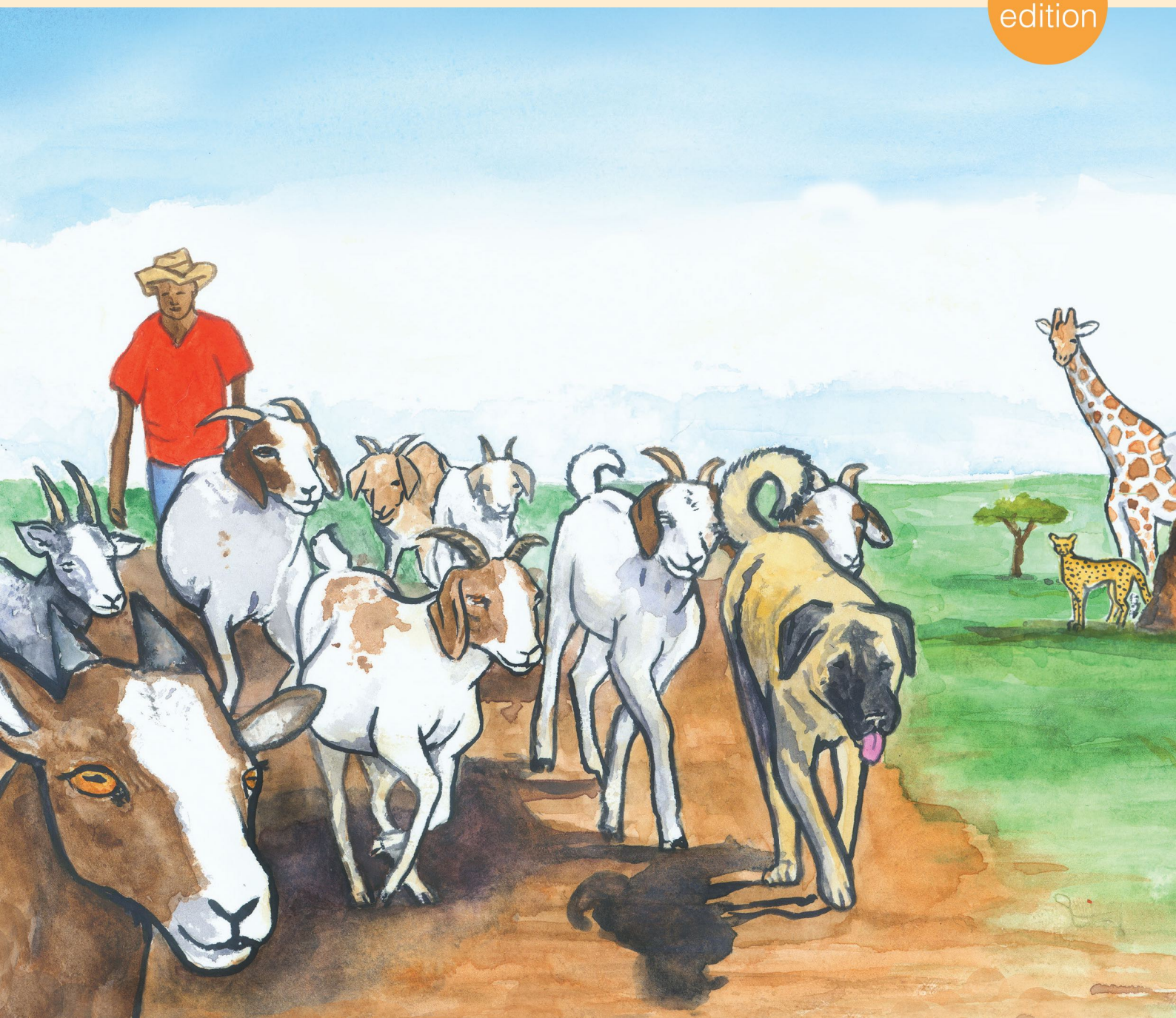
Teacher's Resource Guide

A Predator's Role In The Ecosystem

Curriculum developed for Upper Primary - Secondary Learners

4th edition



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A Letter from the FNB Group CEO Vekuii Rukoro

Dear Educators,

It is with great pride and pleasure that FNB Namibia once again supports the Cheetah Conservation Fund with funding for this book. At FNB Namibia we not only support projects that will make a difference in areas of skills development, education and training, community development, SMEs, culture and heritage and healthcare, we also value the importance of our environment which is interlinked with tourism and conservation. If no conservation happens and natural habitats are destroyed or wildlife is decimated, there would be nothing in Namibia for tourists to come and enjoy anymore. This could mean the loss of many jobs and the loss of a big tax base for the government.

As you know our earth has numerous resources which include water, air, soil, minerals, trees, animals, oil and gas. All of us depend on these natural resources for our livelihood and most of us cannot imagine life without lights, water, a car, etc., but also not a Namibia without our beautiful Camelthorn trees and out unique and free ranging animals. We all hope that our children and grandchildren can still run in forests, play in rivers, fish in dams, stroll along beaches and see our game in their natural environment. If we want this to happen, we need to conserve our natural habitat.

Conservation helps sustain the circle of life and out natural resources. We should only use what we need and respect the land we live in. Conservationists have helped a great deal throughout the years. The principle of conservation is intended to preserve the best outcome of change, which is necessary for any thriving society. We, at FNB Namibia, thank and salute the Cheetah Conservation Fund for the wonderful work they do. Namibia is an example of conservation for all African countries and has over 30% of the remaining cheetah population in the world. This is important as preserving a top predator benefits our entire ecosystem.

This book should convey to you, the reader, the importance of conservation and how organisations such as the Cheetah Conservation Fund and businesses such as FNB Namibia can work together to preserve our fauna and flora for future generations. We hope that you will read the book carefully and also thank you for taking an interest in our country and its natural habitat. Because of you and your interest we will preserve Namibia for many generations to come.

Yours Sincerely

Vekuii Rukuro
CEO FNB Namibia

Acknowledgments

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Cheetah Outreach's Teacher's Resource Guide
Cheetah Conservation Fund's Teacher's Guide (2012)
Cincinnati Zoo's Activity Book
Project Wild
"The Genetic Bottleneck," Smithsonian Institution's National Zoological Park.
Disney African Cats Educator's Guide

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Lesson	Grade 4 Natural Science	Grade 5 Natural Science	Grade 6 Natural Science	Grade 7 Natural Science
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Lesson	Grade 4 Natural Science	Grade 5 Natural Science	Grade 6 Natural Science	Grade 7 Natural Science
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Lesson	Grade 4 Natural Science	Grade 5 Natural Science	Grade 6 Natural Science	Grade 7 Natural Science
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Lesson	Grade 4 Natural Science	Grade 5 Natural Science	Grade 6 Natural Science	Grade 7 Natural Science
Camera Trap Wildlife ID (cont'd)		**Topic 9.2:** Animal dependency on plants. **Objective**: know ways that animals are dependent on plants. **Competencies**: list animals that feed on plants (in their locality). describe at least three ways that animals may be dependent on plants, describe how animals that eat other animals depend on plants, suggest what might happen to animals, in the local environment, if plants disappeared. describe how animals that eat other animals depend on plants suggest what might happen to animals, in the local environment, if plants disappeared		**Topic 7.2.2**: Animals. **Objective**: variations among animals (including mammals, birds, reptiles, fish, insects and amphibians). **Objective**: understand how to classify animals into their major groups and how they are adapted to the environment for survival. **Competencies**: Explain the criteria used to classify each animal group. Describe the life cycles of a local insect and a mammal.
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Lesson	Grade 4 Natural Science	Grade 5 Natural Science	Grade 6 Natural Science	Grade 7 Natural Science
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Lesson	Grade 4 Natural Science	Grade 5 Natural Science	Grade 6 Natural Science	Grade 7 Natural Science
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Agricultural - Agriculture & Conservation Section

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Cheetah Tracking		**Topic 3.5:** Animal diseases, parasites and predators **Objective**: understand the need for protecting animals against predators, diseases and parasites **Competencies**: list any two common diseases, parasites and predators which attack animals in their areas explain how these diseases, parasites and predators can be prevented from attacking our animals		
Whose Hair is it?		**Topic 3.5**: Animal diseases, parasites and predators **Objective**: understand the need for protecting animals against predators, diseases and parasites **Competencies**: list any two common predators which attack animals in their areas explain how these diseases, parasites and predators can be prevented from attacking our animals		

Introduction

Many people fear predators, especially big cats such as the lion, cheetah, and leopard. We are often taught to fear predators without understanding their unique behaviours, special adaptations, and essential roles in the maintenance of healthy ecosystems. Our attitudes and misconceptions about these species have led to their endangerment because often people deal with their fear of predators by eliminating them.

Endangered species exist in low population numbers and need intensive long-term management in order to survive. Attitudes toward predators must be changed if we hope to save endangered species such as the cheetah. By learning the reasons why species are endangered, students learn how the consequences of habitat destruction, environmental pollution, and the loss of biodiversity effects the overall health of the ecosystem. Through environmental education, we can all work together to change the attitudes and behaviors that have led to the endangerment of predator species and help save them from extinction. Individuals can make a difference!

To appreciate predators, we must first understand their roles in the ecosystem. Because predators must kill other animals in order to survive, many myths about them have evolved over the centuries in many cultures. The plight of cheetahs symbolize the problems that other predators face throughout the world.
Cheetahs are endangered because of:

1. Loss of habitat and prey to farming and land development
2. Persecution by farmers as vermin or livestock-killing "problem" animals
3. Poaching
4. The illegal taking of animals for the pet trade

If we are to conserve healthy wildlife populations for the future, people must understand the ecology of animals and recognize their important role in the ecosystem. Wild species maintain healthy ecosystems, provide us with food, shelter, and clothing, benefit us economically, and improve the qualities of our lives by their existence.

EXTINCTION

Extinction is a natural process, and for hundreds of millions of years' plant and animal species have fallen to this phenomenon. But the current rate of extinction is something new. Today the total number of species lost each year may be nearly 40,000 species. This rate of extinction is far greater today than at any other time in the last 65 million years.

The four most common causes of extinction generated through humans are:

1. Destruction of habitat for development and to obtain lumber, minerals, oil, and other products
2. Introduction of exotic species into new habitats
3. Pollution
4. Overuse and exploitation of animals and plants through collecting, hunting or poaching, use for religious beliefs, and pet trade

The cheetah's survival depends on people and their ability to manage the wild population and protect the cheetah's habitat. When habitats are destroyed by constructing buildings or overstocking of livestock, for example, many animal populations are no longer able to survive there, both in the present as well as in the future. Animals compete poorly with humans for space. Humans change the environment rapidly, and animals cannot always adjust to these changes or adapt quickly enough in response. Large predators, like the cheetah, need large areas in which to roam; they usually are not found close together in great numbers. Loss of habitat and a limited geographical range (a reduced area in which to live) threaten the cheetah's survival. Low survivorship (few cheetahs live long after birth or even become adults) also affects cheetahs and makes them more vulnerable to human competition. High cub mortality, up to 90% in the wild, makes it difficult for the cheetah to recover when its population size decreases. Helping predator species survive in spite of competition from people is one aspect of wildlife conservation.

CHEETAH POPULATION DECLINE

Loss of habitat and prey base, competition with large predators and agricultural interests, as well as poaching, are taking a heavy toll on wild cheetah populations throughout Africa. Today, there are less than 10,000 of these endangered cats remaining in Africa and Iran. The vast majority of cheetahs live in small, isolated groups outside protected game reserves where they are often in conflict with humans and livestock, and most populations continue to decline. The largest wild population of cheetahs is found in Namibia; however, in the 1980's their numbers were reduced by half to less than 2,500. Lack of genetic variation, reproductive abnormalities, high infant mortality, and a greater susceptibility to disease place the species at risk of extinction.

While cheetahs were once found throughout Africa, they are now endangered in most of their former ranges. Cheetahs do not pose a threat to human life. Campaigns against cheetahs have continued because some people believe cheetahs frequently kill livestock as well as other prey animals, such as small or young antelopes. In reality, the amount of damage to domestic stock is exaggerated and is usually caused by a limited number of livestock-preying cats, or "problem" animals, and inadequate livestock management practices.

Despite these problems, cheetahs still have a chance for survival on the vast farmlands of southern Africa. Extinction of these cats can be prevented by providing people with a better understanding of their behaviors and their role in the ecosystem.

OUR PLANET'S DIVERSITY

The number of species that inhabit the earth is still unknown. What has been agreed upon however is that **some 86 percent of Earth's species have yet to be fully described**. The diversity of life on our planet is amazing. All species - plants, mammals, invertebrates - depend on one another. People depend on many different plants and animals for food and medicines.

Cheetahs are one of 38 wild cat species that live on the planet. Does it really matter if the cheetah becomes extinct? It is tempting to think that the loss of only one species will not affect us. It is important to understand that all living things are connected. The loss of one species has an impact on all the other species within that ecosystem. When we lose even one species, our world becomes inferior.

YOU CAN MAKE A DIFFERENCE

Youth education and understanding are paramount to helping the sleek hunter of Africa win its race for survival. The ultimate success of the Cheetah Conservation Fund's education programme depends on educators who can take cheetah conservation to their students and communities. In doing so, teachers become part of an international effort to save this endangered species and conserve our world's rich biological diversity. By participating in environmental education, educators model how to care for the land, its wildlife, and the future our students will inherit.

The Cheetah Conservation Fund (CCF) appreciates your initiative in using this resource guide. We hope it will help you motivate students to think critically about individual and communal efforts to conserve wildlife and to act constructively and responsibly to improve our planet's environment.

THE CHEETAH CONSERVATION FUND

The Cheetah Conservation Fund (CCF) was founded in 1990 and occupies a farm outside of Otjiwarongo, in North-central Namibia. CCF's mission is to develop and implement long-term monitoring, and multidisciplinary research, conservation and education programmes to ensure the survival of the free-ranging cheetah and its ecosystems in the remaining ranges in Namibia and other African countries. CCF, a non-profit Namibian Trust, is run by Director and Co-founder, Dr. Laurie Marker, and a local Board of Directors representing the private, government, education, and business communities of Namibia. In addition, CCF's International Research Advisory Board includes internationally recognized specialists in cheetah, predator, livestock, and wildlife research.

The Cheetah Conservation Fund's research is divided into four study areas:

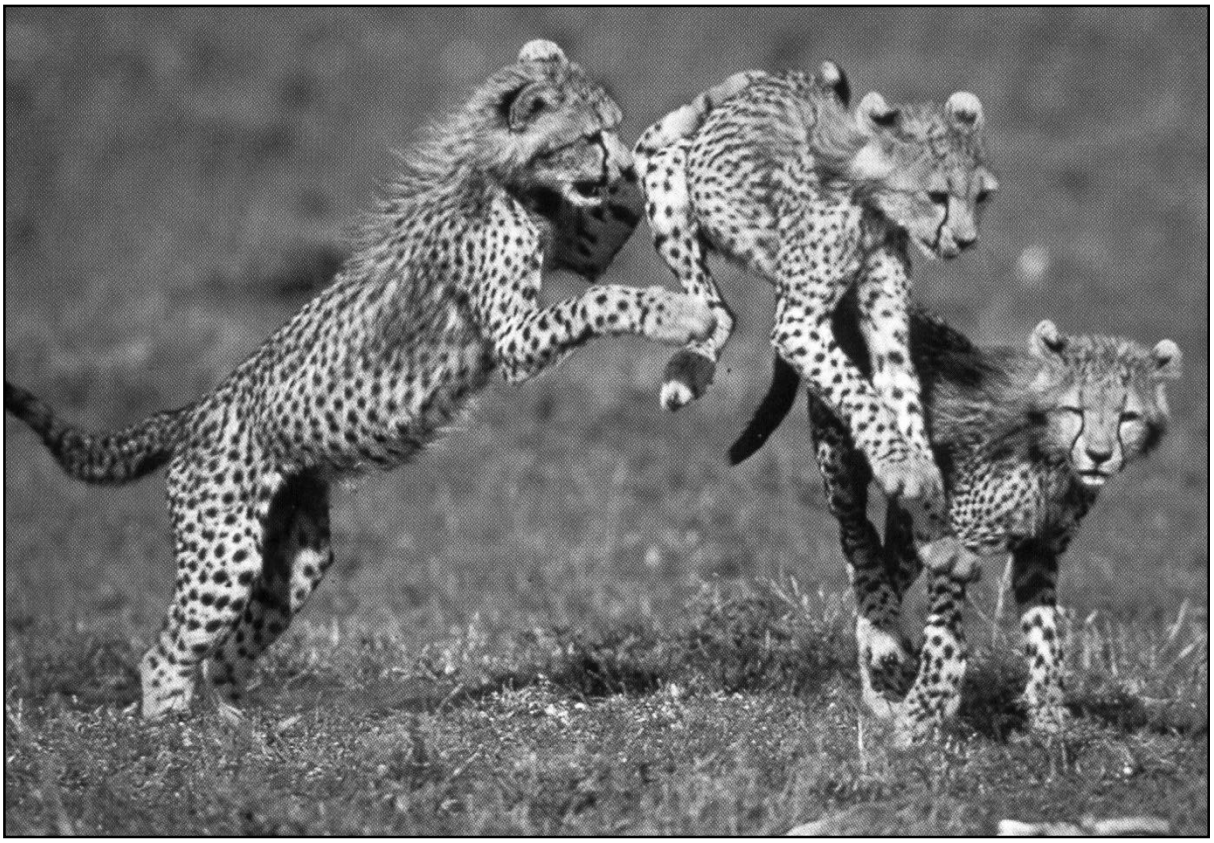
- Cheetah Population Biology
- Cheetah Ecology
- Cheetah Health and Reproduction
- Human Impacts on the Cheetah

The Cheetah Population Biology Programme gathers and analyses data on the demographics and genetics of the Namibian cheetah population. CCF is considered the central database worldwide for information regarding cheetah distribution. The Cheetah Ecology Programme considers the habitat, movements and behavior of the cheetah in the Otjiwarongo farming area (15,000 km^2/9,300 mi^2), which surrounds the CCF Field Research & Education Centre Farms. The soil, vegetation, and wildlife have been studied extensively and cheetah movements have been monitored via GPS/radio-tracking since 1993. The Cheetah Health and Reproduction Programme develops and maintains an extensive physiological database and Genome Resource Bank. This involves taking samples and measurements to better assess the health and genetics of the Namibian cheetah population. The Human Impacts on the Cheetah Programme considers agricultural impact, hunting, and issues related to the cheetah in captivity. This programme assesses farmers' needs and works to develop non-lethal predator control methods, such as the Livestock Guarding Dog Programme. To monitor captive cheetah populations, the Director of CCF created and maintains the International Cheetah Studbook and coordinates the Cheetah African Preservation Programme of the Pan African Association of Zoological, Aquaria and Botanical Gardens.

The Cheetah Conservation Fund's Education Programme targets a wide range of audiences worldwide. The focus of the programme is to build awareness among farmers, educators, students and the general public about the role of the cheetah in healthy ecosystems and the need to preserve Africa's rich biodiversity. CCF offers education programmes through its Field Research & Education Centre and throughout Namibia via the CCF school outreach service. CCF also welcomes Namibian and international interns, conducts training workshops, and heightens global awareness of the endangered status of the cheetah.

Much has been accomplished since the establishment of the Cheetah Conservation Fund, and CCF's work continues to grow as new issues necessitate creative problem solving, further scientific research, and increased education and conservation programming.

Biology



CAT COMPARISONS

SUBJECT AREAS:
Science

DURATION/TIME:
Activity 1: 20 min
Activity 2: 20 min

RECOMMENDED PREPARATION:
- Review Appendix A: Background 'Introduction to the Cheetah' and in Appendix B: Reference 'Cats of the World'

Activity 1:
- Photocopy of 'Cat Comparison' table and cat photographs at the end of the lesson.

Activity 2:
- Photocopy and cut out cat cards

MATERIALS NEEDED:
Activity 1:
- One set of photocopies of cat photos at the end of the lesson & 'Cat Comparison' table

Activity 2:
- Make 8 copies of 'Cat Cards' page for each group

LOCATION:
- Classroom

KEY WORDS TO REVIEW:
Difference
Diurnal
Nocturnal
Range
Similarity
Species

OBJECTIVE:

Learners will study the cheetah by comparing and contrasting the cheetah to other members of the cat family

LESSON ACTIVITIES:

ACTIVITY 1:
Discuss cheetah background, behaviour and history. List the similarities and differences between all the Namibian cats and hold review discussion.

ACTIVITY 2:
Learners will play the Snap Game to help them better differentiate and identify each of the Namibian cat species.

Learning Outcomes

Learners will be able to describe the similarities and differences of some externally visible features of six different Namibia cat species.

Teaching the Lesson

Activity 1 – Similarities and Differences

Using the cat pictures at the end of this lesson, have the learners identify similarities and differences between the six cat species. Also use the 'Cat Comparison' table provided in this lesson for additional information.
Some examples of leading questions are offered below:

- Which cats look the same?
- Any similar patterns/shading? Body size? Body shape? Head size?
- How do the legs of the different cats compare?

Write on the board "Similarities and Differences" and ask learners to give suggestions for all the similarities and differences between the Namibian cats. Using the 'Cat Comparison' table on the following pages discuss with the learners the main differences and similarities between the six cat species.

Activity 2 – Snap Game

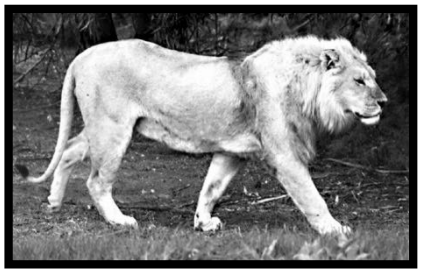
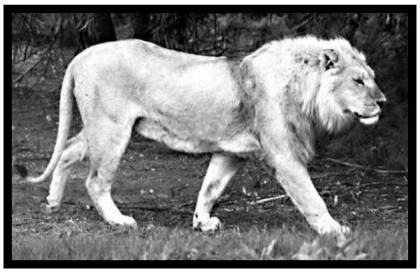
Make 8 photocopies of the 'Cat Cards' page so that you have 48 cards (8 copies of all 6 cats) per group. Divide the class into groups of four, and hand out a set of 48 cards (8 pages) to each group.

Procedure

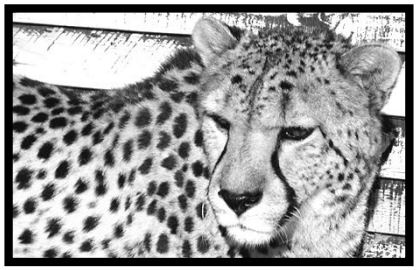
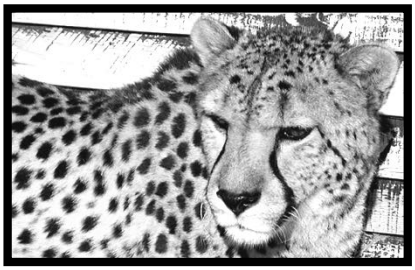
1. Have the learners mix the cards and deal each learner in the group a hand of 12 cards.
2. To start have all four learners in the group place 1 card each face up in the middle of the table, in a row so all players can see. Learners should try to time it so they are all laying down their cards at the same time.
3. If anyone in the group lays down a matching cat card, the learner who calls "snap" first followed by the name of the cat, gets a point. If a learner calls 'snap' and there is no match then they lose 1 point. Once all the cards have been dealt, the learner with the most points wins.

Have the learners assess themselves in the group as to whether they feel capable of moving up to the next level of the game. Use the second sheet of cards to produce 24 more cards by making four photocopies of the page. Remove half of the cards from the previous deck, making sure that you have four copies of each cat and add these to the 24 new cards. Play the games once again to see if the learners are still able to identify the different cats when they are in different positions. This game can be used to assess whether the learners can distinguish between the six cats based on their differences and similarities.

CAT CARDS *(Card setup for easier snap game)*





Cat Cards Key
Lion
Caracal
Serval
Cheetah
Leopard
African wildcat

CAT CARDS *(Card setup for more difficult snap game)*



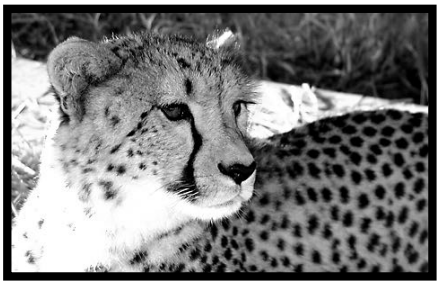
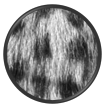
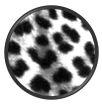



Table 1: Cat Comparison

	Cheetah	Leopard	Lion	Caracal	Serval	African Wild Cat
Scientific name	*Acinonyx jubatus*	*Panthera pardus*	*Panthera leo*	*Caracal caracal*	*Leptailurus serval*	*Felis silvestris lybica*
Distinguishing features	• Long slender body • Tan coat with solid black spots  • Black "tear marks" on face • Small head • Amber eyes • Semi-retractable claws	• Largest spotted cat, short and stocky, muscular • Coats marked with rosettes  • No "tear marks" • Large head, powerful jaw • Green eyes • Retractable claws	• Largest African cat • Uniform tawny sandy coat • Males have long mane • Tail sometimes black on tip • Retractable claws	• Long, slender body • Yellow-grey to reddish-brown coat • Short tails, tapered • Ears narrow and pointed • Long black tufts of hair on ears (4.5 cm) • Hind-legs longer than forelegs • Retractable claws	• Longest legs of any cat relative to body size. • Coat is boldly spotted black on tawny, with two-four stripes from the top of the head down the neck and back, transitioning into spots. • Tall rounded ears • Retractable claws	• Coat is grey-brown with long dark-ringed tails and a well-defined pattern of black stripes over their entire body. • Their coloration is similar to that of a domestic cat • Retractable claws
Size	• Total length: 1.8-2.2m • Tail length: 60-80 cm • Shoulder height: 73-80 cm • Weight: 35-40 kg(F), 40-50 kg(M)	• Total length: 1.6-2.1m • Tail length: 68-110 cm • Shoulder height: 70-80 cm • Weight: 20-60 kg(F), 30-90 kg(M)	• Total length: 2.3-2.7m (F), 2.5-3.3m (M) • Tail 70-100cm • Shoulder height: 1-1.2m • Weight: 110-152 kg(F), 150-225 kg(M)	• Total length: 70-110cm • Tail length: 18-34 cm • Shoulder height: 40-45 cm • Weight: 7-19kg	• Total length:96-120cm • Tail length: 25-38cm • Shoulder height: 60cm • Weight: 8-13kg	• Total length: 85-100cm • Tail length: 25-37cm • Shoulder height: 35cm • Weight: 2.5-6kg
Range	Africa: 20 countries Iran: 80 individuals	Africa: widely dispersed Also found in the Middle East and through Asia into China	Africa; Southern and Eastern Few found in Asia	Africa, Asia, Turkistan, Northwest India, Arabia	Africa: widely dispersed	The African subspecies is found throughout Southern Africa, other subspecies are found throughout Europe, Asia, and China.
Habitat	Grasslands, savannahs, woodlands, bush lands, hill country	Very adaptable – woodlands, lowlands, forests, mountains, savannahs, dry steppes	Grassy plains, arid woodlands, savannahs, semi-deserts	Wide range from open savannah and woodland to semi-arid areas.	Environments with water, adjacent tall grassland, reed-beds or borders of forest	Wide habitat tolerance, but requires cover, such as in woodlands and savannahs
Period of activity	Diurnal hunting early morning, late afternoon	Nocturnal and diurnal	Nocturnal and diurnal	Mostly nocturnal	Mostly nocturnal	Mostly nocturnal
Threats to humans	*Not a threat*	*Are a threat when provoked*	*Are a threat when provoked*	*Not a threat*	*Not a threat*	*Not a threat*

AFRICAN CAT INVESTIGATIONS

SUBJECT AREAS:
Science, Math

DURATION/TIME:
Activity 1: 45 minutes
Activity 2: 20 minutes

RECOMMENDED PREPARATION:
Activity 1:
- Make photocopies of the 'Cat Tracking Cards' and cut out. Also, photocopy the 'Incomplete Field Guide Cards' to be given to each group.
- Prepare your classroom into divided habitats and disperse the 'Cat Tracking Cards' (clues) around the designated habitats.
- Write the habitat onto a piece of paper or cardboard and display with the 'Cat Tracking Cards'.

MATERIALS NEEDED:
Activity 1:
- Photocopies of the 'Cat Tracking Cards' and 'Incomplete Field Guide Cards'.

Activity 2:
- Photocopy Table 1: Cat Comparisons

LOCATION:
- Classroom or outdoor space

KEY WORDS TO REVIEW:
Coalition
Cub
Diet
Diurnal
Habitat
Nocturnal
Species
Track
Threat

OBJECTIVE:

Learners will develop a broader understanding between the differences in the cat species.

LESSON ACTIVITIES:

ACTIVITY 1:
In the 'Track a Cat' activity learners will search 'habitats' to look for clues (Cat Tracking Cards) of their animal and fill in their 'Incomplete Field Guide Cards'. At the end of the lesson, groups will present their findings to the class.

ACTIVITY 2:
Learners will use math to compare the sizes of the cats using weight, length and height.

Learning Outcomes

This activity is designed to reinforce the differences among the six Namibian cat species. Learners will track the lion, leopard, cheetah, caracal, serval and African wildcat through a simulated habitat, learning about each individual animal as they progress through the activity. They will also learn how to use and design field guides of their own.

Teaching the Lesson

Vocabulary

Coalition: Male cheetahs often form small groups with their brothers. This group of males do everything together and are closely bonded. Sometimes males that are unrelated will join a coalition, but the cheetahs are usually close in age.

Activity 1 – Track a Cat
(adapted from Cincinnati Zoo's "Track my cat" activity)

For this activity the teacher needs to adapt the classroom or the outdoor environment into a series of "habitats" suitable to each species of cat. Divide the area (the teacher can decide which size) into four sections designated for savannah, forest, mountain, and farmland. These can be shown as separate simply by using some string to mark off each area or placing representative props within the areas (to show trees, grass, bushes, rocks, etc). Make a sign to show what habitat each area represents (savannah, forest, etc).

Each cat has six different cards with information about that species. Distribute the Cat Tracking Cards throughout the classroom in their respective habitat area as follows:

Commonly Found in:

Savannah (S) - Lion, cheetah, wildcat
Forest (F) - Leopard, serval, caracal, wildcat
Mountain (M) – Leopard, caracal
Farmland (FL) – Leopard, cheetah, serval, caracal, wildcat

Procedures:

1. Make photocopies of the 'Cat Tracking Cards'- There should be three sets of cards copied for each leopard, caracal, and wildcat. Two sets of cards each for cheetah and serval, and one set of cards for lion. Once you have made copies of the 'Cat Tracking Cards' you will have 14 sets of cards.

2. Each cat, except lion, is found in multiple habitats. Mix the cards together for each cat species and randomly distribute them to the habitats where they are found. It is more fun if the cards are spread out through different levels of the room rather than simply on the floor. For example, leopard and caracal can sometimes be found in trees, and cheetah will try to hide in the shade of trees or bushes.

3. Divide the class into 14 groups, assigning each group a cat to track. (1 lion group, 3 leopard groups, 3 caracal groups, 3 wildcat groups, 2 cheetah groups, and 2 serval groups) Some groups will be tracking the same cat. Each group needs to collect six different cards for their cat. Learners may have to visit different habitats to collect all of their cats' cards.

4. Give each group one 'Incomplete Field Guide Card' for their assigned cat species, which only gives information about the appearance of the cat, including a drawing of its body. As the blanks indicate on the 'Incomplete Field Guide Cards', the learners need to discover their cat's habitat , diet, social behaviour, hunting behaviour, reproduction, etc.

5. Explain that the learners are scientific research teams with the task of finding out more about these cat species. They are going to create a field guide to help identify these cats. A field guide is a booklet designed to help identify animals from a picture with a brief description, including habitat, range, diet and behaviour so that people can learn more about the animal they have seen. Learners only know what each cat looks like. Even the name of the cat is unknown. The learners need to follow or "track" the cats to discover more about them. 'Cat Tracking Cards' have been distributed throughout the room in the specific location where people have spotted the cats. The goal is for each group to collect all six of their 'Cat Tracking Cards', identify their cat, and create a field guide using the attached 'Incomplete Field Guide Cards'.

6. Once the learners have found all six of their 'Cat Tracking Cards', they should come to the teacher. The teacher will help the learners identify their cat by name through use of the 'Cat Comparison' table found at the end of Cat Comparisons lesson. After tracking is complete and groups are settled, the group must take the information from their 'Cat Tracking Cards' and fill in their 'Incomplete Field Guide Cards' for their cat. They must write as neatly as possible so that other learners can use this as an identification guide. Explain that hunting behaviour will include the time of day, how the cat hunts, etc.

7. When each group has finished their Field Guide, have the groups present their cat to the class. After learners present their cats, encourage them to make comparisons. Discuss differences and similarities between some or all of the categories listed in the 'Cat Comparison' table.

8. Using the group's field guides, compile a class field guide of the cats.

Activity 2 – Comparing Cats

Procedures:

1. After completing Activity 1 provide learners with a copy of the 'Cat Comparison' table found in the Cat Comparisons lesson.

2. Have each learner look at the 'Size' category in the table. Learners will put the cats in order from:

    a. Smallest to largest based on total body length
    b. Smallest to largest based on body weight

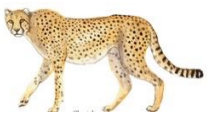
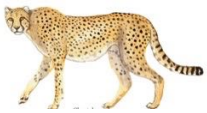
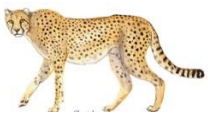
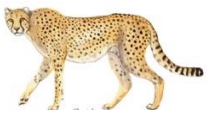
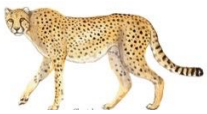
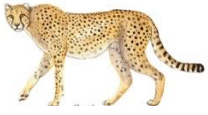
3. When learners have completed ordering the cats ask them to explain why the two orders are different. Have students consider:
    a. The adaptations of the cheetah
    b. What the cats eat
    c. How leopards and cheetahs catch their prey
    d. What is meant by the saying 'Cheetahs are built for speed'.

Cat Tracking Cards

Lion Set: cat tracking cards

A group of adults, both male and female seen lying under a tree. (S) 	Group seen at night feasting on a large antelope kill. (S) . 	Group of females seen during the day stalking a kudu, finishing off with a short chase to bring the prey down. (S) 
Group of females seen with a litter of four cubs, about 6 months old, feeding on a zebra. (S) 	Seen at a water point drinking, while all other animals kept their distance. (S) 	Cat was confronted with a human and was not frightened away. Should keep your distance from this predator. (S) 

Cheetah Set: cat tracking cards

Solitary female spotted under a bush. (S,FL) 	Female with a litter of three young cubs, seen during the early morning, chasing an impala. (S,FL) 	Pair of males seen scent marking a tree with a thick low hanging branch. (S,FL) 
Pair of males, seen in the late afternoon, chasing a springbok at high speeds then tripping, and strangling prey. (S,FL) 	Scientists encountered a lone adult on foot, which ran away from them. (S,FL) 	Female seen with two almost full grown cubs. (S,FL) 

Leopard Set: cat tracking cards

Seen with a dead antelope up in a tree. (F,M,FL) 	Seen at night pouncing on a antelope and killing by snapping the neck. (F,M,FL) 	Female seen with two cubs at night. (F,M,FL) 
Adult seen resting up in a tree during the day. (F,M,FL) 	Almost fully grown cub seen alone. (F,M,FL) 	Scientist confronted by a solitary male, which was not frightened away and was aggressive when provoked. (F,M,FL) 

Serval Set: cat tracking cards

Solitary male seen stalking and pouncing on a hare. (F,FL) 	A small family group of three seen at night. (F,FL) 	Seen resting up in a tree during the day. (F,FL) 
A female seen in an abandoned aardvark burrow with two very young kittens. (F,FL) 	Repeatedly sighted by scientists near rivers and streams. (F,FL) 	Seen digging into a small ground burrow in search of underground prey. (F,FL) 

African Wild Cat Set: cat tracking cards

Small species, but larger than a domestic cat seen hunting along edge of forest. (F,S,FL) 	Observed breeding with a domestic cat. (F,S,FL) 	Scientists usually observed at night or at dawn and dusk. (F,S,FL) 
Solitary adult seen stalking and pouncing on a rodent in short grass. (F,S,FL) 	Female seen with three young kittens playing outside an abandoned warthog burrow. (F,S,FL) 	Ran away as soon as scientists tried to get a closer look at the cat. (F,S,FL) 

Caracal Set: cat tracking cards

Female seen with two young cubs. (F,M,FL) 	Seen at night, pouncing on a bird in flight. (F,M,FL) 	Solitary male seen walking at night. (F,M,FL) 
Seen taking small prey animal up into tree. (F,M,FL) 	Ran away when approached by scientist. (F,M,FL) 	A male seen courting a female at night. (F,M,FL) 

Your Cat's Name: _____
Appearance: This large cat has a long, slender body with a tan coat and solid black spots. The head is small with black tear marks running from the corner of the eyes to the mouth.

Habitat (Where I live): _____

Diet (What I eat): _____

How & when I hunt: _____

Social behavior (Do I live alone or with others): _____

Reproduction (How I raise young): _____

Can I be a threat to humans? _____

Your Cat's Name: _____
Appearance: Pale, yellowish-fawn coat with black spotted and barred pattern. Tall rounded ears. Two back bands separated by white patches on back of ears. Short black-banded and tipped tail.

Habitat (Where I live): _____

Diet (What I eat): _____

How & when I hunt: _____

Social Behavior (Do I live alone or with others): _____

Reproduction (How I raise young): _____

Can I be a threat to humans? _____

Your Cat's Name: _____
Appearance: This large spotted cat is short, stocky, and muscular, with a large head and powerful jaws. The coat is marked with brown spots surrounded by black spots called a rosette pattern.

Habitat (Where I live): _____

Diet (What I eat): _____

How & when I hunt: _____

Social Behavior (Do I live alone or with others): _____

Reproduction (How I raise young): _____

Can I be a threat to humans? _____

Your Cat's Name: _____
Appearance: This medium sized cat has a long slender body with a solid yellow-grey to reddish-brown coat. Tail is tapered, and ears narrow to points with long black tufts of hair. The hind legs are longer than the forelegs.

Habitat (Where I live): _____

Diet (What I eat): _____

How & when I hunt: _____

Social Behavior (Do I live alone or with others): _____

Reproduction (How I raise young): _____

Can I be a threat to humans? _____

Your Cat's Name: _____
Appearance: A small cat with a grey-brown coat and well-defined pattern of black stripes over its entire body. They have a long, dark-ringed tail with a black tip.

Habitat (Where I live): _____

Diet (What I eat): _____

How & When I hunt: _____

Social Behavior (Do I live alone or with others):_____

Reproduction (How I raise young): _____

Can I be a threat to humans? _____

Your Cat's Name: _____
Appearance: This large cat has a uniform tawny- sandy coat with some having a black tip on their tails. The males have a long mane that is dark brown to black in colour.

Habitat (Where I live): _____

Diet (What I eat): _____

How & when I hunt: _____

Social Behavior (Do I live alone or with others):_____

Reproduction (How I raise young): _____

Can I be a threat to humans?_____

ANSWERS: Complete Field Guide Cards

Your Cat's Name: Leopard (*Panthera pardus*)
Appearance: This large spotted cat is short, stocky, and muscular, with a large head and powerful jaws. The coat is marked with brown spots surrounded by black spots called a rosette pattern.
Habitat: Forest, mountain, and farmland
Diet: Broad diet from medium sized rodents and birds to large antelope
Hunting Behavior: Both nocturnal and diurnal, will pounce on prey and kill by snapping the animal's neck or strangulation. Will sometime take kill up into a tree.
Social Behavior: Solitary except when breeding or with cubs, mother generally leaves cubs around 12 to 18 months of age.
Reproduction: 2-3 cubs born in dense cover, rock crevices, or caves.
Threat to Humans: Can be a threat to humans when provoked.

Your Cat's Name: Cheetah (*Acinonyx jubatus*)
Appearance: This large cat has a long, slender body with a tan coat and solid black spots. The head is small with black tear marks running from the corner of the eyes to the mouth.
Habitat: Savannah and farmland
Diet: Small to medium sized antelope, scrub hares, guinea fowl, warthog
Hunting Behavior: Diurnal hunter. Stalks then chases at high speed. Ends with a trip and strangulation.
Social Behavior: Solitary cat, with some males forming coalitions. Female raises cubs till about 18 to 24 months of age. Uses trees for communicating with scent marking.
Reproduction: 1 to 6 cubs are blind when born. The first six weeks they are hidden in dense plant cover and thereafter following the mother.
Threat to Humans: Is not a threat to humans.

ANSWERS: Complete Field Guide Cards

Your Cat's Name: Serval (*Leptailurus serval*)
Appearance: Pale, yellowish-fawn coat with black spotted and barred pattern. Tall rounded ears. Two back bands separated by white patches on back of ears. Short black-banded and tipped tail.
Habitat: Areas with water, such as forests and farmland
Diet: Small mammals (rodents & hares), birds, reptiles, and insects.
Hunting Behavior: Nocturnal hunter, stalking and pouncing on prey. Also a good climber.
Social Behavior: Generally solitary but also found in pairs and small family groups.
Reproduction: Usually 1-3 (up to 5) kittens, are born in burrows dug by other animals or in dense vegetation.
Threat to Humans: Is not threat to humans.

Your Cat's Name: Caracal (*Caracal caracal*)
Appearance: This medium sized cat has a long slender body with a solid yellow-grey to reddish-brown coat. Their tails are tapered, and ears narrow to points with long black tufts of hair. The hind legs are longer than the forelegs.
Habitat: Forest, mountain, and farmland
Diet: Rodents, birds, hares, and small juvenile antelope
Hunting Behavior: Mostly nocturnal hunter, able to pounce on a bird in flight. Will sometimes take its kill up into a tree.
Social Behavior: Solitary, except for females raising kittens. Female typically leaves her young at about one year of age.
Reproduction: 1 to 3 kittens born in burrows dug by other animals, in rock crevices or among dense vegetation.
Threat to Humans: Is not a threat to humans.

ANSWERS: Complete Field Guide Cards

Your Cat's Name: African Wild Cat (*Felis silvestris lybica*)

Appearance: A small cat with a grey-brown coat and well-defined pattern of black stripes over its entire body. They have a long, dark-ringed tail with a black tip.

Habitat: Savannah, forest, and farmlands

Diet: Mainly small animals including mice, birds, and insects.

Hunting Behavior: Mostly nocturnal, will stalk and pounce and is sometimes seen playing with food.

Social Behavior: Solitary, except when mating or when female has kittens.

Reproduction: 2 to 5 kittens born in dense vegetation cover, rocks, or in burrows dug by other animals. Has been seen breeding with domestic cats.

Threat to Humans: Is not a threat to humans.

Your Cat's Name: Lion (*Panthera leo*)

Appearance: The largest African cat. Has a uniform tawny / sandy coloured coat with a black tip on their tails. The males have a long brown-black mane.

Habitat: Savannah

Diet: Mainly large antelope

Hunting Behavior: Nocturnal and diurnal hunter. Stalking as close as possible, finishing off with a short chase. Jumps on prey's back to bring it down.

Social Behavior: Social animal, lives in family groups (prides).

Reproduction: 1 to 4 cubs born under cover while female is secluded from pride. Female and cubs soon rejoin pride after birth. Cubs remain with mother for two years or longer.

Threat to Humans: Can be a threat to humans when provoked.

ADAPTATIONS

SUBJECT AREAS:
Science, English

DURATION/TIME:
Activity 1: 10 min
Activity 2: 30 minutes

RECOMMENDED PREPARATION:
- Read Appendix A: Background - 'Adaptations' and 'Cheetah Speed'

Activity 2:
- Gather supplies needed and make photocopies of student page 'Built for Speed'

MATERIALS NEEDED:
Activity 2:
- All supplies listed under 'Build A Cheetah' and photocopies of student page 'Built for Speed'

LOCATION:
- Classroom

KEY WORDS TO REVIEW:
Adaptation
Metaphor
Rudder
Semi-retractable

OBJECTIVE:

Learners will understand and investigate animal adaptations.

LESSON ACTIVITIES:

ACTIVITY 1:
Discussion: What is an adaptation and what are some examples of adaptations?

ACTIVITY 2:
Learners will explore animal adaptations and complete the student page 'Built for Speed' on cheetah adaptations.

Learning Outcomes

In this lesson learners will learn about the adaptations of animals and the role these adaptations play in their survival. Cheetah adaptations are discussed using metaphor materials.

Teaching the Lesson

Activity 1 – What is an Adaptation?

Animals are adapted to survive in particular habitats. Just as we might try to guess where people of different cultures are from by observing the way they dress, talk and behave, we can tell a lot about an animal's habitat by observing its behaviours and appearance. An adaptation is a physical or behavioural characteristic that helps an animal survive in its habitat. Those best adapted to the conditions in which they live are more likely to survive and reproduce. For example, one of the adaptations that cheetahs have is their black spots. A cheetah's solid black spots help them to hide it in the shade of bushes and trees, making it harder for other predators to see them. Animals come in all different shapes, sizes and colours. These differences make each species, or individual members of a species, especially adapted for success in a specific habitat or place within the habitat.

Procedure:

1. Use the following activity to begin a discussion with the learners on adaptations. To help learners understand the great diversity of life forms found in nature, generate a list of species that have the different colours and shapes listed below. Ask learners to come up with as many species as possible. Some examples are listed. Ask the learners why they think the animals have these adaptations. Help learners link the adaptations to habitat and feeding behaviour.

    - Black (penguins, black wildebeest)
    - Grey (elephant, rhino)
    - Green (grasshoppers, boomslang snake)
    - Spotted (cheetah, leopard, giraffe)
    - Striped (aardwolf, zebra, kudu)
    - Wings (birds, bats)
    - Fur (mammals)
    - Gills (fish)
    - Short tail (hyena, honey badger)
    - Long tail (cheetah, lion, genet)
    - Short legs (warthog)
    - Long legs (giraffe, antelope)
    - No legs (snakes, whales)

Procedure:

1. Learners will explore the special body parts and adaptations cheetahs have that make them the world's fastest land animals.
2. Divide learners into groups of four.
3. Make 1 set of metaphor materials for the class or provide each group with the metaphor materials listed. These can be handed to learners in a bag, box or pillowcase or can be placed on a table in front of each group.
4. Direct the groups to use the metaphor materials and the 'Cheetah Speed' reference page, to describe the various adaptations of the cheetah.
5. Each group member will take turns selecting a different metaphor material and will reflect on what kind of adaptation it represents. All members of the group can help with generating ideas.
6. As a group, the learners will fill out the Cheetah Adaptation Table on the student page 'Built for Speed'. It may be useful to put up a picture of a cheetah to help learners visualize each part.
7. Once all groups have had the opportunity to talk about each of the metaphor materials, provide them with the additional reference page 'Adaptations'. Allow learners time to adjust and revise their answers on the table.
8. When all groups have finished their tables conduct a class discussion. Select each item and ask groups to share their answers. There are no right or wrong answers as long as learners can explain their reasoning. Use the information and questions listed below in the 'Adaptations of a Cheetah for Speed' and 'Cheetah Adaptation Metaphors' to help lead the discussion.

Adaptations of a Cheetah for Speed:

The cheetah is the fastest animal on land, with a maximum speed of 110 - 112 km per hour. Running is the cheetah's main form of defence. A cheetah's speed allows it to hunt and escape from danger.

The cheetah has many adaptations which help it to run so fast. The cheetah has a very light skeleton and does not have a lot of extra muscle bulk. The cheetah's body is thin and streamlined which make it aerodynamic or less resistant to wind. The leg bones are longer than other cats and cheetahs run on the tips of their toes, giving them a bigger step. The cheetah's spine is very flexible allowing them to increase the size of their steps by stretching their body out. Their hip bones can turn where they are attached to the rest of the skeleton; this allows them to stretch their hind legs out further. All these adaptations give the cheetah a stride of 8 meters while running at full speed.

The cheetah's long, narrow tail helps it keep its balance and steer around corners. The feet give them better grip on the ground to stop the cheetah from slipping while it is running. This grip is provided by grooves on the pads of the feet as well as the claws which cannot be pulled into the paw completely (they are semi non-retractable).

It takes a lot of energy for the cheetah to run at such great speed. It is the oxygen in their blood that provides that energy. The cheetahs have a very big heart and big lungs to make sure that they get enough oxygen to their muscles while running to keep up their energy.

The cheetah also has wide and enlarged nasal passages for increased airflow while running and recovering.

Cheetah Adaptation Metaphors

Paper airplane:

Throw it into the air and watch it fly. The cheetah has a long, thin body to create less resistance to wind while running, just as a paper airplane flies easily through the air. Now crumple the paper and throw it; it will not fly like an airplane. Animals that move quickly through the air like birds or through the water like fish are streamlined. Cheetahs' long, thin bodies help them to run faster.

Running shoe/soccer shoe:

What type of shoe? *(Running shoe / soccer shoe)*
When do we wear these shoes? *(Running / sport / exercise)*
Why are these shoes worn for sports or hiking and not other shoes? *(The rough sole provides better grip decreasing the chances of slipping and falling)*
Cheetahs' paws are like running or soccer shoes. The paws have two adaptations which allow them to grip the ground. The semi non-retractable claws help the cheetah dig into the ground and the grooves on the pads work similar to the treads on running shoes.

Sticks:

How do the long sticks represent a cheetah's legs? Long legs increase the stride of a cheetah, allowing it to cover a greater distance in less time.

Phone cord, spring or coil:

Squeeze and straighten the phone cord, spring or coil to show how flexible it is. This represents the cheetah's spine. The cheetah has a very flexible spine, which allows the body to stretch out in a run. Together with the long legs, this gives the cheetah a stride of 8 meters (pace out 8m). Cheetahs also have a large portion (60%) of muscle attached to their spine. They use this muscle to propel themselves forward when they run.

