

Although it will help you personally to modify your training approaches should you be able to discuss their answers with participants, they should not feel compelled to share their responses with you. If they are willing to share their responses, either collectively or individually, then use the information that you gather to assess your own training skills. Also note from participants' responses where these printed training materials might require amendment, for example, if an activity or section of the text is proving problematic.

List of Handouts that you should make available for this Module

MODULE 3.8, HANDOUT #1:	Key principles for successful wildlife management
MODULE 3.8, HANDOUT #2:	Habitats of different wildlife species
MODULE 3.8, HANDOUT #3:	Habitat and food selection by wildlife in Namibia
MODULE 3.8, HANDOUT #4:	Diet of different wildlife species
MODULE 3.8, HANDOUT #5:	Water dependence of different wildlife species
MODULE 3.8, HANDOUT #6:	Population dynamics parameters of wildlife in Namibia
MODULE 3.8, HANDOUT #7:	Average mass of adult wildlife (male and female)
MODULE 3.8, HANDOUT #8:	Length of pregnancy and weaning age for different wildlife species
MODULE 3.8, HANDOUT #9:	Birth seasons & peaks per category of wildlife in Namibia
MODULE 3.8, HANDOUT #10:	Peak pregnancy, birth & suckling periods for plains game in Namibia
MODULE 3.8, HANDOUT #11:	Indicative annual percent population increase per year for wildlife populations living in areas with and without predators
MODULE 3.8, HANDOUT #12:	Species fact sheets (examples)
MODULE 3.8, HANDOUT #13:	Assessment

All Handouts are one page only except Handout #12 which currently has two double-sided pages. Please make sure that you make enough copies for each trainee.

NOTES


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