String / ribbon:

The cheetah's tail acts like a rudder helping the cheetah turn while running. The cheetah uses its tail like a rudder on a boat is used to steer the boat. The rudder helps the cheetah steer and also helps it maintain its balance.

Heart / ball-bicycle pump:

What is the function of your heart? *(Pump blood with oxygen to your muscles)*
When you are active you need more blood and oxygen to keep muscles working. Animals and people get tired when they are very active because there is a lack of oxygen getting to the muscles. It takes a lot of oxygen for a cheetah to run at 110km/h. The cheetah has an enlarged heart to pump blood and oxygen faster to the muscles.

Binoculars:

Cheetahs have excellent vision. It is important for them to be able to see their prey from great distances and to sneak up on it. Their eyes work like a pair of binoculars (binocular vision), allowing the cheetah to see up to 5 km away. Cheetahs are able to see a bird at that distance. Use a landmark 5 km from the school that the learners all recognize, to help them visualize the distance.

Sunglasses:

Due to its speed a cheetah has to hunt by day in order to clearly see where it is going. When a cheetah is active, early morning / late afternoon, the sun is low on the horizon, often resulting in the cheetah looking directly into the sun.

- When you look into the sun can you see clearly?
- How could the sun's glare affect the cheetah's ability to hunt and catch its prey? *(The glare could cause the cheetah to have to squint)*
- What do we use to protect our eyes from the sun? *(Sunglasses)*
- What structure or marks on the cheetah would function like sunglasses? *(Tear marks)*
  The colour black absorbs light, attracting the glare of the sun below the eyes, not directly into the eyes.

Suggested Answer Key for Student Page – Built for Speed

Supplies	Body Part	Function of the Adaptations
Paper airplane	Long, thin body	Aerodynamic build for speed
Running shoe / soccer shoe	Paws with claws out	Better traction for running
Long, medium, short sticks	Long legs	Bigger, longer stride
Piece of wire or phone cord coil	Flexible spine	Increased stride length
Long piece of string or ribbon	Long & narrow tail	Balance and steering
Paper heart or ball/bicycle pump	Large & strong heart	Increased oxygen supply to muscles
Binoculars (two toilet rolls tied together can substitute)	Eyes	Enhanced vision of 5 km
Sunglasses	Face markings	Tear marks on face to protect eyes from sun's glare

Name: _____ **Date**: _____

Instructions: Next to each of the metaphor materials, list the body part it might represent and describe what the function of the adaptation might be. The first one is done for you as an example. Go through items one by one and explain why each is an important adaptation for the cheetah.

Cheetah Adaptation Table

Metaphor Materials	Body Part	Function of the Adaptations
Paper airplane	Long, thin body	Aerodynamic build for speed
Running shoe / soccer shoe		
Long, medium, short sticks		
Piece of wire or phone cord coil		
Long piece of string or ribbon		
Paper heart or ball/bicycle pump		
Binoculars (two toilet rolls tied together can substitute)		
Sunglasses		

DESIGNED FOR THE WILD

SUBJECT AREAS:
Science, Information and Communication, Arts

DURATION/TIME:
Activity 1: 45 minutes

RECOMMENDED PREPARATION:
- Review background 'Adaptations' in Appendix A and Adaptations Lesson

MATERIALS NEEDED:
- Photocopy student page - 'Designed for the Wild'

LOCATION:
- Classroom or outdoor space with place to write

KEY WORDS TO REVIEW:
Adaptation
Camouflage
Crepuscular
Diurnal
Nocturnal

OBJECTIVE:

Learners will become familiar with different animal adaptations and how they use them to survive.

LESSON ACTIVITIES:

ACTIVITY 1:
Story telling: Designed for the Wild. Learners design a creature for the wild and write a story about the creature and how it lives.

Extension: Learners will create a drawing or sketch of their "Built for the Wild' creature.

Learning Outcomes

In this lesson learners will become familiar with local animal adaptations and how they use these adaptations to survive in the wild.

Teaching the Lesson

Activity 1- Story Telling

Storytelling, folk tales, and myths serve as a means of handing down traditions and customs from one generation to the next in Africa. Often, after a hard day's work, the adults would gather the children together, around a fire and tell stories. Usually the stories are meant to prepare young people for life, and so often taught a lesson or moral.

In many African folk tales, the stories reflect the culture where many types of animals' live side by side with people. For better understanding of animals and natural phenomenon, the animals and the natural world were often given human attributes, so it is not uncommon to find animals talking, singing, or demonstrating other human characteristics such, as values and emotions.

Procedure 1:

Read the story on the next page aloud to the learners. Ask learners to close their eyes and imagine they are on the trip to Etosha National Park.

Procedure 2:

Provide learners with the student page, 'Designed for the Wild' and have them create a creature that is designed 'adapted' for the wild. Once learners choose from all the possible adaptations, have them write a story about the creature and how it lives. Discuss and review all of the adaptations listed on the student page and have learners share their stories with the class.

Extension - Built for the Wild

Once learners have designed and written a story about their wild creature allow them to sketch, draw or sculpt the animal. Learners can then display their creatures and their stories.

You are on a class trip to Etosha National Park, on a game drive. On the game drive you see lots of animals. In the open grass areas, you see numerous antelope grazing and gathered in large groups. Your class gets lucky and you get to see some male antelope "sparing" with each other. They are clashing their horns together in a fight to show who is dominant. Later you see some antelope all gathered together looking in one direction. Your class drives a bit closer to see what the antelope are staring at. The antelope are all looking at a group of lions laying under a tree. You can hear the antelope snorting and stomping, giving away the lion's location. Your class watches as the group of lions interact with each other, grooming and resting with others in the pride.

You continue on the game drive and arrive at a waterhole. There you see many different animals taking turns drinking water. A black rhino is wading deep into the water, while warthogs are quickly kneeling at the waters edge to drink. Later a herd of elephants come rushing to the water and all other animals give them room at the waterhole. The elephants are drinking by pulling water into their trunks and pouring it into their mouths. Once the elephants have drunk their fill they are filling their trunks with water to spray on themselves to cool their bodies in the hot Namibian sun.

As the sun is setting your class heads back to camp and the game drive is completed. Over dinner all of the learners' swap stories of the animals they saw on the game drive, many seeing small mammals and birds that your class didn't stop to view.

Later that night when everyone is safely tucked into the tents for the night, you hear a noise that wakes you up. The noise is not scary but it is different from any animal noise you have ever heard. You quietly peak your head out of the tent to have a look. There in the dark you see the outline of an animal you have never seen before. The next morning you are asked to describe the animal and explain how you think it lives in the wild.

Student Page- Designed for the Wild

Name: _____ **Date**:_____

Instructions: Choose and circle the adaptation of your choice for each category. Once you have designed your creature, write a story about it and how it lives.

Adaptations:

1. Size (Pick 1)	Small and swift like a mongoose or Large and strong like a rhino	
2. When active (Pick 1)	Daytime (Diurnal) Dawn & Dusk (Crepuscular) Nighttime (Nocturnal)	
3. Protection (Pick 2)	Camouflage like an owl Horns like an antelope Spines like a porcupine Runs fast like a cheetah	Shell like a tortoise Fly like a bird Tusks like a warthog
4. Food (Pick 1)	Sharp teeth like a lion for eating other animals Long flexible lips like a giraffe for eating leaves and twigs Long sticky tongue like an aardvark for catching and eating insects	
5. Family life (Pick 1)	Live in the open with a group like zebras for protection Live hidden and alone like a leopard Live in a pack like a meerkat with a family member always on guard	
6. Shelter 'Home' (Pick 1)	Burrow in the ground like a pangolin Up in a tree like a genet In a rocky cave like a rock hyrax In a nest like a weaver bird	
7. Additional Adaptations (Pick 1)	Enhanced sense of sight Enhanced sense of hearing Enhanced sense of smell Strong thick nails for digging Long tail for balance Sticky toes for climbing	

My Creature Story:

On another piece of paper or on the back of this page write a story about your creature and how it lives.

HOW FAST IS A CHEETAH?

SUBJECT AREAS:
Physical Education, Mathematics, Science

DURATION/TIME:
Discussion: 10 minutes
Activity 1: 35 min

RECOMMENDED PREPARATION:
Activity 1:
Review in Appendix B Reference- 'Cheetah Speed'

Activity 2:
Set up a 28 meter track
Photocopy the student page 'How Fast is the Cheetah?' for each learner.

MATERIALS NEEDED:
Activity 2:
28 meter Track
Clock/watch (with a second hand)
Photocopies of the student page for each learner

LOCATION:
Classroom & Outdoors

KEY WORDS TO REVIEW:
Adaptations
Sprinter
Stride
Unique

OBJECTIVE:

Learners will compare their speed to the cheetah's and develop an appreciation for the cheetah's unique adaptations.

LESSON ACTIVITIES:

ACTIVITY 1:
Learners will discuss the cheetah's speed and the adaptations cheetahs have that make them the fastest land animals.

ACTIVITY 2:
Learners will compare their speed to the speed of the cheetah's by running on a 28 meter track and timing themselves for various activities. Learners will complete the student page 'How Fast is the Cheetah?' with the information gathered.

Learning Outcomes

Learners will develop an appreciation for the cheetah's unique adaptations and amazing speed by comparing their speed to the cheetah's.

Teaching the Lesson

Outside set up a 28 meter track. You will also need a stopwatch or clock with a second hand and a tape measure.

Activity 1 – a cheetah's adaptations for speed

Have the learners review the fact sheet (found in Appendix B) 'Cheetah Speed' to review the unique adaptations cheetahs have that allows them to be the fastest land animal. This information will allow the learners to complete the student page 'How Fast is the Cheetah?'

Activity 2 – How fast is the cheetah?

Learners will time themselves in various events on the 28 meter track in order to complete the student page.

Time the learners on the following events:
- Run 28 meters (on two legs)
- Run 28 meters (on four legs)

Also:
- Measure the learner's distance of one stride
- Take a breathing rate when the learners are resting
- Run for three minutes, then take a breathing rate

Answers to the student page – How Fast is the Cheetah?

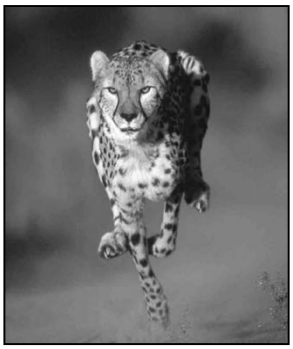
Note: answers will vary depending on individual times

1. A sprinter can run 40 km/h.

2. Individual answer

3. Individual answer
   It takes a cheetah 7 strides to cover 56 meters.

4. A cheetah's breathing increases by 90 breaths per minute.
   It is a 60% increase. (90 / 150 * 100)
   Individual answers



Student Page – How Fast is the Cheetah?

Name: _____ **Date**: _____

Instructions: Today you are going to compare your speed to that of the fastest animal on land, the cheetah. Remember, the cheetah has many special adaptations to its body that help it run so fast. As you are running and completing the stations today, think of the differences between your body and the cheetah's which help it run so much faster than you! Review the fact sheet 'The Cheetah's Speed' with your teacher before you begin in order to help you answer some of these questions below.

Cheetah Olympics:

1. A cheetah can run up to 110 km/h.
   A human sprinter can run _____ km/h.

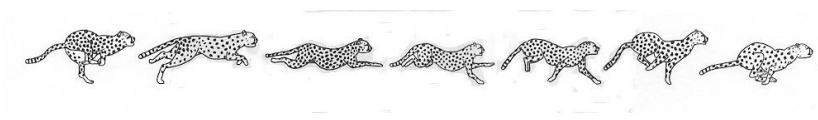
2. At 100 km/h, a cheetah can run 28 meters in 1 second.
   I can run 28 meters on two legs in _____ seconds and on four legs in _____ seconds.
   How many seconds faster can a cheetah run this distance? _____
   How much faster can a cheetah run this distance in a percent? _____
   (Example: If you run 28 meters in 9 seconds, the cheetah is 8 seconds faster. Divide 8 by 9 to find the percent that the cheetah is faster.)

3. A cheetah can cover 8 meters in one stride.
   I can cover _____ meters in one stride.
   (A stride is one cycle of sequential footsteps, that is, two steps for a human and four steps for a cheetah.)
   How many more meters can a cheetah cover in a stride than you? _____
   How many more strides does it take you to cover 8 meters? _____
   How many strides does it take a cheetah to run 56 meters? _____

4. A cheetah's breathing rate goes from 60 breaths per minute to 150 breaths per minute after running.
   How much does the cheetah's breathing increase? _____
   What percentage increase is this? _____

5. Count your breath rate before and after running for 3 minutes. To count your rate, place your hand on your chest where your bottom ribs meet. Count one breath for each time your chest rises. Count the number of breaths you take in one minute.

   What is your resting breath rate per minute? _____
   What is your breath rate after running for 3 minutes? _____
   How much did your breathing rate increase? _____
   What percentage increase is this? _____



LIFE CYCLES

SUBJECT AREAS:
Science, Mathematics

DURATION/TIME:
Activity 1: 45 minutes

RECOMMENDED PREPARATION:
Activity 1:
- Read Appendix A: Background-'A Cheetah's Life Cycle'.
- Read Appendix B: Reference- 'Hunting Development of Cubs'.
- Photocopy student page 'Cheetah and Me' for learners.
- Make one photocopy of the 'Weight and Age Chart' to post on the board.

MATERIALS NEEDED:
Activity 1:
- Photocopies of the 'Cheetah and Me' student page for learners and graph paper, if necessary

LOCATION:
- Classroom

KEY WORDS TO REVIEW:
Captivity
Cub
Den
Gestation
Graph axis
Habitat
Litter
Maturity
Mortality

OBJECTIVE:

Learners will work on their graphing skills by comparing the similarities and differences in the growth of cheetah cubs and human children

LESSON ACTIVITIES:

ACTIVITY 1:
Learners create a line graph in a weight/age activity and then learners compute results from the graph. Learners also review of information in the background 'A Cheetah's Life Cycle' found in Appendix A.

Learning Outcomes

In this activity learners will work on their graphing skills by comparing the increase in weight after birth of cheetah cubs and human children.

Teaching the Lesson

Activity 1 – Cheetah and Me

Procedure:

1. Begin a class discussion with learners about cheetahs (use background information 'A Cheetah's Life Cycle' and 'Hunting Development of Cubs' found in the Appendix. Ask learners to guess how much a cub (baby cheetah) might weigh when it is born. Learners can write down their guess on a piece of paper. Call for their guesses.
    - Ask for their ideas about how long mother cheetahs are pregnant
    - What baby cheetahs eat when they are born
    - How much they might weigh when they are a year old
    - How many brothers and sisters they might have who are their same age
    - How much they weigh when they are fully grown and how long they live. (answers can be found on the Development Chart)
2. Following the discussion, post a copy of the 'Development Chart' (found on the next page) and pass out the student page 'Cheetah & Me'. Review with learners any of the background information not covered in the class discussion. Ask learners to plot the cheetah's weight and age.
3. Ask the learners to plot the human weight at the same ages as the cheetah shown on the chart. Ask the learners to graph both sets of data. (Refer to Weight & Age Chart for human development.)
4. Ask the learners to compute the following, and include their results with their graph:
    A. How much weight did the cheetah gain at each interval (that is, from birth to four months, 12 months to two years, etc).
    B. How much weight did the human child gain during the same intervals?
    C. Who gained weight more quickly, the human or the cheetah?
    D. Why do you think it would be important for cheetah cubs to grow quickly?
5. In discussion, ask the learners to comment on the similarities and differences between the lifecycles of cheetahs and people.

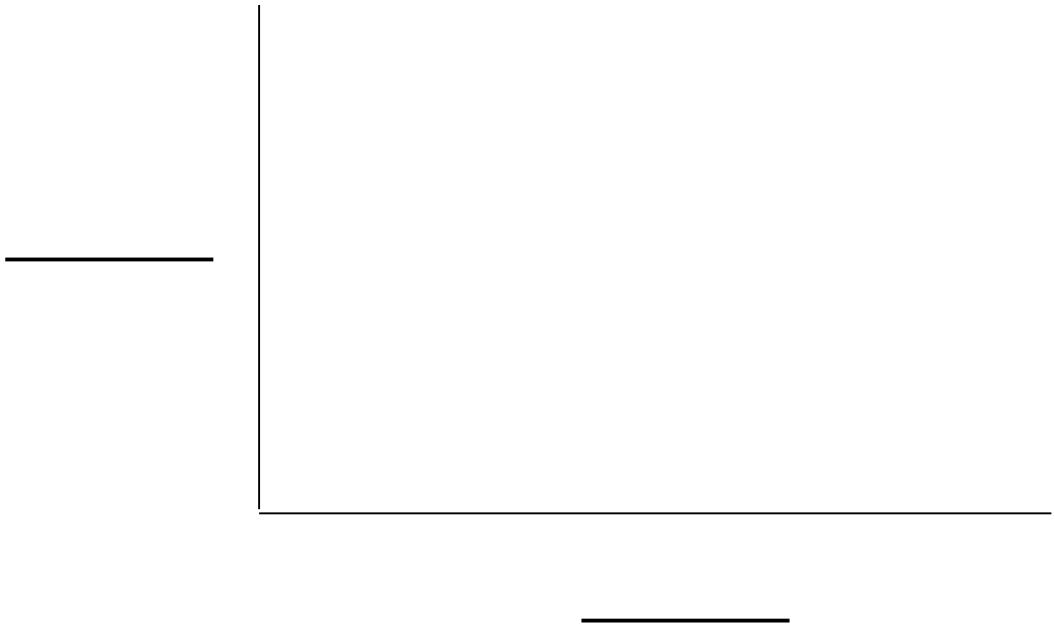
Development Chart

Stage of Development	Cheetah	Human
Gestation	*90-95 days*	*9 months*
Open eyes	*4-14 days*	*From birth*
First tooth	*3 weeks*	*6 months*
Loose milk teeth	*6 weeks*	*By 30 months*
Permanent teeth	*8 months*	*By 13 years*
Weaning	*Starts at 6 weeks*	*6 months to one year*
Walk	*3 weeks*	*12-16 months*
Average life span	*8-10 years*	*70 years*

Name: _____ **Date**: _____

Instructions: Create a line graph in which one line represents cheetahs and one line represents humans. Don't forget to put the correct labels on each axis!

Graph Title: _____



Weight and Age Chart

The amounts for the cheetah and the child have been averaged and rounded up for convenience.

Cheetah		**Child**	
Age	*Weight*	*Age*	*Weight*
Birth	0.3 kg	Birth	3 kg
2 months	3 kg	2 months	5 kg
4 months	7 kg	4 months	7 kg
6 months	12 kg	6 months	8 kg
12 months	25 kg	12 months	9 kg
16 months	30 kg	16 months	10 kg
24 months	35 kg	24 months	12 kg
Adult	35 - 50 kg	4 years	16 kg
		8 years	25 kg
		12 years	40 kg
		16 years	55 kg
		Adult	56-70 kg

NUTRITION & TEETH

SUBJECT AREAS:
Sciences, Health

DURATION/TIME:
Activity 1: 20 min
Activity 2: 40 min

RECOMMENDED PREPARATION:
Activity 2:
- If possible, borrow actual skulls to use.
- Photocopy of the 'Skull Reference Page' and student page-'Teeth Talk' for each learner or groups of learners.

MATERIALS NEEDED:
Activity 1:
- hand held mirror

Activity 2:
- Skulls and photocopies of 'Teeth Talk' student page & 'Skull Reference Page'
- Scissors

LOCATION:
- Classroom

KEY WORDS TO REVIEW:
Canines
Carnassial
Carnivore
Domestic
Herbivore
Incisors
Nutrition
Omnivore
Premolars

OBJECTIVE:

Learners will discover what the teeth of an animal can tell us about the animal's diet.

LESSON ACTIVITIES:

ACTIVITY 1:
Review terms and lead a discussion on animal diets and the teeth of different animals. Explain the different types of teeth and their functions.

ACTIVITY 2:
Categorizing animals based on the skulls. Complete the 'Teeth Talk' student page and discuss the reasons for grouping the skulls.

Learning Outcomes

Learners will discover what the teeth of an animal can tell us about what the animal eats and they will use this information to group common animals.

Teaching the Lesson

Activity 1 – Learning about Teeth

Review with the learners the terms: carnivore, omnivore and herbivore.
Explain the different types of teeth and their different functions, using the labelled skull pictures found on the next page. Bring a handheld mirror to class and let the leaner's take turns looking at their teeth and identifying and naming the different teeth.

Molars and Premolars	- grind
Canines	- tear / puncture
Incisors	- slice / cut
Carnassial (carnivores)	- cutting

You can also discuss with the class eye socket placement on the skulls. Some skulls have front facing eye sockets like humans and some skulls have side facing eye sockets like sheep. Use the rhyme below to teach learners how to identify from an animals' skull whether it was a predator or prey species.

Eyes on the side, we like to hide
Eyes on the front, we like to hunt

Activity 2 – Teeth Talk

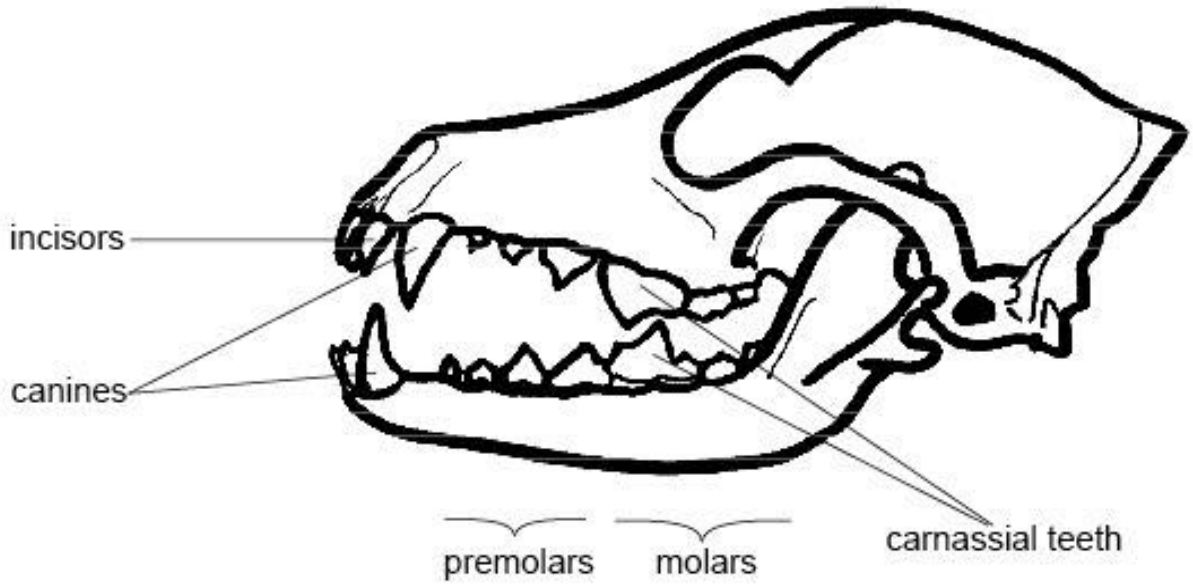
Have the learners work separately or in a small group looking at the pictures of the various skulls as shown on the 'Skull Reference Page'. If possible, try to have some actual skulls available. Look into borrowing them from the local university, museum, or have the learners bring in skulls they have found, as long as they are clean. Ask the learners to look at the teeth and predict the diet of the animal by the different teeth present. For example, do they see canines? Learners can cut out the skulls images on the 'Skull Reference Page' (keeping the 2 photos of each skull grouped together) and group the skulls into categories based on what they see, giving their reasons for that grouping on a separate sheet of paper.

Review again the function of the teeth and write the name and function of the teeth on the board. Pass out the student page 'Teeth Talk' and have learners review their original skull groupings and make any changes based on the new information and fill out the student page. After learners have finished the student page, brainstorm as a class ideas on which animal the skull belongs to, writing the list of animals up on the board.

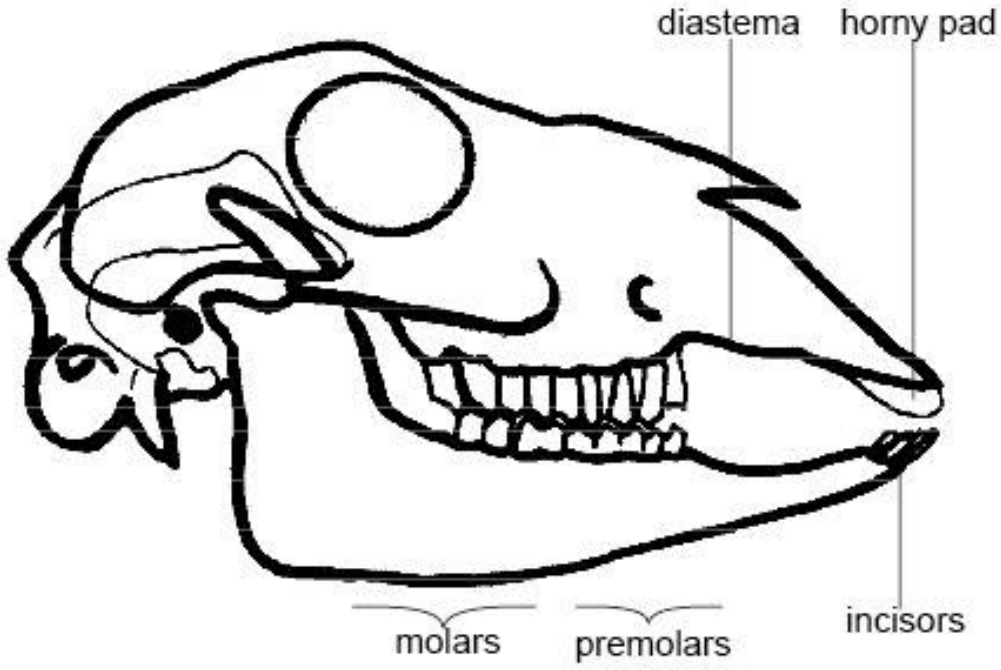
Skull Reference Page Key

1) Cheetah - Carnivore
2) Domestic Cat - Carnivore
3) Baboon – Omnivore
4) Warthog – Herbivore
5) Horse – Herbivore
6) Human - Omnivore
7) Spotted Hyena - Carnivore
8) Domestic Dog – Omnivore/Carnivore
9) Pig - Omnivore
10) Sheep - Herbivore

Domestic Dog Skull

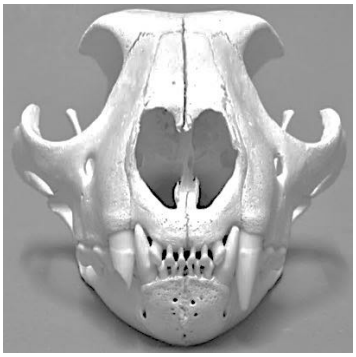


Domestic Sheep Skull



Skull Reference Page

1



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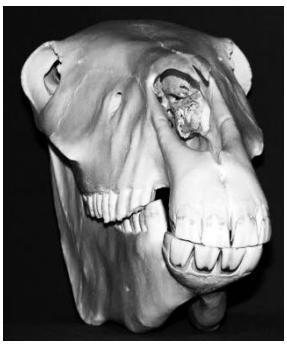

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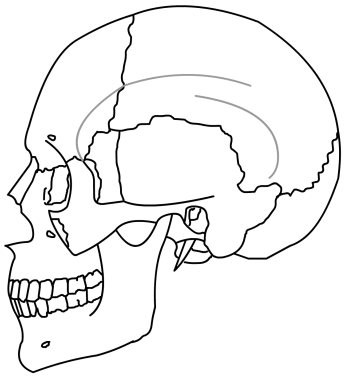

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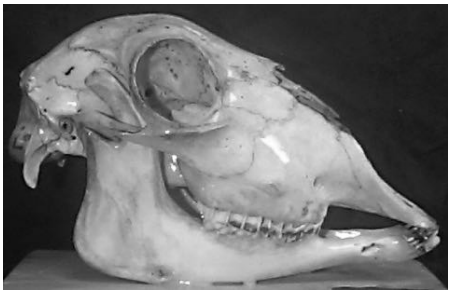


Student Page – Teeth Talk

Name: _____ **Date**: _____

Instructions: Using the pictures from the 'Skull Reference Page', find the special teeth that help the animal eat its' food. Place this animal in the table showing what you think their diet would be and whether it is a herbivore, carnivore, or omnivore.

Skull #	**Category** (*herbivore, carnivore, or omnivore)*	**Diet** (plants, animals, both)	**Reasoning** (what type of teeth are present)	**Name of Animal**
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

THE GENETIC BOTTLENECK

SUBJECT AREAS:
Science, Mathematics

DURATION/TIME:
Activity 1: 45 min

RECOMMENDED PREPARATION:
Activity 1:
- Review Appendix B: Reference- 'A Singular Species'.
- Prepare one set of 'Environmental Situation' cards. For a class of 31-40 learners make 2 sets of environmental situation cards. Keep the two sets separate so groups do not get the same card twice.
- Photocopy of the student page 'Cheetah Population Bottleneck' (for each group).

MATERIALS NEEDED:
Activity 1:
- One or two sets of 'Environmental Situation' cards and photocopy of student page- "Cheetah Bottleneck Scenario" per group.
- Coloured items, 10 items per 10 different colours (jellybeans, paper or beads) and a bottle

LOCATION:
Classroom

KEY WORDS TO REVIEW:
Characteristic
Diversity
Dominant
Genes
Genetic
Genetic variant (=allele)
Population
Recessive
Susceptible

OBJECTIVE:

Learners will understand the importance of genetic diversity by demonstrating the concept of the genetic bottleneck.

LESSON ACTIVITIES:

ACTIVITY 1:
The lesson will begin with a discussion on genetic diversity (what it is and why/how the low levels of genetic diversity occurred) in the cheetah population. Learners will then participate in the 'Cheetah Bottleneck Scenario' activity and complete the student page.

(Adapted with permission from the Smithsonian Institution's National Zoological Park School Outreach Programme, "Black-Footed Ferret Ambassador Programme, Secondary School Teacher guide," copyright 1999.)

Learning Outcomes

This lesson demonstrates the importance of genetic diversity in healthy populations by simulating a genetic bottleneck event.

Teaching the Lesson

Review with the learners the reference page 'A Singular Species' found in Appendix B which discusses the lack of genetic diversity in the cheetah population. Discuss why this occurred and what it means for the cheetah population today.

Activity 1 – Cheetah Bottleneck Scenario

This activity will demonstrate how a population with low genetic diversity is more susceptible to changes in the environment. You will need 100 different coloured objects to represent genes (10 colours, 10 objects per colour). Use coloured jellybeans, paper or beads for the activity. An empty bottle will also be needed to distribute the coloured objects.

Previous to the activity, print and cut out the 'Environmental Situations' cards. You will need 1 set for a class of 24-30 learners and 2 sets for 31 to 40 learners. Keep the two sets separate so groups do not get the same card twice.

Procedure:

1. Have the learners break up into small groups of 3 to 4 learners. Distribute one student page- 'Cheetah Bottleneck Scenario' to each group.

2. Review the concepts of genetic diversity and population bottlenecks.

3. Distribute 10 random genetic traits (different coloured objects) to the groups by shaking them out of the bottle.

4. Have each group randomly choose five 'Environmental Situation' cards.

5. Learners include the following on the student page:
    A. The population's percent genetic diversity
    B. A description of their population based on its current genetic makeup
    C. A scenario for their population for a one-year time frame. They must address the following:
        - Is their population genetically equipped to survive in its environment? How well or poorly?
        - Does a high or low percent genetic diversity impact their population's survival?
        - How do random changes in the environment affect their population?

6. Groups present results to class.

Group Names: _____ **Date**:_____

Key to Genetic Characteristics

Yellow	*camouflage*	**Green**	*agility*
Black	*precise vision*	**Purple**	*acute hearing*
Orange	*high speed*	**White**	*strong immune system*
Red (R)	*kinked tail*	**Pink (r)**	*small skull leading to crowded incisor and palatine erosion*
Dark Blue (B)*	*dominant genetic variant for healthy rate of reproduction*	**Light Blue (b)***	*recessive genetic variant for abnormal sperm*

*Notes on dominant/recessive alleles: (1) **BB**= dominant allele active;
(2) **Bb**= dominant allele active; (3) **bb**= recessive allele active.

List each **COLOUR/GENE** received and what genetic characteristic each represents:

Colour: _____ Characteristic: _____
Colour: _____ Characteristic: _____
Colour: _____ Characteristic: _____
Colour: _____ Characteristic: _____
Colour: _____ Characteristic: _____
Colour: _____ Characteristic: _____
Colour: _____ Characteristic: _____
Colour: _____ Characteristic: _____

1. **Calculate the percent (%) genetic diversity of your population.**
   10 genetic variants (colours) represent 100% genetic diversity in the original population. Calculate the % genetic diversity of your population.

_____ genetic variants received / 10 original genetic variants = _____ (decimal) x 100 = _____%

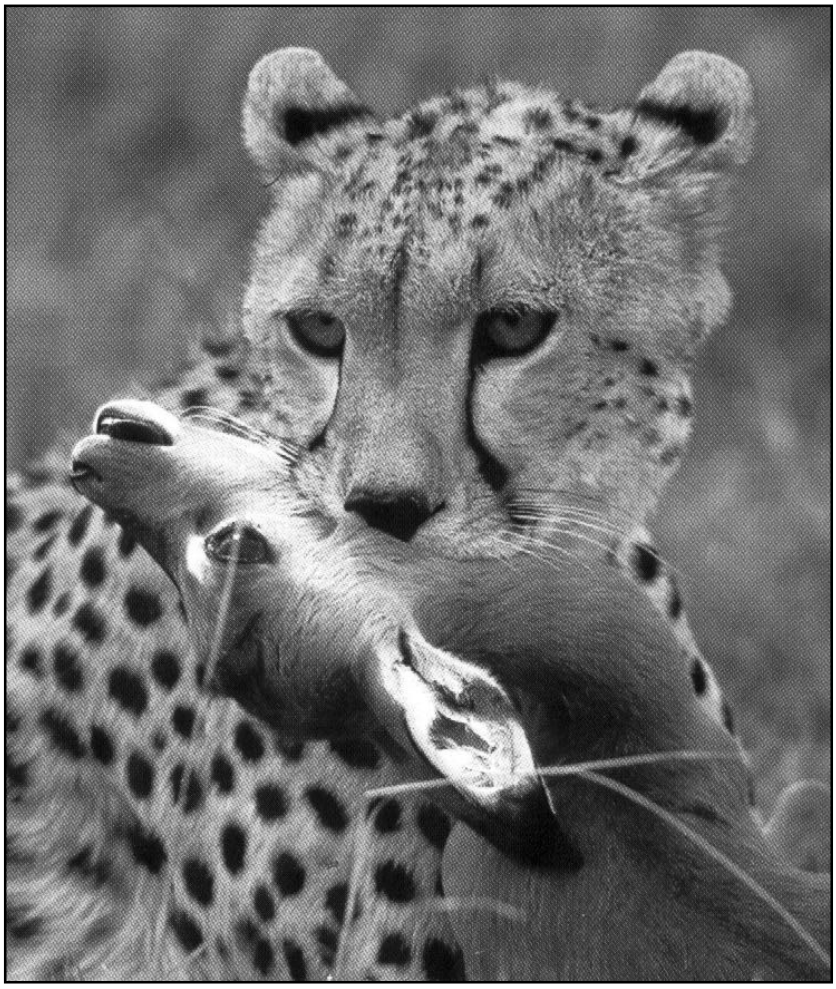
2. **Describe your new population based on the genetic variants you have.**
   Does your population have precise vision and a strong immune system ? Are there any recessive genes present in your population? Etc.

3. **Describe what happens to your population based on the five environmental situations randomly drawn. Record whether your population struggles, survives, or thrives for each environmental situation card and assess the overall outcome of your population.**

1. It will be difficult for your population to find and kill your preferred prey of steenbok because they have been over hunted in your territory. Your population must adapt to hunting faster prey. Does your population have the genetic variants necessary for high speed? If so your population Thrives, if not you population just Survives.	2. Cheetahs use their precise vision to help them locate their prey and also to avoid predators. Add an allele for precise vision if you do not already have one. Your population Thrives.
3. Cheetahs have a reputation for being shy and will generally avoid human contact. Does your population have the genetic variant for camouflage to keep well hidden from approaching tourists, hunters and farmers? If so your population Thrives, if not your population Struggles.	4. The trait for kinked tails is common in species with low genetic diversity like cheetahs and the Florida Panther. The trait doesn't appear to have any effect on the animals but all animals in your population have the trait. Add a kinked tail allele if you do not already have one. Your population Survives.
5. The savannah in your population's habitat has been overgrazed and bush encroachment has taken over. This significantly reduces the available hunting territory for your cheetah population. There is no genetic variant to help with this issue. Your population Struggles.	6. Your cheetahs are hunting in bush encroached areas and one has gotten an eye injury from a thorn bush. The eye injuries have compromised your cheetah's sight. The cheetah will need to rely more on hearing to hunt. Does your cheetah have the genetic variant for acute hearing? If so your population will Survive, if not your population will Struggle.
7. Scientists have decided that genetic restoration is necessary for the survival of your population. Namibian cheetahs have been introduced to your area. These cheetahs have the dominant variation for a healthy rate of reproduction. Add this genetic variant to your list if you do not already have it. Your population Thrives.	8. In the past governments have sponsored programs to destroy predators such as the cheetah. Although it is now illegal to simply kill these cats, it is legal to kill predators that are preying on livestock. Does your population have the genetic variant for agility so it can capture wild game instead of livestock? If so your population Thrives, if not your population Struggles.
9. Cheetahs carrying the recessive genetic variant for poor sperm quality risk passing on reduced reproductive success to future generations. Add a recessive genetic variant for abnormal sperm. If this makes two recessive alleles your population will have poor sperm quality and Struggle. If not, your population Survives.	10. Some cheetahs carry diseases like Feline Immunodeficiency Virus (FIV). If your population has the genetic variant for a strong immune system your population will Thrive, if not your population will Survive.

11. The government granted conservancy status to a group of commercial farmers who dropped their game fences to allow for an integrated system with livestock, game and predators. Your population is Thriving in this area.	12. Cheetahs have become popular in the illegal pet trade. Poachers regularly kill females to catch the cubs. Most cubs die due to poor care and feeding. Your area is seeing an increased number of poachers who are killing females and taking cubs. Your population Struggles.
13. Some cheetahs have the two recessive alleles for crowded incisors and palatine erosion. This results in teeth and gum problems that cause early death for cheetahs, usually at the age of 6 to 8 years. If you have two alleles for crowded incisors your population Struggles. If not your population Thrives.	14. Female cheetahs have fewer offspring if the males in the population have poor sperm because they carry the recessive genetic variant for abnormal sperm. Does your population have the recessive genetic variant for abnormal sperm? If so your population Struggles. If not your population Survives.
15. The rapid decline of cheetahs living in the wild has caused an increase in inbreeding in your population. Inbreeding has resulted in an increase in extreme birth abnormalities including deformed legs and paws in cubs. Many of your cheetah cubs die as a result of inbreeding and your population Struggles.	

Ecology



INSECTS & SPIDERS- PREY & PREDATORS

SUBJECT AREAS:
Science, Math, Information and Communications

DURATION/TIME:
Activity 1: 1 hour
Activity 2: 1 hour to 2 hours
Activity 3: 1 to 2 hours or more

RECOMMENDED PREPARATION:
- Investigate schoolyard areas that would be good for collecting spiders and insects.
- Collect extra insects for students who might not have an insect for Activity 2.
- Review "Arthropod Capturing Techniques" found at the end of this lesson.

MATERIALS NEEDED:
- Photocopies of student page- 'Critter Card-Insect ID' & student page-'Insect Investigation Questions & Observations
- Insect and spider collecting materials such as vials, jars, nets, beating sheets (see diagram at end of lesson)
- Hand lens or magnifying glasses
- Small paint brushes, sticks, spoons
- 3 large clear containers with lids such as clear totes or gallon jars

LOCATION:
- Outdoors and in the classroom

KEY WORDS TO REVIEW:
Arthropods
Classify
Exoskeleton
Experiment
Herbivore
Insect
Investigation
Parasite
Predator
Prey
Ratio
Scavengers
Variable

OBJECTIVE:

Learners will be able to classify arthropods as insects or spiders, observe the structures and behaviors of insects, and compare the number of prey to the number of predators.

LESSON ACTIVITIES:

ACTIVITY 1:
Insects and Spiders: Learners will collect, compare, and classify insects and spiders collected from the schoolyard or an area near the schoolyard.

ACTIVITY 2:
Insect Observations: Learners will fill out the student page 'Critter Card-Insect ID' about their arthropods and compile a class insect ID book.

ACTIVITY 3:
Insect Inquiry: Learners will design an experiment to collect information about their insect specimen.

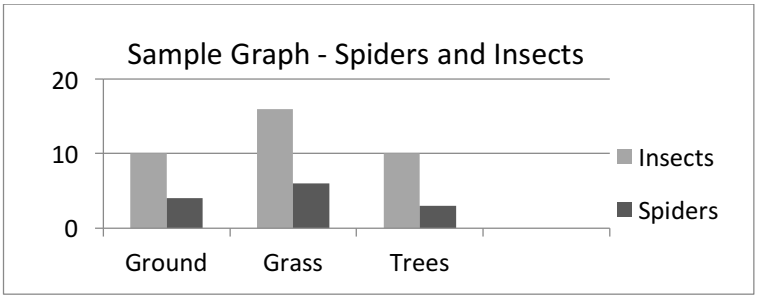
Learning Outcome

Learners will recognize the differences between insects and spiders, identify their adaptations, and recognize the importance of maintaining a balance between the number of predators and the number of prey.

Teaching the Lesson

Activity 1 – Insects and Spiders

1. Divide the class into three groups. Explain that they will be capturing insects and spiders in three different habitats: (1) the trees/bushes, (2) the grass, and (3) on the ground. Give one learner in each group two small containers for holding the captured arthropods.
2. Show learners how to use the "beating sheet" to capture tree/bush arthropods, how to use a net to capture the arthropods in the grass and how to use the small containers to capture the arthopods on the ground. (See the following directions on Arthropod Capturing Techniques)
3. Label three large, clear containers with the three different habitats – (1) tree/bush, (2) grass, and (3) ground.
4. Assign each group a habitat and tell them they have five minutes to capture as many arthropods as possible. At the end of the five minutes, call the learners back and have them place their arthropods in the container with corresponding habitat where they were collected.
5. Have the learners rotate habitats and give them another five minutes to collect. Call the learners back and again have them place their arthropods in the correct container.
6. Repeat the process until all of the learners have collected from each habitat and used each of the sampling methods.
7. Bring the learners together and give each group one habitat container. Have each group count (learners may need to estimate) the number of insects and the number of spiders in each container. Explain to learners that insects have six legs while spiders have eight legs and that this can help them identify and sort their arthropods.
8. When all the groups have finished counting ask them to share their information. Each learner will then create a bar graph of the number of insects and the number of spiders for each habitat. Make sure learners create a title for their graphs and label the axis. See sample below.



Questions:

1. How many total insects and total spiders were captured?

2. In which habitat were the most insects captured?

3. In which habitat were the most spiders captured?

   Show the ratio of insects to spiders for each habitat. In the graph above the ratios would be: Ground – 10:4 or 5:2, Grass – 16:6 or 8:3, Trees – 10:2 or 5:1

   A **ratio** is a relationship between two numbers indicating how many times the first number contains the second. For example, if a bowl of fruit contains eight oranges and six lemons, then the **ratio** of oranges to lemons is eight to six (that is, 8:6, which is equivalent to the **ratio** 4:3)

4. Discuss why it is important to have more prey than predators in any habitat or a higher ratio of prey to predators.

Activity 2 – Insect Observations

The lesson can be adapted to use other equipment if any of the materials are not available, or simply make sure the learners collect large enough insects for easy observation by the naked eye.

Materials Needed:

- Container for the insect to be kept in for easy observation. A small clear bag with a "zip" top, plastic container with a clear top, or a clear plastic bottle will work.
- 1 Critter Card per learner
- Spoon, small paintbrush or small stick
- Metric ruler
- Hand lens or magnifying glass if available

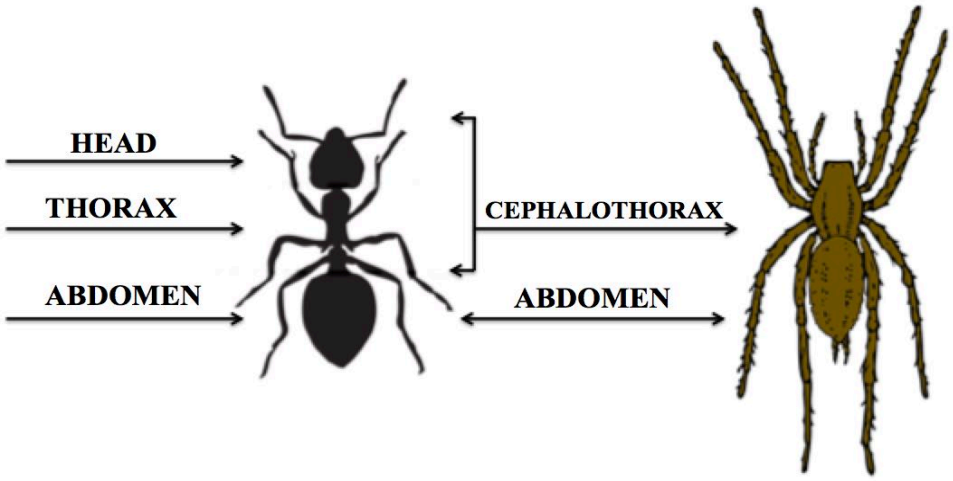
1. Each learner will select an insect species to investigate (cricket, grasshopper, beetle, etc).
2. Have leaners collect 2 or 3 specimens of their insect species from the schoolyard or bring them from home. Be sure to have enough extra insects for the learners to investigate.
3. Use a spoon and the brush to place two or three insects into a container.
4. Gently work with the insects in order to fill out the 'Critter Card- Insect ID'
5. Learners can then present about their insect and compile a class Insect ID book with all of the class Critter Cards.

Activity 3 – Insect Inquiry

Once learners have become familiar with the insect's physical structure, have them think about a scientific investigation they could design and perform about the behaviour of their insect. Have learners work in pairs with one student page 'Insect Investigation Questions & Observations' per pair. Allowing learners to spend several days on this investigation will result in more in depth experiment.

Things to consider for scientific investigation:
When designing their experiment, make sure that learners can answer the following questions.

- Are each of the variables identified?
- How will the variables be controlled?
- How will variables be measured?
- What equipment and supplies are needed?
- Will your investigation answer your question?
- How many organisms will you use in your investigation?
- Is the experiment designed to avoid harming the organisms?
- How many times will you repeat the investigation to ensure that the results are valid?



An Insect has:
- 6 legs
- 2 antenna
- Most have wings
- 3 body sections
- 2 complex eyes

A Spider or Arachnid has:
- 8 legs all attached to the cephalothorax
- 2 body sections
- 8 eyes

Critter Card-Insect ID	Critter Card-Insect ID
Date:	Date:
Type of Insect:	Type of Insect:
Average Length: (measure 3 different insects if possible)	Average Length: (measure 3 different insects if possible)
Number of Legs:	Number of Legs:
Antennae Present: (yes or no)	Antennae Present: (yes or no)
Number of Eyes: (visible)	Number of Eyes: (visible)
Wings Present: (if yes how many)	Wings Present: (if yes how many)
Color:	Color:
Describe the Insect:	Describe the Insect:
Draw a sketch of your insect below. Label all of the parts you can clearly recognize.	Draw a sketch of your insect below. Label all of the parts you can clearly recognize.

Student Page- Insect Investigation Questions and Observations

Names:_____ **Date:**_____

Instructions: Now that you have become familiar with the insect's physical structure, think about a scientific investigation you could design and perform about the behaviour of your specimen.

1. Brainstorm with your partner about possible behaviour questions you would like to investigate about your insect. List at least three questions.

2. Select one of the questions to investigate and rewrite it below. Avoid yes/no questions. *Sample question – If I place mopane worms in a box where they can choose between light and dark surfaces which surface will they choose?*

3. Write a hypothesis that relates to your question. Write your hypothesis in the form of an "if, then, because" statement. (For example, "**If** mopane worms are placed in a box where they can choose between light and dark surfaces, **then** they will choose dark surfaces **because** it is cooler in the dark and the worms will not dry out as easily.")

4. Give your project a descriptive title and write the title below.

5. Make a list of all of the factors that may influence your investigation. Determine the variable that you will change (it is the independent variable) and write it below. [Remember that you should change only one independent variable at a time]. Also determine the variable that you will measure (the dependent variable), and the variables that will be consistent throughout the investigation (the controlled variables).

   Independent (manipulated) variable: _____

   Dependent (measurable) variable: _____

   Controlled (consistent) variables: _____

   Example: If I place mopane worms in a box where they can choose between light and dark surfaces which surface will they choose?
   Independent variable: light or dark surfaces
   Dependent variable: surface the mopane worms choose
   Controlled variables: box, texture of surfaces, # of mopane worms used

6. Develop a series of step-by-step instructions that you will follow to test the question in your investigation. The instructions will be the design of your experiment. [Make sure that the design of the experiment will really do what it is supposed to do] The design should include a way to answer the question in your investigation.

7. Make a drawing to illustrate the design of your experiment.

8. Conduct the experiment that you designed.

9. Use a data table to record your data and summarize the results. Include an appropriate graph type (line or bar) to show your results. The graph should have a descriptive title and a label for each axis.

10. Write a paragraph that states your conclusions. It should include a discussion about your investigation question and whether or not you confirmed your hypothesis. Also, discuss how the results of the experiment may relate to the ability of the insect to survive in its own natural environment.

Arthropod Capturing Techniques

Demonstrate for the whole class how to capture arthropods from each habitat using the different collection methods. Then divide learners into three groups and have then rotate through each habitat.

Ground Arthropods: Give one group of learners two small containers with lids. Show them how to "stalk" ground insects and spiders by walking or crawling slowly along, looking ahead about two to three feet. Watch for quick movements. When you spot the spider or insect, quickly drop to your knees with the container in one hand and the lid in the other. Gently nudge the arthropod with the lid toward the mouth of the container. When the arthropod runs into the vial close with the lid and put the vial in a pocket. Repeat using the other container. It might be possible to capture more than one arthropod in each container. Do not attempt to pick up the spiders with your hands as the spiders are easily crushed.

Grass Arthropods: Give one group of learners one net and two small containers with lids. One learner works the net, the other learner work the containers. Grab the net toward the end of the handle and sweep through the grass in a 180 degree arc, between 40 and 100 cm off the ground. Keep the net constantly moving for 10 to 15 sweeps. Shake the net down and then quickly squeeze the net closed at the top. Gradually open the top and capture the arthropods in the containers as they emerge. When one container is full the learners switch jobs.

Tree and Bush Arthropods: Give one group of learners two small containers with lids, a beating sheet (see picture) and a beating stick. Insects and spiders in trees and bushes can be easily collected by hitting the plants with some sort of stick or handle while holding a beating sheet (or pan) under the area being beaten. A beating sheet is basically just a piece of heavy duty cloth stretched across two diagonal pieces of wood. Beating sheets can be easily made and can vary in size, but a typical beating sheet would be about 1-meter square.

For smaller plants that are low to the ground, place the beating sheet on the ground next to the plant. For plants that are higher, hold the beating sheet in one hand while hitting the plant several times with a stick or handle held in the other hand. The insects on the plant will fall onto the sheet and must be collected quickly before they escape. For flying insects it is recommended that an aspirator be used to suck up the bugs. Other slower moving insects can be picked up by hand or with forceps.

Beating Sheet – This is a canvas cloth with pockets. Sticks are inserted into the pockets to hold the sheet in place. Beating sheets can be made from an old bed sheet if necessary.

HABITATS

SUBJECT AREAS:
Science, Math, and Arts

DURATION/TIME:
Activity 1: 40 mins
Activity 2: 40 mins

RECOMMENDED PREPARATION:
- Read the Appendix A: Background- 'Habitats'

MATERIALS NEEDED:
- Photocopies student pages- 'What Do Cheetahs Need to Survive?'
- 'Data Sheet- 'Cheetah Challenge Activity Data Sheet'
- student page- 'What Do Cheetahs Need to Survive?'
- student page- 'How Do Cheetah Populations Change?'

LOCATION:
- Outdoors and in the classroom

KEY WORDS TO REVIEW:
Availability
Carrying Capacity
Community
Habitat
Limiting Factors
Population
Preferred
Resources
Survive

OBJECTIVE:

Learners will be able to describe the four basic resources that all animals need to survive and how varying habitat resources can change the size of animal populations.

LESSON ACTIVITIES:

ACTIVITY 1:
What is a Habitat?
Learners will discuss the basic needs of food, water, shelter, and space that make up an animals' habitat. They will discuss the difference between want and need and complete the student page- 'What Do Cheetahs Need To Survive?'

ACTIVITY 2:
Food, Water, Shelter
In this interactive activity, learners will investigate the required habitat resources for cheetahs and understand that when these four resources change, the size of the cheetah population will also change.

Learning Outcomes

These activities will investigate the factors that influence an animal's habitat and what habitat resources cheetahs require. Learners will discover that the cheetah population can change in relation to the changing availability of the four required habitat resources.

Teaching the Lesson

Vocabulary

Population: All the people in a country or region; number of animals in a region.

Community: Any group living in the same area or having common interests.

Limiting Factors: Resources are environmental conditions that limit the growth, abundance, or distribution of any plant or animal in a habitat.

Carrying Capacity: The number of people, animals, or plants which a habitat can support without damage to the environment.

Activity 1 – What is a Habitat?

1. Begin a discussion with learners by asking them what they need to survive (food, water, shelter and space). Ask them to explain the difference between a "need" as in water and a "want" such as a soda. Refer to the background info 'Habitats' in Appendix A

2. Ask learners to brainstorm what a cheetah needs to survive. How or where do they find water, food, and shelter? How much space do you think cheetahs require to find everything they need? Record learners' ideas on the board.

3. Distribute the student page, "What Do Cheetahs Need To Survive?" along with coloured pencils or crayons to each learner. Review the student page instructions and have learners draw their own cheetah habitat based on the habitat elements they listed on the board from your discussion.

Activity 2 – Cheetah Challenge- Cheetah Carrying Capacity

1. Take the class outside to a large open playing area. Make two lines on the ground opposite each other 10 meters apart. This is the playing field.

2. Ask the learners to count off in fours. Have all the "ones" go to one side of the playing field and the rest to the other side of the playing field. Learners that are "ones" will become the cheetahs and all the rest will become habitat resources.

3. Have the two groups stand at opposite ends of the playing field, behind their designated lines. Record at the beginning of the game and after each round how many cheetahs & habitat resources are on each side of the playing field.
   To recognize habitat resources, the learners should use hand motions to describe which resource they are or if they are cheetahs which resource they need.
   Demonstrate each of these to the class:

   - Food - place both hands over your stomach
   - Water - make a wave motion with your hands
   - Shelter - create a "roof" over your head by touching hands together in a triangle shape

4. Begin the first round by asking all learners to turn their backs to the centre of the field. It is important that the cheetahs and resources not see each other. Learners now make their resource signs - each Cheetah deciding what it is looking for, each Habitat Resource deciding what it is. Give the learners a few moments to put their hands in place. (The two lines of learners normally will display a variety of signs. As the activity proceeds, sometimes the learners will confer with each other and all will make the same sign. That's okay, and you may encourage it. For example, all learners in the habitat might decide to be shelter. This could represent a drought year with no food or water.) Note: Switching symbols in the middle of a round can be avoided by telling the learners if they are caught cheating they will not participate.

5. When the learners are ready, say: "Cheetah Challenge!" Each cheetah and each habitat resource turn to face the opposite group, continuing to hold their sign clearly.

6. When the cheetahs see the habitat resource they need, they run to it. Each cheetah must hold the sign of what it is looking for until getting to the learner in the habitat with the same sign. Each cheetah that reaches its necessary habitat resource takes the "water," "food," or "shelter" back to the cheetah side of the activity area.

7. "Capturing" a habitat resource represents the cheetah successfully meeting its needs and successfully reproducing as a result. Any cheetah that fails to find its water, food, or shelter, dies and becomes part of the habitat. Note: When more than one cheetah reaches a habitat resource, the learner who arrives first survives. Resources stay in place until a cheetah chooses them. If no cheetah needs a particular habitat resource during a round, the resource just stays where it is in the habitat. That habitat resource can, however, change which resource it is from round to round.

- Record the number of cheetahs and habitat resources at the beginning of the activity and at the end of each round. Continue the activity for approximately 10 rounds. If possible, have a learner or two assist you in recording the numbers.
- After each round, ask the learners to observe what is happening to the cheetah population. Why did it change?

8. Repeat steps 5-7 several times. Cheetahs and Habitat Resources may change their resource or need at the beginning of each round, but not once the round is in play.

Conclusion

After completing the Cheetah Challenge lesson, return to the classroom to look at the data. Learners will graph the data on the student page- "How Do Cheetah Populations Change?" and discuss the results.

Answer Key For student page- "How do cheetah populations change?'

1. If another predator is introduced to this game in addition to the cheetah, what do you predict would happen to both graphs?
   (ANSWER: *Cheetah populations may go down due to competition for food.)*

2. How might humans affect changes in wildlife populations? Think about both predators and prey.
   (ANSWER: *Humans could disturb the balance by removing too many animals of one species so that reproduction will not be successful enough to rebuild the population or if too many prey species are removed then there will not be enough food for predators.)*

3. What are some of the "limiting factors" that affect the survival of animals?
   (ANSWER: *Food, disease, water, space, shelter, increases in predation, etc.)*

Discussion Questions

1. What do animals need to survive? And why?
   (ANSWER: Food, water, space, shelter)

2. How do the habitat resources influence carrying capacity?
   (ANSWER: *If any of these resources are absent or there is an insufficient amount it will decrease the number of animals that can live in that habitat.)*

3. Describe the shape of both the cheetah and resource graphs.

4. Which graph peaks first, the cheetah or the resources? Explain why you think this occurs.

5. Would a farmer trapping cheetahs be a natural factor?
   (ANSWER: *No. Farmers tend to remove too many predators from a system resulting in an imbalance.)*

6. What is realistic and unrealistic about this simulation?
   (ANSWER: *Cheetahs that don't survive DO become recycled as nutrients but it is not instantaneous. Cheetahs need ALL habitat resources to survive. Poor habitat usually results in weakened individuals that succumb to disease, not instant death.)*

Student Page: What Do Cheetahs Need To Survive?

Name:_____ **Date:**_____

Instructions: Review the habitat resources that a cheetah needs to survive. Remember that the four required habitat resources include Food, Water, Shelter, and Space. Create a savannah habitat by drawing habitat items in the space provided or on a separate page. Then, draw your cheetah living in its savannah home. Ideas for habitat resources are listed below. Other habitat resources can be included.

Tall Grass	Bird Nest	Zebra
Short Grass	Hole in the ground	Giraffe
Acacia Tree	Termite Mound	Springbok
Shepherd's Tree	Rocks	Warthog
Namibian Puzzle Bush	Sun	Scrub Hare
Waterhole	Road	Jackal
Natural Spring	Fence	Baboon
River	Puddle	Snake

Student Page: Cheetah Challenge Activity Data Sheet

At the beginning of each round of play, record the number of surviving cheetahs and habitat resources in the table below.

	Total Number of Habitat Resources (Food, Water, Shelter)	Total Number of Cheetahs
Start of Activity: Round 1		
Round 2		
Round 3		
Round 4		
Round 5		
Round 6		
Round 7		
Round 8		
Round 9		
Round 10		

Student Page – How Do Cheetah Populations Change?

Name:_____ **Date**:_____

Instructions: Use the data you recorded from the Cheetah Challenge Activity to graph the changes in the cheetah population and the amount of habitat resources over time. Plot changes in cheetah population in 1 colour and changes in the habitat resources in a different colour. Make a key to indicate the colours you choose to represent the cheetahs and resources below.

CHANGES IN THE CHEETAH POPULATION OVER TIME

Total number of cheetahs and resources

Rounds 1-10

Questions

1. If another predator is introduced to this game in addition to the cheetah, what do you predict would happen to both graphs?

2. How might humans affect changes in wildlife populations? Think about both predators and prey.

3. What are some of the "limiting factors" that affect the survival of animals?

KEY

Cheetahs ☐ **Habitat Elements** ☐

PREDATOR FEEDING BEHAVIOURS

SUBJECT AREAS:
Science

DURATION/TIME:
Activity 1: 15 min
Activity 2: 45 min

RECOMMENDED PREPARATION:
Activity 1:
- Review Appendix B: Reference- 'Cheetah Speed' & 'A Predator's Role in the Ecosystem'

Activity 2:
- Make 40 'prey' cards to use in the outdoor activity and mark out the 20x20 meter outdoor area needed.

MATERIALS NEEDED:
Activity 2: Prey cards

LOCATION:
- Classroom & Outdoors

KEY WORDS TO REVIEW:
Behaviour
Cub
Instinct
Nocturnal
Predator
Prey
Survival

OBJECTIVE:

Learners will be able to describe the behaviour of animals including predator-prey relationships and interactions between predators.

LESSON ACTIVITIES:

ACTIVITY 1:
The class will take part in 'lion encounter,' a classroom activity, and will then hold a discussion.

ACTIVITY 2:
Predator and Prey- Outdoors the class will take part in a predator and prey activity and then discuss the lesson.

Learning Outcomes

This lesson is designed as an introduction to animal behaviours using the cheetah as a focus. Classroom and outdoor activities introduce the topic of predator behaviour to the learners.

Teaching the Lesson

Activity 1 – Lion Encounter

Select eight to ten volunteers from the class. Take one volunteer separately and group the rest together. Ask the class to imagine that the front of the classroom is a savannah, the group represents a pride of lions, and the individual is a cheetah. Ask learners what would happen if the lone cheetah made a kill and the pride of lions found the cheetah and its kill. Lead this into a discussion of how cheetahs interact with other predators and how they ensure their survival in the wild. Use the background information below and the reference information 'Cheetah Speed' found in Appendix B.

Background –

The body size and structure of cheetahs make them extremely fast but also means they have a slender build and a lighter body. Cheetahs are built for speed and not for fighting. They must avoid other predators in the area such as lions, leopards, hyenas and even groups of jackals. Due to their build, cheetahs are very vulnerable to injury in a fight and so they avoid confrontation with larger predators. Cheetahs often lose their food to these other predators as they cannot defend their kill when larger predators come to take it from them.

Activity 2 – Predator and Prey

1. Prepare: Photocopy the two Prey Template Pages, and cut apart. Review reference page- 'A Predator's Role in the Ecosystem' before leading this activity.

   Prey items:
   - Zebra
   - Springbok
   - Lizard
   - Fly
   - Mouse
   - Caterpillar
   - Hare
   - Kudu (calf)
   - Eland (adult)
   - Warthog

2. To begin the activity- Ask the learners about the things that animals need to live and grow. Discuss the terms predator and prey. Tell learners that they will all become predators in this lesson. They will go outside and move over the area where the prey has been placed. Learners should look at the different prey items and collect it if their predator would normally feed on that prey.

3. Give each individual learner a piece of paper, indicating which predator they represent. There will be 3 or 4 of each predator depending on the size of the class. Discuss which of the prey animals each predator would eat. Learners can write this down on the back of their predator card if needed.

   - Spider
   - Cheetah
   - Lion
   - Eagle
   - Leopard
   - Owl
   - Jackal
   - Snake
   - Lizard

4. Take the class outside and have them help spread the prey items over an area of 20 x 20 meters. The class will line up at one side of the area and on the count of three, traverse the area searching for appropriate prey items for the predator they represent. Allow the predators to collect prey for 30 seconds.

5. After the 30 seconds, learners then stop and discuss at this point what was collected and determine if it is an appropriate item for that predator.

    - Spider – caterpillar, fly
    - Cheetah – springbok, hare, kudu (calf), warthog
    - Lion – zebra, springbok, kudu (calf), eland (adult), warthog
    - Eagle – mouse, hare
    - Leopard – springbok, hare, kudu (calf), warthog
    - Owl – mouse, hare
    - Jackal – mouse, hare
    - Snake – mouse, lizard
    - Lizard – fly, caterpillar

6. Learners record the kind of prey they collected and the number of each. To survive each predator must have collected at least four appropriate prey items.
    - Lions are allowed to steal food from cheetahs if the lion did not get four prey items.
    - Jackals are allowed to take food from any animal that did not survive as they are scavengers.

7. Scatter the prey in the playing area again and play a second round of the game. Those that did not survive do not participate in this round. (Repeat # 6 here).

8. For the third round allow all learners back in the game. During this round tell students there has been a drought and many antelope species died as a result. Remove the Eland (adults) and half of the kudu (calves) from the prey and scatter they prey in the playing area and play the round.

9. Complete the round and check that students collected the correct prey items and have recorded their information.
    - Lions are allowed to steal food from cheetahs if the lion did not get four prey items.
    - Jackals are allowed to take food from any animal that did not survive as they are scavengers.

10. Ask students to raise their hand if they survived the drought. Discuss who survived and why.

11. On the fourth round put half the amount of food out and only the predators that hunt during the day play this round. Do not allow the leopards, jackals, owls and half of the spiders to hunt. The drought is over so the eland (adult) and kudu (calves) are back in the game.

12. Complete the round and check that students collected the correct prey items and have recorded their information.
    - Lions are allowed to steal food from cheetahs if the lion did not get four prey items.

13. Play a final fifth round of the game. Spread half the prey items out and allow only the nocturnal predators to play this round. Do not allow the lions, cheetahs, eagles, snakes, lizards, and half the spiders to hunt.
    - Jackals are allowed to take food from any animal that did not survive as they are scavengers.

14. Complete the round and check that learners collected the correct prey items and have them record their information.

15. Return to the classroom and discuss with learners which predators survived and which died during each round. Discuss the following points:
    - The effects of drought on the predators
    - Effect of separating predators into day and night hunters
    - Competition between lions and cheetahs
    - Which other predators competed for food

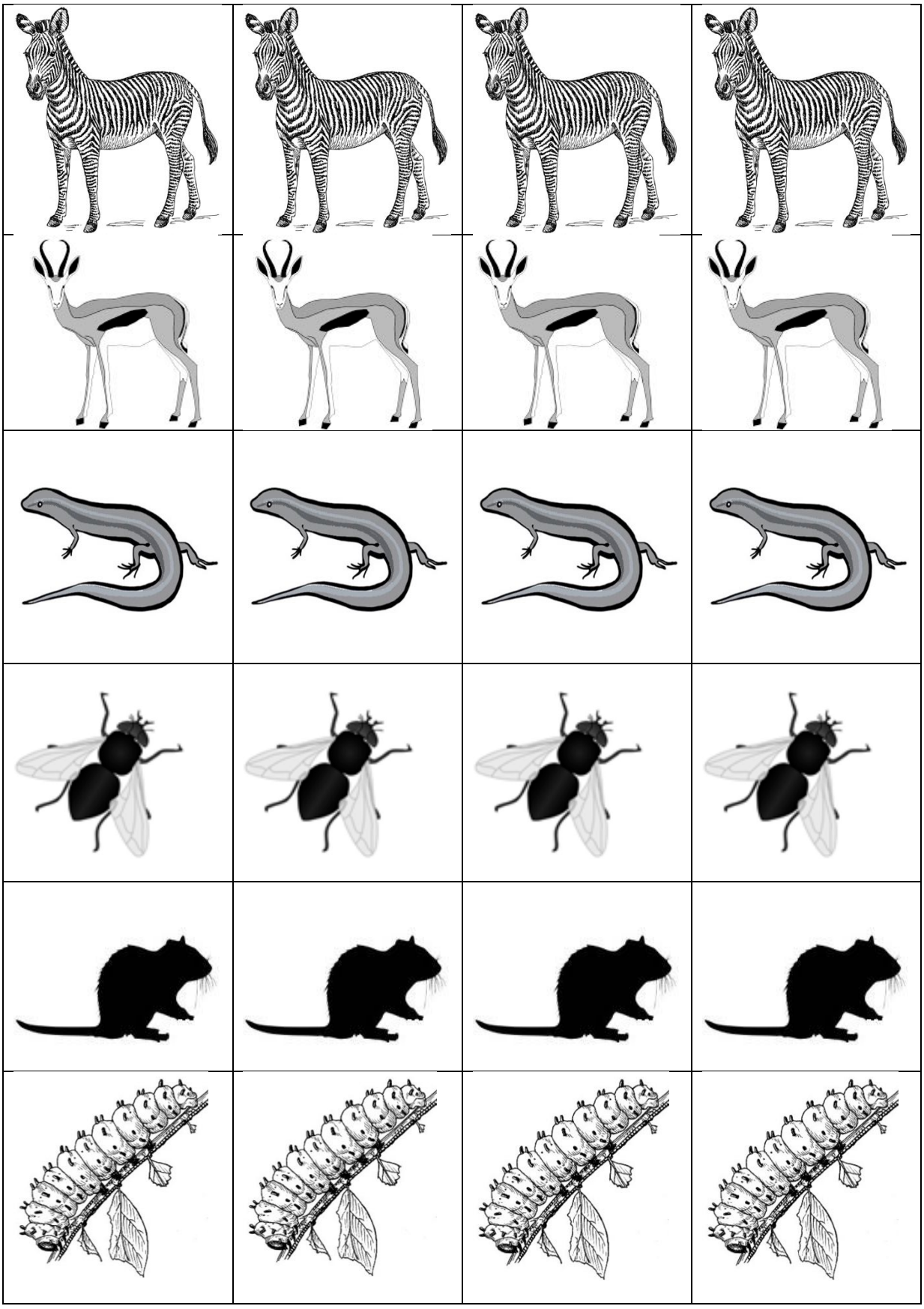
16. Follow this game with a discussion of how the cheetah hunts and what adaptations allow the cheetah to be the fastest land mammal. Review adaptations of a cheetah using the background information at the beginning of the lesson and in Appendix A.

17. Ask learners to explain why cheetahs often lose their food to other predators like lions, hyenas, leopards, and groups of jackal.

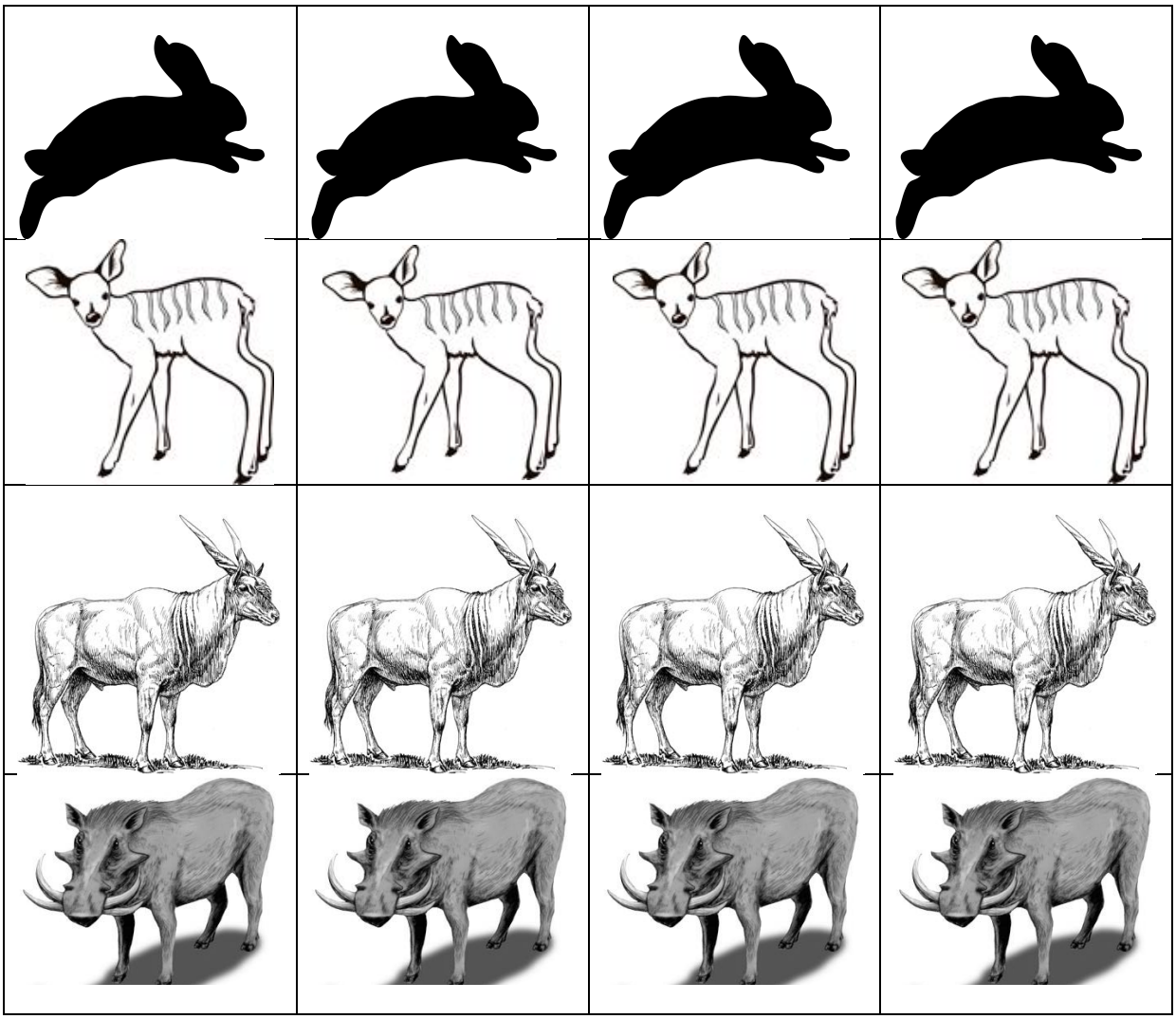
Questions

1. If lions were removed from this game, what would happen to the cheetah population?

Prey Template Page



Prey Template Page



FOOD CHAINS

SUBJECT AREAS:
Science, Math, Arts

DURATION/TIME:
Activity 1: 30 minutes
Activity 2: 20 min
Activity 3: 45 min

RECOMMENDED PREPARATION:
- Review Appendix A-Background: 'Food Chains'

Activity 1 & 2:
- Copy and cut out items on the 'Food Chain Picture Page' for individual learners or small groups

Activity 3:
- Remind learners to bring cans.
- Make photocopies of student page 'Energy Pyramids'
- Have magazines and prepare paint (and other art materials) for activity

MATERIALS NEEDED:
Activity 1:
- Photocopies of the 'Food Chain Picture Page' and cut out images.

Activity 3:
- Soda or tin cans, paint, paint brushes, water (to rinse brushes), magazines/pictures, scissors, glue, or tape
- Photocopies of student page 'Energy Pyramids'

LOCATION:
- Classroom

KEY WORDS TO REVIEW:
Carnivore
Consumer
Ecosystem
Energy pyramid
Food chain/web
Herbivore
Primary & Secondary consumer
Producer
Tertiary consumer

OBJECTIVE:

Learners will study the difference between a food chain/web and energy pyramid.

LESSON ACTIVITIES:

ACTIVITY 1:
Lead a discussion explaining the food chain, web and energy pyramid and how animals depend on one another in an ecosystem. Use the background-'Food Chains' in Appendix A.
The class will work together to organize an Energy Pyramid on the front chalkboard.

ACTIVITY 2:
Learners use pictures from the "Food Chain Picture Page" to form a food chain. Small groups will present to the class.

ACTIVITY 3:
Learners will use cans and drawings to create an energy pyramid of their own. Groups will present their pyramids to the class.

Learning Outcomes

In this activity learners study food chains, food webs, and energy pyramids in relation to the cheetah. Learners use this information to make their own model of an energy pyramid in Activity 3.

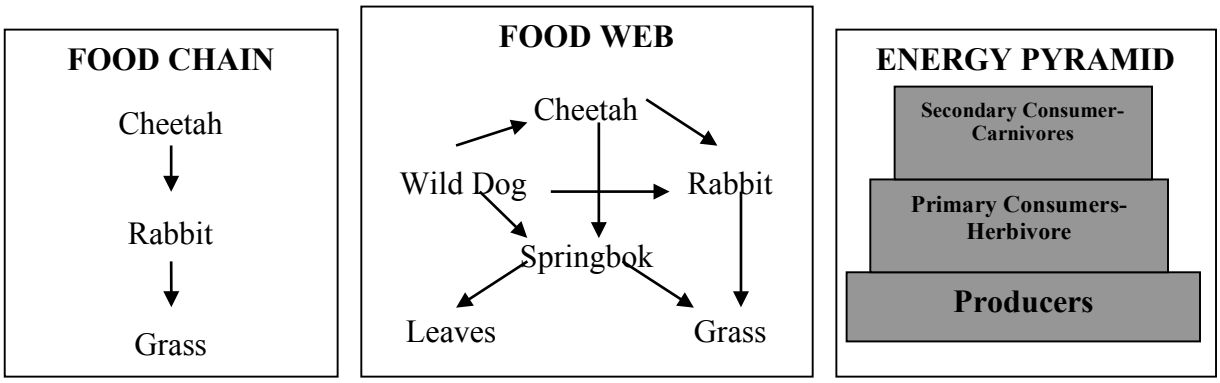
Teaching the Lesson

Vocabulary

- Producer: are mainly green plants that produce their own food through energy they get from the sun.
- Consumer: are plants and animals of a food chain which receive energy by consuming other plants or animals.
- Energy Pyramid: An energy pyramid is a model of energy flow in a community. The different levels represent different groups of organisms that might compose a food chain. From the bottom-up, they are as follows:
    - Producers- bring energy from nonliving sources into the community
    - Primary Consumers- herbivores and omnivores
    - Secondary Consumers- omnivores and carnivores
    - Tertiary Consumers- top predators/carnivores
- Primary Consumer: are usually herbivores, feeding on plants and fungus.
- Secondary Consumers: are mainly carnivores that prey on and eat other animals.
- Tertiary Consumers: are mainly top predators that are not killed by other animals for food.

Activity 1 – Discussion & Energy Pyramid

1. Review the background 'Food Chain' found in Appendix A and then discuss the concepts with learners using the diagrams below.



(Arrows indicate what organism preys on another organism. If you want to show the flow of energy through the system reverse the direction of the arrows)

This is a discussion with the whole class involved and includes a simple activity. Discuss with the learners the different levels of an energy pyramid, food chain/web. Draw the energy pyramid seen above on the chalkboard. The bottom level should read 'Producers", the second level should read 'Primary Consumers-Herbivores & Omnivores', and the top level should read 'Secondary Consumers- Omnivores & Carnivores'. Then using the 'Food Chain Picture Page,' cut out the pictures and have learners tack the pictures on the chalkboard under the appropriate headings of Producer, Primary Consumer, and Secondary Consumer.

Activity 2 – Food Chain

Use the 'Food Chain Picture Page' and divide the class into groups of three. Each group must use the pictures on this page (either cut out pictures or just the names of animals) to form a food chain and food web. Each group is then given an opportunity to present to the class explaining why they used the pictures they did. (Alternatively they can just write the names of the organism down in a diagram as above, allowing you to reuse the picture page.)

Activity 3 – Assemble an Energy Pyramid

1. Prior to the lesson have each learner bring in two to three clean, empty soda or small tin cans. Learners can also bring in magazines with pictures of plants, antelope, dogs, cats, etc (i.e. examples of producers, herbivores and carnivores) or make drawings of their own.

2. Explain and discuss the concept of energy pyramids to the learners.

3. Break the class into small groups of 5 to 10 learners with one 'Food Chain Picture Page', magazines brought in by the class or drawings, 10 to 12 cans and a copy of the student page- 'Energy Pyramids'.

4. Instruct the groups to assemble an energy pyramid of their own using the cans and pictures. Each pyramid must include producers, primary consumers (herbivores and omnivores), secondary consumers (omnivores and carnivores) and tertiary or top level consumers (carnivores/top predators).

5. Let each group present their energy pyramid to the class, describing the kinds of organisms that are a part of their energy pyramid and the ways they depend on each other for energy. Require groups to use the words: producers, herbivores, omnivores, carnivores, and primary, secondary and tertiary consumers. Presentations should show that learners understand the energy flow through the pyramid.

6. As an entire class, construct one giant pyramid selecting cans from each groups' pyramids.

7. Point to different organisms in the energy pyramid and ask learners to explain what would happen it that species was removed. For example point to the hare (rabbit) and ask the learners to explain how removing all hares from the pyramid would affect the rest of the energy pyramid. Repeat this with different organisms including the top predators.

8. Discuss the importance of maintaining balance in an ecosystem. If one can is removed from the pyramid the whole system weakens or collapses. Stress the significance of each individual animal to the natural world.

Answer to Questions on Student Page 'Energy Pyramids':

1. To gain a better understanding of how energy is lost at each level of an energy pyramid, calculate the number of Calories available to secondary consumers. Producers in a field have stored 50,000 Calories. The first-level/primary consumers that eat all the producers store 5,000 Calories. If the pattern continues, how much energy would the level of secondary consumers store? *Secondary-500, Tertiary-5*

2. Why is only 10% of a plant or animal's energy passed on to the next level of the energy pyramid? What happens to the other 90% of the energy? *Energy is lost to the environment in the form of animals producing heat.*

3. Why is the base of an energy pyramid so wide? *The base of the energy pyramid is widest to support the upper levels because only 10 % of the energy is passed level to level.*

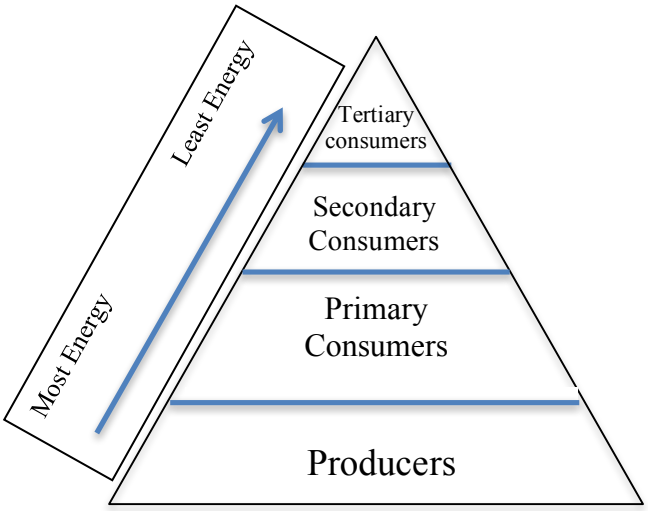
4. Why are there so few consumers at the top of an energy pyramid? *At the top level there is less energy available to the organisms which limit the number.*

5. What would happen to the pyramid if you removed the tertiary consumers? Describe what would happen at each level, secondary, primary, and producer and why. *If you removed the tertiary consumers the secondary consumers would increase in population because they no longer have predators to keep their numbers smaller. An increase in secondary consumers would create a decrease in primary consumers which could lead to the primary consumers being totally eliminated and eventually lead to the secondary consumers starving to death. With a decrease or elimination in primary consumers the producers would increase.*

Food Chain Picture Page

Student Page – Energy Pyramids

Group Names:_____ **Date:**_____



1. Based on the energy pyramid above assemble a model energy pyramid using cans and pictures. Label the cans with pictures that represent each level and stack the cans into a pyramid. Each pyramid must include producers, primary consumers (herbivores and omnivores), secondary consumers (omnivores and carnivores) and tertiary or top level consumers (carnivores/top predators).

2. Once the model has been completed draw a diagram like the one above adding labels to identify the organisms included in your energy pyramid (i.e. producers – acacia trees and grasses).

3. As a group answer the questions below.

Questions:

1. To gain a better understanding of how energy is lost at each level of an energy pyramid, calculate the number of Calories available to secondary consumers. Producers in a field have stored 50,000 Calories. The first-level/primary consumers that eat all the producers store 5,000 Calories. If the pattern continues, how much energy would the level of secondary consumers store?

2. Why is only 10% of a plant or animal's energy passed on to the next level of the energy pyramid? What happens to the other 90% of the energy?

3. Why is the base of an energy pyramid so wide?

4. Why are there so few consumers at the top of an energy pyramid?

5. What would happen to the pyramid if you removed the tertiary consumers? Describe what would happen at each level, secondary, primary, and producer and why.

Namibian Species Research Project

SUBJECT AREAS:
Science, Information and Communication

DURATION/TIME:
Activity 1: Several 1-hour class periods

RECOMMENDED PREPARATION:
- Materials for learners' project presentations
- Review Appendix A-Background: 'Food Chains'

MATERIALS NEEDED:
- Access to research materials – computers, books, reference field guides

LOCATION:
- Classroom

KEY WORDS TO REVIEW:
Carnivore
Consumer
Ecosystem
Food chain
Herbivore
Life cycle
Predator
Producer
Scientific names
Species

Objectives:

Learners will develop an understanding of ecosystem interactions and the importance of both plants and animals to the ecosystem.

Lesson Activities:

ACTIVITY 1:
Learners research and create a presentation on three species that are commonly found in Namibia and that interact with each other; a plant, a herbivore, and a carnivore.

Learning Outcomes

The learners will develop an awareness of plants and animals that live in Namibia and understand how plants and animals are dependent on one another. Learners will also become familiar with the characteristics of living organisms.

Teaching the Lesson

Activity 1 – Namibian Plants and Animals

1. Brainstorm with the class names of plants and animals that occur in Namibia. Write the names on the board as they are offered by the learners.

2. Place a P, H, or C behind the name of each species listed to indicate if it is a plant, herbivore, or carnivore or place in separate columns on the board.

3. Discuss with learners which of the plants, herbivores, and carnivores could make up different food chains.

4. Arrange learners into groups of three and have each learner in the group research either a plant, herbivore, or carnivore that together makes up a food chain.

5. Direct learners to collect the following information for each organism:
    - Scientific and common names for each species
    - A map showing the range of the species
    - Picture of each species
    - A brief description of life cycle, diet, behavior, etc.
    - A brief description of the ecosystem where the species is found
    - What is being done to protect each species if anything
    - Current events/news related to any or all of the species
    - Connections the species has to cheetahs. For example:
        - Does the plant provide food for the animals cheetahs prey on?
        - Do cheetahs prey on the herbivore animal?
        - Does the animal steal food from the cheetah?

6. Once learners have collected the information, have them put it together in a skit, play, poster, book, or report.

7. Have groups present their projects to the class- reminding them that they must do more than just read their information out loud.

Recommended websites:

- http://www.namwild.com/
- http://www.nacoma.org.na/Our_Coast/FaunaFlora.htm
- http://animals.nationalgeographic.com/animals/facts/

CHEETAH HUNT

SUBJECT AREAS:
Science, Math

DURATION/TIME:
Activity 1: 10 minutes
Activity 2: 40 minutes

RECOMMENDED PREPARATION:
- Activity 1: Read Appendix A-Background: 'Cheetah Hunt'
- Activity 2: Prepare and label 200 'prey' (use slips of paper, plastic cups or rocks). Prepare outside area for game.

MATERIALS NEEDED:
Activity 2:
- 200 'prey'
- Blindfold

LOCATION:
- Outdoors (game)

KEY WORDS TO REVIEW:
Carrying capacity
Factor
Hunt
Prey
Shelter

OBJECTIVE:

Learners will discover limiting factors and carrying capacity by participating in a discussion and game.

LESSON ACTIVITIES:

ACTIVITY 1:
Discussion on carrying capacity, limiting factors and population.

ACTIVITY 2:
Play the game 'cheetah hunt' and answer questions relating to game.

Learning Outcomes

In this activity learners discover limiting factors and carrying capacity by playing a game in which they all become cheetahs competing in the savannah.

Teaching the Lesson

Activity 1 – Background

Is it possible for each of the over 7 billion people on Earth to fit in a country the size of Namibia? Discuss with the learners the current population of Namibia and whether or not all 7 billion people on Earth would all survive in the space of Namibia. What else would we need? How would we need to change? Review with them the four factors that affect an animal's habitat (food, water, shelter, and space).

The limiting factor is the factor which is in the shortest supply. For example, a cheetah can have excess space, food, and shelter, but if water is in short supply, it still will not be able to survive. The maximum number of animals that can survive in an environment with all their habitat needs met is the carrying capacity. As long as the limiting factor increases, the carrying capacity can increase as well. But as soon as the limiting factor decreases, the carrying capacity must also decrease.

This activity will demonstrate carrying capacity by using food as the limiting factor. The food is divided into different cheetah prey animals, each counting as a certain amount of energy. Each animal requires a certain amount of energy it requires to survive, and those who do not meet that requirement will die.

Activity 2- Cheetah Hunt – Outdoor Game

Before the activity begins, prepare 200 'prey.' Small, reusable cups are useful because they are easy to pickup, but even slips of paper or small blocks of wood will work. Label with a G, R, P, D, or S according to the chart below. You will need to make 100 (G) guinea fowl, 50 (R) rabbits, 30 (P) porcupines, 19 (D) duikers, and 1 (S) springbok

Prey animal	Population	kg of prey
Guinea Fowl (G)	100	1
Rabbit (R)	50	2
Porcupine (P)	30	7 1/2
Duiker (D)	19	20
Springbok (S)	1	75

You will also need an eyepatch or blindfold (only covering 1 eye) for one of the 'cheetahs.'

Procedure:

1. Begin by setting up the outside playing area. Evenly spread the cups or whatever materials you choose to represent the (prey) throughout the field.
2. Discuss with learners that they will be playing a game which demonstrates how many cheetahs can live in an area.

   Here are the rules of the game:
   - Each person will represent a cheetah
   - Together, you are a population of cheetahs in a defined habitat
   - You need to find enough food to survive for one month (50 kg)
   - Each cheetah must find a shelter where they can keep their prey
   - Cheetahs stalk their prey and only use their incredible speed when their prey runs. Your prey will not be running away, so you can't run either!
   - A cheetah can only take one prey at a time and take it back to its shelter
   - Cheetahs cannot fight over prey because they can get injured
   - Do not damage the prey! Be careful!
   - When all of the prey has been picked up, we are done. Stay at your shelter.

3. Send the learners to their shelter. Learners will need a sheet of paper with their name on it for keeping score and helping to find their 'shelter' as they collect prey. Review that each 'cheetah' needs 50kg to survive. There are five different prey animals and each one is worth so many kg of food. Review the prey and kg of each prey.
4. Begin the game! Each (cheetah) must walk to collect 1 prey item and bring it back to their shelter. Learners should keep collecting (prey) and bringing back to their shelter until all the prey has been collected. When the learners are finished, have them add up their kg's and meet up to discuss.
5. Ask each learner to tell how many kg's of prey they caught. Keep track of the number as you go. When they are finished, tell them how many cheetahs survived out of how many there were originally.
6. For a second round, ask for three volunteers. One volunteer will be injured and must drag one leg the entire time. One is blind in one eye because of an unfortunate encounter with a thorn bush, so cannot see in one eye. Give the 'partially blind cheetah' an eyepatch to use. The last is a mother with two cubs. Each cub needs an extra 25kg of food to survive so she needs 100kg for her family to survive.
7. Begin the game again! When the learners are finished, have them add up their kg's and meet up to discuss.
8. Ask each learner to tell how many kg's of prey they caught. Keep track of the number as you go. Ask the three volunteers to go last. When they are finished, discuss how many cheetahs survived out of how many there were originally.
9. After the game ask the learners what the limiting factor to cheetah survival was in this case. *(Food)* Then ask what the carrying capacity of this habitat is for cheetahs. This is the number that survived. Discuss why so many died. Also, how did the three volunteers do? How easy is it for a mother cheetah to get enough food for both her and her cubs?
10. Discuss what would happen to the cheetah population if a virus killed off the rabbit population. Conversely, what would happen to the rabbit population if hunters lowered the cheetah population? *(It's all interrelated!)*

CHEETAH COMPUTATIONS

SUBJECT AREA:
Math, Science

TOPICS:
Activity 1:
• Number facts
• Averages
• Unit conversion

Activity 2:
• Fractions
• Percentages

Activity 3:
• Acceleration
• Velocity

DURATION/TIME:
Activity 1: 30 min
Activity 2: 30 min
Activity 3: 30 min

RECOMMENDED PREPARATION:
Review Appendix B-Reference: 'Cheetah Fact Sheet'

MATERIALS NEEDED:
Graph paper

LOCATION:
Classroom

KEY WORDS TO REVIEW:
Acceleration
Average
Conversion
Facts
Fraction
Percentage
Unit
Velocity

OBJECTIVE:

Learners will solve mathematical problems by using the cheetah as a guide.

LESSON ACTIVITIES:

ACTIVITY 1:
Covers the topic of number facts, averages and unit conversion. There are questions for the learners and an answer key for teachers.

ACTIVITY 2:
Covers the topics of fractions and percentages. There are questions for the learners and an answer key for teachers.

ACTIVITY 3:
Covers the topics of acceleration and velocity. There are questions for the learners and an answer key for teachers.

Learning Outcomes

This activity includes mathematics problems that centre on the cheetah. Topics include; number facts, averages, unit conversions, fractions, percentages, acceleration, and velocity.

Teaching the Lesson

These mathematics problems can be used on their own or in conjunction with the other activities in a science or math class. For background on cheetahs, refer to the fact sheets, especially the 'Cheetah Fact Sheet' in Appendix B.

Activity 1 – Number facts, averages and unit conversion

1. It is a fact that cheetahs can cover 7-8 meters in each stride.
   The cheetah spots a springbok 200 meters away. If the cheetah can cover 8 meters in a stride, how many strides will it take it to reach the springbok? (**25 strides**)

2. At a speed of 4 strides/sec, how long will it take the cheetah to cover the distance of 200 meters? **(Answer: 200 m divided by 32 m/sec = 6.6 seconds)**

3. A second cheetah can cover only 7 meters in a stride. How many strides would it take to reach the springbok? (**28 strides**)

4. At a speed of 4 strides/sec, how long will it take this cheetah to cover a distance of 200 meters? **(Answer: 200 m divided by 28 m/sec = 7.14 seconds)**

5. How many seconds more does it take the second cheetah to reach the springbok? **(Answer: 0.54 seconds)**

6. Calculate your stride. Run a distance of 20 meters and count the number of strides (steps) taken. A stride is the length of your step, from heel to heel. It is basically the distance you travel with each step you take.

7. Based on your stride how many strides would it take you to cover a distance of 200 meters?

8. If a cheetah and a human were to run 100 meters, how long would the cheetah wait at the finish line for the human to finish? Assume the cheetah runs 30 m/sec and the human 10 m/sec. **(Answer: 6.7 sec.)**

9. Cheetahs kept in captivity eats about 2 kg of meat a day. At CCF there are usually around 30 cheetahs. How many kilograms of meat does CCF need for the cheetahs each week? **(Answer: 420 kg/week)**

10. Cheetahs weigh 300 g at birth and 45 kg when full grown. Based on this how much weight does a cheetah have to gain by the time it reaches its full growth? **(Answer: 44.7 kg or 44,700 g)**

11. A cheetah's average length is about 212 cm from the tip of its nose to the end of its tail. A cheetah's tail is around 64 cm long. How long is the cheetah's body? **(Answer: 148 cm)**

12. Leopards are around 200 cm in length with their tail being about 72 cm. How long is the leopard's body? **(Answer: 128 cm)**

13. How much longer is the average cheetah than the average leopard? **(Answer: 20 cm)**

14. Female cheetahs weigh, on average, 35 kg. Female leopards weigh 50 kg. Why do you think a cheetah is longer than a leopard but weighs less?

15. The gestation period (pregnancy) for a cheetah is 95 days, for an elephant it is 22 months and for a human it is 9 months. List the gestation periods for these animals in order based on the number of days each is pregnant. (Answer: Cheetah 95 days, Human 270 days, Elephants 660 days)

16. In the captive cheetah population in 1992, 180 cubs were born in 55 litters. What was the average litter size rounded to the nearest whole number? **(Answer: 3 cubs/litter)**

Activity 2 – Fractions and percentages

1. Namibia has the largest number of cheetahs in the world. About 2,500 wild cheetahs live in Namibia. The world's population of wild cheetahs is approximately 10,000 animals. What percentage and what of the total population lives in Namibia? (**Answer: 25% or 1/4th of the total population)**

2. If two-fifths of the cheetahs found in Namibia die or are killed, how many will be left in Namibia? How many cheetahs will be left in the world? **(Answer: 1500 in Namibia, 8500 world)**

3. Cheetahs successfully catch half of the prey they hunt. If they need to find prey 4 times a week how many hunting attempts will they need to make? **(Answer: 8 attempts)**

4. The following is a list of all the cheetahs in one study area that had cubs, the number of cubs each one had, and the number that survived the first 3 months.

Cheetah	# of Cubs Born	# of Cubs Alive after 3 Months
Malkia	3	1
Sukari	6	0
Gizzy	2	2
Khama	5	3
Tamu	4	4

- How many cubs were born in this area? **(Answer: 20 cubs)**
- What was the average number of cubs born per litter? **(Answer: 4 cubs/litter)**
- How many cubs survived the first 3 months? **(Answer: 10 cubs)**
- What percentage of the cubs did not live to be 3 months old? **(Answer: 50%)**
- Which mother successfully raised the most cubs? **(Answer: Tamu)**
- Which of the mothers raised the highest percentage of her cubs? **(Answer: Gizzy and Tamu)**

Activity 3 – Acceleration and velocity

1. If a cheetah can go from 0 km/h to 72 km/h in 2 seconds, what is its rate of acceleration? (Assume a constant rate of acceleration.) If prior to acceleration the cheetah's initial velocity was 5 m/sec, what is its rate of acceleration over 2 seconds?
   (Answer: 10 5m/sec^{2,} 7.5m/sec^{2})

2. What is the distance in meters travelled by a cheetah accelerating from 0 km/h to 72 km/h in 2 seconds? What is the distance travelled if the cheetah's initial velocity was 5 m/sec?
   (Answer: 20 metres travelled, 25 metres travelled)

3. Assume a cheetah runs at 20 m/sec and a wildebeest at 15 m/sec, the wildebeest is 60 meters ahead of the cheetah, how long before the cheetah catches up with the wildebeest?
   (Answer: 12 sec.)

4. A resting cheetah sees a wildebeest 60 meters away. How long before it catches the wildebeest? (Assume the cheetah can accelerate at 20 m/sec^{2}.) **(Answer: 16.7 sec.)**

CAMERA TRAP WILDLIFE ID

SUBJECT AREAS:
Science, Information & Communication

DURATION/TIME:
Activity 1: 45 minutes
Activity 2: 1 to 2 1-hour class periods

RECOMMENDED PREPARATION:
- Photocopy several 'Namibian Wildlife Reference Guide' sheets and student page- 'Camera Trap Photos'
- Review Appendix A-Background: 'Tools for Ecological Research'

MATERIALS NEEDED:
- Photocopies of student pages- 'Camera Trap Photos' & 'Namibian Wildlife Reference Guide'
- Animal field guide books if available.

LOCATION:
- Classroom

KEY WORDS TO REVIEW:
Browser
Ecosystem
Grazer
Identification
Predator
Prey

OBJECTIVE:

Learners will be able to identify and classify wildlife found in Namibia.

LESSON ACTIVITIES:

ACTIVITY 1:
Learners receive photos from camera traps located around Namibia. Similar to the work done by researchers at the Cheetah Conservation Fund the learners will use the attached 'Namibian Wildlife Reference Guide' to identify the animals in the student page- 'Camera Trap Photos'. Learners will also classify the animals as grazers, browsers or predators.

ACTIVITY 2:
Learners will select one animal from the camera trap photos to research. Students will report on the animal's life cycle and behaviors.

Learning Outcomes

The learners will recognize wildlife found in Namibia, understand life cycles of some Namibian animals and be able to group and classify animals.

Teaching the Lesson

Activity 1 – Namibian Wildlife Identification

The Cheetah Conservation Fund in Namibia and other conservation organizations around the world use camera traps to collect information about wildlife found in the area. Camera trapping is a method for capturing wild animals on camera when researchers are not present, and has been used in research for many years. The remote cameras have sensors that trigger the camera to take a photo whenever there is motion.

Wildlife can be grouped into different categories. In this lesson the wildlife will be classified in the following ways:

- Predator – An animal (carnivore) that eats or preys on other animals
- Browser – An animal (herbivore) that feeds on leaves, soft shoots, or fruits of high-growing plants such as shrubs
- Grazer – An animal (herbivore) that feeds on grass or other low vegetation

Procedure:

1. Arrange learners into small groups of three to four.
2. Provide each group with a set of six camera trap photos- 1 page.
3. Learners will use field guides if available or the 'Namibian Wildlife Reference Guide' at the end of this lesson to identify the animals.
4. Once the animals have been identified, learners will need to determine if the animals as grazers, browsers or predators.
5. Learners should record the information by listing the photo number, the name of the animal and the feeding category. For example: Photo 9, Cheetah, Predator.

For discussion or individual work

Questions:

1. How do the animals, found in the ecosystem where these traps were placed, interact with one another?
2. Describe how grazers and browsers are different even though they both eat plants.
3. Explain how all animals are dependent on plants including carnivores.

Answer Key- Camera Trap Photo Identification

Photo 1 – Leopard

Photo 2 – Oryx (Gemsbok)

Photo 3 – Warthog

Photo 4 – African Wild Cat

Photo 5 – Dik Dik

Photo 6 – Black-backed Jackal

Photo 7 – Greater Kudu

Photo 8 – Leopard

Photo 9 – Cheetah

Photo 10 – Steenbok

Photo 11 – Giraffe

Photo 12 – Red Hartebeest

Photo 13 – Serval

Photo 14 – Brown Hyena

Photo 15 – Bat-eared Fox

Photo 16 – Springbok

Photo 17 – Caracal

Photo 18 – Eland

Photo 19 – African Civet

Photo 20 – Spotted Hyena

Photo 21 – African Wild Dog

Photo 22 – Honey Badger

Photo 23 – Genet

Photo 24 – Black Rhino

Activity 2 - Lifecycle Report

1. Each learner selects one animal to research and report on. Reports must include information about:
   a. the life cycle of the animal
   b. feeding habits
   c. where it fits in the food chain, is it a predator or prey?
   d. habitat
   e. reproduction/number of young
2. Students make a poster or power point presentation to share their report with the class.

Student Page- Camera Trap Photos

Photo 1

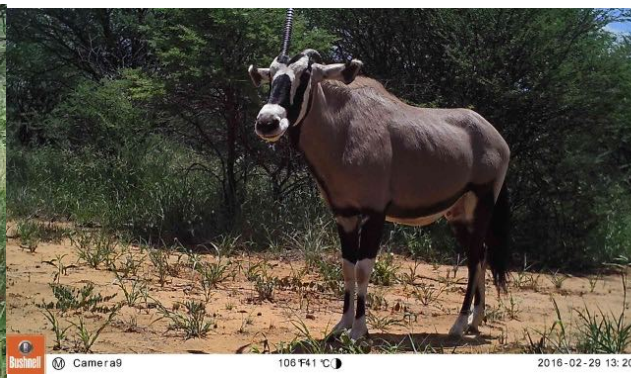


Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

Photo 8

Photo 9

Photo 10

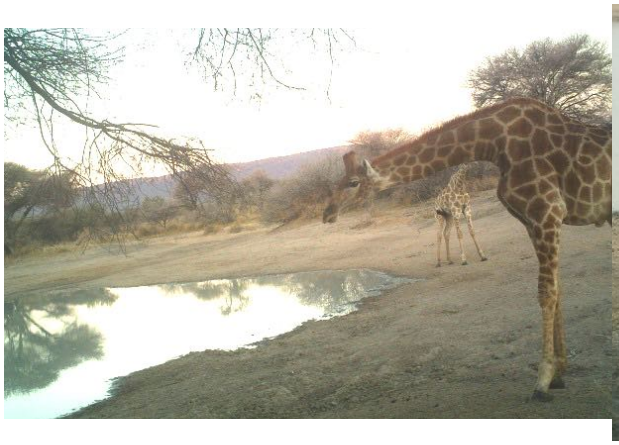


Photo 11

Photo 12

Photo 13

Photo 14

Photo 15

Photo 16

Photo 17

Photo 18

Photo 19

Photo 20

Photo 21

Photo 22

Photo 23

Photo 24

Photos 1 – 18 courtesy of Cheetah Conservation Fund
Photos 19-24 courtesy of Dr. Louisa Richmond-Coggan

Namibian Wildlife Reference Guide- Have learners use this guide to identify the animals in the camera trap photos

Antelope

Dik Dik

Greater Kudu

Eland

Red Hartebeest

Steenbok

Oryx/Gemsbok

Springbok

Felines

Caracal

African Wildcat

Serval

Cheetah

Leopard

Canines

African Wild Dog

Black Backed Jackal

Brown Hyena

Spotted Hyena

Bat-eared fox

Large Mammals

Black Rhino

Zebra

Giraffe

Small Mammals

Warthog

African Civet

Genet

Honey Badger

WILDLIFE SAMPLING

SUBJECT AREAS:
Science, Math

DURATION/TIME:
Activity 1: 45 minutes

RECOMMENDED PREPARATION:
- Photocopy the 3 student pages- 'Wildlife Sampling Investigation & Data Sheet'
- For each group of 3-4 learners fill a small bag with 80, 90, 100, or 110 beans. Label the bags with a code so the teacher knows how many beans are in each bag.

MATERIALS NEEDED:
Activity 1:
- 80 to 110 beans per group
- Bag or container for holding beans
- Markers

LOCATION:
Classroom

KEY WORDS TO REVIEW:
Capture
Estimate
Population
Recapture
Sampling

OBJECTIVE:

Learners will simulate the mark and recapture method of population sampling and will discuss how scientists use data to make decisions about protected areas and managing wildlife.

LESSON ACTIVITIES:

ACTIVITY 1:
Learners will conduct an investigation that simulates a mark and recapture sampling technique to calculate the number of beans in a container.

Learning Outcomes

Learners will be able to follow a sequence of instructions, record data accurately, and make estimates about wildlife population sizes. They will understand how biologists can estimate the size of different populations of animals and will predict possible consequences of overpopulation.

Teaching the Lesson

Activity 1- Wildlife Sampling

Background

Research Work Related to Mark and Recapture Sampling Technique

The mark/recapture sampling method is used to estimate the abundance or size of an animal population such as the springbok populations in Etosha National Park, Namibia. Typically, a researcher visits a study area and uses traps to capture a group of individuals alive. Each of the individuals is marked and then released unharmed back into the environment. Sufficient time is allowed to pass for the marked individuals to redistribute themselves among the unmarked population.

Next, the researcher returns and captures another sample of individuals. Some individuals in this second sample will have been marked during the initial visit and are now known as recaptures. Other animals captured during the second visit will not have been captured during the first visit to the study area. They will be released unmarked.

Over a period of time, the animals from the population continue to be trapped and data is taken on how many are recaptured with marks/tags. The researcher collects the data for each sample, recording the number of animals captured and the number that were recaptured. A mathematical formula is then used to estimate population size, survival, or movement.

Knowing the population size of an animal species can help biologists determine how to manage the species and if the population is increasing or decreasing.

Procedure:

1. Teacher prepare before the class: For each group of 3-4 learners fill a small bag with 80, 90, 100, or 110 beans. Label the bags with a code so the teacher knows how many beans are in each bag.
2. Pass out a bag of beans and a student page- 'Wildlife Sampling Investigation & Data Sheet' to each group
3. Go over the instructions on the student page- 'Wildlife Sampling Investigation & Data Sheet' with learners

Answer Key for Analysis Questions on student page- Wildlife Sampling Investigation & Data Sheet

3. Compare the actual size to the estimated size. How does the actual number of beans in the bag compare to your estimate in question #1? Explain why your estimate might have been different than the actual number.
   The mark/recapture technique is a way to estimate population numbers. The more animals that are marked and the more recaptures that are made the more accurate the results will be.

4. Why is it important for wildlife managers to be able to estimate the population size of different species of animals on their land?
   Wildlife managers need to make decisions about the need to reduce the numbers of certain species of animals to protect the environment and make sure there is enough food for the animals. Managers also need to be able to decide if certain species of animals can be hunted sustainably.

5. What might be some of the impacts that would occur if there was an overpopulation of springbok in a national park? Think about the land, the grasses that the springbok eat, and the animals that prey on the springbok.
   If the population of springbok gets too high the land could be trampled and overgrazed. This would reduce the amount of food available for the springbok and they would begin to starve. The number of predators that preyed on the springbok would increase until the springbok population dropped due to starvation. The predator population would then also begin to starve or would have to search out another source of food.

The teacher should read this to the class to explain the activity and student page

Wildlife researchers and game reserve managers must be able to estimate the size of wildlife populations in specific areas. This information allows populations of animals such as antelope, fish, and birds to be managed more effectively. Managers can limit negative effects such as over-grazing when there are too many animals or reduce harvesting of animals when populations become too low. In this lesson you will engage in a research sampling technique called Mark and Recapture.

Procedure:

1. Work in small groups of 3 to 4 to complete the investigation. Make sure to record your data on the student page- 'Wildlife Sampling Investigation & Data Sheet'.

2. You will receive a bag of beans that represent your springbok population. Your task is to determine the number of springbok living on the reserve.

3. Remove 10 beans from the bag and mark each of these with a small X. This is the original number captured and marked. Record this number on the Data Table.

4. Return the 10 marked beans to your bag.

5. Mix the beans around and without looking capture another sample of 10 "springbok" beans. This is the recapture step. Record the total number of animals captured (10) and the number of animals recaptured (marked with an X) in the data table on your student page.

6. Return all of the "springbok" beans to your bag and repeat #5. Complete a total of 10 recaptures.

7. Record the data from each of the recaptures in the data table.

8. Estimate your springbok population size _____

9. Conduct another 10 capture/recapture samples and record the data.

10. Calculate the population size based on 20 trials.

Group Names:_____ **Date:**_____

Population Estimate Calculations Formula

Population Estimate = (Total number captured) x (Number Marked {10})
(Total Number Captured with Mark)

1. **Wildlife Sampling Data Table**

Original number captured and marked = _____

Sample # (1, 2, 3…)	Total Number Captured	Number Recaptured (Marked with X)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Total		

Population Size = _____

2. **Wildlife Sampling Data Table**

Original number captured and marked = _____

Sample # (1, 2, 3…)	Total Number Captured	Number Recaptured (Marked with X)
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
Total (for all 20 samples)		

1. Use the code name on your bag to check with your teacher how many "springbok" are actually in your population.

   Code name on bag:_____

   Actual population size:_____

Analysis

2. Compare the actual size to the estimated size. How does the actual number of beans in the bag compare to your estimate in question #1? Explain why your estimate might have been different than the actual number.

3. How did your population estimates compare between conducting 10 capture/recapture samples and then conducting 20 capture/recapture samples? How might the estimate change if you conducted 50 samples?

4. Why is it important for wildlife managers to be able to estimate the population size of different species of animals on their land?

5. What might be some of the impacts that would occur if there was an overpopulation of springbok in a national park? Think about the land, the grasses that the springbok eat, and the animals that prey on the springbok.

ANIMAL TRACKS

SUBJECT AREAS:
Science, Math, Art

DURATION/TIME:
Activity 1: 30 minutes
Activity 2: 30 minutes
Activity 3: 1-hour class broken into 2 sections.

RECOMMENDED PREPARATION:
- Read Appendix A-Background: 'Tools for Ecological Research'
- Make photocopies of student pages- 'Spoor Identification Key' and 'The Story Tracks Can Tell'

MATERIALS NEEDED:
Activity 1: student page- 'Spoor Identification Key'
- Bowl or bucket of water
- Concrete area

Activity 2: student pages- 'The Story Tracks Can Tell' and 'Spoor Identification Key'

Activity 3: student page- 'Spoor Identification Key'
- Shallow bowl of water for 'waterhole'
- Rulers
- Paper and pencils
- Animal Tracks field guides if available

LOCATION:
- Classroom & Outside

KEY WORDS TO REVIEW:
Inference
Investigate
Observation
Spoor
Stride
Tracks

OBJECTIVE:

Learners will discover more about how animals move and be able to identify what animal spoor looks like and how it can differ. Learners will also discuss how researchers can use spoor to study animals in the wild.

LESSON ACTIVITIES:

ACTIVITY 1:
Learners will study and discuss the 'Spoor Identification Key' and will create and observe their own spoor.

ACTIVITY 2:
Learner will discuss the difference between an inference and observations and how researchers can use spoor to study wildlife. Learners will complete the student page- 'The Story Tracks Can Tell'

ACTIVITY 3:
Learners will set up their own waterhole on school grounds to observe animals and their tracks.

Learning Outcomes

Learners will discover more about how animals move and be able to identify what animal spoor looks like and how it can differ. Learners will also discuss how researchers can use spoor to study animals in the wild.

Teaching the Lesson

Spoor (Footprint) Tracking
Researchers can study animals by looking at the footprints they leave behind. Scientist call an animal's footprint a *track* or *spoor*. Animals can leave their spoor in dirt, sand, mud, and snow. From an animal's spoor researchers can identify the animal species and density (number) in a study area. They can identify if the spoor is small, average, or large in size for the species and sometimes tell if it was from a male or female based on the size. Animal spoor can also tell researchers a story. The spoor can tell if an animal was running, walking, or was in a struggle with another animal.

A *stride* in animal movement is the forward movement completed when all the feet are returned to the same position as at the beginning of the step. With people we take two steps to make a stride. With a cheetah they take four steps to make a stride.

Activity 1- Making Tracks

Have learners review the Spoor Identification Key and hold a discussion with the class about animal spoor and how they differ in shape, number of toes, and size. Review the background 'Tools for Ecological Research' in Appendix A with the class. For this activity learners are going to take a closer look at their own spoor.

Procedure:

1. Prepare a place outside on concrete such as a sidewalk for the learners to leave their own spoor.

2. Have learners remove any shoes and socks and supply the class with a bowl or bucket of water to dip their feet in.

3. Ask a few of the learners to walk normally for a few strides, then a few learners to run, and a few to skip.

4. Have all the learners gather to look at the differences in the strides between the walking, running, and skipping learners wet footprints (spoor).

5. Instruct learners to make their own track story with their wet footprints. They can ask other learners to be apart of their story and leave their wet footprints in the same area. Consider having learners do this on a piece of paper drawing the tracks and then either write a story or trade papers and have others write their inferences and observations. The wet footprints will dry before students complete the lesson.

Extension

If you have access to washable paint you can have the learners paint their feet and leave footprints on long sheets of paper or cardboard boxes instead of using the water for a more permanent work of art.

Activity 2- The Story Tracks Can Tell

Divide learners into small groups of three or four. Give each group the two student pages- 'The Story Tracks Can Tell'.

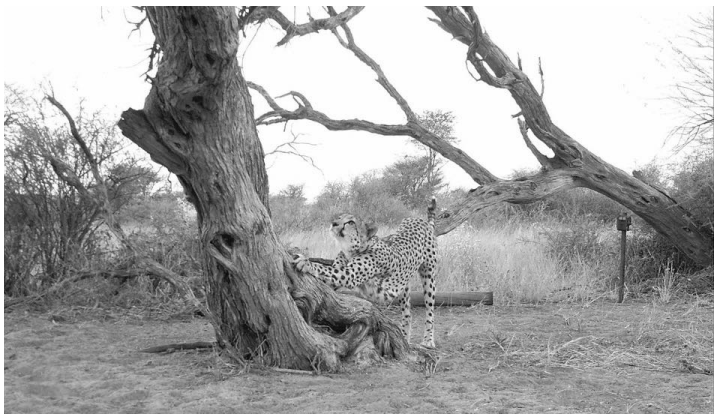
Have the learners examine the two scenes on the student pages and identify what animal spoor is present and what they think happened in the scene. Talk to learners about how researchers studying animals can look at animal spoor to learn more about the animals without having to see the actual animal. Scientists can use the spoor to make inferences and observations about the animal. Have learners give examples of some inferences and observations they made from the student page scenes.

Once the learners have answered the questions on the student pages, have a class discussion on what the learners think happened at each scene and why.

Vocabulary:
Observation: a statement based on something one has seen, heard, or noticed.
Inference: a conclusion reached on the basis of evidence and reasoning.

What is a Play Tree?

Cheetahs, like many other large mammals, communicate with one another via scent marking. In southern Africa, cheetahs have been observed using distinctive scent posts and repeatedly returning to the same scent posts. These posts are called "play trees" and have been used heavily by biologists to study cheetahs. For instance, CCF has been conducting a cheetah census since 2005 using camera traps (motion activated cameras) placed at these trees. When a cheetah comes to visit the tree, a photograph is taken and from that picture they can identify the individual cheetah (a cheetah's spots are just as unique as a fingerprint) and with enough of this data a population estimate can be determined. Play trees are quite recognizable as they normally have a large trunk, a wide canopy, and a good view of the surrounding area.



Answers for Student Pages- 'The Story Tracks Can Tell'

'The Story Tracks Can Tell': Wild Waterhole
Questions:

1. What animal tracks are present at the waterhole?
   Adult & calf warthog, adult oryx (gemsbok), adult jackal, and an adult cheetah.

2. For what reasons, other than drinking water, would animals visit a waterhole?
   Sometimes animals can visit a waterhole and not drink. They can do this for a few reasons. They may be wanting to socialize, establishing a territory, or looking for food.

3. What story do the tracks tell you?
   The warthogs, oryx, and cheetah came to drink water. The jackal came to the waterhole but did not drink and left the way the cheetah came. Maybe the jackal was looking for an animal carcass left over from the cheetah.

'The Story Tracks Can Tell': Play tree
Questions:

1. What animal tracks are present at the play tree?
   Cheetah and oryx (gemsbok) tracks

2. Why do you think animals visit the play tree?
   Cheetahs use play trees to communicate with other cheetahs and to find out what other cheetahs are in the area. Female cheetahs can advertise that they want to mate and male cheetahs can use a play tree to mark or define their territory. Other animals may visit a play tree to mark their territory, or to scratch an itc,h or use it for a shady place to rest.

3. What other evidence of activity did you see at the play tree?
   Cheetah poop on the play tree to mark that they were there, or to mark their territory, and a camera trap used by researchers to study the cheetah.

Activity 3- School Waterhole

Ask the class to discuss how wildlife uses a waterhole and reference the questions below. Once the learners understand more about waterholes have the class brainstorm how and where your class can place a small waterhole for local wildlife on your school grounds. Select an area where not many people will be walking by as they can scare the wildlife away and damage the tracks the animals leave behind. Also choose an area with smooth dirt or sand which is best for seeing the tracks.

Questions

1. Do you think animals in Namibia should be provided with man-made waterholes? Explain your answer.
2. For what reasons, other than drinking, would animals use waterholes?
3. Why would animals prefer a waterhole that is open with few trees and bushes around to one with a lot of cover?
4. How can Namibians use waterholes for tourism?

Namibian Waterholes

Namibia is a very dry country in south-western Africa. Namibia gets its name from the Namib Desert as most of Namibia is a desert habitat., Many of Namibia's wildlife are adapted to living in these very hot and dry conditions. Tourism is a growing industry in Namibia with many people from within Africa and around the world, traveling there to view Namibia's breath taking landscapes and wildlife. A growing tourism industry is good for Namibians and the wildlife as this gives local people more reason to treasure wildlife as they can profit financially by having tourists take safari adventures to watch and photograph the wildlife. Waterholes benefit the people and wildlife by giving animals a source of water and a place to bring tourists to show them the animals. Waterholes can be natural or man-made. In Namibia, most of the drinking water is far underground and must be pumped to the surface much like a well for a man-made waterhole.

Procedure:

1. Decide on a place for you school waterhole, this can change if you see your first place does not work well or you want to experiment with the waterhole placement.

2. Get a shallow bowl, you can cut a large jug or bottle to make the bowl.

3. Place your bowl full of water at your chosen waterhole sight. It is often best if the water is not in direct sunlight for the entire day. Look for a tree or building over-hang to partially shade your waterhole.

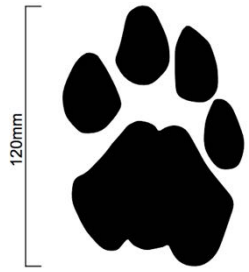
4. Put one learner in charge of sweeping/wiping the ground around the waterhole to make a 'clean slate' for collecting your animal tracks. This is best done at the END of the day. You are looking to collect animal tracks that come to the waterhole in the evening and overnight.

5. The following morning, meet the class in the classroom and prepare for visiting the waterhole site. Explain to learners that they will need to approach the waterhole site

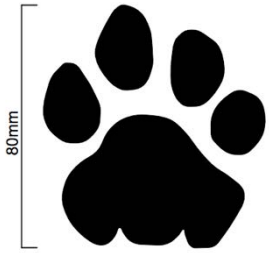
slowly in order not to cover or damage any of the animal tracks. Give learners a few copies of the 'Spoor Identification Key' and any other animal tracks guide books you may have. Also bring a ruler for the class to measure the tracks as well as, paper & pencil to draw some of the animal tracks.

6. Travel to your waterhole site and have learners observe all of the animal tracks around the waterhole. Learners can make a circle in the dirt around each different group of tracks. This is what researchers do to keep the spoor from getting stepped on and damaged.

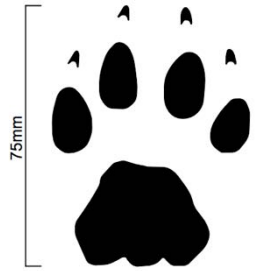
7. Once learners have circled all of the tracks at the site, have them draw the animal tracks. Encourage learners to measure the tracks and draw them to scale.



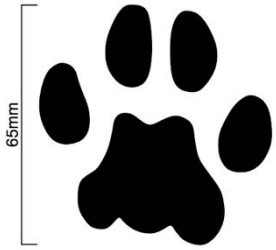
African Lion



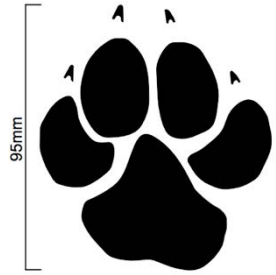
African Leopard



Cheetah

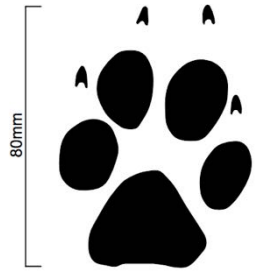


Caracal

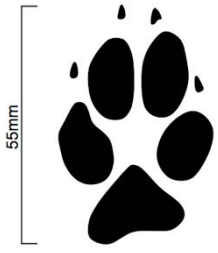


Spotted Hyena

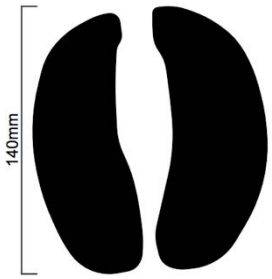
Brown Hyena



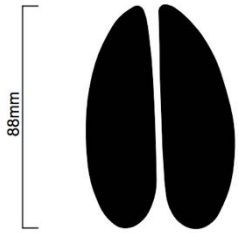
African Wild Dog



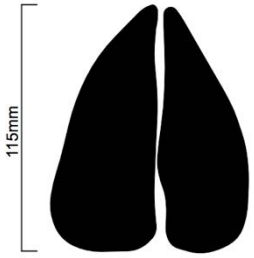
Black-Backed Jackal



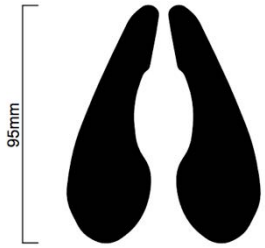
Eland



Greater Kudu

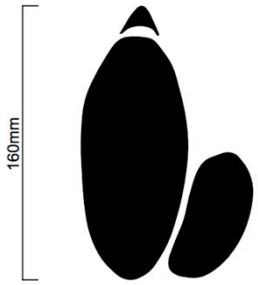


Gemsbok-Oryx

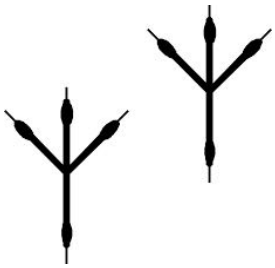


Red Hartebeest

Warthog



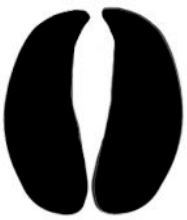
Ostrich



Bird

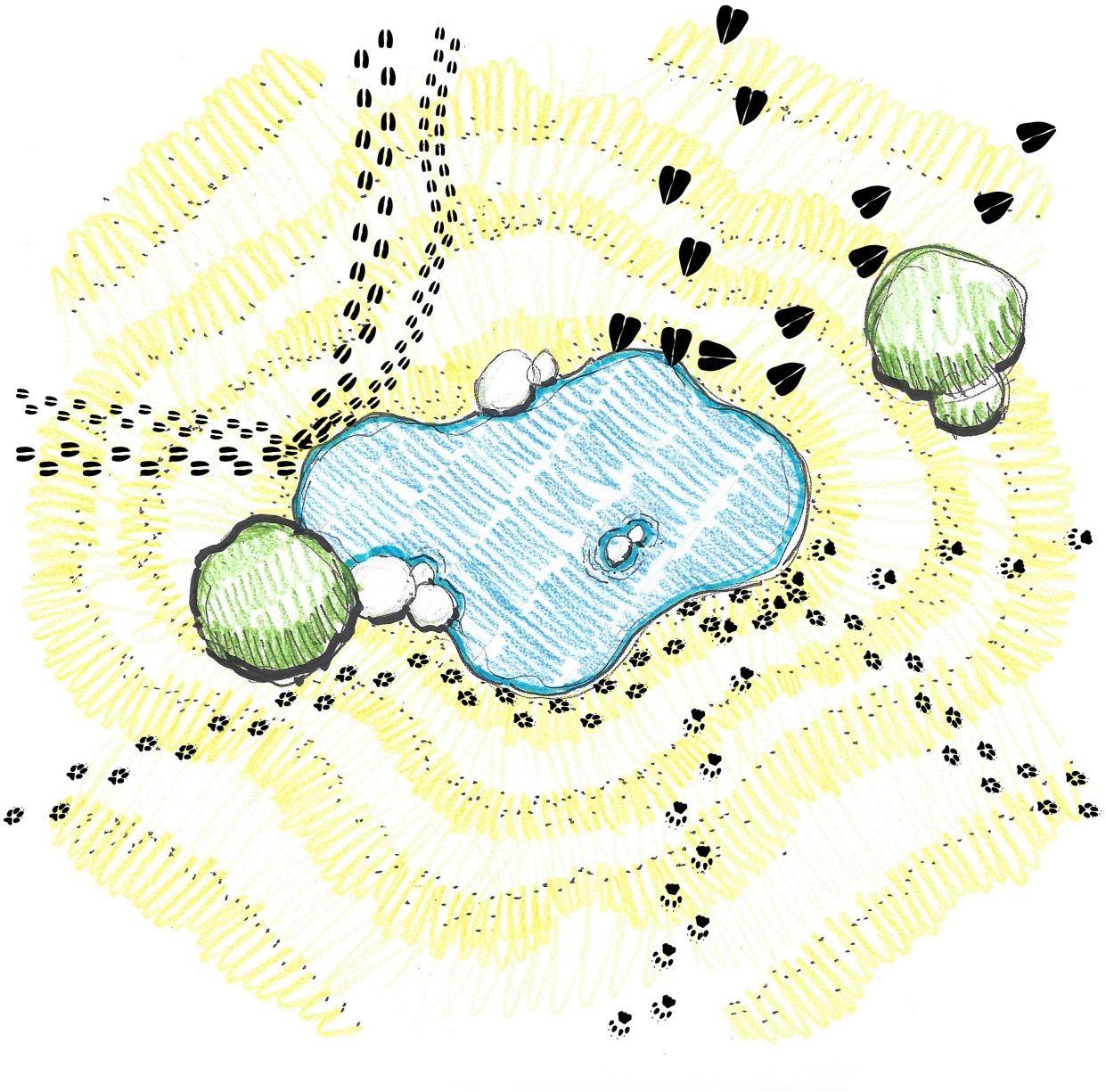
Goat

Sheep



Cow

Name:_____ **Date:**_____



Questions:

1. What animal tracks are present at the waterhole?

2. For what reasons, other than drinking water, would animals visit a waterhole?

3. What story do the tracks tell you?

Name:_____ **Date:**_____

Questions:

4. What animal tracks are present at the play tree?

5. Why do you think animals visit the play tree?

6. What other evidence of activity do you see at the play tree?

MAPPING THE CHEETAH

SUBJECT AREAS:
Geography, Social Studies, Agriculture, Science

DURATION/TIME:
Activity 1: 20min
Activity 2: 20 min
Activity 3: 20 min
Activity 4: 20 min

PREPARATION NEEDED:
Review Appendix B- Reference 'Cats of the World'

Activity 1 -4:
- Photocopies of map student pages for each learner

MATERIALS NEEDED:
Activity 1 -4:
- Colouring materials (pencils, crayons)
- Photocopies of map student pages for each learner

LOCATION:
Classroom

KEY WORDS TO REVIEW:
Delta
Distribution
Geography
Population
Protect
Region
Vegetation

OBJECTIVE:

Learners will learn about cheetah populations by studying maps of different African countries.

LESSON ACTIVITIES:

ACTIVITY 1:
Map student page- 'Cheetahs of Namibia.' Learners have a colouring activity and questions to answer.

ACTIVITY 2:
Map student page- 'Cheetahs of Botswana.' Learners have a colouring activity and questions to answer.

ACTIVITY 3:
Map student page- 'Cheetahs of Zimbabwe.' Learners have a colouring activity and questions to answer.

ACTIVITY 4:
Discuss the 'Broad Vegetation Regions of Africa' map and have learners complete the student page- 'Distribution of Cheetahs in Africa and Asia'. Learners have a colouring activity and questions to answer.

Learning Outcomes

These activities focus on the distribution of the remaining cheetah populations throughout Africa and Asia. Learners are asked to get specific information from world and local maps concerning geography and the location of human and cheetah populations.

Teaching the Lesson

These activities are designed to give learners a better understanding of where people and cheetahs live. Each student page contains a detailed map with areas of cheetah population drawn in. Learners should begin by shading or colouring in the areas of cheetah population before answering the questions. More detailed questions can be added to the student pages to better integrate the topic of study.

Procedure:

1. Begin by asking the learners to look at the 'Broad Vegetation Regions of Africa' map. Using what they know about the best habitats for cheetahs (review the 'Cheetah Fact sheet' found in Appendix B), ask learners to predict the regions that cheetahs would most likely be found.

2. Pass out and explain the map student pages for Namibia, Botswana, and Zimbabwe. Have learners complete the maps.

3. Once learners are done with the map student pages for Namibia, Botswana, and Zimbabwe, have the learners complete the student page- 'Distribution of Cheetahs in Africa and Asia' using the map of Africa provided.

Answer Key:

Student Page- 'Cheetahs of Namibia'

"*Cheetahs of Namibia*": (1) Otavi and Otjiwarongo; (2) No; (3) north-central farmlands; (4) Orange and Kunene Rivers; (5) Yes; (6) surveying people who live in area and sightings of cheetahs and their tracks.

Student Page- 'Cheetahs of Botswana'

"*Cheetahs of Botswana*": (1) Yes; (2) a delta is a fertile area of land formed at the mouth of a river, the Okovango Delta is a good habitat for cheetahs because the water and vegetation support a wide range of prey species; (3) Ghanzi, Mamuno, Maun; (4) Central Kalahari Gemsbok National Park, Kruger National Park; (5) North.

Student Page – 'Cheetahs of Zimbabwe'

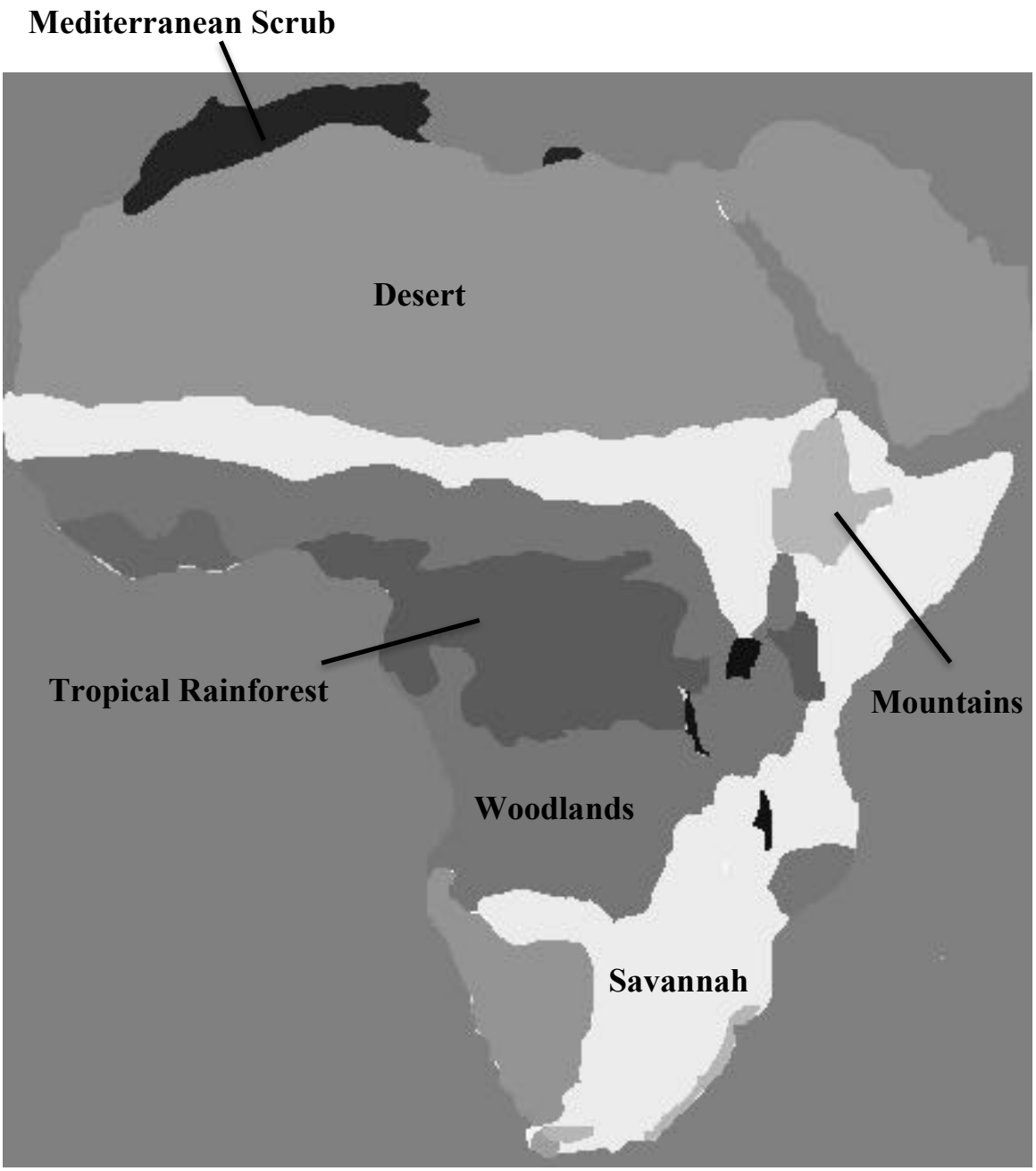
"*Cheetahs of Zimbabwe*": (1) Zambezi River, Lake Kariba, Limpopo River; (2) Hwange National Park, Yes; (3) Yes; (4) Yes, there is less competition from larger predators such as lions and hyenas; (5) No.

Student Page –'Distribution of Cheetahs in Africa and Asia'

Maps and worksheets are provided to learners in order to better understand the broad distribution of cheetahs throughout Africa and Iran. Answer key is in lesson.

COUNTRIES OF AFRICA

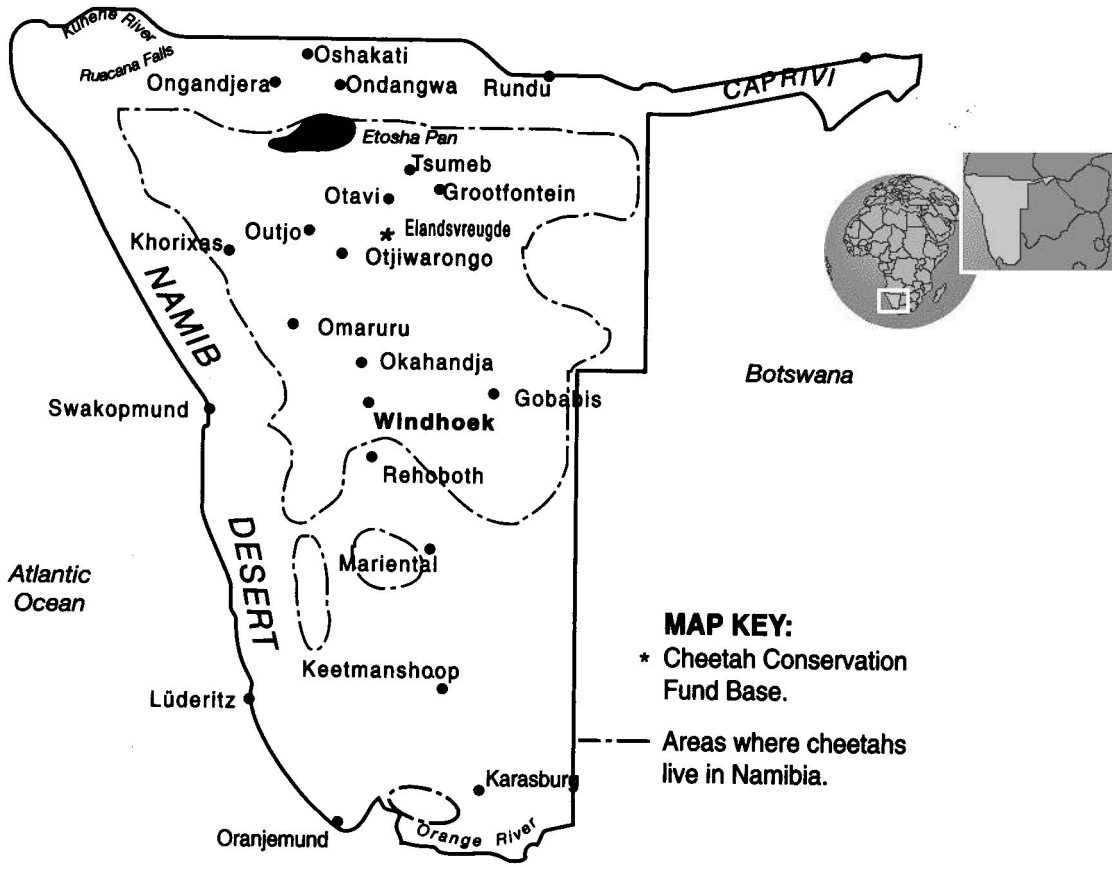
BROAD VEGETATION REGIONS OF AFRICA



Student Page – Cheetahs of Namibia

Name: _____ **Date**: _____

Instructions: Colour in the areas on the map where cheetahs live and answer the questions using the information provided on the map.



Map Questions:

1. Name the two towns closest to the Cheetah Conservation Fund's base at Elandsvreugde.

2. What is the farthest north cheetah are found?

3. Which region inhabited by cheetahs is Namibia's largest?

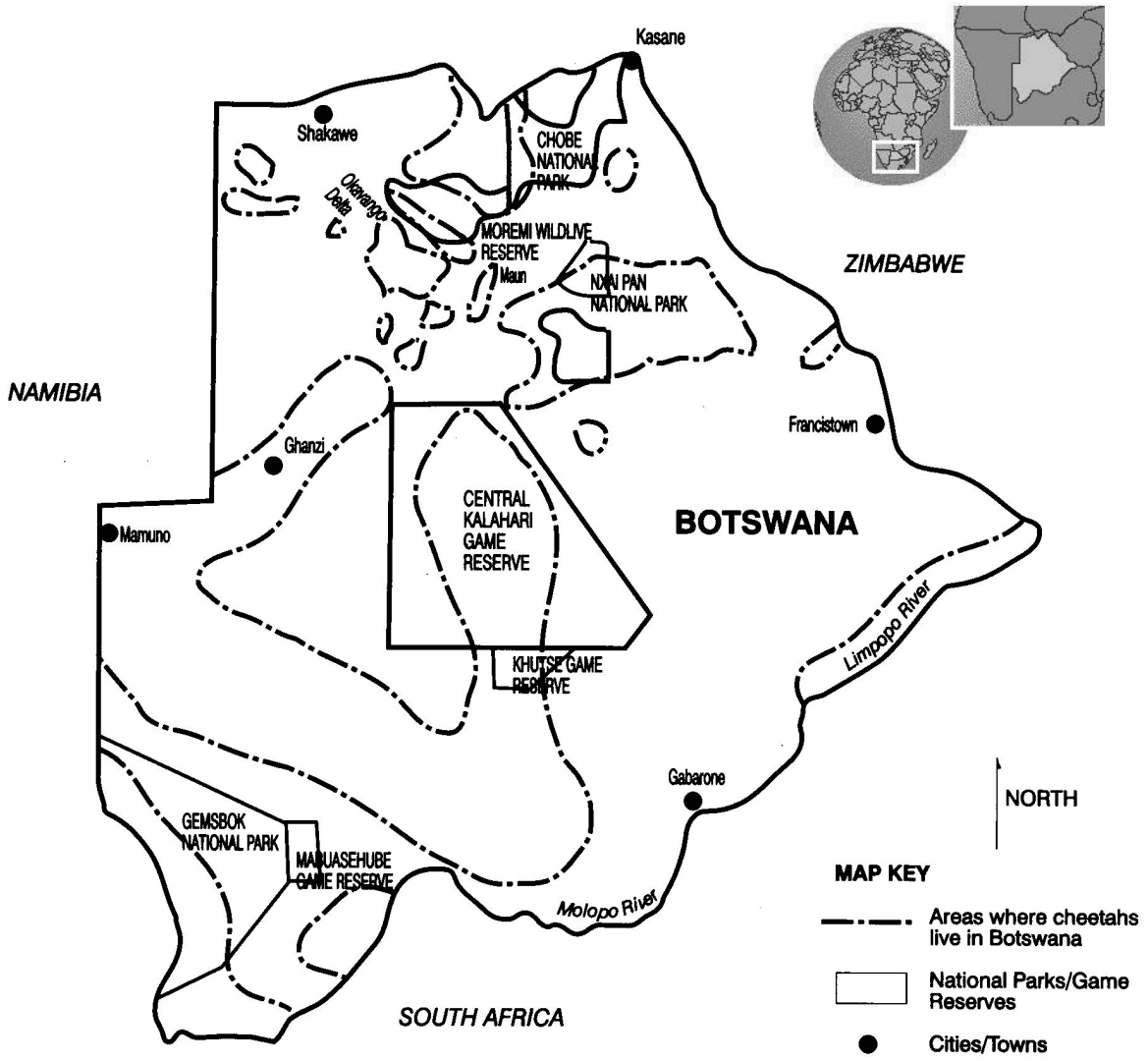
4. Name two rivers that cheetahs live near.

5. Do the Namibian and Botswana cheetahs form a geographically connected population?

6. How do you think researchers discovered where cheetahs live in Namibia?

Name: _____ **Date:** _____

Instructions: Colour in the areas on the map where cheetahs live and answer the questions using the information provided on the map.

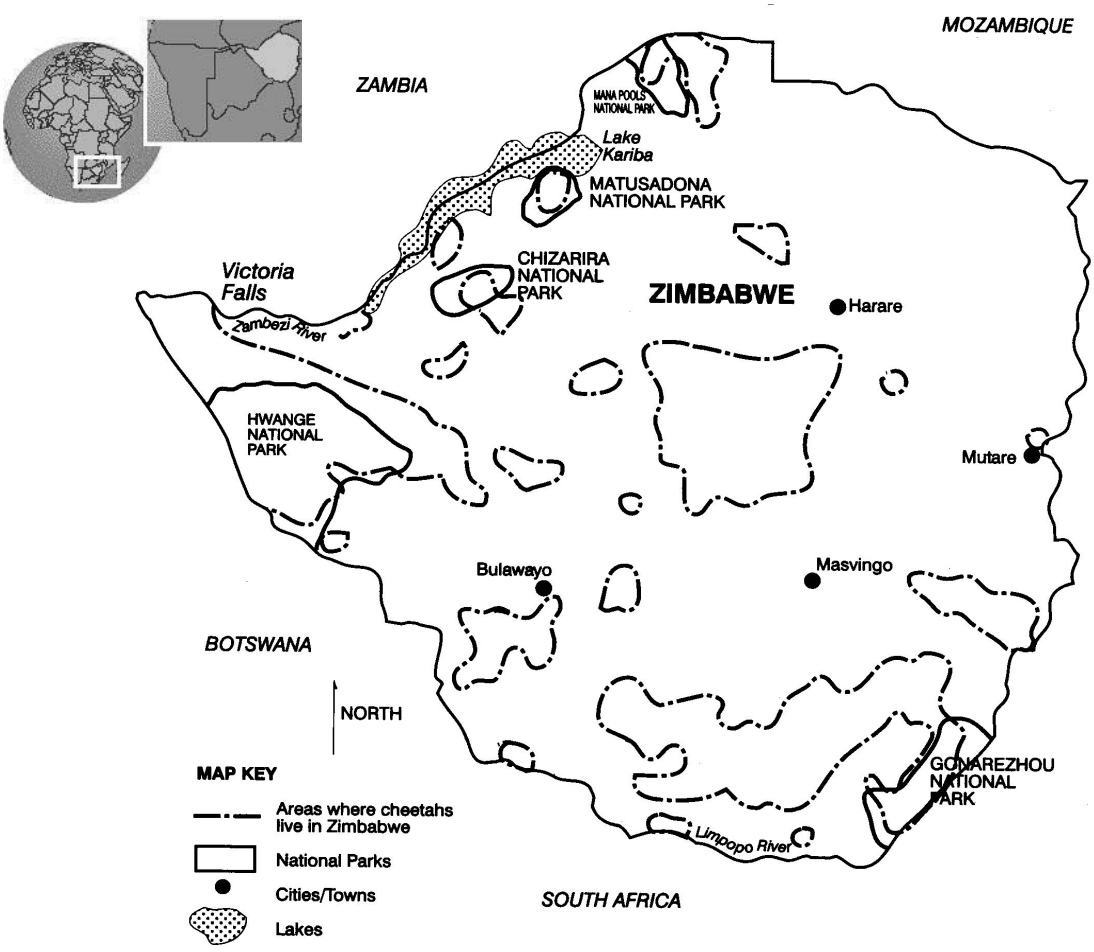


Map Questions:

1. Do cheetahs in Botswana form a geographically connected population with cheetahs in Namibia?
2. What is a delta? Why might the Okavango Delta be a good habitat for cheetahs?
3. What three towns are within the range of the cheetah in Botswana?
4. What is the largest game reserve in Botswana? Do cheetahs live there?
5. What river do cheetahs live near?

Name: _____ **Date**: _____

Instructions: Colour in the areas on the map where cheetahs live and answer the questions using the information provided on the map.



Map Questions:

1. What large sources of water do cheetah populations live near in Zimbabwe?

2. What is the largest national park in Zimbabwe? Do cheetahs live there?

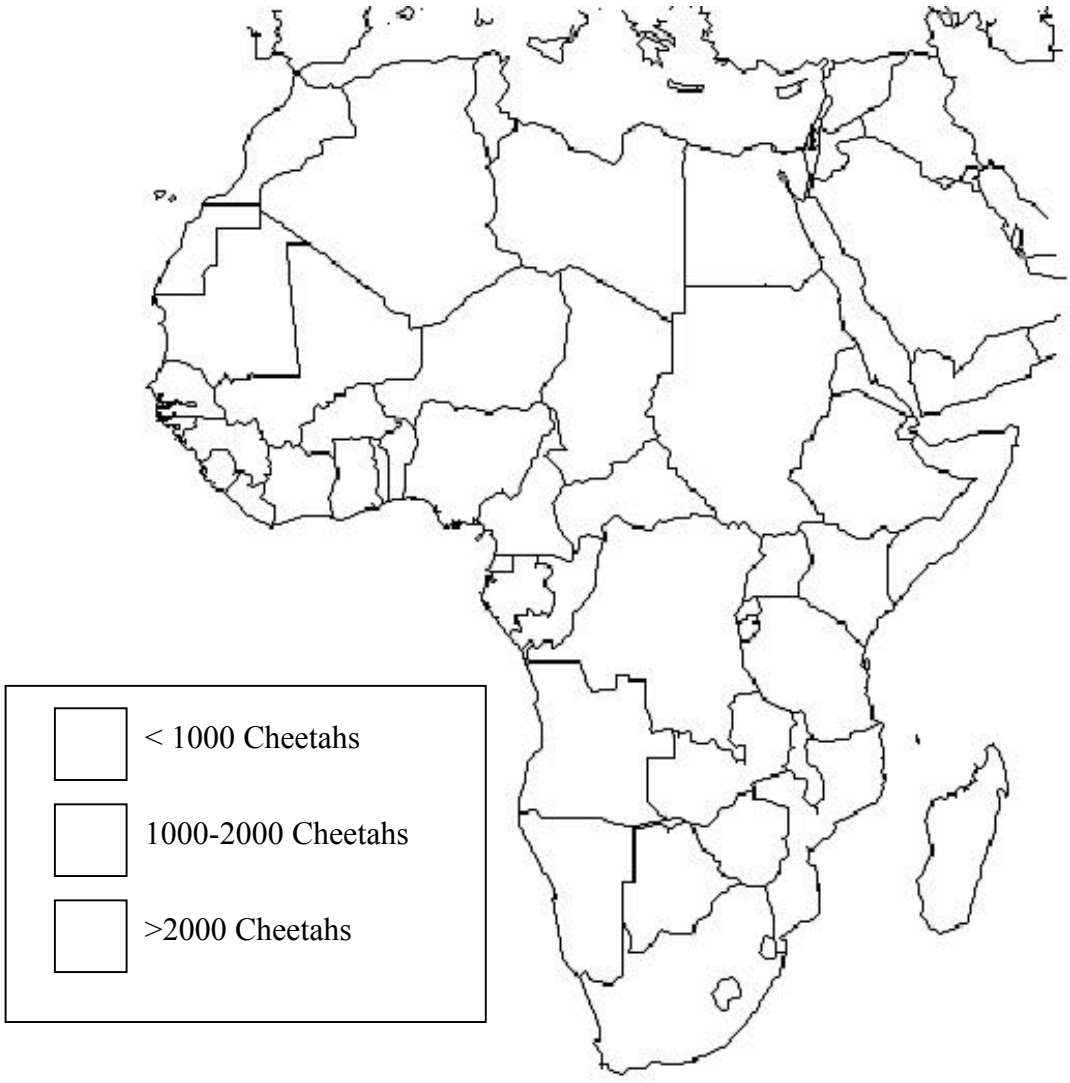
3. Are cheetah populations in Zimbabwe geographically connected to cheetah populations in Botswana?

4. Are cheetahs living outside of protected national parks in Zimbabwe? If so, why might this occur?
5. Are any of the cities listed on the map within areas where cheetahs live? If so, name the cities.

Student Page – Distribution of Cheetahs in Africa and Asia

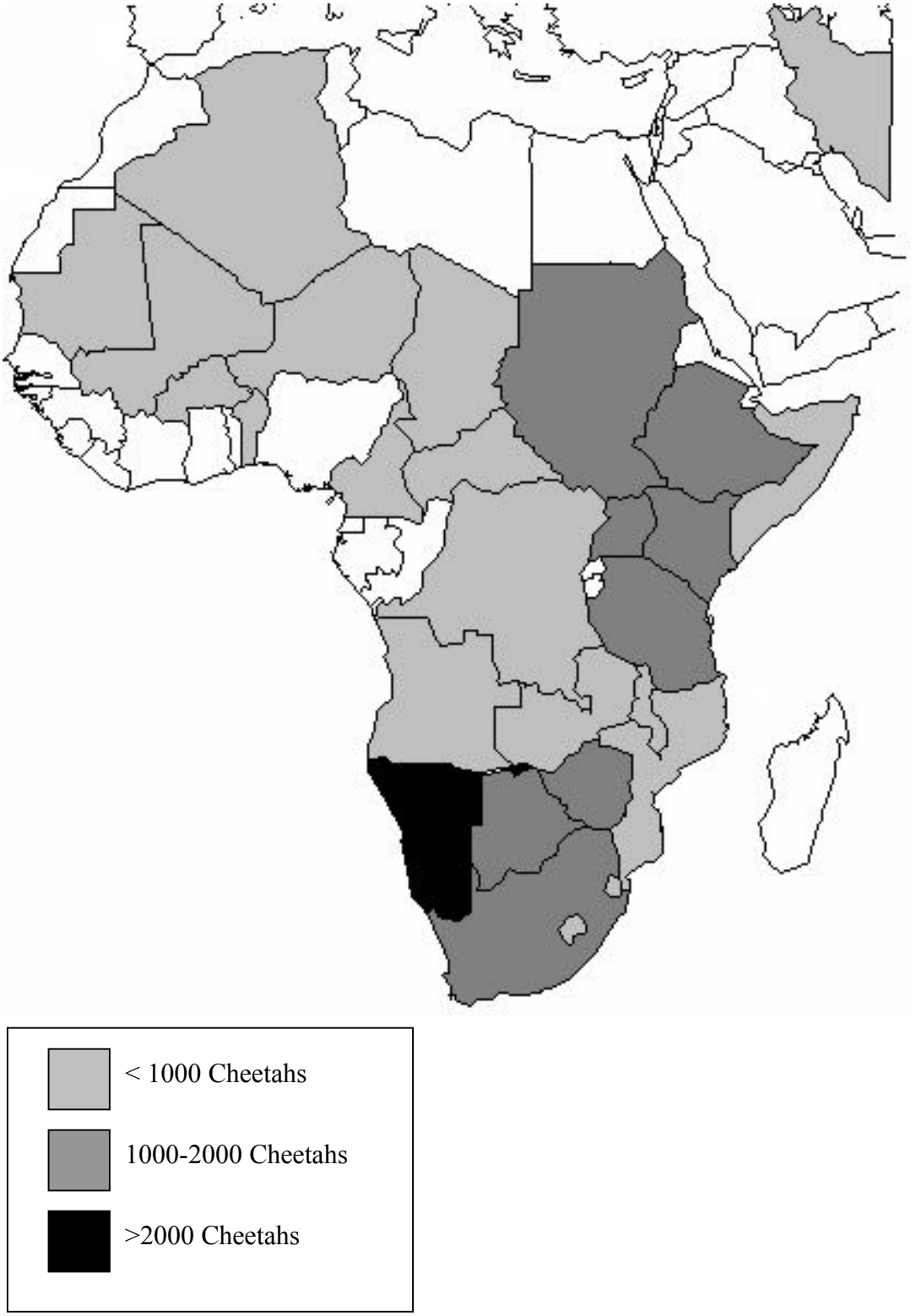
Name: _____ **Date**: _____

Instructions: This map will help show where cheetahs live today. Begin by choosing 3 colours or shades for the key below. Shade all countries with cheetah populations of < 1000 one colour, between 1000 and 2000 another, and over 2000 another. Be sure to label each country with its name.



Country	# of Cheetahs
Algeria	100
Angola	500
Benin	100
Botswana	1,500
Burkina Faso	100
Cameroon	50
Central African Republic	50
Chad	500
Democratic Rep. of Congo	300
Ethiopia	1,000
Kenya	1,500
Iran	100
Malawi	100

Country	# of Cheetahs
Malawi	100
Mali	500
Mauritania	500
Mozambique	100
Namibia	2,500
Niger	500
Somalia	300
South Africa	1,000
Sudan	1,500
Tanzania	1,500
Uganda	300
Zambia	100
Zimbabwe	1,000



Agriculture & Conservation

FARMERS & CHEETAHS: CAN THEY LIVE TOGETHER?

SUBJECT AREAS:
Agriculture, Science

DURATION/TIME:
Activity 1: 20
Activity 2: 20
Activity 3: 20

RECOMMENDED PREPARATION:
- Review the role play activity and review Appendix B Reference- 'Cheetahs and Farmers,' 'A Place for Predators', 'Conservation Efforts', 'Threats to the Cheetah's Survival' and 'Livestock Guarding Dogs' to assist with the activities and discussion.

MATERIALS NEEDED:
Activity 3:
- Student page 'Farm Management and Planning for Predators' photocopied for each learner

LOCATION:
- Classroom

KEY WORDS TO REVIEW:
Conflict
Conservation
Guard
Livestock
Management
Over-hunting
Play-trees
Technique
Wildlife

OBJECTIVE:

Learners will discuss the threats to the cheetah's survival and come up with possible livestock management solutions to the cheetah's decrease in population.

LESSON ACTIVITIES:

ACTIVITY 1:
Read and discuss a story about a livestock guarding dog.

ACTIVITY 2:
Role play/drama on livestock guarding dogs and discussion.

ACTIVITY 3:
Learn about how farmers and cheetahs can live together and complete the student page 'Farm Management and Planning for Predators.'

Learning Outcomes

This lesson is designed to begin a discussion on possible solutions to the cheetah's decrease in population. It also allows learners to discuss how cheetahs and farmers can live together.

Teaching the Lesson

Activity 1- Boots' Story

Read-a-loud to the class the Boots' Story: Guarding Goats and Saving Wildlife in Namibia. Ask the class if they know anyone who has a livestock guarding dog. Discuss with students how and why predators do not prey on livestock when there is a guard dog around. Discuss why it is important for the dog to bond with the small stock herd.

Activity 2 – Anatolian shepherd role play/drama

Ask for 10 volunteers from the class: one 'farmer', one 'cheetah' (female learner to play female cheetah with cubs), one 'Anatolian shepherd', six 'sheep', and one 'springbok.'

Call the six sheep up first and explain that they are the farmer's herd. Every time you, the teacher, says sheep they are to 'baa'. Have the learner playing the 'springbok' stand on the other side of the room as the sheep. Then call up the farmer. The farmer works long hours a day, starting early in the morning and ending late at night. This is necessary in order to be able to support their family. During this long day the farmer takes a rest from looking after the sheep in order to have lunch. The farmer then stands to one side of the room having "lunch." Before going off to lunch the farmer must count the sheep aloud. The next volunteer is designated as a female cheetah going out to find food for her cubs. The last volunteer is called aside so that the class cannot hear, tell the learner that he/she is a livestock guarding dog and when the cheetah is approaching the sheep looking for food, he/she is to go out and place itself in between the sheep and cheetah, barking and growling in order to scare off the cheetah.

With the sheep in one corner with the dog guarding, and the farmer away eating lunch, the cheetah approaches looking for food. In the far distance is a springbok, but the sheep are nearer at hand and the cheetah is very tired and very hungry. The cheetah approaches the herd, but the dog comes out barking and scares her away.

When the "dog" starts barking, the "cheetah" should get a fright, as she is not expecting this and backs away from the herd. As the teacher, you then ask her if she was frightened, and would she approach the herd again or go away looking for prey without the dog guarding it. Then call up the farmer and ask if they had a good lunch and while they were away did he lose any of the sheep. Have the farmer recount them out aloud. Ask the class how farmers would feel about cheetahs if they were not a livestock problem.

DISCUSSION:

Lead this role-play into a discussion on how CCF uses the Anatolian Shepherd as a protection for the cheetah on the Namibian farmlands. Guide the learners in a discussion/brainstorming session on other ways to protect the cheetah, both in Namibia and southern Africa, using the fact sheets and recommended reference pages in Appendix B to stimulate ideas if necessary.

Activity 3 – Student page- 'Farm Management and Planning for Predators'

In this student page learners look at common management problems faced by farmers. They then try to match management techniques that would begin to solve these problems.

Answer Key for student page – 'Farm Management and Planning for Predators'

2, 3, 4, 5, 6, 7, 8	1) Carnivores have access to domestic livestock during calving time
8, 9	2) Drought has caused the death of a large amount of wildlife on your farm and cheetahs have begun to attack small stock for food
1	3) Cheetahs are killing young hartebeest in your game farm. They have managed to get through the game fence by crawling through warthog holes in the fence
3, 7, 8	4) Farm workers have seen leopard tracks near the kraal.
2, 9	5) Cows giving birth in camps with play-trees present lose more young calves than those in camps without trees or bushes
8, 9	6) Over-hunting of wildlife on a farm to provide more grazing area for cattle has caused predators in the area to hunt livestock

Boots cried as Marie carried him away. He was afraid and no longer saw his brothers and sisters, nor did he see the little goats. Marie put him onto the seat in an old truck. "It's okay, Boots," said Marie. "You'll like it at the DeKlerc farm." The Anatolian shepherd dog had an important job to do; he had to protect the goat herd from jackals, cheetahs, and other predators. Marie drove away from the Cheetah Conservation Fund's farm in Namibia, near the town of Otjiwarongo. Boots put his head out the window and looked back, he did not see his farm anymore.

A NEW HOME FOR BOOTS

Betty eagerly watched the road, wanting to see the new puppy. A truck pulled up to the farmhouse. "They are here," shouted Betty. "Do not get too excited, Betty," said her father. "This dog is not going to be a pet. He is going to guard the goats out in the bush." Marie stepped out of the truck; she was holding ten-week-old Boots in her arms. Betty ran up to Marie and Boots jumped into Betty's arms. He had tan-colored fur covering his body with black fur around his eyes, nose, and ears. Boots stuck out his tongue and licked Betty's face and Betty, Marie and Betty's father all laughed. "He knows he is at his new home," said Marie.

BOOTS AND THE KIDS

Boots was put in a barn stall with the little kid goats. Betty and her father watched him as he sniffed and licked the kids. This was more like home. He liked goats, they were part of his family and soon he fell asleep. "Tomorrow Boots will meet the rest of the herd," said Betty's father. "Then he will stay in the pen with the kid goats for a while." The next morning, Betty watched Boots meet the big goats. His ears were flat against his head and his tail was down. He touched noses with each goat and he even licked some of them. "Don't

take him out of the pen to play with him," said Betty's father. "The goats need to be his family."

BOOTS' NEW FAMILY

A few weeks passed and every morning before school, Betty sat outside the pen. Boots came to say hello to Betty, but then he went back to his small herd. He ate with the goats. He played with the goats. He slept with the goats. They were his family. "Now, he's ready to go out with our herder John and the big herd," said Betty's father.

WATCHING OUT FOR WILDLIFE

One day, Boots saw a strange dog in the bush. He stood up and barked loudly. It was a black-backed jackal. John the herder picked up a stick and yelled, "Go away!" He shook the stick at the jackal and it ran into the bush. "Good job, Boots," said John as he patted him on the head. Boots saw other wild animals out in the dry thorn-bush savannah. There were kudu, gemsbok, hartebeest, springbok, and lots of warthogs. These animals ate grasses and leaves from the bushes and they never tried to attack his goat family. One day, Boots and John saw a large, spotted cat. Boots stood up and barked. It didn't leave. Boots moved toward it and barked again. The cheetah looked at him and it turned away and trotted into the bush.

BOOTS ON HIS OWN

A few months passed and Boots was a big, one-year-old shepherd dog. He went out alone with his goats now. Every morning, Betty saw Boots at the pen. Every afternoon, Betty saw Boots bring the goats into the pens for the night. Boots was always friendly and working hard. He had to guard his goat family. On the weekend, Betty looked at birds through her binoculars. There were many beautiful birds. She watched swallows and shrikes, mouse birds, and hornbills. She walked far away from the farmhouse. Betty looked around. "Where was she?" It was going to get dark soon and she was afraid. Leopards, brown hyenas, and caracals lived on the savannah farmland.

BOOTS SAVES THE DAY

Betty heard noises and hid behind a bush. It was Boots and the goats so Betty stood up. Boots ran over to her and touched his nose to her hand, he was telling her to follow him. Betty walked with Boots and the goats. The shepherd dog was taking her home along with his goats. Suddenly Boots stopped walking. He barked loudly as Betty saw a dark shadow creep up to the herd. The goats bleated and were frightened. Boots moved toward the shadow and gave two more deep barks. Betty held her breath. The leopard stopped. He stared at the big dog and the girl, and then he crept away into the bush. Betty let out her breath. The sun went down behind the blackthorn acacias as Betty and the goats started to walk again toward home. They were all safe—thanks to Boots! Betty told her father what had happened, he told her not to go so far from the farmhouse EVER again. Then he hugged and hugged her. "Getting that shepherd dog was the best thing we ever did for our farm," said Betty's father.

Student Page – Farm Management and Planning for Predators

Name: _____ **Date**: _____

Instructions: You are a member of the Cheetah Conservation Fund team. Find the best management technique(s) that you might use to reduce cheetah/human conflicts. Write the numbers of the management techniques you would recommend to address the farm management problems. You may use more than one number for each problem.

Farm Management Problem

_____1) Carnivores have access to domestic livestock during calving time

_____2) Drought has caused the death of a large amount of wildlife on your farm and cheetahs have begun to attack small stock for food

_____3) Cheetahs are killing young hartebeest in your game farm. They have managed to get through the game fence by crawling through warthog holes in the fence

_____4) Farm workers have seen leopard tracks near the kraal

_____5) Cows giving birth in camps with play-trees present lose more young calves than those in camps without trees or bushes.

_____6) Over-hunting of wildlife on a farm to provide more grazing area for cattle has caused predators in the area to hunt livestock

Management Techniques

1. Electrify fence and barb the lower wires to prevent warthogs from digging holes.
2. Reduce livestock losses by moving cattle posts and kraals away from play-trees to reduce contact level. Play-trees are known sent-marking locations for cheetahs and will have regular visitors.
3. Increase human presence, integrate dogs, and make small cooking fires close to kraal during calving times to keep predators away.
4. Keep a few older cows left with their horns to protect the calves.
5. Keep a larger concentration of livestock in camps during calving to help protect the young.
6. Place guarding animals with new born/young livestock, such as dogs and donkeys that are brought up with the herd are aggressive toward intruders and chase away cheetahs.
7. Rotate livestock more rapidly through camps.
8. Employ herders and large breeds of livestock guarding dogs to protect small stock.
9. Promote wildlife repopulation on farms, because farms with larger wildlife populations experience fewer predator problems.

Human-Wildlife Conflict

SUBJECT AREAS:
Science, Information & Communication

DURATION/TIME:
Activity 1: 30 minutes
Activity 2: 15 minutes
Activity 3: 45 minutes

RECOMMENDED PREPARATION:
- Appendix A-Background: 'Conservation Solutions'
- Appendix B- Reference: 'A Place for Predators', 'Cheetahs & Farmers', 'Livestock Guarding Dogs'

MATERIALS NEEDED:
Activity 1:
- Predator Profiles

Activity 2:
- A chalkboard or large paper to record discussion, markers or chalk

Activity 3:
- Photocopies of the HWC Sites 1-9, 'Livestock Predation-Kill ID Chart', and student page 'Who Killed My Goat?'

LOCATION:
Classroom or outside

KEY WORDS TO REVIEW:
Carnivore
Diurnal
Human-Wildlife Conflict
Lethal methods
Nocturnal
Nomadic
Non lethal methods
Predation
Predator
Prey

Objective:

Learners will become familiar with predator behaviour, livestock predation, and how to reduce livestock losses through non-lethal methods.

Lesson Activities:

ACTIVITY 1: Predator's Role in the ecosystem discussion.

ACTIVITY 2: Learners will define the term "Human-Wildlife Conflict". Learners will talk about lethal vs. non-lethal methods to protect livestock and their rates of success.

ACTIVITY 3: Learners will do the Livestock Predation-Kill ID activity to better understand how predators hunt, identify how to prevent livestock losses, and the job of local game rangers.

Learning Outcomes

The learners will become familiar with the term "Human-Wildlife Conflict", predator behaviour, the factors that influence livestock predation and how to reduce livestock losses. They will then apply their knowledge to themselves and brainstorm ways to reduce human-wildlife conflict.

Teaching the Lesson

Activity 1 – Predator Profiles

Introduce learners to all of the large local predators in Namibia with the Predator Profiles Sheet. Divide learners into nine small groups, giving each group a different Namibian predator to investigate. The groups must take turns presenting their predator to the class. At the chalkboard make a visual chart of the predators, comparing their similarities and differences, such as what time of day they hunt, and how they are adapted to catch their prey.

Activity 2 – Human-Wildlife Conflict

Write the term "Human-Wildlife Conflict" on the chalkboard. Have learners brainstorm what the term means by breaking down the three words and defining each. Have learners discuss what they think the term means and decide on a definition to write on the board. *The term 'human-wildlife conflict' refers to the interaction between wild animals and people and the negative impact on people and their resources, or wild animals and their habitat.* Next have learners list examples of human-wildlife conflict locally and around the word. Make certain learners know that human-wildlife conflict is a global problem and will increase as human population increases.

Activity 3 – Identifying Livestock Predation-Kill ID

Background

Researchers, scientists, and game rangers are often able to determine which predator killed an animal by looking at the clues left behind. This technique is important to help farmers learn how to protect their livestock against the specific predator that is visiting their farm. Sometimes scavengers & predators get blamed for killing an animal when in fact they are just eating what was killed by local dogs or even died of disease.

What is a Game Ranger? In Africa the prime responsibility of a game ranger is to ensure the territorial integrity and safety of the protected area under his/her management. This protected area may be a national park, private or conservancy land. Game Rangers are responsible for maintaining fence lines for protection, protecting wildlife from poaching, and investigating cases of human-wildlife conflict (HWC) and enforcing HWC mitigation techniques.

In this activity learners will act as local game rangers called to investigate a claim of Human-Wildlife Conflict. The learners "Game Rangers" will use the Livestock Predation Chart to identify if a predator killed the livestock and if so which predator was responsible. Learners will work in groups and rotate to different HWC Sites (1-9) to examine each goat and determine which predator was responsible for the kill.

The teacher should photocopy 1 set of the HWC Sites 1-9 that will be scattered throughout the classroom to make 9 different stations that the groups will rotate through and record their findings on the student page 'Who Killed My Goat?'. Also make 1 photocopy of the 'Livestock Predation Chart' and student page- 'Who Killed My Goat' per group before doing this activity.

Vocabulary

Predation- the preying of one animal on others.
Mitigation- the act of mitigating, or lessening the force or intensity of something Unpleasant such as livestock predation.

Procedure

1. Divide the class into small groups of 3 to 4 learners. Photocopy and hand each group the 'Livestock Predation Chart' and student page 'Who Killed My Goat?'.
2. Have the groups rotate each HWC Sites 1-9 and use the 'Livestock Predation Chart' to answer and record their findings on the student page 'Who Killed My Goat?'
3. Once the class has rotated through all of the sites, bring all of the learners together for discussion.
4. Go over the learners' answers on the student page 'Who Killed My Goat?'. Ask learners which predator they picked for each station and why? Make sure to go over the correct answers with the class and make sure learners understand why and how each predator kills in a different way.

Questions

1. How would it be helpful for a farmer to be able to identify which predator is killing his/her small stock (sheep & goats)?
   If a farmer knows which predator is killing livestock, they can focus their efforts to protect against just that predator. It can save them time and money and help them offer more effective protection to their livestock.

2. What are some non-lethal mitigation techniques farmers could use to protect livestock against each of the predators in this activity?
   Look at the Predator Profiles from Activity 1 for non-lethal depredation techniques for each of the predators.

3. Why should farmers try to live with predators in the same area that they are farming?
   Many predators like cheetahs live on farmland because they get pushed out of protected areas by competition and lack of space to find all their needed resources. Without farmland for wildlife to live on, most species would go extinct. We need predators to maintain healthy ecosystems by maintaining the health of prey populations and sustaining biodiversity.

Answer Key to HWC Sites & student page- 'Who Killed My Goat?'

1. Caracal
2. Wild Dogs
3. Domestic Dog
4. Cheetah
5. Leopard
6. Spotted Hyaena
7. Jackal
8. Lion
9. Brown Hyaena

Activity 1- Predator Profiles:

Domestic Dog (*Canis lupus familiaris*):

Physical Description: Dogs are the domesticated descendants of wolves. Varies widely in size, build, and colour.

Habitat: Urban areas

Food: Omnivore, eating meat, grains, and fruits. Should be fed commercial dog food pellets.

Behavior: Dogs have a unique relationship with humans and contribute to human society in many ways. Long valued as guards and rescuers, they now also work as guides, therapy, and as companion dogs.

Hunting Behavior: Often hunting in a small group, biting at the animal all over the body. Often not effective hunters and will kill by tiring and injuring the prey. Many domestic dogs cannot properly open a carcass to eat the meat. Many pet dogs also bury bones or favorite toys for future use, just as their wild relatives sometimes bury a kill to secure the meat for later feasts.

Effective Predator Mitigation Techniques: Use of a herder with small stock and bringing your small stock in at night to a kraal or boma. Farmers can use the smell of smoke and fire, barking dogs and the presents of people to deter predators from livestock.

Caracal (*Caracal caracal*):

Physical Description: Coat colour varies from pale reddish-fawn to a rich orange-red. Long, pointed ears with tufts of long, black hair at the tips. Cat's back legs are longer than its front legs. The face is marked with black and white patches around the eyes and mouth. Shoulder height: 40-45 cm, Mass: 7-19 kg.

Habitat: Semi-desert to savannah woodland; hilly country to coastal forests.

Food: Carnivore, eating mainly small to medium sized mammals, ranging from mice to small antelope. It also catches birds and reptiles. In some small-stock farming areas caracals can cause a problem by preying on very young sheep and goats.

Behavior: Mainly nocturnal (active at night). Solitary, except when mating or females with kittens.

Hunting Behavior: Stalks prey as close as possible and then pounces or short run. Also has been know to take small prey up into a tree to eat and save for later.

Effective Predator Mitigation Techniques: Bringing in your small stock at night to a kraal or boma. High fences and no vegetation cover or trees near the fences to kraal or boma. Having people, lights, fire, or barking dogs near kraal or boma. Livestock guarding dogs out with grazing small stock and also in kraal or boma at night.

Black-backed Jackal (*Canis mesomelas*):

Physical Description: Dog-like appearance with dark, white-flecked "saddle" on the back. Fairly large, pointed ears and black-bushy tail.

Habitat: Found throughout with a wide habitat tolerance, but prefers drier areas.

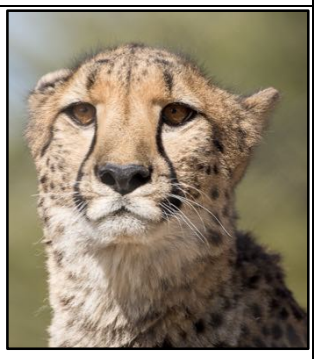
Food: Omnivore, eating a wide range of foods from young antelope, rodents, hares, birds, reptiles, and insects to fruits and berries. They are good hunters but also feed on carrion (dead animals) and because of this are considered scavengers.

Behavior: Mainly nocturnal (active at night), but can frequently be seen in the early morning or late afternoon. Usually seen in pairs (male & female) or in family groups. Pairs form long-term pair-bonds, with both male and female marking and defending a territory.

Hunting Behavior: They hunt by stalking prey as close as possible and then pounces or a short run, usually at night. They are also scavengers and will eat left-over animal carcasses when available.

Effective Predator Mitigation Techniques: Having a livestock guarding dog with small stock while out grazing and in the kraal or boma at night. No vegetation cover near the kraal or boma fences. Protecting sheep and goats that are about to give birth and the very young lambs and kids. Farmers can use the smell of smoke and fire, barking dogs, lights, and presents of people to deter predators from livestock.

Cheetah (*Acinonyx jubatus*):



Physical Description: Tall and slender cat, with long legs and a small, rounded head. Coat colour is off-white to pale-fawn and is dotted with black rounded spots. Black lines (tear marks) runs from the inner corner of each eye to the corner of the mouth. The long tail is black-ringed. The cheetah is the only cat that does not have fully retractable claws and the impressions of the claws can be seen in their tracks.

Habitat: Found throughout Namibia but prefer open savannah and light woodlands.

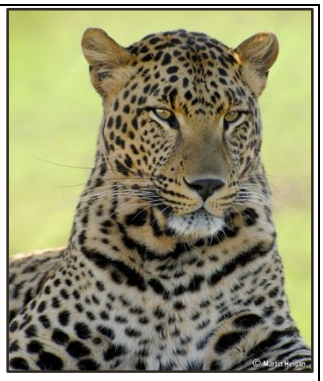
Food: Carnivore, eating small to medium sized mammals up to a mass of +-60kg. Antelope are their main prey but they can also hunt birds and hares.

Behavior: Females are solitary unless mating or raising cubs. Females raise cubs up to ~ 18-24 months of age. Males can form groups with their brothers call coalitions.

Hunting Behavior: Stalks prey as close as possible and then runs at great speed (up to 112kph) to catch prey. Trips prey using their sharp dew claws, then drags the animal to the ground where it kills prey by suffocation on the throat. Cheetahs are diurnal (day time) hunters, often hunting early morning and late afternoon.

Effective Predator Mitigation Techniques: The use of a human small stock herder and/or a livestock guarding dog for protection of herd during the daytime hours and kraal at night. Farmers can use the smell of smoke, fire, barking dogs, and the presents of people to deter predators from livestock.

Leopard (*Panthera pardus*):



Physical Description: Large, muscular cat with rosette (flower petal design) spots on back, and solid black dots everywhere else on the coat. The base colour of the coat varies from almost white to orange. The tail is about ½ of the total body length with a white tip.

Habitat: Wide habitat tolerance, from high mountains to coastal plains, from low to high rainfall areas. Found throughout Africa, the Middle East, and through Asia into China.

Food: Carnivore, eating a broad diet ranging from rodents and birds to medium to large sized antelope.

Behavior: Mostly nocturnal (active at night). Fully retractable claws that are sharp for climbing trees and capturing prey.

Hunting Behavior: Stalks prey from the ground or tree day or night. Once the prey is close enough they will pounce on the animal and either kill by biting on the back of the neck and snapping it or by biting on the throat and suffocating the animal. Surplus food may be stored up in a tree or under vegetation.

Effective Predator Mitigation Techniques: Bringing in your small stock & young cattle at night to a kraal or boma with adult livestock for added protection. No vegetation cover or trees near kraal or boma fences. Having people, lights, fire, or barking dogs by the kraal or bomas at night. Monitoring when livestock are to give birth and keeping them safe in the kraal for birthing. Keeping horns on some or all livestock for them to better protect themselves while out in the bush. Using a herder and/or livestock guarding dog to protect small stock while out grazing and at night in the kraal or boma.

Brown Hyaena (*Parahyaena brunnea*):

Physical Description: The brown hyaena is higher at the shoulders than at the hindquarters; shoulders and chest are heavily built. The body is covered in a long, brown, shaggy coat. The coat colour varies from light to dark brown. Ear are long, upright and pointed.

Habitat: Are found throughout southern Africa, having a wide habitat tolerance

Food: Carnivore, mainly scavenging on carrion (dead animals), but they also eat a wide variety of small vertebrates, insects, and fruits. Hunting and killing of prey is very rare. Surplus food (food cashing) may be hidden in holes or under vegetation.

Behavior: Mainly nocturnal (active at night) and solitary. Brown Hyaenas have an excellent sense of smell and can smell a rotting carcass up to 3km away. They live as part of a clan structure but tend to forage alone. They are not vocal like Spotted Hyaenas.

Hunting Behavior: Do more scavenging than hunting and mainly forage at night.

Effective Predator Mitigation Techniques: Bringing your small stock in at night into a kraal or boma. Making sure all small stock is healthy when out in the bush and protecting small stock about to give birth and very young lambs and kids.

Spotted Hyaena (Crocuta crocuta):

Physical Description: Heavily built shoulders and chest that is higher than hindquarters. Large head and prominent rounded ears with a black snout. Coat is usually fawn-yellow to grey-fawn with scattering of dark-brown spots and blotches.

Habitat: Open country like grasslands and savannah, but also rocky areas and open woodland. Rare to find on farmlands and are limited to protected areas due to heavy persecution by farmers.

Food: Carnivore, diet ranges from small antelope to large game such as zebras, wildebeest and giraffe. Know also as scavengers for eating carrion (dead animals) when available and will chase other predators from their kills.

Behavior: Usually live in family groups or "clans" led by a female. Clan members share a territory and den and may number from 3 to 15 or more. Mainly nocturnal (active at night) but also seen during the day. Very vocal with whoops, groans, grunts, whines, yells, and giggles.

Hunting Behavior: Hunts alone and with other clan members, in small groups, or in a pack, depending on the type of food taken.

Effective Predator Mitigation Techniques: Bringing your cattle in at night into a kraal or boma. Clear all vegetation cover from around the kraal or boma. Keeping horns on cattle so they can protect themselves. Farmers can use the smell of smoke, fire, barking dogs, lights, and the presents of people to deter predators from livestock.

Lion (*Panthera leo*):

Physical Description: Largest of the African cats. The males have brown-black long manes (long hair) on head and neck. Coat colour ranges from reddish-grey to a pale tawny-yellow. Faint spots are present on cubs, but these fade by adulthood.

Habitat: Wide habitat tolerance, from desert to woodland or open savannah. Rare to find on farmlands and are limited to protected areas due to heavy persecution by farmers.

Food: Carnivore, mainly hunt medium to large sized mammals, particularly antelope and game. They also scavenge, and often chase other predators from their kills.

Behavior: The most social member of the cat family, living in prides of 3-30 individuals. Some prides hold territories and some are nomadic, following the movement of prey. Most active at night and during the cooler parts of the day.

Hunting Behavior: The females do most of the hunting, usually with the help of other females in the pride. Lions stalk their prey and get as close as they can to it, then pounce or a quick run and then jumps onto of the animal's back to bring it down to the ground.

Effective Predator Mitigation Techniques: Bringing your cattle in at night into a kraal or boma. Clear all vegetation cover from around the kraal or boma. Keeping horns on cattle so they can protect themselves. Farmers can use the smell of smoke and fire, barking dogs, lights, and presents of people to deter predators from livestock.

A**frican Wild Dog (*Lycaon pictus*):**

Physical Description: They have large, rounded ears, long legs, and a bushy, white-tipped tail. Their coat is irregularly blotched with black, white, brown, and yellowish-brown. Snout is black, with black continuing as a line from the snout to between the ears.

Habitat: They rely heavily on their eyesight for hunting, so they prefer open country and bush for cover to surprise and disorient prey.

Food: Carnivore, eating a wide range of mammals, ranging in size from small to large antelope. They also eat rodents, hares, and birds.

Behavior: Social and live in packs, usually numbering 5-25 individuals. The pack will raise young together as a group.

Hunting Behavior: Mainly diurnal (active during the day), most of the hunting taking place in the cooler morning or late afternoon hours. Hunting is done as a group by the whole pack, which moves slowly towards the prey. Wild Dogs are known as endurance runners that will single out prey and chase the prey to the point of exhaustion until caught. Smaller prey may be pulled down immediately, but larger prey is bitten and torn while running until it weakens from shock or loss of blood and they can be overpowered.

Effective Predator Mitigation Techniques: Protecting small stock and cattle during the day with a herder and/or livestock guarding dog and kraaling animals at night in open areas with guard dog. Keeping cattle with horns to protect themselves. Farmers can use the smell of smoke, fire, barking dogs, and presents of people to deter predators from livestock.

Livestock Predation Chart

	Species	Tracks Front/Back	Prey Location	Livestock Prey	Claw Marks	Stomach	Bite Marks	Parts Eaten	Bones Eaten	Other Evidence
A	**Domestic Dog** Hond		Anywhere	Young or small goats/sheep	none	partially eaten	Bite marks can be found all over the body	Messy & not much eaten	none	Wool, fur, skin & remains scattered. No marks on throat.
B	**Caracal** Rooikat	5.5 cm	Under tree or In shade	Young or small goats/sheep		None eaten	Bite marks on the back of neck for small prey or throat for large prey	Underside, belly, & rump	Chewed on, not eaten	Wool, fur pulled out & scattered. Does not eat skin or guts. Red hair on prey skin.
C	**Black-backed Jackal** Rooi Jackkals	3.5 cm	Anywhere	Young or small goats/sheep	none	Partially eaten	Bite marks on the throat and rump	Underside, belly, & legs	none	Face & ears chewed or torn. Front legs of larger prey may be separated from carcass. Meat taken leaving skin flap.
D	**Cheetah** Jagdluiperd	7-8 cm	Under tree or In shade	Young or small goat/sheep up to 6 month cow		None eaten	Bite marks on the throat	Underside, rump, & makes a bowl in the body cavity	Chewed on, not eaten	Does not eat skin or guts
E	**Leopard** Luiperd	12 cm	In tree or hidden well in shade	Young or small goat/sheep up to 9 month cow		None eaten	Bite marks on the back of neck/skull Or for large prey on throat	Underside	Chewed on, not eaten	Wool, fur pulled out & scattered. Does not eat skin or guts
F	**Brown Hyaena** Bruin Hiëna	7 cm	Under tree or In shade	Mainly scavenges sick or already dead animals	none	Partially eaten	None obvious or the head is crushed	Head, underside, & rump	Eats and breaks large bones	Wool, fur, skin and remains scattered. Bites on rump. Only crushed bones, wool, hooves, blood and guts remain.
G	**Spotted Hyaena** Gevlekte Hiëna	8 cm	Anywhere	Mainly young to adult cows	none	Partially eaten	None obvious	Everything eaten	Eats and breaks large bones	Messy carcass remains. With a large clan, no evidence remains.
H	**Lion** Leeu	11cm	Anywhere	Mainly young to adult cows	Claw marks on belly	Fully eaten	Bite marks on face covering the nose & mouth	Everything eaten	Chewed on, not eaten	Massive tissue damage
I	African Wild Dog Wilde Hond	6-6.5 cm	Anywhere	Mainly young to adult cows	none	Fully eaten	Bite marks at the stomach and underside	Everything eaten & scattered	Spread around	Messy carcass remains. With a large pack, no evidence remains.

Student Page- Who Killed My Goat?

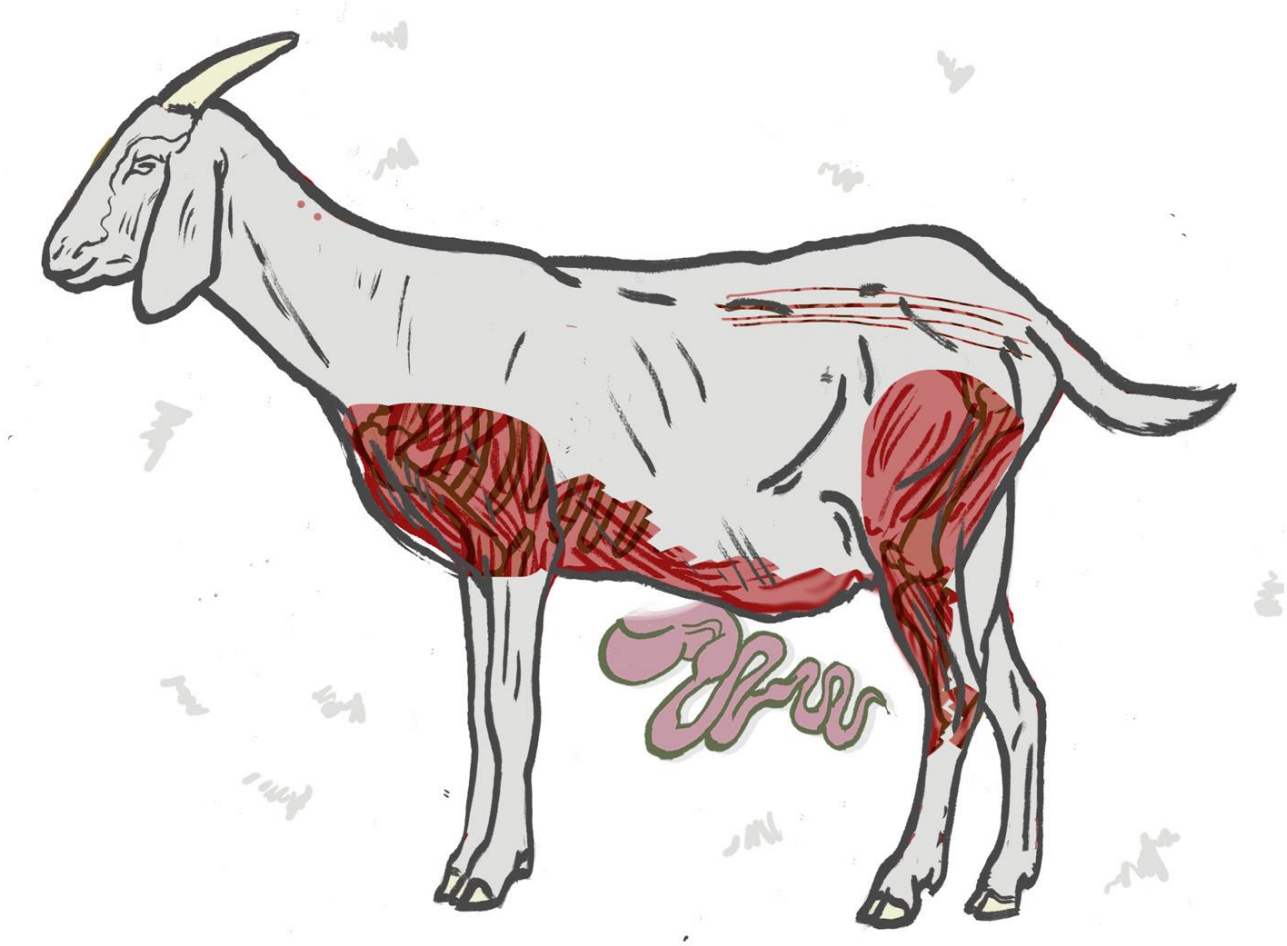
Name:_____ **Date:**_____

Instructions: Work in small groups of 3 to 4 learners. Your group represents a local game ranger tasked with visiting each Human-Wildlife Conflict (HWC) Site to verify if it was a predator that killed each of the livestock and which predator was responsible. Record your findings from each HWC Sites in the table below. Make sure to keep your group's answers to yourself and everyone will have a chance to share which predator they think killed each goat at the end of the activity.

HWC Site #	**Signs of Predation** (Where are the bite marks located? Are there claw marks on the body? Etc…)	**Who Killed Your Goat?** (Name the predator responsible)
1		
2		
3		
4		
5		
6		
7		
8		
9		

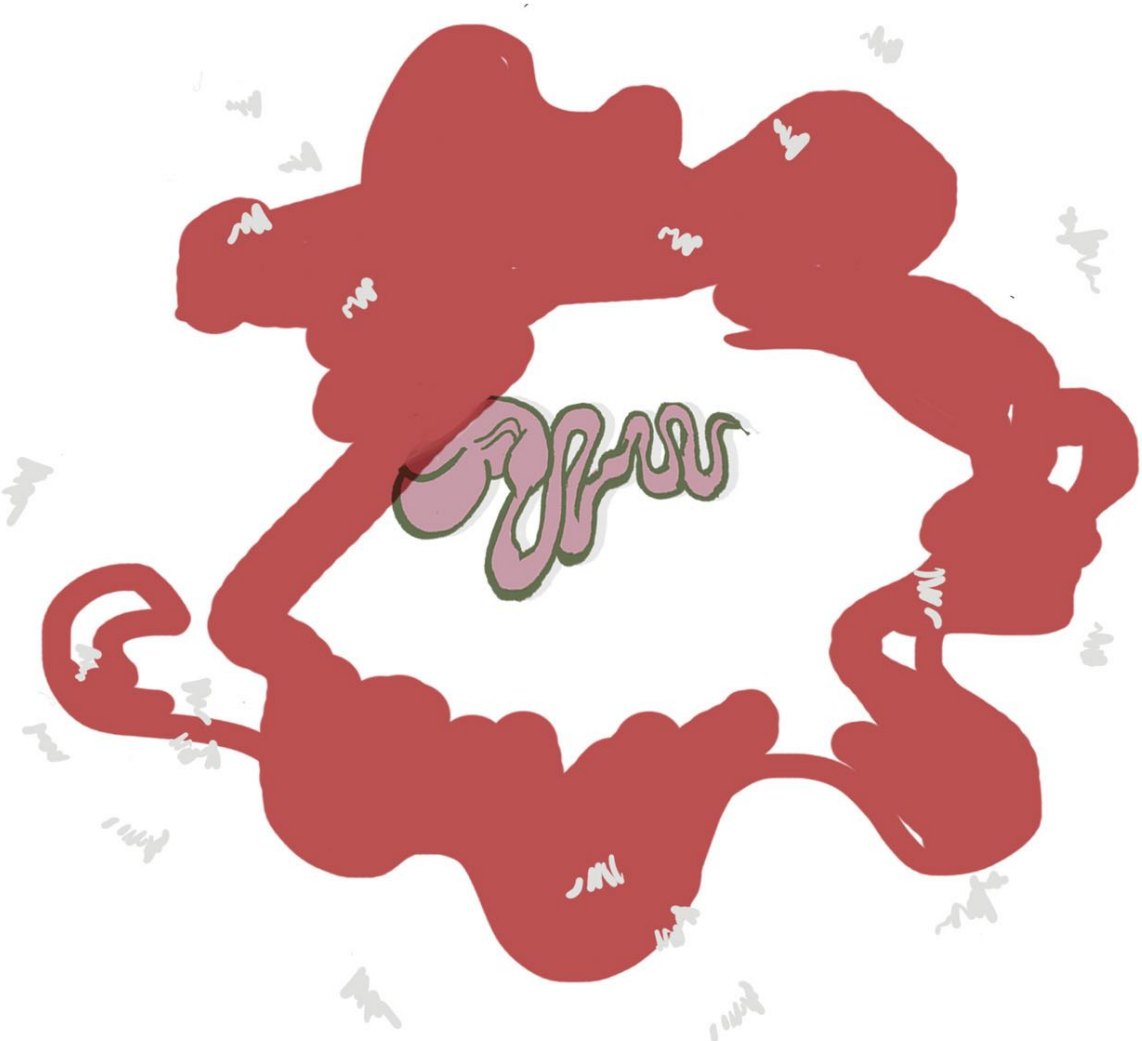
HWC Site # 1

As you approach the site you notice the dead goat has been dragged about 1 meter under some trees. The farmer thinks the small goat was attacked near the end of the day. You notice small bite marks on the back of the neck and small claw marks (4 nails per paw) on the back and sides of the goat. You observe that fur has been pulled from the goat and the stomach and guts remain untouched. You also fine a few reddish hairs on the goat.



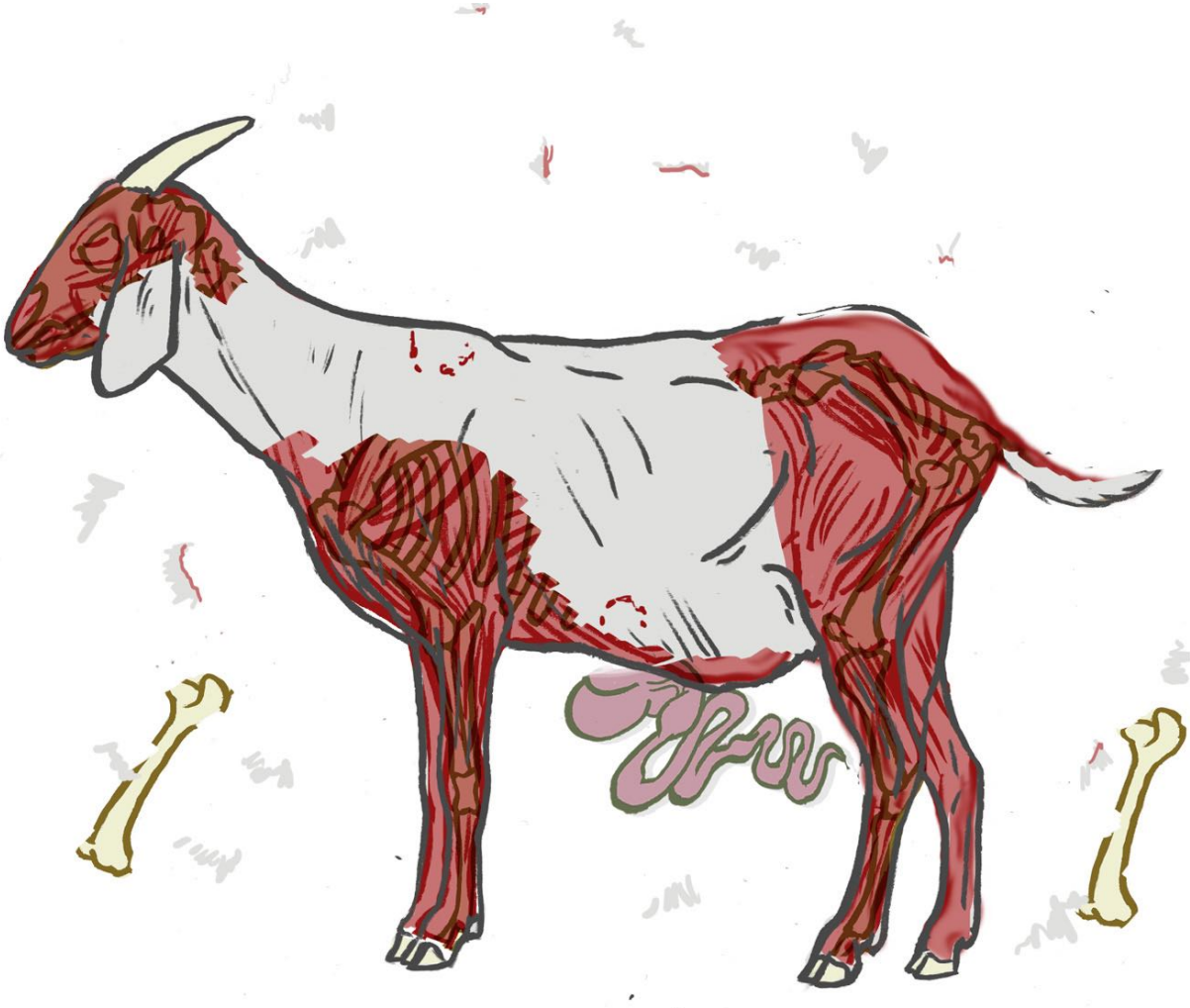
HWC Site # 2

When you approach the site there is not much left of the cow to look at. You find lots of tracks and scattered remains of some bones, skin, intestines, and blood. The farmer believes that this happened during the day because he brings his cows into a kraal at night and that is when he noticed the missing cow.



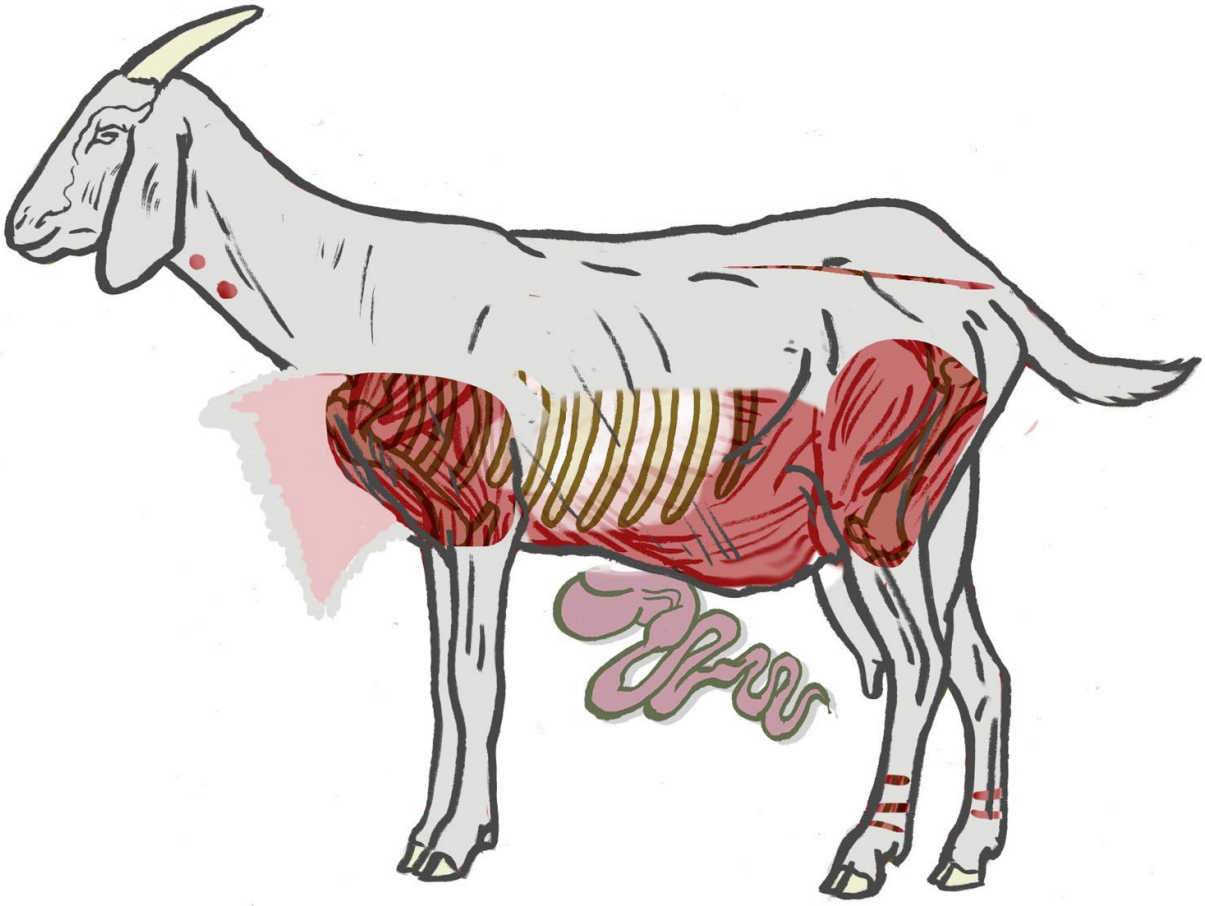
HWC Site # 3

The site is located on communal land not far from town. The goat does not look like it was in good health before it was killed. You notice bite marks all over the body but no killing bites to the neck or throat. You see that some of the goat was eaten such as the easy or tender areas including part of the stomach, while a lot of the animal was left uneaten.



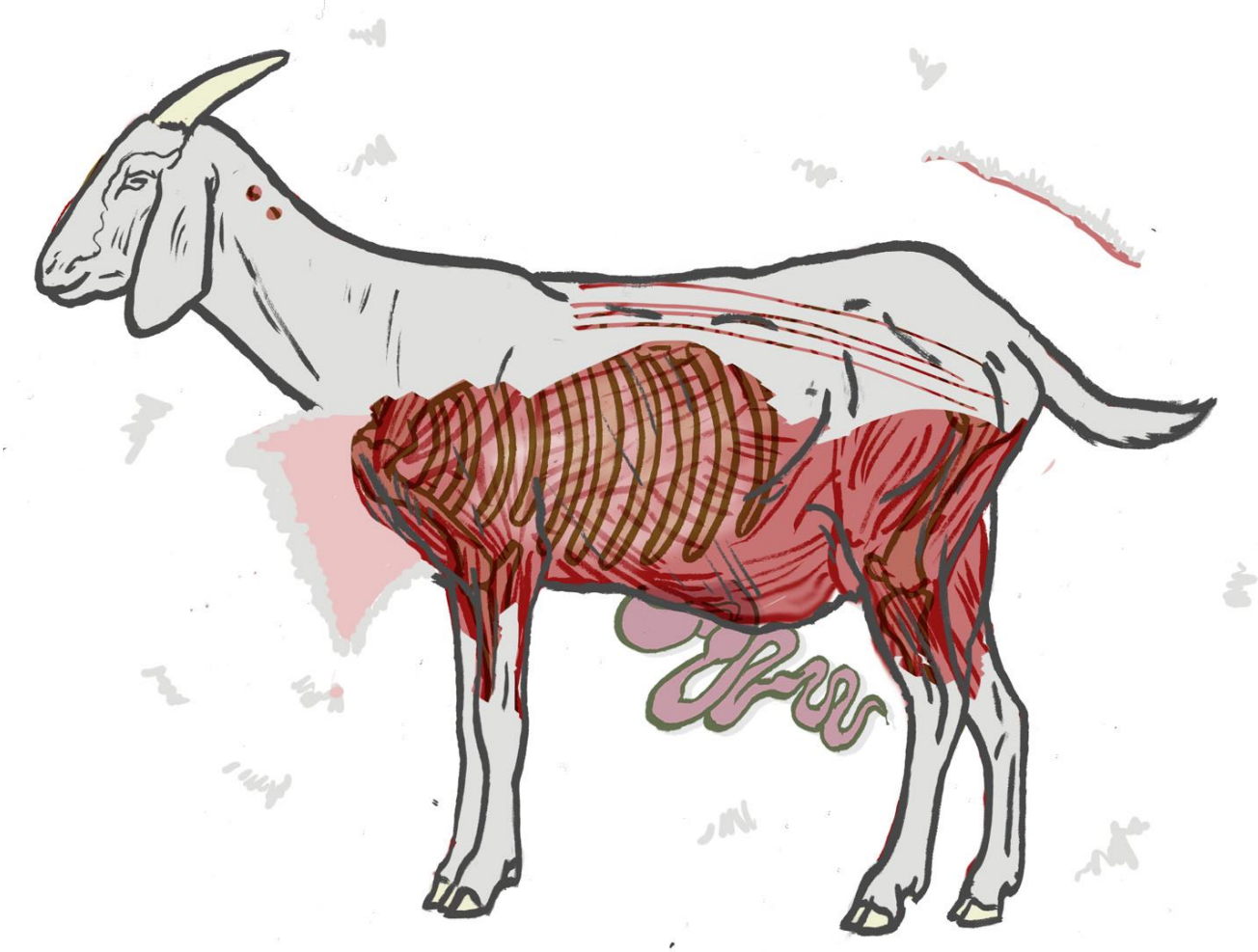
HWC Site # 4

As you approach the site you see the goat has been dragged about 1 meter under the shade of a tree. You notice bite marks on the throat and 1 claw mark along each side of the back. You also see slash marks on the goat's ankles. Most of the underside and rump of the goat has been eaten and a bowl has been formed to eat from the body cavity. The stomach and guts remain untouched.



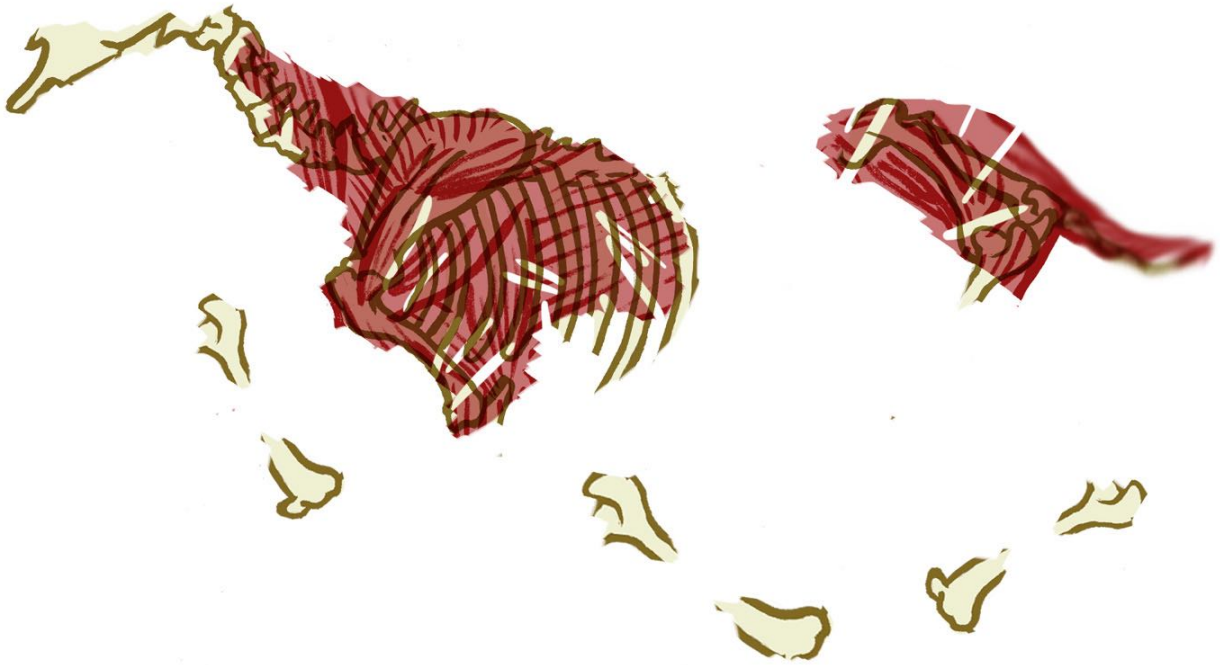
HWC Site # 5

You find a large goat's remains up in a tree. You notice bite marks on the back of the goat's neck and claw marks (4 nails per paw) all over the animal's back. You see that fur has been pulled and removed from the goat. The stomach and intestines lay untouched at the base of the tree.



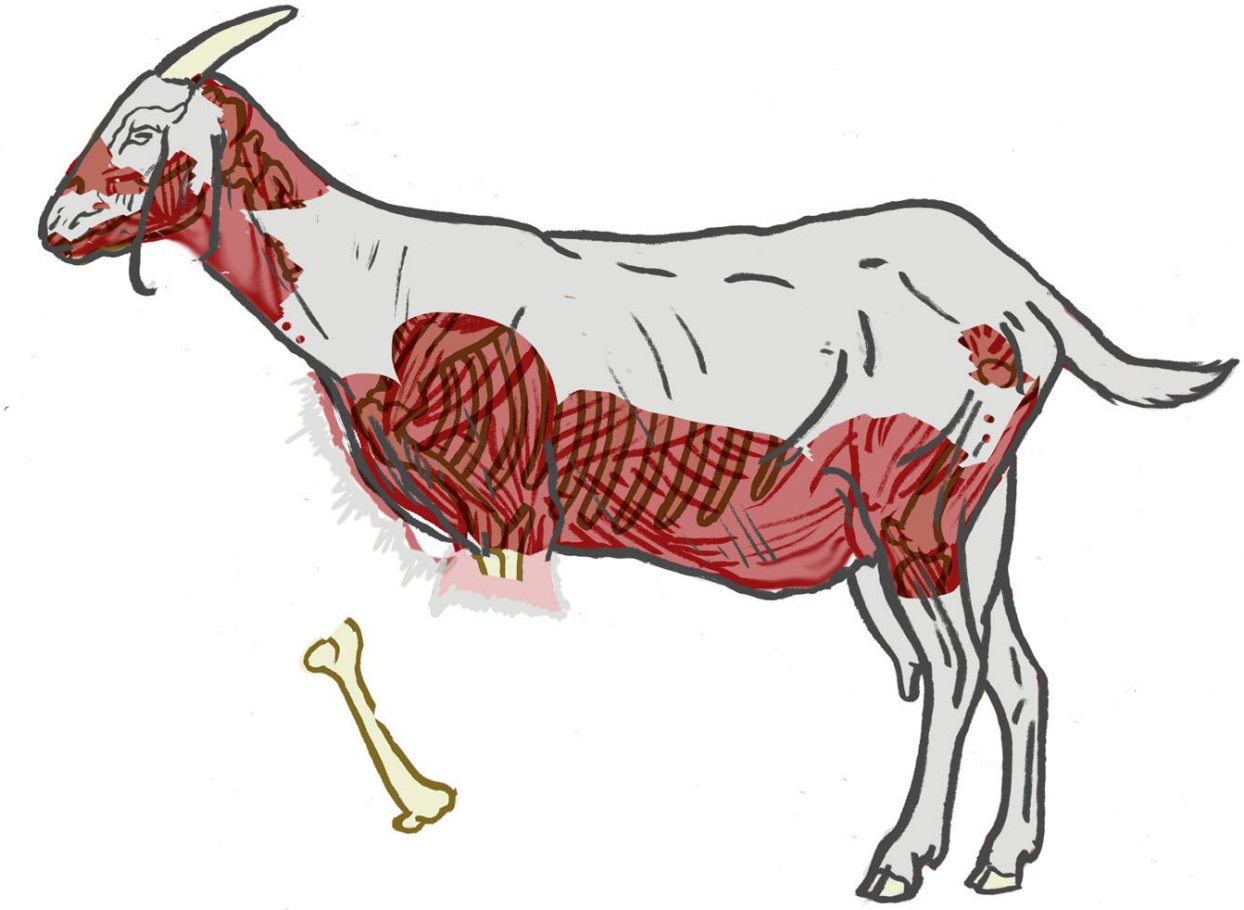
HWC Site # 6

You are at a site that borders a National Park in Namibia. You find only a few remains of a large dead cow. You notice that the bones have been chewed and some eaten. You find a few large tracks with nail marks on the ground near the remains.



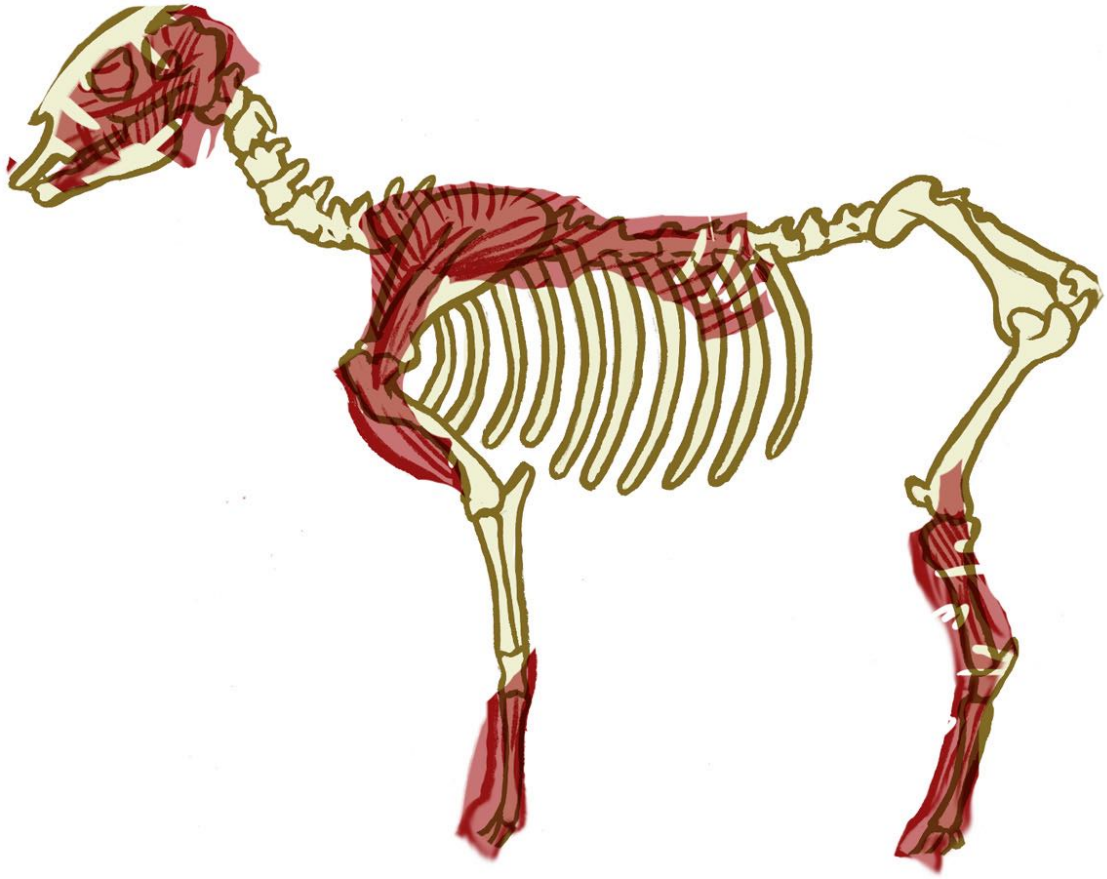
HWC Site # 7

You find a young goat with bite marks on the throat and another set of bite marks near the rump. You notice that the face and ears of the goat have been chewed on and there are flaps of skin left where meat was taken. There are also 2 whole legs missing from the site.



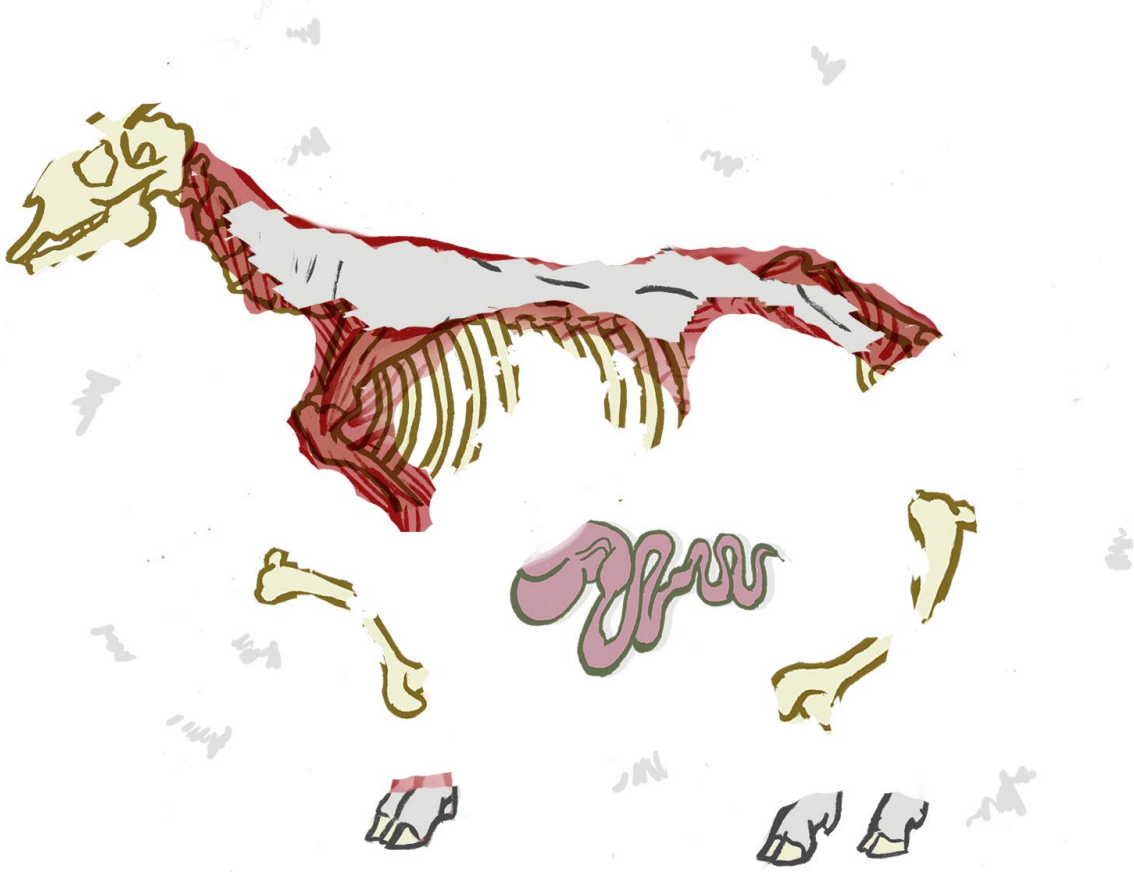
HWC Site # 8

You are at a site that borders a National Park in Namibia. You do not find much left of the large goat. You do find the bones that have been chewed on but not eaten and massive tissue damage. You notice that the stomach, intestines, and organs have all been eaten. You also find very large tracks with no nail marks in the sand near the remains.



HWC Site #9

At the site you notice that the dead goat is very small and looks to be a new born. You examine the hooves of the goat and still find the protective coating the baby was born with, meaning the goat kid was stillborn. The farmer confirms that one of his goats was pregnant but seems to have had the baby in the bush earlier than expected. The dead goat is very small and its skull has been crushed and partially eaten. Not much remains but some crushed bones, the hooves, and some intestines.



RESETTLED FARM PLANNING

SUBJECT AREAS:
Agriculture, Science, Social Studies

DURATION/TIME:
Activity 1: 3-5 class periods

RECOMMENDED PREPARATION:
- Read Appendix A-Background: 'Conservation Solutions' and Appendix B-Reference: 'Livestock Guarding Dogs'
- Photocopy student page 'Resettled Farm'

MATERIALS NEEDED:
- Photocopy student page 'Resettled Farm'

LOCATION:
Classroom

KEY WORDS TO REVIEW:
Abiotic
Biotic
Browsing- eating leaves, twigs, and grass
Bush encroachment
Ecosystem
Grazing-eating mainly grasses
Human-wildlife conflict
Kraal
Overgrazing

OBJECTIVE:

Learners will examine and reflect on factors that must be considered when planning and managing land.

LESSON ACTIVITIES:

ACTIVITY 1:
Learners will make decisions on how to manage a 600-hectare plot of land.

Learning Outcomes

Learners will recognize the many factors that must be considered to manage land in a manner that considers both economic and ecology impacts.

Teaching the Lesson

Activity 1- Planning and Developing a Resettled Farm

All citizens of a country are responsible for making wise decisions about how to use their land and resources. It is important to think about both the biotic (living) and abiotic (non-living) parts of the ecosystem and how humans can have both positive (good) and negative (bad) impacts on the ecosystem.

In this lesson you will make decisions on how to manage a piece of land. The government has granted you a resettled farm of 600 hectares.
The maps provided show the resettled farmland. The map is divided into 30 squares, each square representing 20 hectares. The land has some bush encroachment and one bore hole is located in the northeast corner. Your job is to make decisions on how you will use this land and its resources. You need to strike a balance between maximizing the money you can make from your land and the health of the ecosystem.

Name:_____ **Date:**_____

Instructions: You will need to consider the factors listed below to develop a plan for your resettled farmland. Study the map of the land and make decisions, then show them neatly on the maps for the two years indicated. Year 1 is the year you obtain the land. Year 2 will show changes you have made to the farmland and changes in the amount of livestock you have on the land. Be sure to label areas as you choose them for different uses

1. You will develop a model farm over the course of 2 years.
2. Year 1: Add in the required elements to the farmland and indicate those on Year 1 Map. Include in Year 1 Map:
    a. Location of house and area around house including gardens if any
    b. Location of kraal
    c. Grazing land
    d. Land for crops
    e. Fences: include a key to indicate the type of fences (cattle, game or both)
    f. Number of sheep, goats and cattle on the farm
    g. Wildlife on the land
3. Year 2: Add in the required elements to the farm and indicate those on Year 2 Map. Include in Year 2 Map:
    a. Location of house and area around house including gardens if any
    b. Location of kraal
    c. Additional pens or holding areas for animals
    d. Bore holes
    e. Grazing land
    f. Land for crops
    g. Fence: include a key to indicate the type of fences (cattle, game or both)
    h. Number of sheep, goats and cattle on the farm (consider reproduction and sale of livestock)
    i. Wildlife on land
    j. Bush clearing areas if any

Important Factors to Consider

1. Acacia and other bush can be cleared from the land to prevent bush encroachment and increase grazing area.
    a. It is also commonly believed that bush encroachment can be caused by a combination of factors which include overstocking and overgrazing, drought, fire suppression, and restricted movement of large herbivores like elephant and rhino.
2. You currently own 50 goats. You have to decide if you will purchase more goats or if you also want to have cattle or sheep.
    a. In central Namibia each mature sheep/goat requires around $\pm$5 hectares of land for grazing/browsing

   b. Each cow requires ± 20 hectares for grazing
   c. In the absence of regular rainfall farmers can never depend on a reliable supply of grass, as would be needed for cattle. You may need to supplement feed with hay and grain.

3. There is only one bore hole on the land. You will need to decide if this will provide enough water for your livestock and for wildlife.
   a. Farm animals should drink at least once each day and their foraging is thus restricted to feeding areas within walking distance of water points.
   b. A mature sheep/goat requires 3-5 liters of water per day. A mature sheep/goat can travel 2km per day for water. A mature cow required 40-60 liters of water per day and can travel 2km per day for water.

4. You would like to have wild game on the land as it is a source of food for your family and can keep predators from eating your livestock. Decide if the game will pass freely in and out of the land or if you will ask the government to be allowed to build game fences to keep wild game out.

5. It is possible to raise some crops on the land. Decide if you will plant crops.
   a. Corn (maize), wheat, and cotton grow fairly well some years in Namibia

6. You are required to build a house for you and your family. Indicate on the map where you will place your house and how much land will be set aside for the family living space.
   a. You can have a garden and raise some food for your family. Decide if you will have a garden, where it will be placed and how much land will be needed.
   b. Homesteads and kraals are sited at water sources, which are generally boreholes.

7. The government requires that you have a kraal for your livestock.
   a. Kraals, crush, dip tank and storeroom will require about 1/2 hectare. Additional protective areas will need to be built if the goats and sheep are not returned to the kraal each night.
   b. Homesteads and kraals are sited at water sources, which are generally boreholes.

8. Farmers must plan for protection from predators. Indicate what predator prevention methods might be used.
   Consider:
   a. Livestock guarding dogs (best for sheep & goats)
   b. Donkeys (Best for cattle)
   c. Herders
   d. Pens and kraals for holding goats/sheep at night

Explaining Your Decisions

Answer the following questions based upon the decisions you made.

1. Describe why you did or did not plant crops. If crops are planted explain your choice for the crops you selected.

2. If you dig additional boreholes for water for animals explain why they were needed and how you determined where to place them.

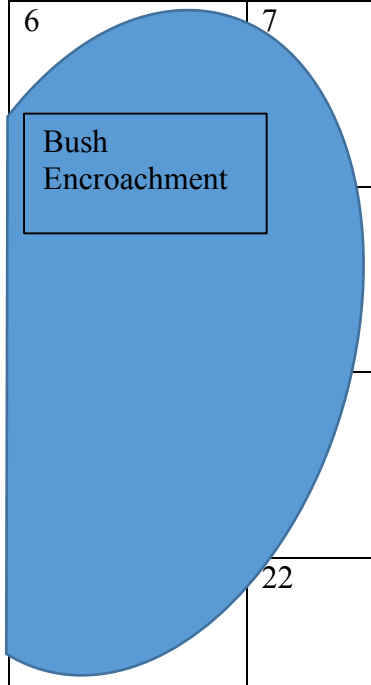
3. Describe your reasoning for fences or no fences and the type (cattle or game) of fences you selected.

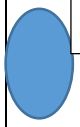
4. Explain why you decided to include or not include areas for wildlife on your land.

5. Explain your reasoning for clearing or not clearing bush from the property.

6. Describe the predator prevention methods you will use and why you believe those are good choices.

1	2	3	4	5
6	7	8	9	10
		13	14	15
		18	19	20
	22	23	24	25
26	27	28	29	30





Goats 50_____ # Sheep_____ # Cattle_____

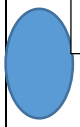
Predator Prevention Methods:

Key:

_____ House and area around house including gardens if any _____Wildlife on the land

_____Kraal _____Grazing land _____Land for crops

_____Fences: include a key to indicate the type of fences (cattle, game or both)

1	2	3	4	5
6	7	8	9	10  Bore Hole
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26	27	28	29	30

Goats_____ # Sheep_____ # Cattle_____

Predator Prevention Methods:

Key:

_____ House and area around house including gardens if any _____Wildlife on the land

_____Kraal _____Grazing land _____Land for crops

_____Fences: include a key to indicate the type of fences (cattle, game or both)

PREDATOR PERCEPTIONS

SUBJECT AREAS:
Science, Social Studies, Information & Communication

DURATION/TIME:
Activity 1: 25 mins
Activity 2: 45 mins

RECOMMENDED PREPARATION:
- Read Appendix A-Background: 'Conservation Solutions'
- Read Appendix B-Reference: 'A Place for Predators', 'Cheetahs & Farmers', 'Livestock Guarding Dogs'

MATERIALS NEEDED:
- Activity 1: Make photocopies of student page 'Predator Perceptions', 1 for each learner
- Activity 2: Make 1 set of photocopies of the 'Interest Group' cards for the class

LOCATION:
- Classroom or outdoors

KEY WORDS TO REVIEW:
Conservancy
Interest Group
Predation
Predator
Perception

OBJECTIVE:

Reflect on a variety of different feelings and attitudes about predators and predation.

LESSON ACTIVITIES:

ACTIVITY 1:
What would you do? Small group and class discussions on how learners feel about different predator scenarios.

ACTIVITY 2:
Learners will be assigned different interest groups and their opinions on building a game lodge in their conservancy. Learners will discuss their interest group's opinion and elect a Conservancy Board member to represent their group. The Conservancy Board will hold a vote to decide the outcome.

Adapted from National Wildlife Federation's, Predators! They're Part of the Picture Educator's Guide

Learning Outcomes

Learners will reflect on a variety of different feelings and attitudes about predators and predation. Learners will take part in an interest group role play and witness some of the differing perspectives people living in the same community can have about predators while reflecting on their own personal perceptions of predators.

Teaching the Lesson

Activity 1- What would you do?

In this lesson your class will reflex on how they feel about predators. To begin, pass out copies of the student page- 'Predator Scenarios' and divide the class into small groups of four to five learners.

Procedure:

1. Have one learner from each group read a scenario to their group members, then each learner in the group choses the option that best reflects their feelings. Explain that if none of the options apply, the learners can list other actions they would take. Once learners have completed one scenario (allow 10 minutes) for learners to discuss it with their group, then have them move onto the next scenario.
2. When all the scenarios have been read, ask groups to share their reactions (you might want to keep a tally where everyone can see it.). Tally the answers and see how many different reactions the learners had to each scenario. Ask them what kinds of things they kept in mind as they made their decisions. For example, did they choose what they thought were the most responsible actions to take? Did they think about laws that might affect the situation? Did they need more information before they felt comfortable making a decision?
3. After your discussion, have the learners read each scenario again. Then ask if the group discussion helped provide new perspectives or if, after listening to other people's opinions, any of the group members had changed their mind about what they might do.

Activity 2- Interest Group Role Play

Your village is part of a communal conservancy in Namibia and a few of the local members are getting together to start a game lodge for tourism. The game lodge will put aside several thousand hectares of land for wildlife and wants to showcase predators for photo tourism. Your teacher will give you an interest group role, describing your interest groups' perspective on this proposal. Put aside your personal views for this activity, and discuss with your group how you will argue your interest group's position to the conservancy board.

Procedure:

1. Divide the class into seven groups and provide each group with a different 'Interest Group Card'.
2. Have learners discuss their 'Interest Group' positions on the scenario in their divided groups. Stress that their discussions should be based on their role, not their own opinions. After 10 minutes of group discussions, tell each group that they must choose one Conservancy Board Member to represent their Interest Group on the conservancy board of directors. (1 person from each of the groups should be chosen for a total of 7 Conservancy Board members)
3. The seven Conservancy Board members will now separate from their interest group and form a new Conservancy Board of Directors group. This group will work together to develop criteria that can be used to score interest group arguments for or against the game lodge. They should consider:
    - How to maintain healthy wildlife populations in their conservancy
    - Financial interests of conservancy members
    - Safety for the community
    - Predator conflict with livestock
    - Current vs. historical use of the land
    - Jobs for conservancy members
4. Once the Conservancy Board group has come up with a way to score interest group arguments for or against the game lodge, each Interest Group will then present their argument to the Conservancy Board of Directors. All members of the interest group should be responsible for part of the presentation. As each Interest Group presents their argument, all Conservancy Board members score them based on their previously agreed on criteria.
5. Once all of the Interest Groups have presented to the Conservancy Board of Directors, the Board will adjourn for 10 minutes to make their vote on whether or not the game lodge will be allowed to operate in their conservancy based on their scoring criteria. Having a representative from each interest group in the conservancy board represents real life democracy within the conservancy. After the vote, ask leaners if the result was what they personally wanted. Why or why not? How did you feel about your role? Did you agree or disagree with the position your interest group took? Why?
6. Be sure to discuss with learners that this is just a role play, and therefore not necessarily what scientists or government officials would choose in "real life". The point of this activity is for the class to consider all of the possible viewpoints of those involved in the issue.

Background- What is CBNRM and Communal Conservancies?

A brief history of Community Based Natural Resource Management (CBNRM) in Namibia from The Namibian Association of Community Based Natural Resource Management (CBNRM) Support Organisations (NACSO) www.nacso.org.na.

“One of the many tasks facing the newly independent Namibia Government in the early 1990s was to evolve a structure for the management of wildlife resources. The South African administration had granted commercial farmers some rights over wildlife, but these rights did not extend to communal areas. During the armed struggle many animals were hunted almost to extinction, and communal farmers were often in conflict with animals such as hippos and elephants which damaged their crops, and therefore adversely affected their livelihoods.

The idea of a national CBNRM support structure emerged in the early 1990s through the work of the CBNRM partners, the Ministry of Environment and Tourism and the national NGOs, and was supported by the USAID funded Living in a Finite Environment (LIFE) project. International support was received through USAID, DfID, SIDA, WWF and others together with domestic support from the Ministry of Environment and Tourism, the NNF and others. The objective was "to promote activities that demonstrate that sustainably managed natural resources can result in social development and economic growth, and in suitable partnership between local communities and government." This has certainly been demonstrated and the programme has been successfully mainstreamed into national development - representing one of CBNRM's major, over-riding achievements. CBNRM and the conservancy programme are now an integral part of Namibia's Millenium Development Goals, Rural Poverty Reduction, Rural Development, National Development Plants, Vision 2030 and so on. In short, it is a win-win livelihoods and conservation/sustainability programme.

To provide a structure for the CBNRM concept to develop, legislation was tabled in 1996 to allow for the formation of communal conservancies. These conservancies would take responsibility for the natural resources, mainly wildlife, within their boundaries by monitoring numbers and preventing poaching, but it was essential that they should perceive wildlife as a valuable resource. This they did, for attracting tourists and for hunting in a managed and sustainable way. The conservancy movement has been a great success, and there are now 82 registered conservancies in Namibia, and several in the process or registration.”

1. You are on a walk with your friends and you spot a hawk circling over a field just ahead. You motion for your friends to approach the field quietly. As you get closer you see a rabbit feeding in the grass. Then you realize that the hawk is planning to make a meal out of the rabbit.

   What Would You Do?
   A. Make loud noises to scare away the hawk and/or the rabbit
   B. Sit quietly with your friends and watch a real predator-prey interaction
   C. Throw rocks at the hawk because it is mean of the hawk to kill other animals, and you don't want it to get the rabbit
   D. Turn and walk away because you don't want to know what happens
   E. Other

2. You and your family visit a local game farm advertising predators for view. After paying a few dollars each to get inside, you see that the cages holding the animals are small, falling apart, and the animals are poorly cared for. The lion looks thin and sick. The cheetah is crammed into a cage barely big enough for it to turn around. (Cheetahs, like many predators, have large ranges in the wild.) And the leopard is chained by the neck. You also see advertised that you can pay to take a picture with the animals.

   What Would You Do?
   A. Ask to see the owner and explain how upset you are about the conditions
   B. Not say anything because you don't want to make the people that are working there feel bad
   C. Ask for your money back and leave
   D. Think about it and eventually call or write a letter to an animal protection organization
   E. Contact MET (Ministry of Environment & Tourism) to report your concerns and ask if laws are being broken by the local farm.
   F. Not say anything because you feel that the people who run the farm know more about taking care of animals than you do.
   G. Pay to take a photo with one of the predators- because when else will you have a chance to get close to that type of wild animal again?
   H. Other

3. You are on a hike with your friends. Around a bend in the trail, 2 of the people in the group spot a puff adder snake. The snake is close to the trail, sunning itself on a rock. Your 2 friends that first spotted the snake tell everyone to stay still, then they each pick up rocks and throw them at the snake, killing it.

   What Would You Do?
   A. They were right to kill the snake because puff adders are venomous.
   B. They shouldn't have killed the snake because the snake was not hurting anyone- but if the snake had looked as if it might strike, they would have been right to kill it.
   C. All of you should have walked away without harming the snake.
   D. They were right to kill the snake because it's OK to kill any predator if it is too close to people.
   E. Other

Game Lodge Developer Your conservancy is in a prime location for tourism as you have beautiful landscapes and are located close to a main road for tourist access. As a conservancy member yourself you have seen your community struggle greatly with poverty and want to help. You went to university to study wildlife management and tourism and want to bring the benefits of your education home. By building this game lodge you will be able to employ 100 local conservancy members including, construction workers, cleaners, cooks, servers, and assistant management. You plan to have a gift shop showcasing local artisans as well as bringing back rich wildlife that has all but disappeared in the area. You believe the game lodge will bring prosperity to your conservancy and allow your local community to reconnect with wildlife and see the benefits financially.	**Villager in the Conservancy** You and your ancestors have lived in this area for many generations. You have grown children and now grandchildren that visit you here. You have noticed a change in the amount of local wildlife over the last two decades and that it is increasingly hard to find wild bush meat to eat. This saddens you as you need the meat for nourishment, but also the wild animals bring beauty with them as well. You are glad that there are fewer predators around as they can attack people and eat the wildlife. You are concerned that the new game lodge will bring in predators that could get out and come to the village. You worry for your safety as well as your children and grandchildren.
Local Livestock Farmer You inherited your land and most of your livestock from your father and your grandfather before that. You have 400 sheep and goat and 1,000 head of cattle on your land. Your main income is from selling your livestock. Your privately owned farm boarders the communal conservancy and you are concerned about the predators that might be attracted to the wildlife the new game lodge will bring. You are also concerned the the game lodge will be taking away more communal grazing land and communal cows will start encroaching on your property and livestock.	**Ministry of Environment & Tourism (MET) Wildlife Biologist** After working for MET for almost 10 years you are very happy to see communal conservancies finding ways to benefit from local wildlife. You know as a wildlife biologist that you need people to see the value of wild animals in order to save them. With a growing human population, wildlife has less and less suitable habitat to live. With less habitat comes conflict with people and their livestock. You have seen the beneficial effect first hand of predators to sustain a healthy ecosystem and support the development of the new game lodge.

Traditional Authority

As your communities' Traditional Authority you represent the tribe's traditional values and customs. Your job is to look at the bigger picture of each new development or event. You are entrusted with guiding the community to prosperity but keeping the tribe's customs and values in mind. You like that the new game lodge would bring prosperity to your people, giving jobs and other forms of livelihood to the community, such as selling traditional crafts. However, you know that most of your community are livestock farmers based on a long standing tradition. You worry that most of your community would be against the building of the new game lodge based on the potential increase in predators and decrease in livestock grazing land. You are concerned that you could lose local support if you encourage the development of the game lodge.

Environmental Educator

As an environmental educator at a local not-for-profit conservation organization, you know the benefits of predators for a healthy ecosystem. Your job is to teach youth and adults about a predator's role in an ecosystem as well as, teaching how people can respect predators instead of fear them. You are excited that Namibia is one of the only countries that use the conservancy model for connecting wildlife habitat and benefiting from wild animals. You know that the world is looking to Namibia as a model for wildlife conservation. You believe that the proposed game lodge in a communal conservancy will bring in tourism and money to the conservancy. A wealthy conservancy can bring educational aid, human-wildlife conflict mitigation, and diversified income for the community. You are also exited that local children will be able to view and benefit from keeping wildlife in the area.

Mining Company Executive

You an executive of a successful mining company in Namibia. You operate on property belonging to this communal conservancy that you rent on a yearly basis. You are afraid with the development of the new game lodge that you will loose rights or permits to the land. You also fear with eco-tourism being brought into the area would increase the development of new environmental laws, restrictions, and zoning for mining in the area. This may lead to an inability to profit from Namibia's natural resources and a loss of local well paying jobs.

CHEETAH TRACKING

SUBJECT AREAS:
Sciences

DURATION/TIME:
Activity 1: 30-45 mins

RECOMMENDED PREPARATION:
- Read Appendix A-Background 'A Cheetah's Life Cycle', 'Threats to survival', Tools for Ecological Research', and 'Conservation Solutions'
- Read Appendix B-Reference: 'Cheetahs & Farmers', and 'Livestock Guarding Dogs'

MATERIALS NEEDED:
For each group:
- Photocopy student pages- 'Understanding Cheetah Movements'
- Photocopy 'Cheetah Tracking Illustration Page'

LOCATION:
- Classroom

KEY WORDS TO REVIEW:
GPS- Global Positioning System
Fix
Cluster

OBJECTIVE:

Learners will discover how local researchers can track cheetahs by GPS collar to collect valuable data on the species.

LESSON ACTIVITIES:

ACTIVITY 1:
Have learners study the 'Cheetah Tracking Illustration Page' and answer the questions on student pages- 'Understanding Cheetah Movements'.

Learning Outcomes

Learners will interpret two different cheetah GPS movements and try to interpret the cheetah's behaviour based on the movement patterns. Learners will also come up with conservation solutions for farmers and cheetahs to co-exist on farmland.

Teaching the Lesson

Activity 1- Analysing Cheetah Movements

GPS technology has significantly advanced wildlife studies and our understanding of the secretive lives of some of our most elusive species. This activity will teach learners how scientists use GPS technology when studying cheetahs and how results can be applied in real-life conservation scenarios.

Vocabulary:

GPS- 'Global Positioning System', which is a navigational system made up of satellites in orbit around the Earth.

GPS Fix- A GPS fix is the locational information that the GPS system provides for a specific point.

Cluster- A grouping of GPS fixes or 'points'

Procedure

1. Divide the class into small groups of 4 to 5 learners and hand out the student page 'Understanding Cheetah Movements' -3 pages and the 'Cheetah Tracking Illustration Page' to each group.

2. Have learners analyse and compare the data from the 'Cheetah Tracking Illustration Page' and try to interpret the data. Learners should fill in the student page 'Understanding Cheetah Movements' to help them process the data like a field researcher.

3. The researcher wants to recommend some conservation solutions to the farmers that will protect both their livestock and the cheetahs. Have learners help the researcher come up with some conservation solutions by referencing the 'Predator Profiles' page in Human-Wildlife Conflict lesson and Appendix A-Background: 'Tools for Ecological Research' and 'Conservation Solutions'. Also look at Appendix B-Reference: 'Hunting development of Cubs'. Cheetahs & Farmers', and 'Livestock Guarding Dogs'.

Part A- Page 1

1. Why might a wildlife biologist set a collar on a cheetah to collect fixes every 15 minutes rather than every 6 hours? *With more frequent fixes (i.e. every 15 minutes) the data collected on that animal is much more fine scale and movements/behaviour can be monitored much more closely.*

2. Why might a wildlife biologist set a collar on a cheetah to collect fixes every 6 hours rather than every 15 minutes? *The wildlife biologist may be looking for broad scale data that just shows less of the cheetahs' behaviour and more of their ecology such as, territory or home range size, or generally where the cheetah is moving.*

Part B- Page 2

3. What GPS fix frequency is this cheetah's collar set to? Meaning how often is the GPS collar sending fix points? *Every 4 hours*

4. How many hours does this cluster span? *8 hours*

5. With our understanding of the limitations of GPS data, what's the longest period of time that the cheetah could have been at this cluster? *b. 12 to ~16 hours*

6. Based on what we've already learned about cheetah behaviour and the times of day they are most active, what do you think the cheetah was doing at Cluster A? *Because this cluster started late in the evening and ended first thing in the morning the next day and because we know that cheetahs are primarily diurnal, we can assume that Cluster A was simply a resting/sleeping spot.*

7. What is the difference between Cluster A and Cluster B? *Cluster B is longer and happens during the day and overnight through to the next morning.*

8. What do you think the cheetah was doing at Cluster B? Provide your reasoning. *Cluster B was most likely a kill site where the cheetah ate and slept/rested.*

9. After Cluster B we see one fix labelled 1200h and then seven more fixes that haven't been labelled. With what we've learned so far, label these fixes and then describe what the cheetah is doing at Cluster C. *Based on that the cheetah made a kill at cluster B, we can assume the cluster C the cheetah is sleeping/resting.*

10. Cluster D shows behaviour unlike that of any other cluster on our map. Based on what we've learned about cheetahs in this guide, what do you think Cluster D represents? *A mother cheetah with young cubs. When cheetah cubs are born they spend the first 6 weeks in a 'den' or in dense vegetation. Their mother is giving them milk but must leave them every day or two to hunt, eat, and find water. After the mother has eaten she quickly goes back to her cubs to let them nurse from her.*

Part C- Page 3

11. Based on the GPS data we can see clearly that the cheetah has gone very close to Farm House 1, but the farmer does not report any livestock losses. Why is this? *Farmer 1 has kraals near the house to keep the small stock (sheep & goats) safe at night. The farmer also uses livestock guarding dogs to protect the small stock during the day while out grazing and that stay with the livestock at night.*

12. Farmer 2 blames cheetah for the losses he's experienced near his house. Based on our GPS data and the other predator data we have in the area, what do you think is happening with Farmer 2? *Farmer 2 is having problems with leopard.*

13. What are some of the techniques and skills learned in this guide that Farmer 2 could employ to understand his situation better? *Farmer 2 should do the Kill ID activity (see Human Wildlife Conflict Lesson) to be able to properly identify which predator is killing his livestock. Farmer 2 can also keep small stock and calves safe in kraals at night and use a livestock guarding dog to protect small stock during the day while grazing and in the kraal at night.*

14. What data/examples could you provide to Farmer 2 to help him understand his situation and to convince him that livestock kraals and guarding dogs are an effective method at reducing livestock losses? *Show Farmer 2 that his/her farm is part of a leopard's territory. Also show the GPS data the the cheetah is going right next to Farmer 1's house and kraal but causing no trouble because of the livestock guarding dogs and the kraal system.*

Group Names:_____ **Date:**_____

Part A: Understanding GPS and GPS data

GPS stands for 'Global Positioning System', which is a navigational system made up of satellites in orbit around the Earth. Today GPS technology is found everywhere in life; from your car to your cell phone and cameras and it allows for you to determine your exact position on the Earth. GPS positions are recorded as geographical North/South and East/West coordinates. For example, CCF's Headquarters are located at S20.484312 E017.032822.

For many years now, wildlife researchers have been using GPS collars to track the movements and behaviour of wildlife. The introduction of GPS technology into wildlife studies has substantially improved the quality of location data that researchers can collect on species and, as a result, has significantly improved the quality of conservation efforts.

The GPS points taken from a wildlife collar, which are called '***fixes***', can be used in a variety of ways to help understand an animal, but it is important to understand the limitations of the data before applying it.

A GPS fix only shows where the animal is at a very specific point in time. What the animal is doing or where it goes specifically during the time between two GPS fixes is unknown and can only be speculated. For example, have a look at the dashed line labelled *Actual Cheetah Path* on the right side of the 'Cheetah Tracking Illustration Page'. As you can see here there are two GPS fixes; one is at 0800h and the next is at 1200h. Using these two points, we can calculate a distance that the cheetah moved but this is only the MINIMUM distance moved as we cannot know exactly the path that cheetah took to get from the 0800h fix to the 1200h fix. Because the shortest distance between two points is a straight line and because we know it is VERY unlikely that a cheetah travels in a completely straight line from one fix to the next, this distance calculated is the absolute minimum distance that cheetah travelled.
•*note: new technology is being developed to help reduce this limitation of GPS data*

Most GPS collars today are set to take GPS fixes at a specific interval and can usually be anywhere from every 15 minutes to every 6 hours. With more frequent fixes (i.e. every 15 minutes) the data collected on that animal is much more fine scale and movements/behaviour can be monitored much more closely. Also the more frequent the fixes, the more draining it is on the battery life of the collar. Researchers have to keep in mind the battery life of the collar with the type of data they want to collect.

Questions:

1. Why might a wildlife biologist set a collar on a cheetah to collect fixes every 15 minutes rather than every 6 hours?

2. Why might a wildlife biologist set a collar on a cheetah to collect fixes every 6 hours rather than every 15 minutes?

Part B: Understanding Movement, Clusters, and Behaviour

From the left hand side of the activity sheet we can see our cheetah's first GPS fix labelled '0400h' meaning that this is precisely where the cheetah was at 4am in the morning. From there the next fixes we see are labelled '0800h', '1200h', and '1600h'.

3. What GPS fix frequency is this cheetah's collar set to? Meaning how often is the GPS collar sending fix points?

Marked with the red circle labelled 'A' we can see that three fixes are all in the same exact area. Whenever we see fixes 'grouped' like this, we refer to this occurrence as a '***cluster***'. Because we have multiple fixes in one location, we know that the cheetah spent an extended period of time in the same area. Depending on the 'size' of the cluster (i.e. how many fixes are in the cluster), the behaviour of the cheetah before the cluster, the location of the cluster, and the time that the cluster started/ended we can speculate what it is that cheetah is doing. As we can see easily on the map, Cluster A starts at 2000h and ends at 0400h the next morning.

4. How many hours does this cluster span?

5. With our understanding of the limitations of GPS data, what's the longest period of time that the cheetah could have been at this cluster?
    a. 16 to ~20 hours
    b. 12 to ~16 hours
    c. 20 to ~24 hours
    d. 8 to ~16 hours

6. Based on what we've already learned about cheetah behaviour and the times of day they are most active, what do you think the cheetah was doing at Cluster A?

Because this cluster started late in the evening and ended first thing in the morning the next day and because we know that cheetahs are primarily diurnal, we can assume that Cluster A was simply a resting/sleeping spot.

7. What is the difference between Cluster A and Cluster B?

8. What do you think the cheetah was doing at Cluster B? Provide your reasoning.

9. After Cluster B we see one fix labelled 1200h and then seven more fixes that haven't been labelled. With what we've learned so far, label these fixes and then describe what the cheetah is doing at Cluster C.

10. Cluster D shows behaviour unlike that of any other cluster on our map. Based on what you've learned about cheetahs in this guide, what do you think Cluster D represents?

Part C: Applying GPS Data to Conservation Solutions

By understanding the movement and behaviour of an animal/species, conservationists can fine-tune their conservation solutions to differing scenarios. Using what we've learned in this activity so far, consider the situations below and answer the questions. For this activity we will assume that the collared cheetah is the only cheetah in the area.

Farmer 1 raises both cattle and small stock (goats and sheep), and uses guarding dogs, kraals overnight for his small stock, and calving kraals for his cattle. Farmer 1 reports that he occasionally sees cheetahs near his farmhouse, but also sees signs of leopard in the area that his livestock graze. However, despite the obvious presence of predators Farmer 1 reports no livestock losses due to predators.

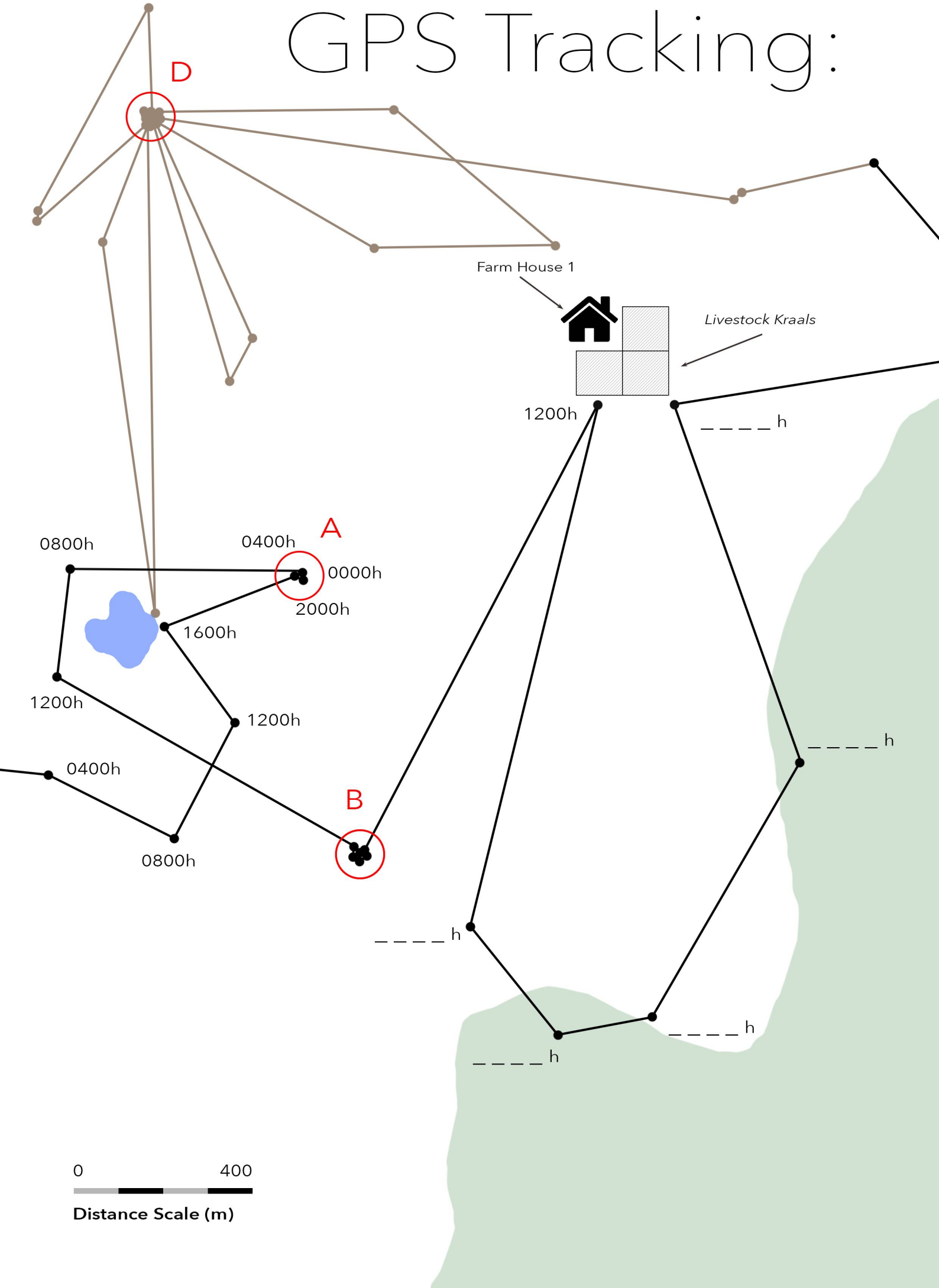
Farmer 2 also raises cattle and small stock but does not use guarding dogs or calving kraals. Farmer 2 reports many livestock losses near his farmhouse and says that cheetahs are the culprits because he has seen them on his farm.

11. Based on the GPS data we can see clearly that the cheetah has gone very close to Farm House 1, but the farmer does not report any livestock losses. Why is this?

12. Farmer 2 blames cheetah for the losses he's experienced near his house. Based on our GPS data and the other predator data we have in the area, what do you think is happening with Farmer 2?

13. What are some of the techniques and skills learned in this guide that Farmer 2 could employ to understand his situation better?

14. What data/examples could you provide to Farmer 2 to help him understand his situation and to convince him that livestock kraals and guarding dogs are an effective method at reducing livestock losses?


GPS Tracking:
D
Farm House 1
Livestock Kraals
1200h
_ _ _ _ _ h
A
0800h
0400h
0000h
2000h
1600h
1200h
1200h
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0400h
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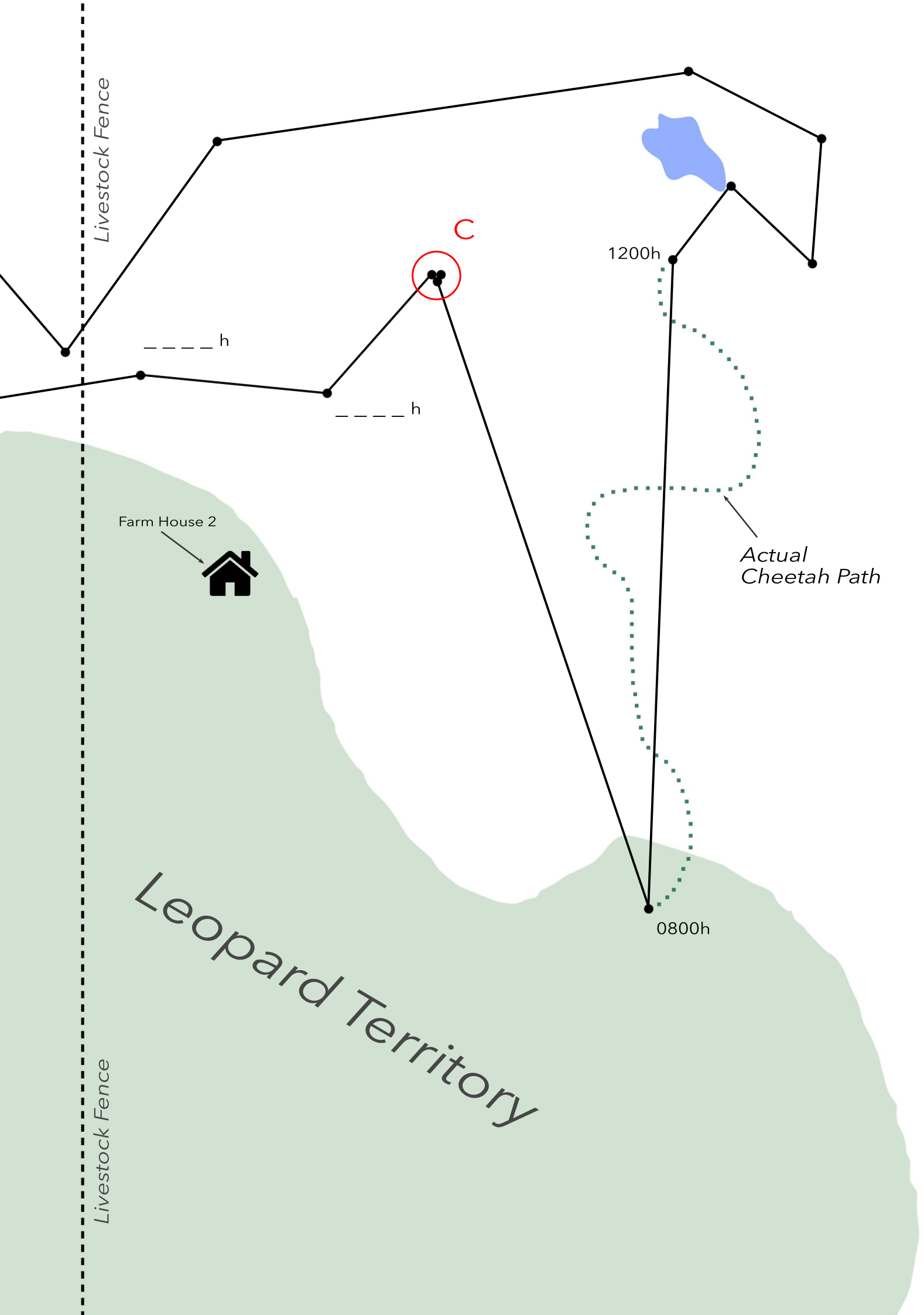
Distance Scale (m)


Livestock Fence
C
1200h
_ _ _ _ _ h
_ _ _ _ _ h
Farm House 2
Actual
Cheetah Path
Leopard Territory
0800h
Livestock Fence

WHOSE HAIR IS IT?

SUBJECT AREAS:
Science

DURATION/TIME:
Activity 1: 1 hour

RECOMMENDED PREPARATIONS:
- Review Appendix B- Reference: 'Cheetahs & Farmers', 'Human-Wildlife Conflict', & 'Livestock Guarding Dogs'.

- Make photocopies of Hair Sample Reference Cards and student pages 'Cheetah Scat ID Pages'

MATERIALS NEEDED:
- Copies of:
  - Hair Sample Reference Cards
  - 'Cheetah Scat ID' student pages
  - 'Whose Hair Is It?' student page
- You will be dividing the class into 3 groups, each group will have 3 cheetahs (6 Cheetah Scat ID Pages) & 1 set of Hair Sample Reference Cards.
- Laminate all pages for yearly use.

LOCATION:
- Classroom

KEY WORDS TO REVIEW:
Identify
Mammalian
Samples
Scat
Species

Objective:

Learners will explore how to use scientific evidence to determine the prey species eaten by cheetahs and determine if the cheetahs are preying on livestock.

Lesson Activities:

ACTIVITY 1:
Learners will look at hair samples collected from the scat of different cheetahs. The learners will then determine the different prey species that each cheetah has eaten and if any of the cheetahs are eating livestock.

Learning Outcomes

The learners will become familiar with the different species of animals that cheetahs feed on. They will determine if any of the samples contain hair from livestock and if there is a potential problem cheetah.

Teaching the Lesson

Activity 1 – Whose Hair Is It?

A cheetah's scat (a scientific word for poop) can be used to identify the prey animals they have eaten. Every species of mammal has a unique scale pattern on their hair. Through identification of the hair that is present in the cheetah's scat, researchers can find out what the animal ate and if it is eating livestock.
The scat is collected and placed in nylon stockings for washing in a washing machine. The washing process leaves behind only the hair, bones, teeth, or feathers present in the scat. The stockings and their contents are then hung out to dry. The dried remains are spread evenly into a dissecting pan and hairs are randomly chosen. The randomly chosen hairs are placed between two glass slides on a plastic slip, held together by four small clips, and heated for five minutes at 108°C. The hair is then gently removed from the plastic slip and an imprint of the whole hair is left on the plastic slip. The pattern of the hair can then be examined to identify the prey animals. The Cheetah Conservation Fund has 3 different researchers look at the hairs to verify the identity of the animal, so don't be discouraged if you find it difficult to identify the hairs on your first try.

More information about the hairs:
Each mammal including humans have different textured and coloured hairs all over their bodies. Think of us, we have different hair on our heads compared to our arms. The hairs may be different colours, textures, and grow to different lengths. This is also true for other mammals. In the 'Hair Sample Reference Cards' you will find a key on how to identify each animals' different hairs. The photos of the hairs were taken under a microscope and look just like what you would see looking at each individual hair under a microscope like CCF genetic scientists. You may notice some circles, bubbles, or scratches on the photos and those where made by scratches on the microscope or dirt and debris on the slides. You will also see that all of the hair photos are in three with a proximal, middle, and distal section. All three sections are needed by genetic scientists to properly identify which animal the hair comes from.

Vocabulary:
Proximal- the beginning of the hair, close to the root
Middle- middle part of the hair
Distal- tip or end of hair

Procedure:

1. Introduce the lesson to the learners by reading aloud the information above that describes how hair samples are collected from scat. Explain that researchers are able to identify the animals eaten by identifying the hair samples.
2. Provide learners with the Hair Sample Reference Cards that identify the animals and photos of their hair. Review some of the obvious characteristics seen on the different hair samples.
3. Divide learners into 3 groups and provide each group with Cheetah Scat ID Pages from 3 different cheetahs (each cheetah has 4 scat samples).
4. Ask learners to compare samples to reference photos and determine the prey species eaten.
5. Learners should record data on what each cheetah ate on the "Whose Hair Is It" student page.
6. Ask groups to compare the data for the cheetahs. If there are discrepancies in the group, then learners should look again to identify the hair and the prey species.
7. Discuss with students which cheetahs were feeding on livestock and why this might occur. For example:
    - injured cheetah that has trouble hunting
    - no livestock guarding dog so livestock is easy prey
    - livestock is far away from the farm without a herder
    - young cheetah that is lacking hunting skills
    - no wild game for the cheetah to hunt

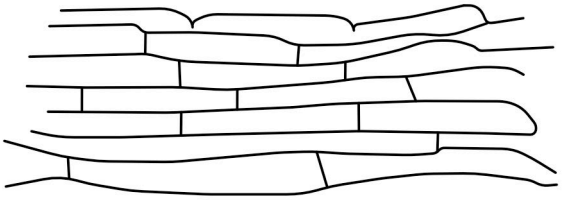
It is important that learners see that most cheetahs hunt wild game, and very few prey on livestock. Cheetahs are opportunistic hunters and go for the prey that is easiest to catch. If you have a problem with a cheetah eating sheep or goat, and then take precautions to protect the herd in the future, you are less likely to have problems with the cheetah again.

Answer Key For Student Page 'Whose Hair Is It?'

Group 1:	Cheetah 1 – oryx, steenbok, warthog, kudu calf Cheetah 2 – steenbok, warthog, kudu calf, rabbit Cheetah 3 – rabbit, steenbok, warthog, oryx
Group 2:	Cheetah 4 – kudu calf, warthog, steenbok, rabbit Cheetah 5 – oryx, rabbit, kudu calf, warthog Cheetah 6 – rabbit, sheep, goat, steenbok
Group 3:	Cheetah 7 – kudu calf, rabbit, steenbok, warthog Cheetah 8 – oryx, kudu calf, warthog, goat Cheetah 9 – rabbit, steenbok, warthog, kudu calf

Key to Hair Scale Distance- Look at the distance between the hair scales- Not the pattern

Close-



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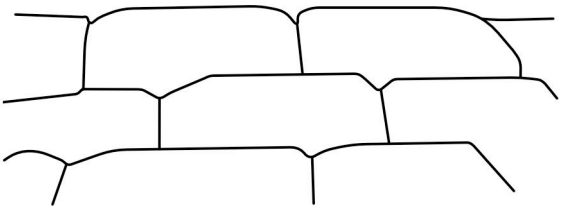
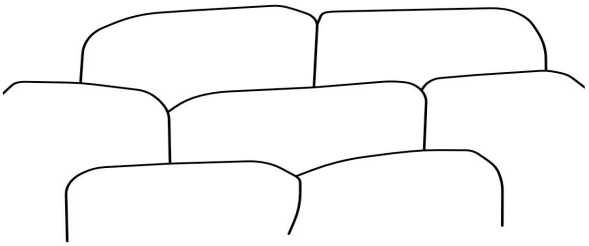


Distant-



Student Page – Whose Hair is it?

Group Names: _____**Date:**_____
Instructions: Compare each of your Cheetah Scat ID Pages with the Hair Sample Reference Cards to find out which prey species your cheetahs were eating. Record your findings in the table below.

Data Collection

Cheetah #	Hair Sample ID #1	Hair Sample ID #2	Hair Sample ID #3	Hair Sample ID #4

Questions:

1. Which if any, of the cheetahs you investigated might be a problem for farmers?

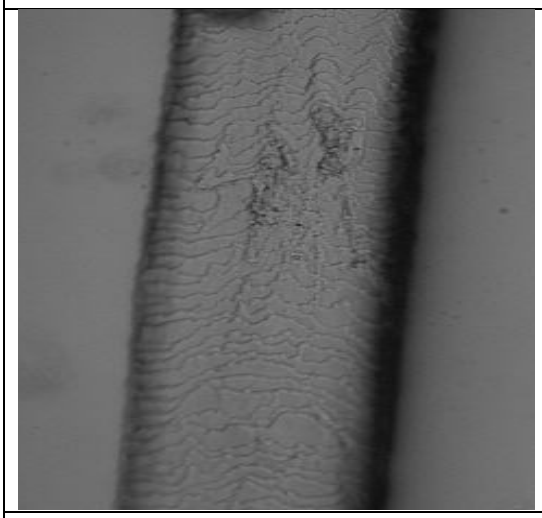
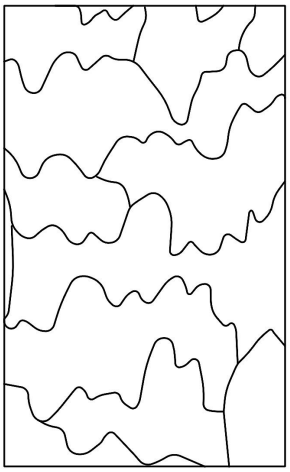
2. Why might a particular cheetah feed on livestock instead of, or in addition to wildlife?

3. What are some things a farmer might do to prevent cheetahs or other predators from killing livestock?

4. Why is it important to know what predators are killing livestock?

5. How can livestock guarding dogs protect livestock from predators?

Hair Sample Reference Card: Kudu Calf

Distal		
	Scale Pattern: 50% irregular waved	
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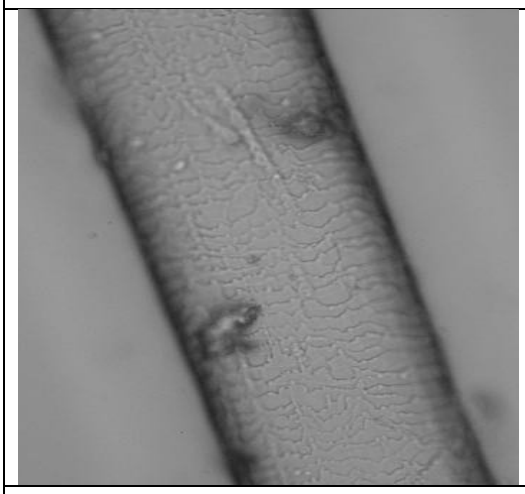	Scale Distance:	Hair Scales **Medium** Distance
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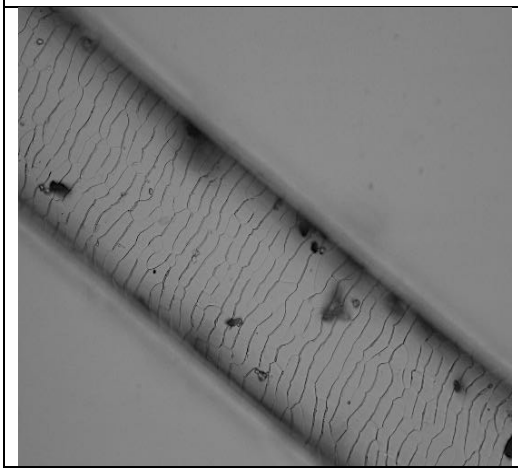
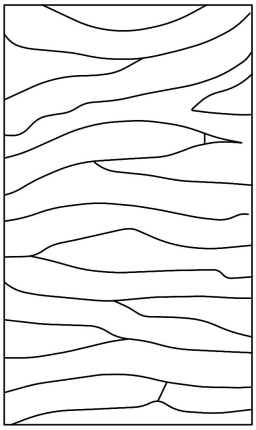
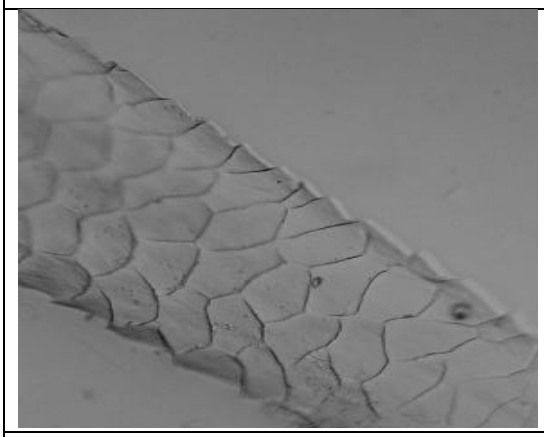
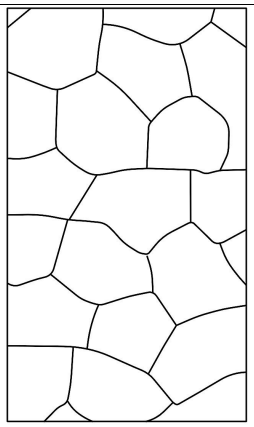
	Scale Pattern: 50% regular waved	

Hair Sample Reference Card: Steenbok

Distal		
	Scale Pattern: regular mosaic	
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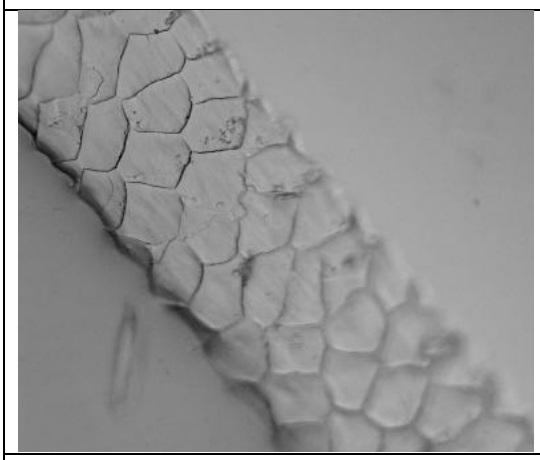	Scale Distance:	Hair Scales **Distant** Distance 3-4 scales per width
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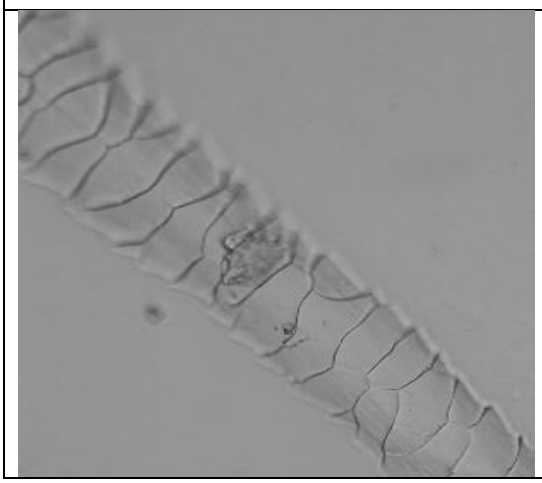
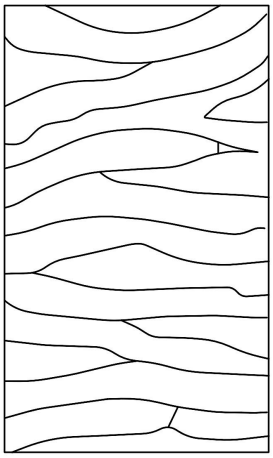
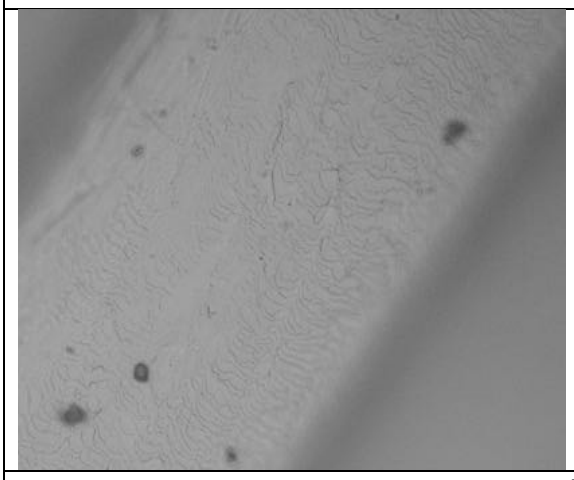
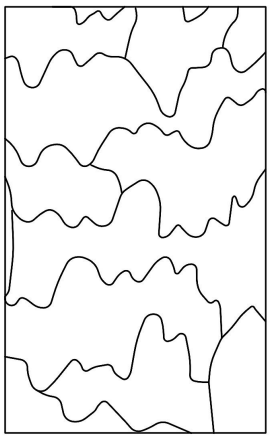
	Scale Pattern: Regular waved	

Hair Sample Reference Card: Warthog

Distal		
	Scale Pattern: 100% irregular waved	
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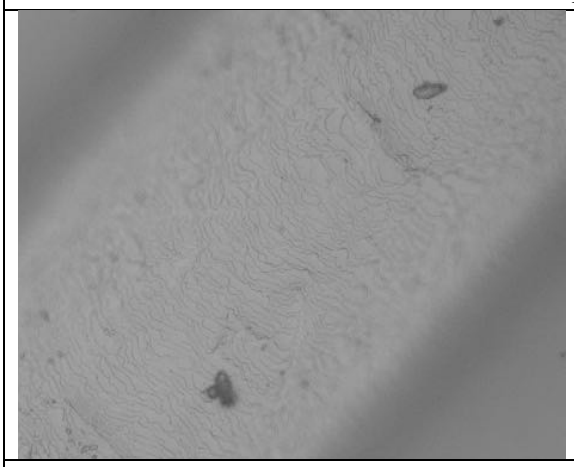	Scale Distance:	Hair Scales Very **Close** Distance
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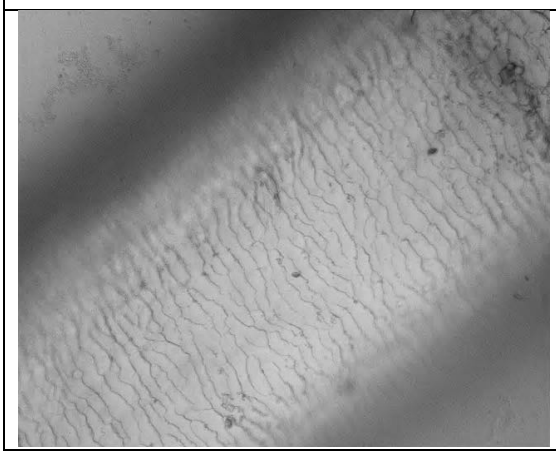
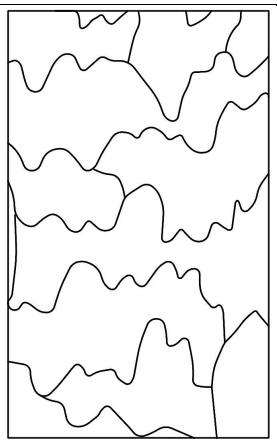
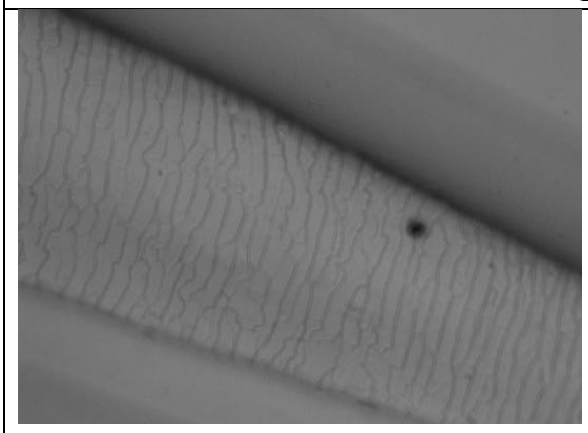
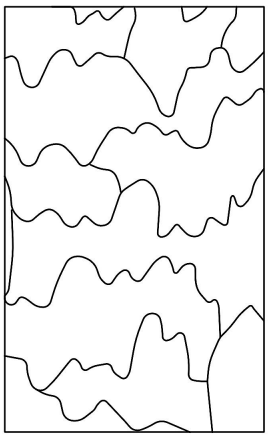
	Scale Pattern: 100% irregular waved	

Hair Sample Reference Card: Oryx

Distal		
	Scale Pattern: 60% irregular waved	
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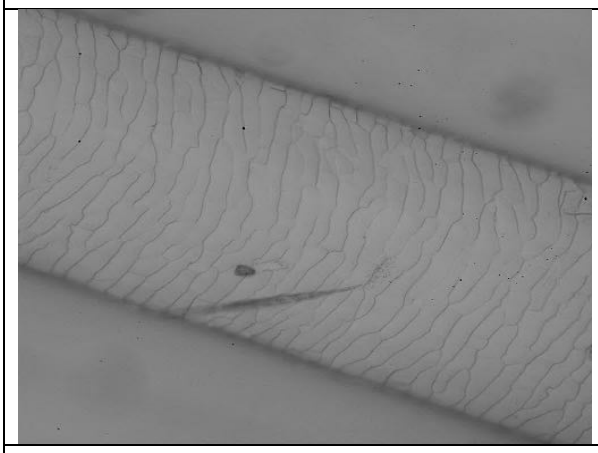	Scale Distance:	Hair Scales **Medium** Distance
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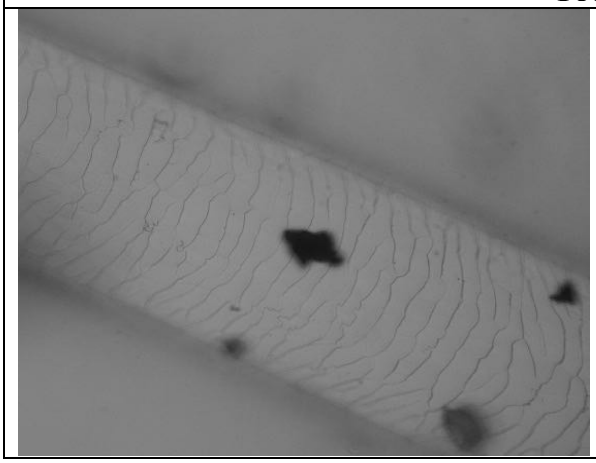
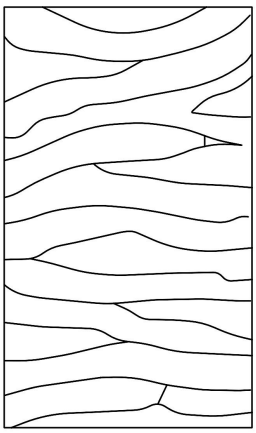
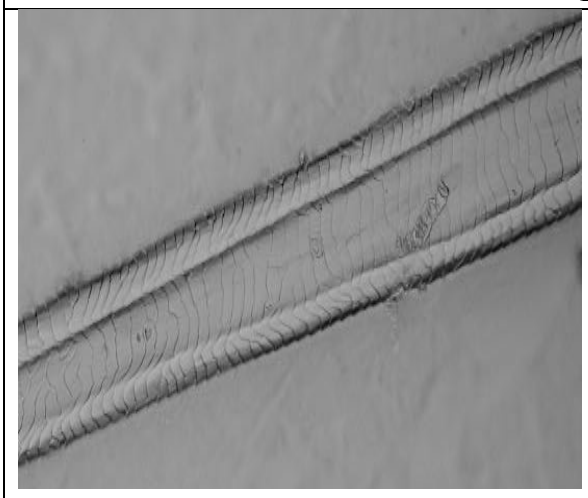
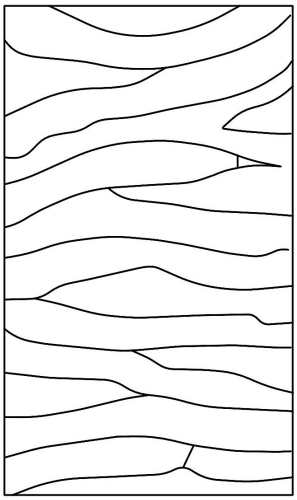
	Scale Pattern: 40% regular waved	

Hair Sample Reference Card: Rabbit

Distal		
	Scale Pattern: Pectinate- Having narrow parallel divisions or lines like teeth of a comb	
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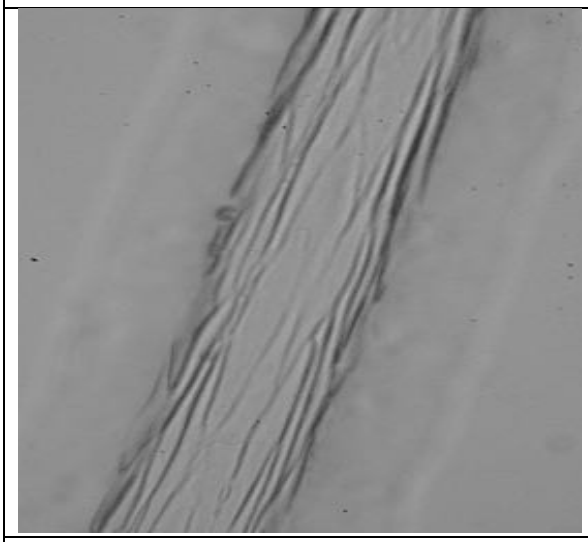	Scale Distance:	
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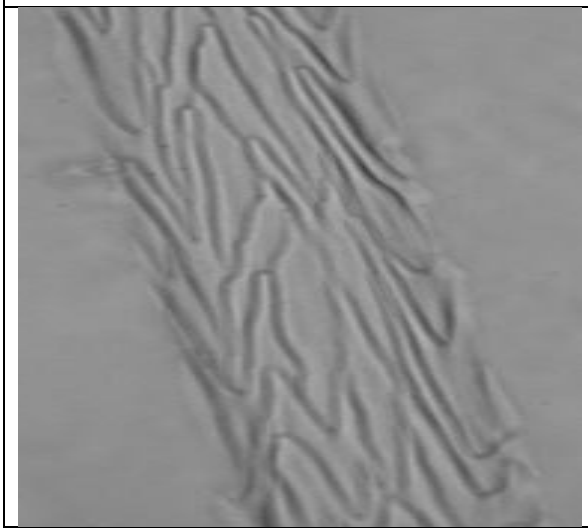
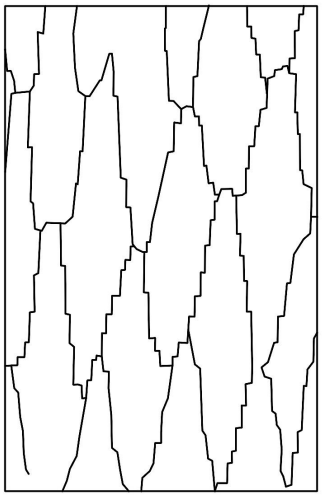
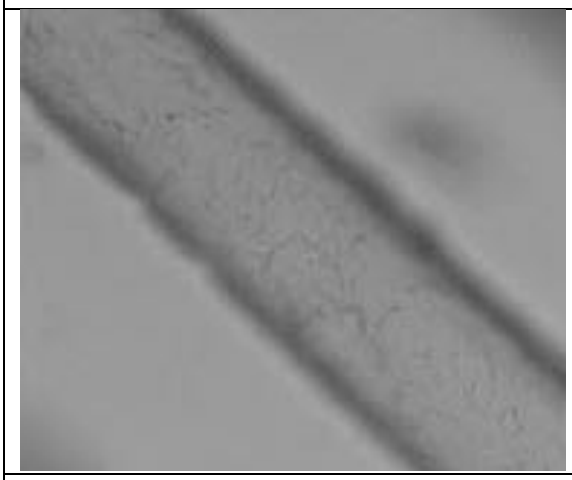
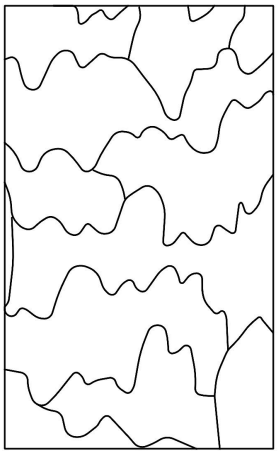
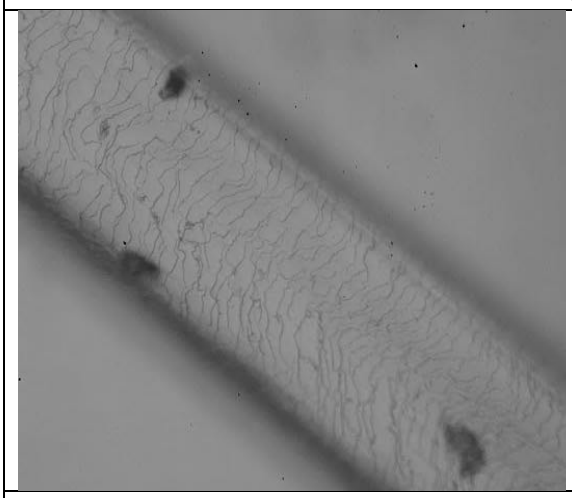
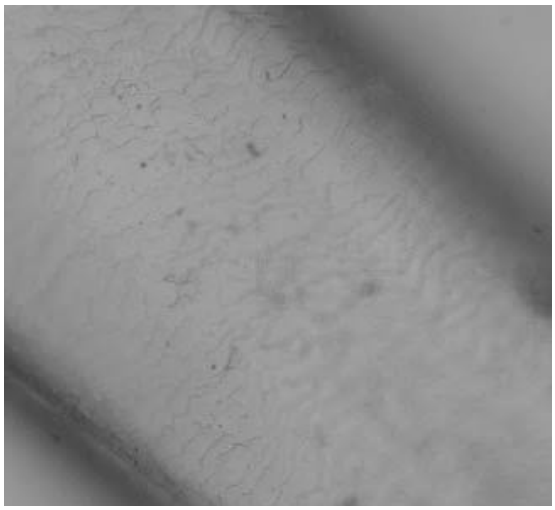
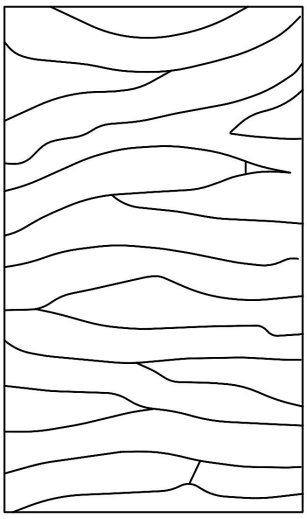
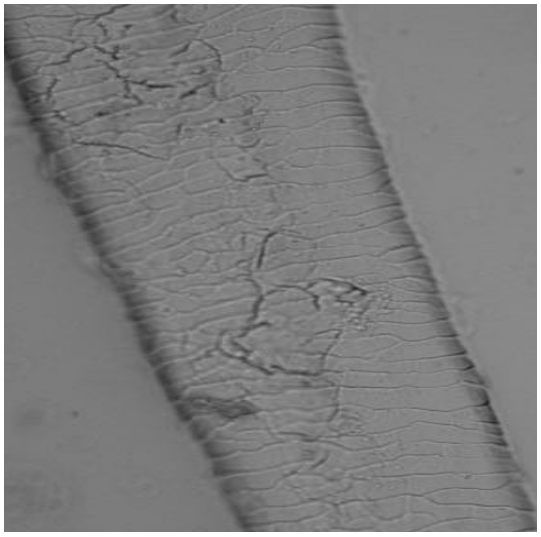
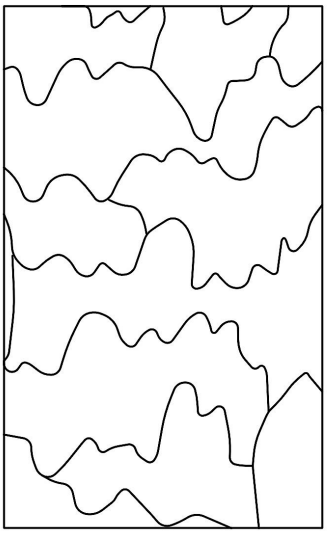
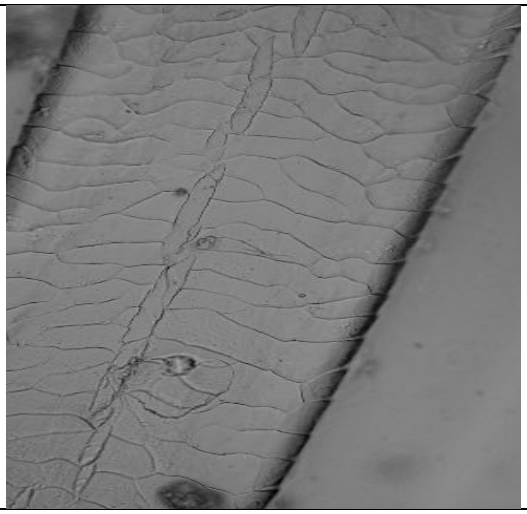
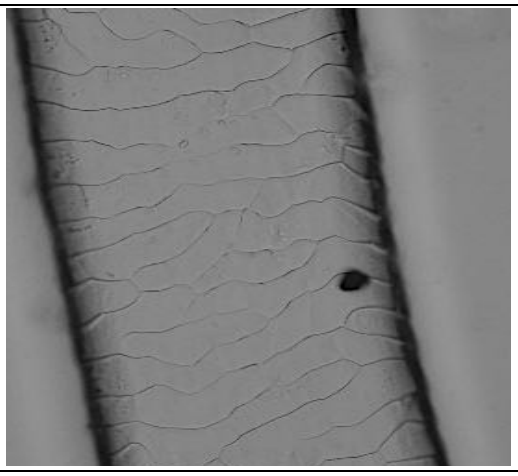
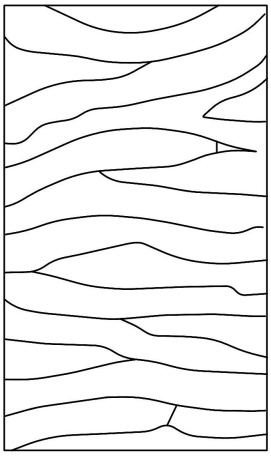
	Scale Pattern: regular waved	

Hair Sample Reference Card: Goat

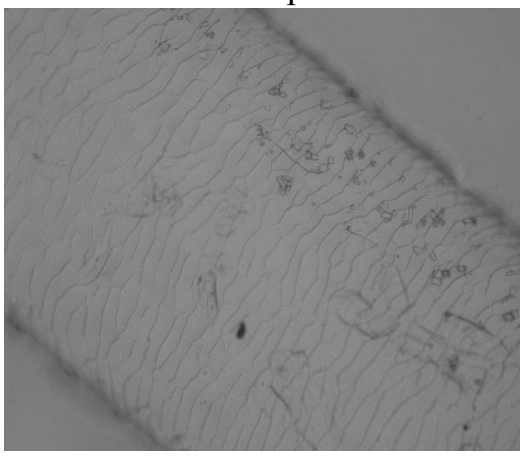
Distal		
	Scale Pattern: 10% irregular waved	
Middle		
	Scale Distance:	Hair Scales **Close to Medium** Distance
Proximal		
	Scale Pattern: 90 % regular waved	

Hair Sample Reference Card: Sheep

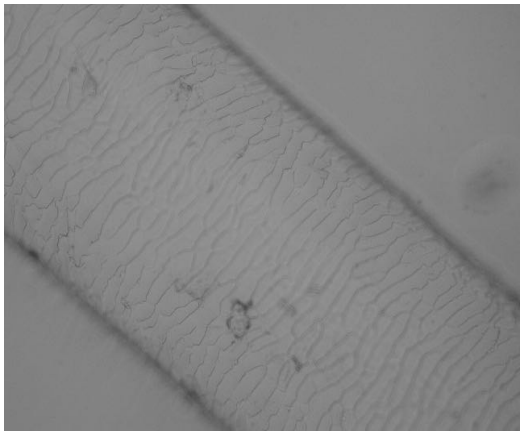
Distal		
	Scale Pattern: 10% irregular waved	
Middle		
	Scale Distance:	Hair Scales **Medium to Distant** Distance
Proximal		
	Scale Pattern: 90% regular waved	

Student Page- Cheetah Scat ID: Cheetah 1

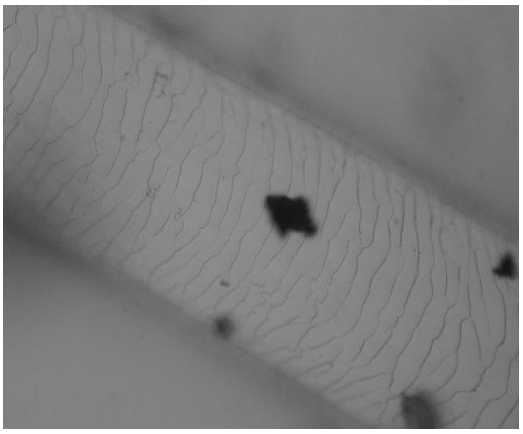
Scat Sample #1



Distal

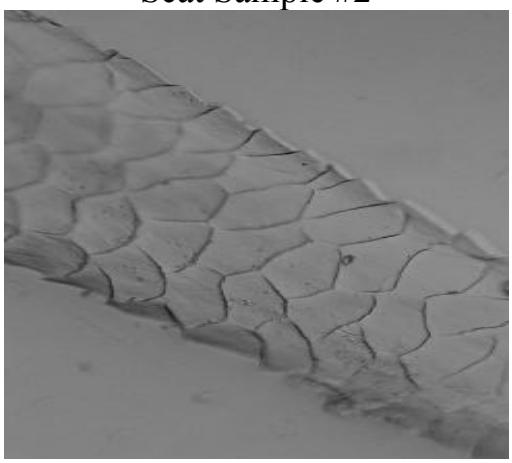


Middle

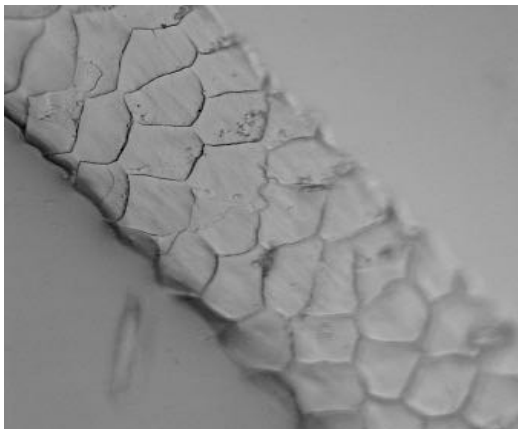


Proximal

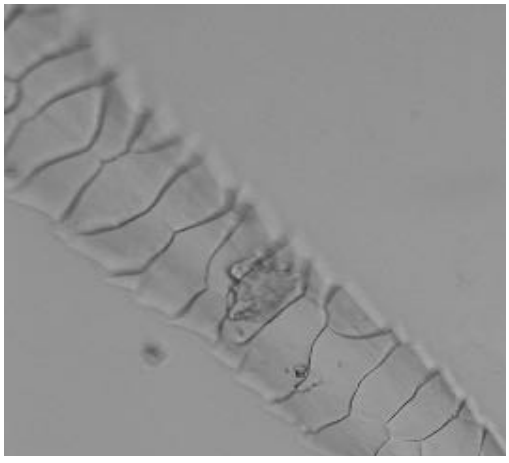
Scat Sample #2



Distal



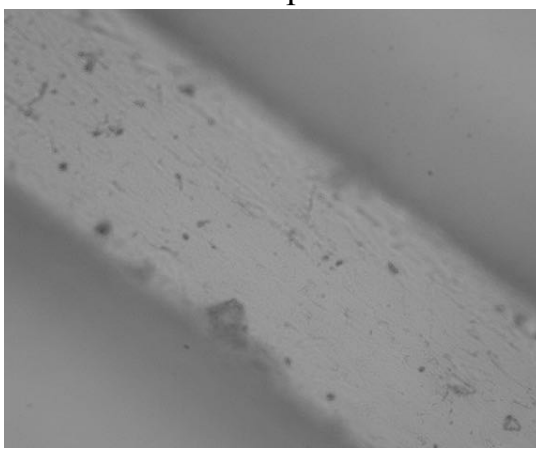
Middle



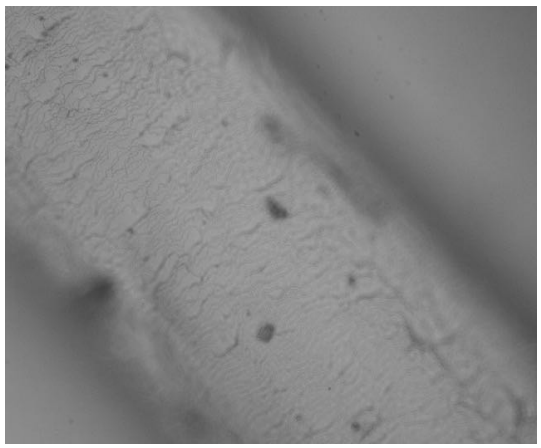
Proximal

Student Page- Cheetah Scat ID: Cheetah 1

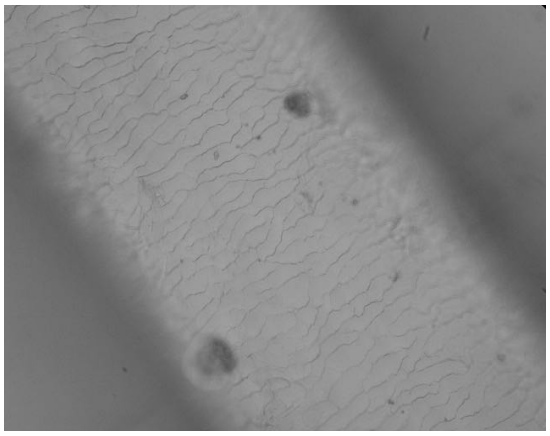
Scat Sample #3



Distal

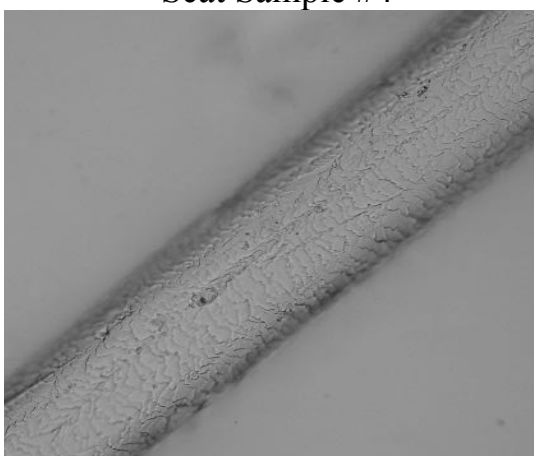


Middle

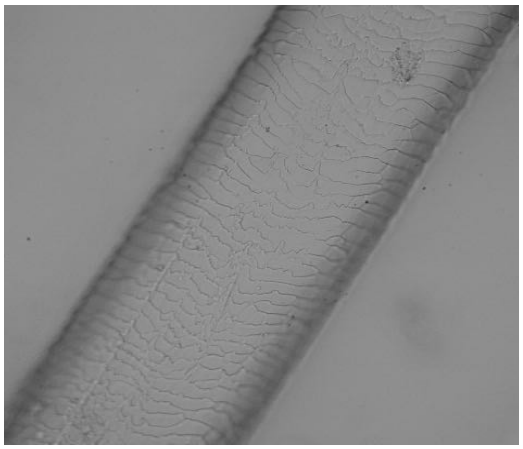


Proximal

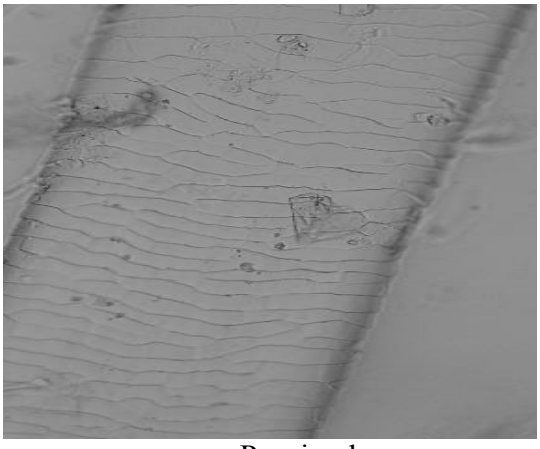
Scat Sample #4



Distal

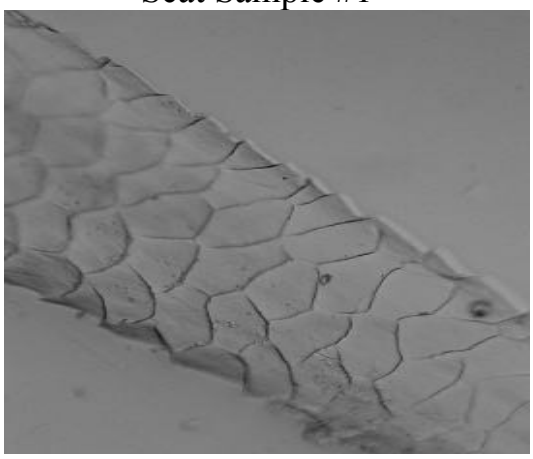
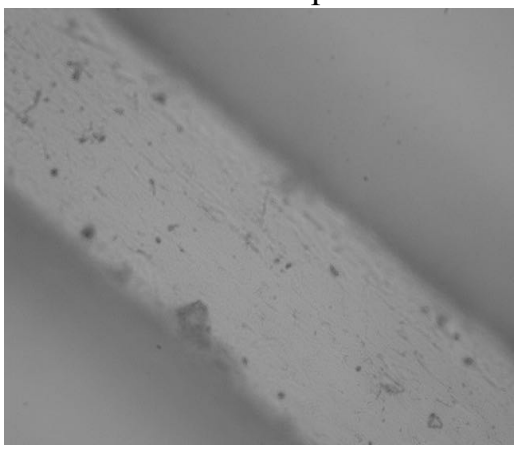
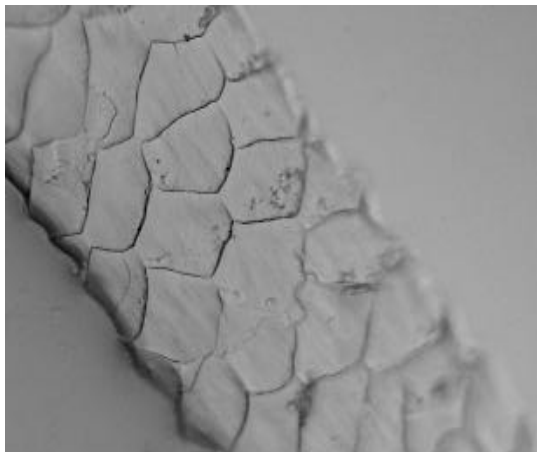
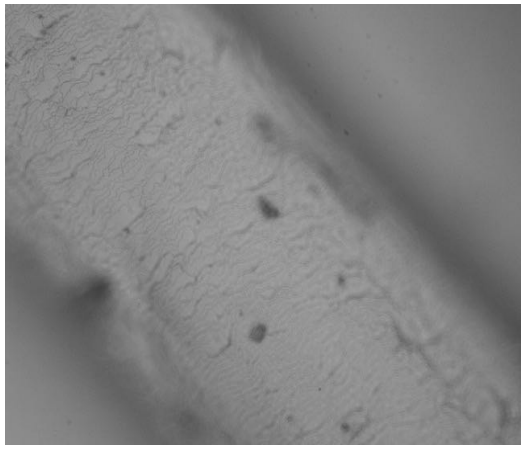
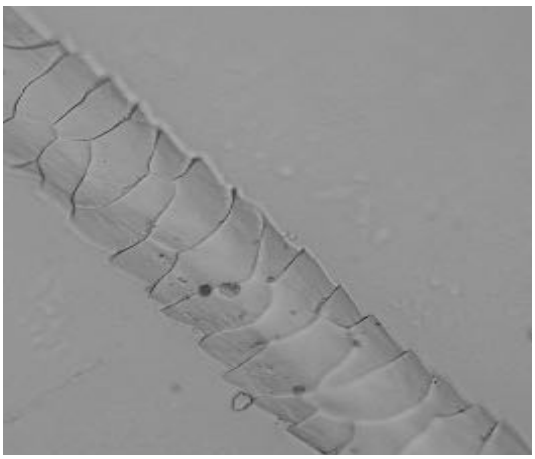
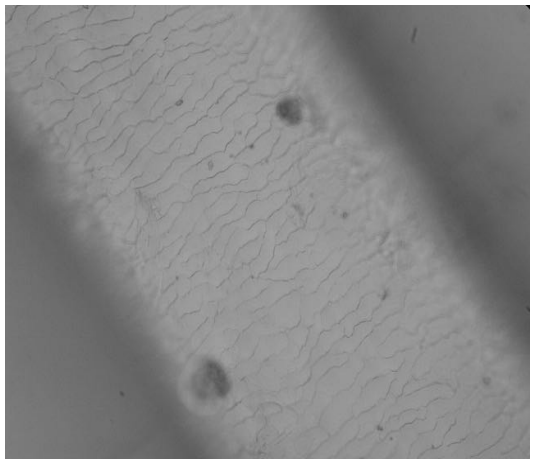


Middle



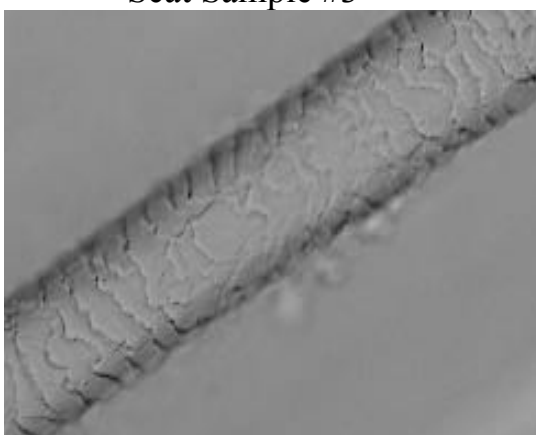
Proximal

Student Page- Cheetah Scat ID: Cheetah 2

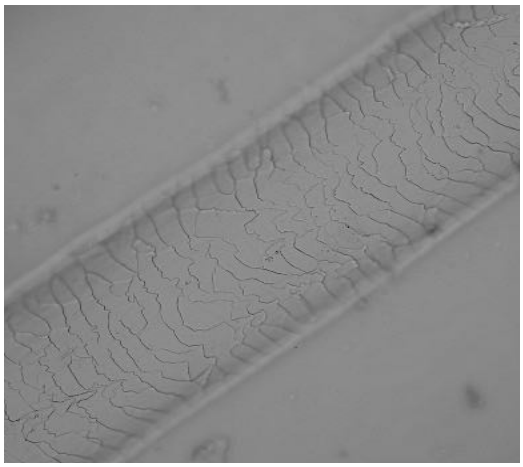
Scat Sample #1	Scat Sample #2
	
Distal	Distal
	
Middle	Middle
	
Proximal	Proximal

Student Page- Cheetah Scat ID: Cheetah 2

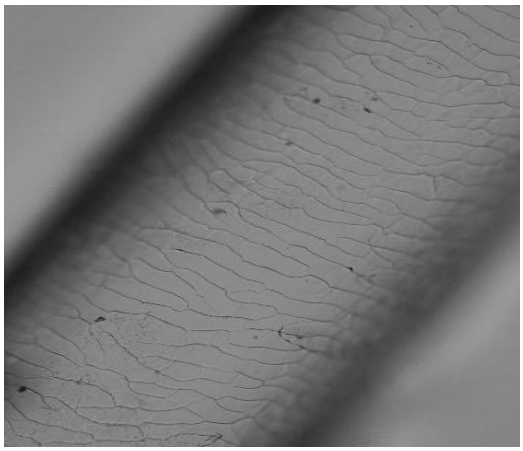
Scat Sample #3



Distal

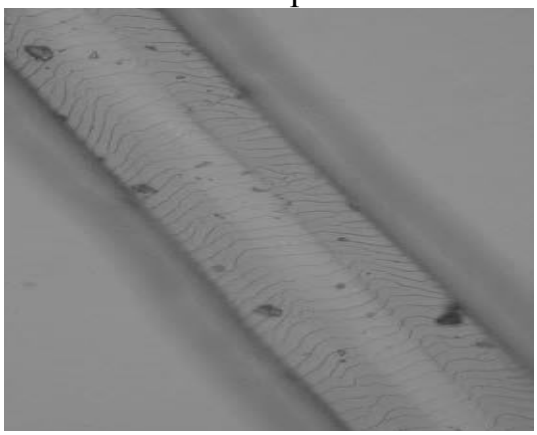


Middle

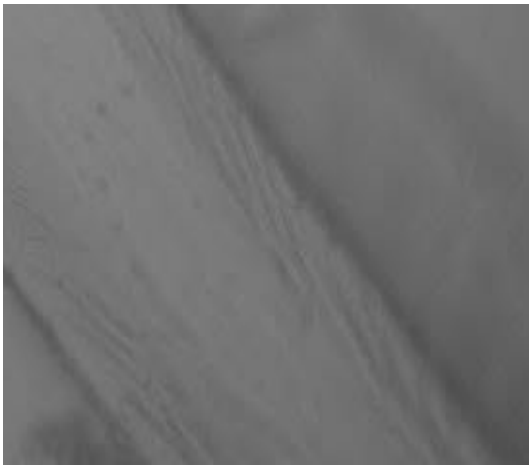


Proximal

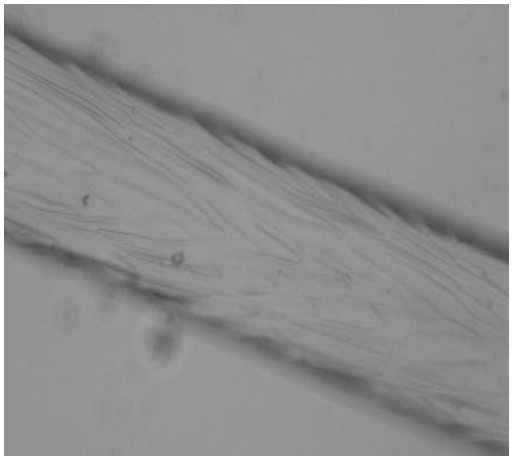
Scat Sample #4



Distal



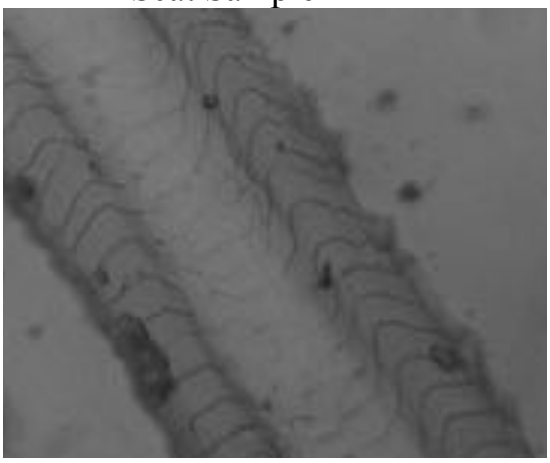
Middle



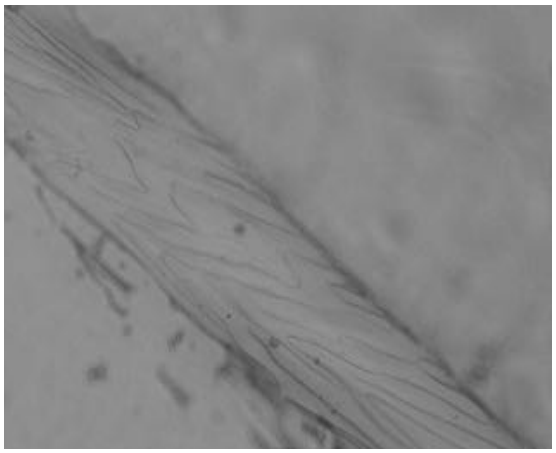
Proximal

Student Page- Cheetah Scat ID: Cheetah 3

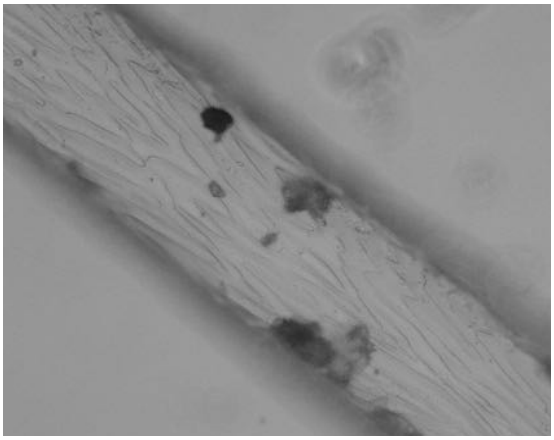
Scat Sample #1



Distal

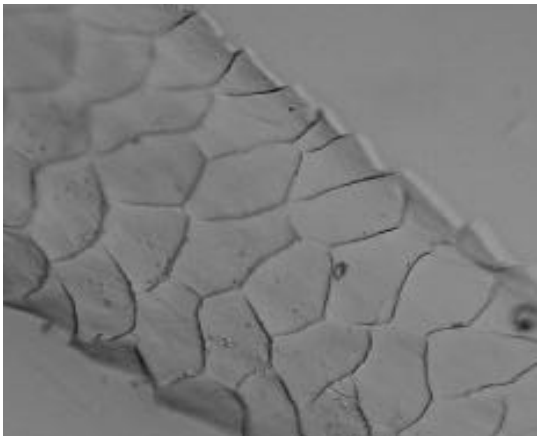


Middle

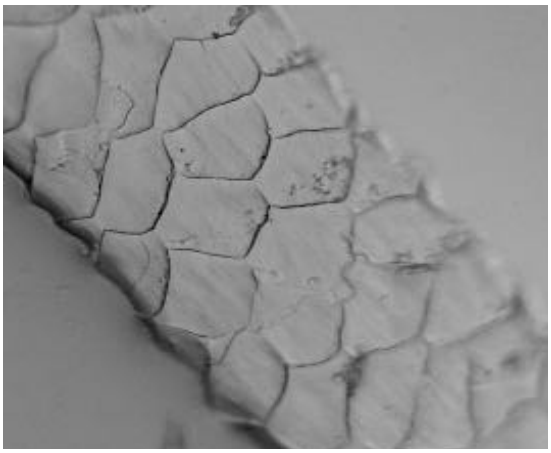


Proximal

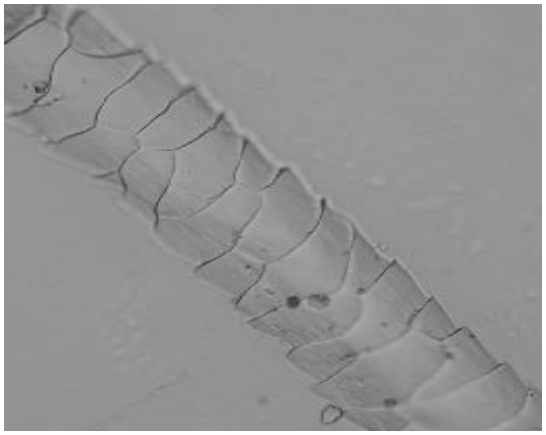
Scat Sample #2



Distal



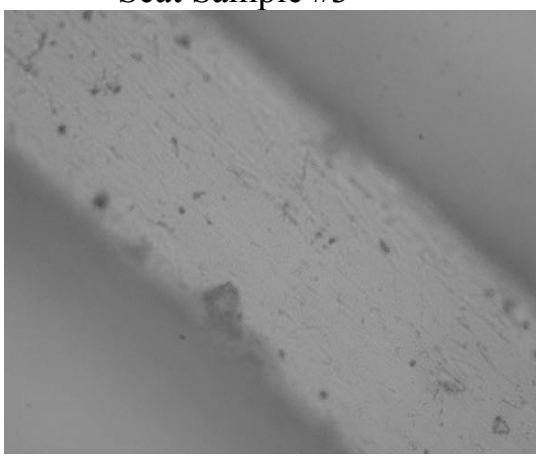
Middle



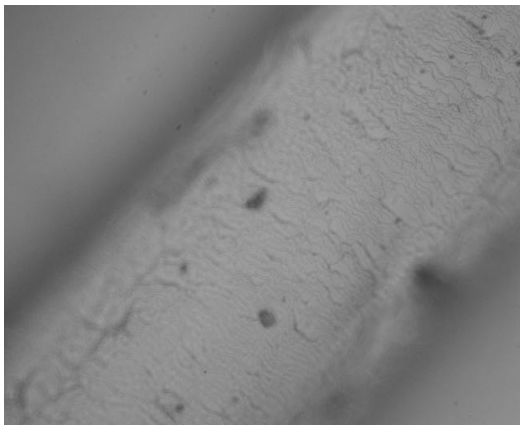
Proximal

Student Page- Cheetah Scat ID: Cheetah 3

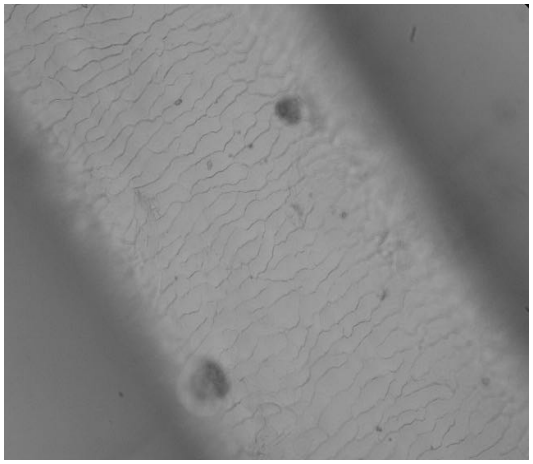
Scat Sample #3



Distal

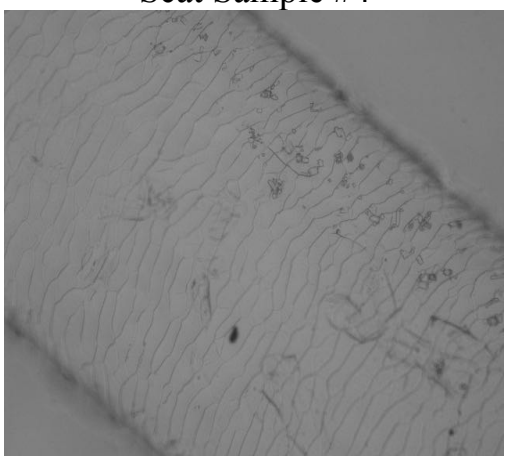


Middle

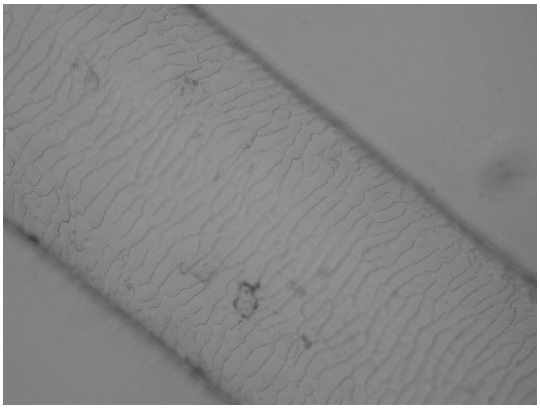


Proximal

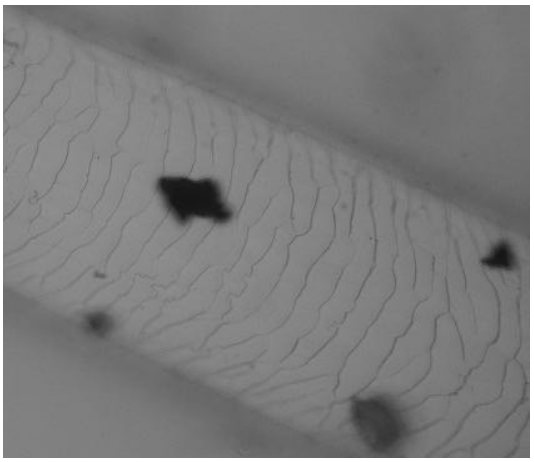
Scat Sample #4



Distal



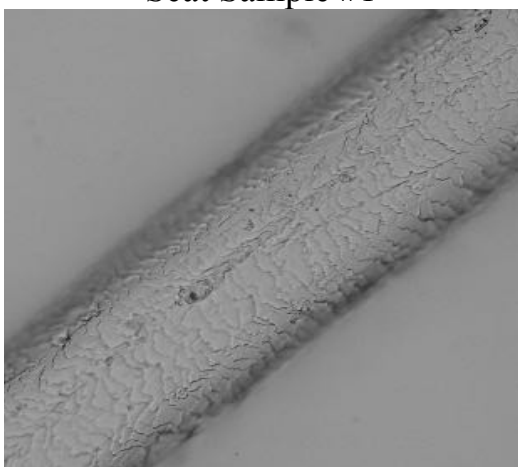
Middle



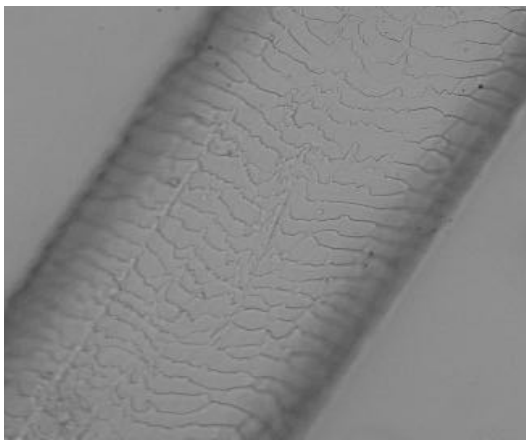
Proximal

Student Page- Cheetah Scat ID: Cheetah 4

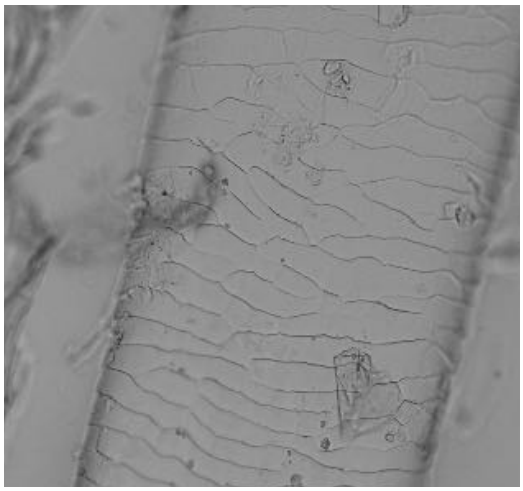
Scat Sample #1



Distal

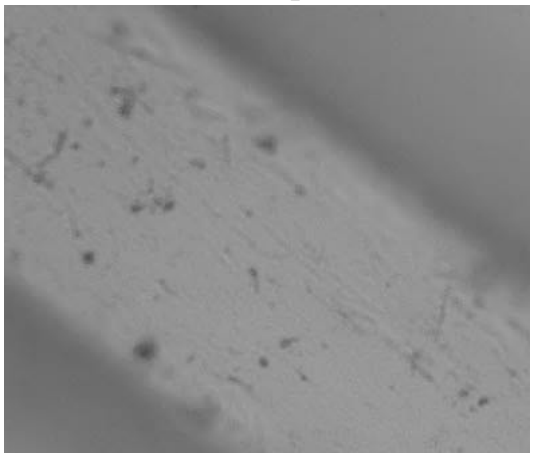


Middle

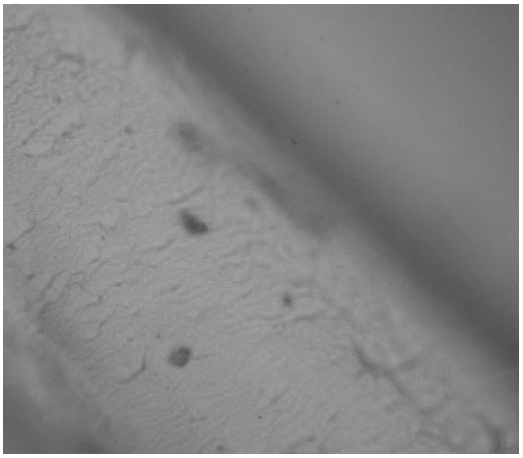


Proximal

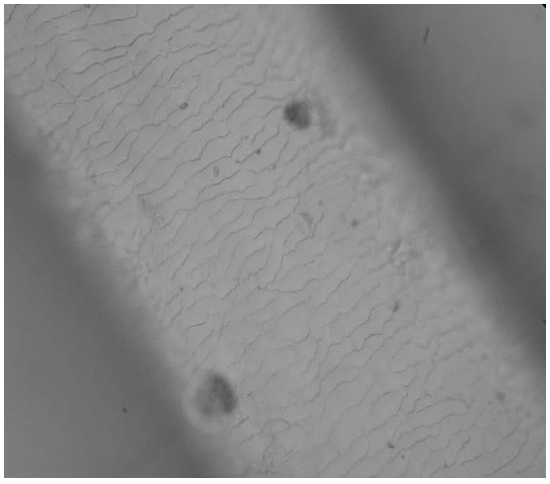
Scat Sample #2



Distal



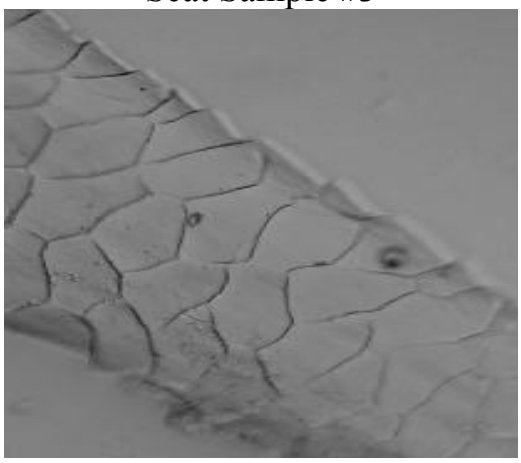
Middle



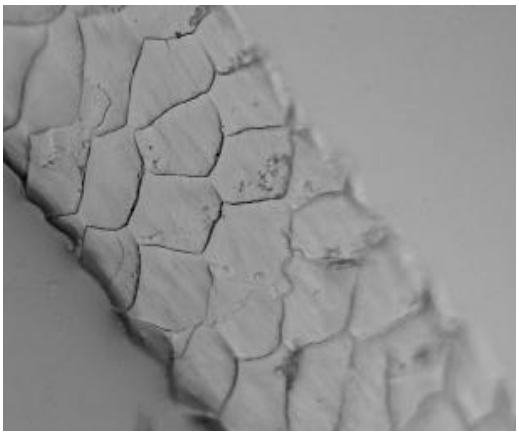
Proximal

Student Page- Cheetah Scat ID: Cheetah 4

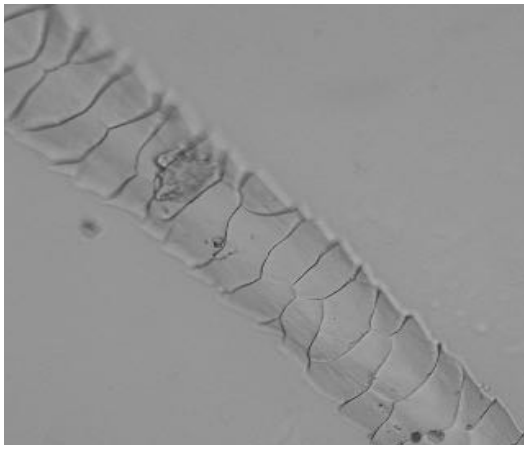
Scat Sample #3



Distal

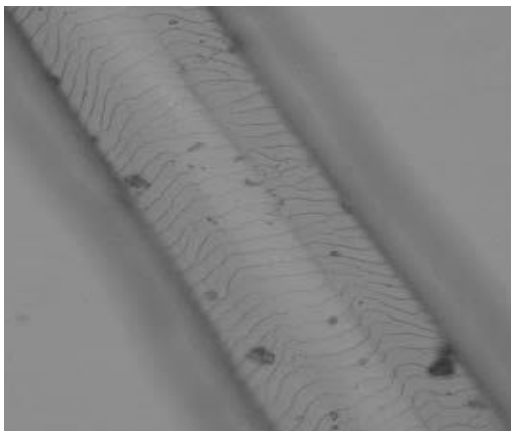


Middle



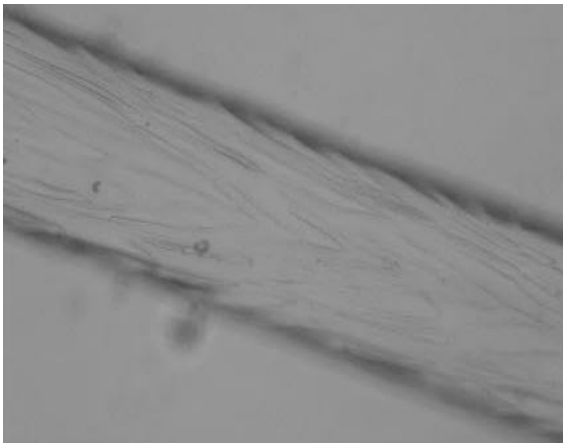
Proximal

Scat Sample #4



Distal

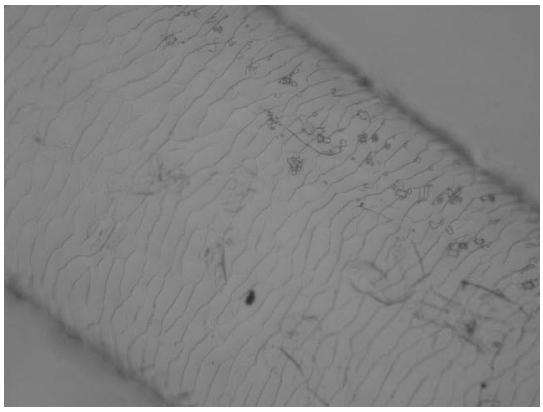
Middle



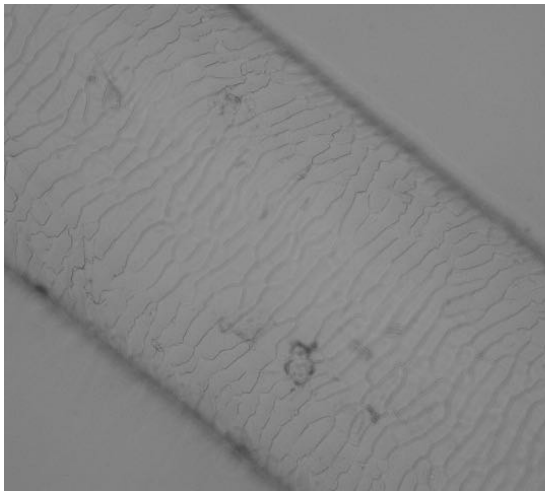
Proximal

Student Page- Cheetah Scat ID: Cheetah 5

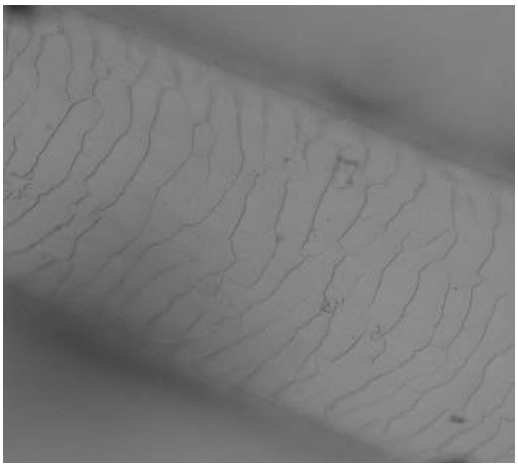
Scat Sample #1



Distal

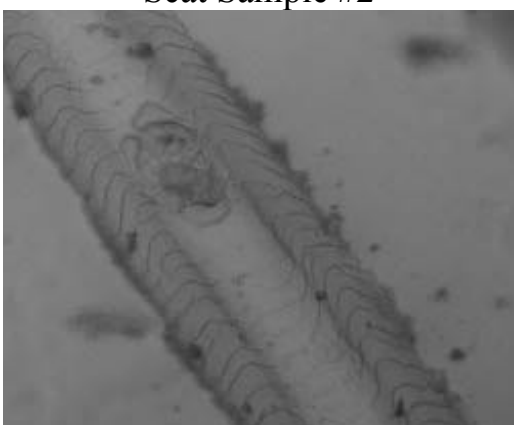


Middle

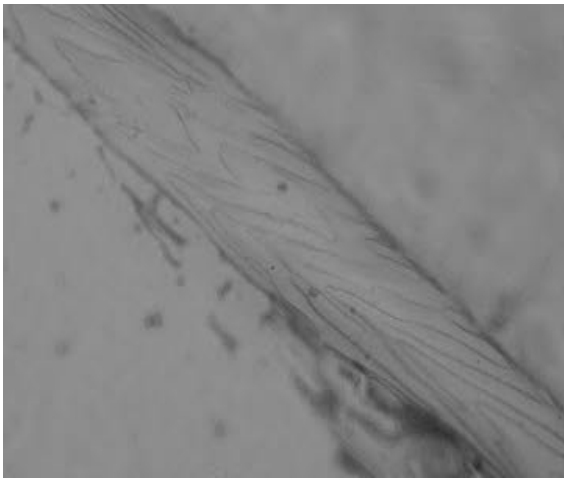


Proximal

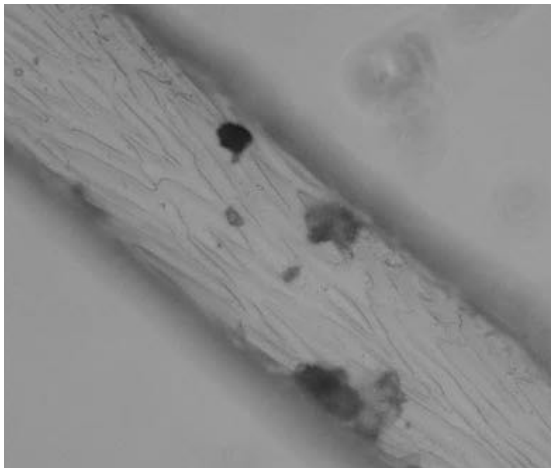
Scat Sample #2



Distal



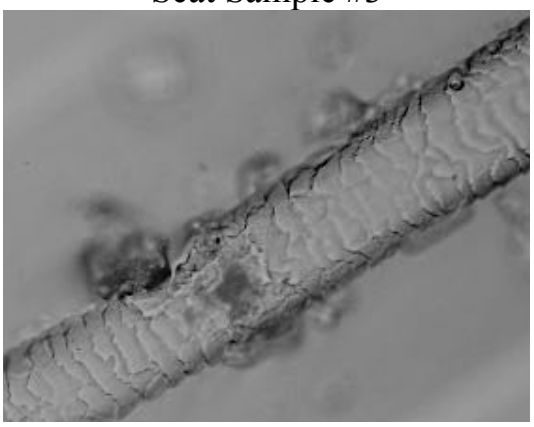
Middle



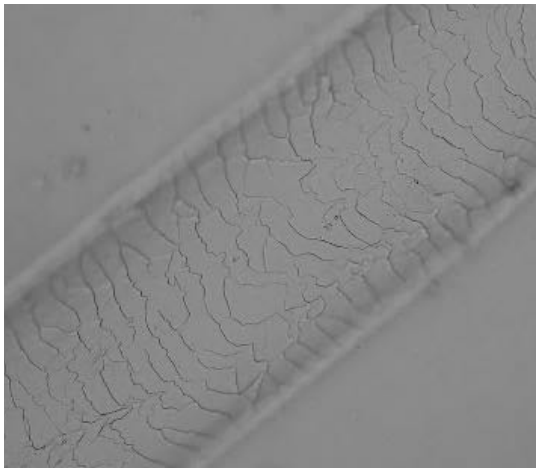
Proximal

Student Page- Cheetah Scat ID: Cheetah 5

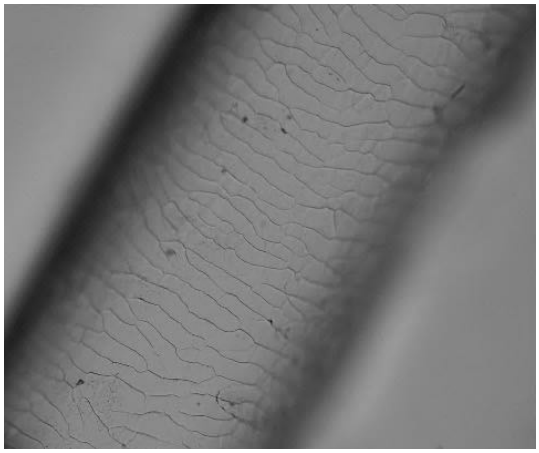
Scat Sample #3



Distal

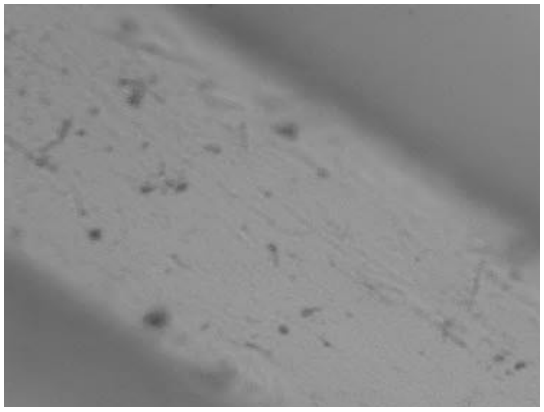


Middle

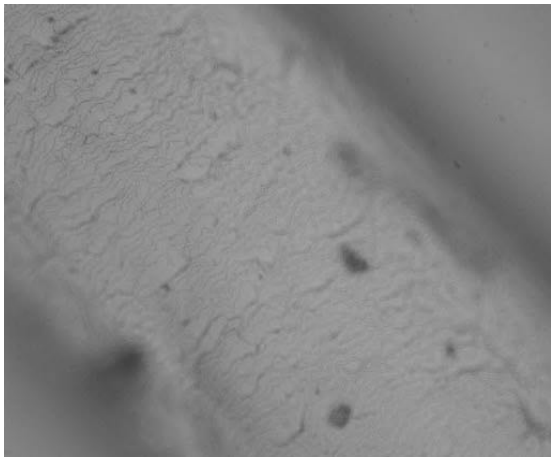


Proximal

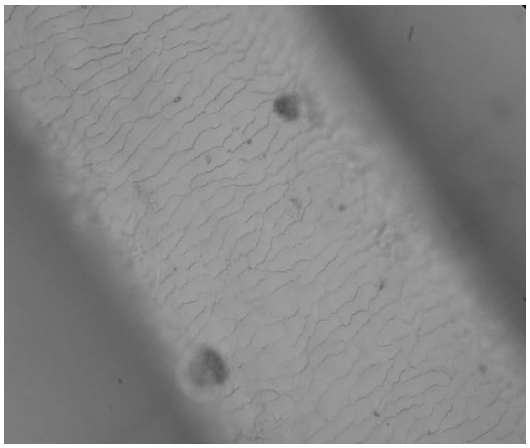
Scat Sample #4



Distal



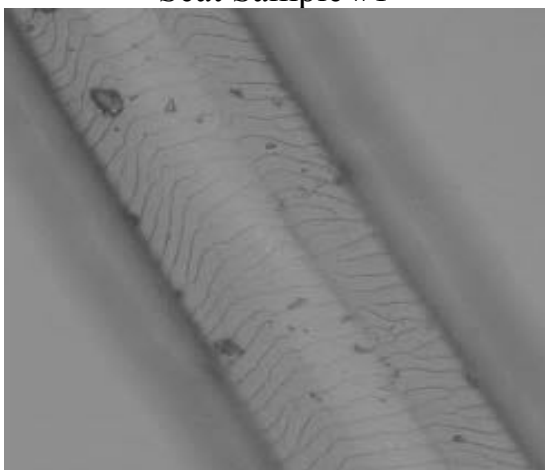
Middle



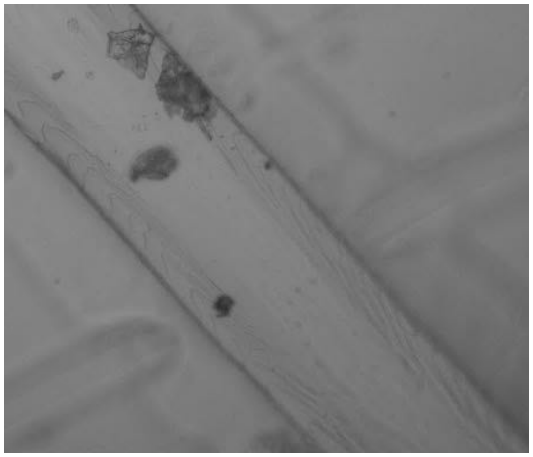
Proximal

Student Page- Cheetah Scat ID: Cheetah 6

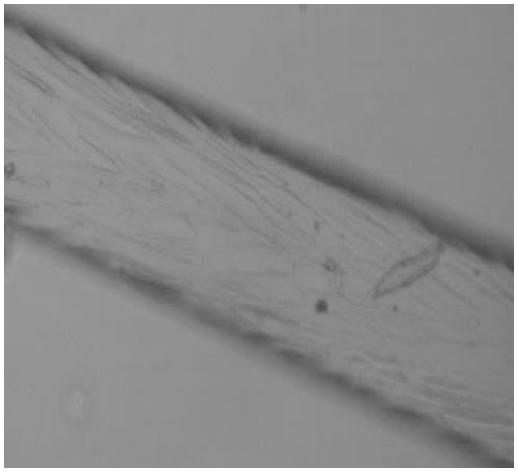
Scat Sample #1



Distal

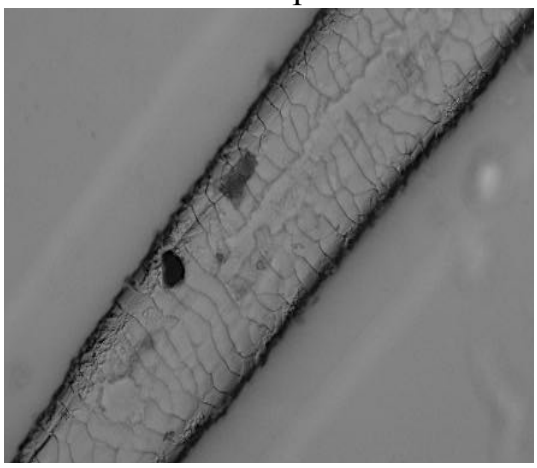


Middle

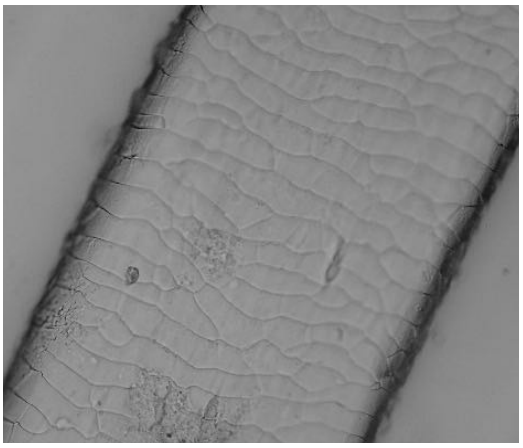


Proximal

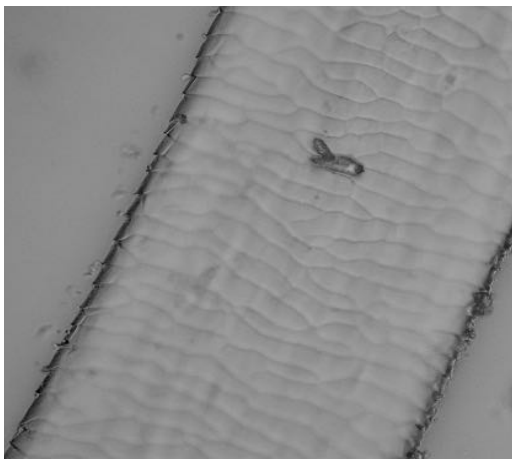
Scat Sample #2



Distal



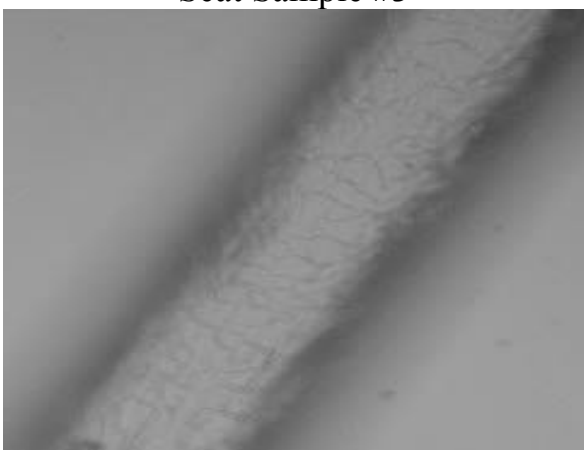
Middle



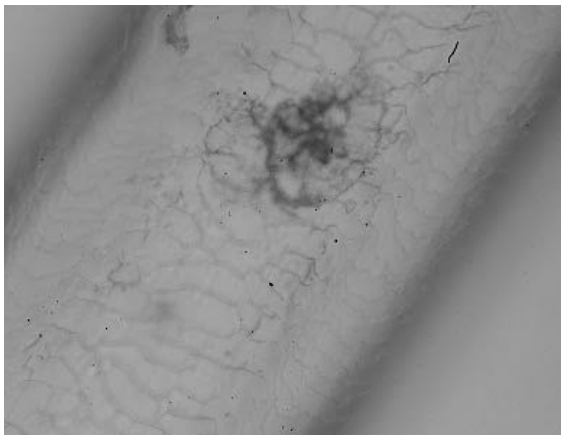
Proximal

Student Page- Cheetah Scat ID: Cheetah 6

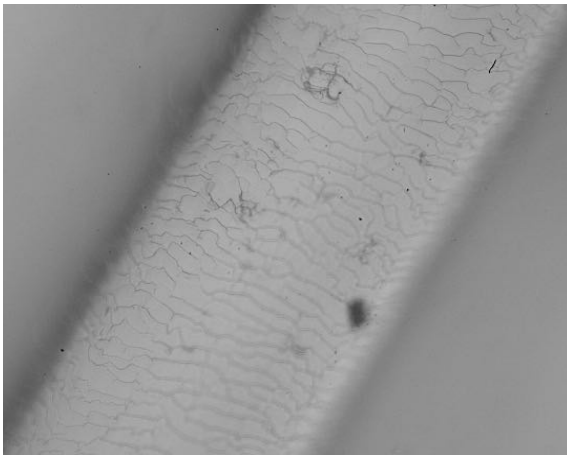
Scat Sample #3



Distal

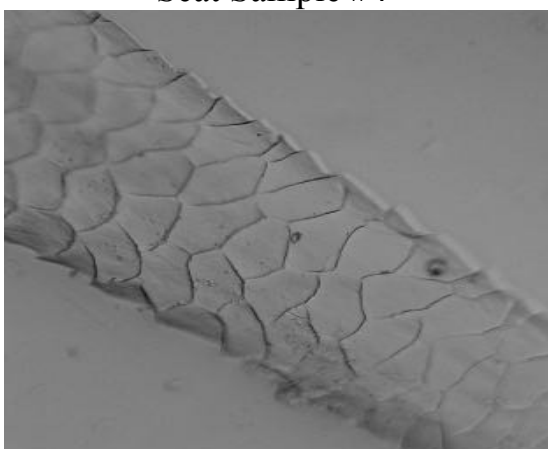


Middle

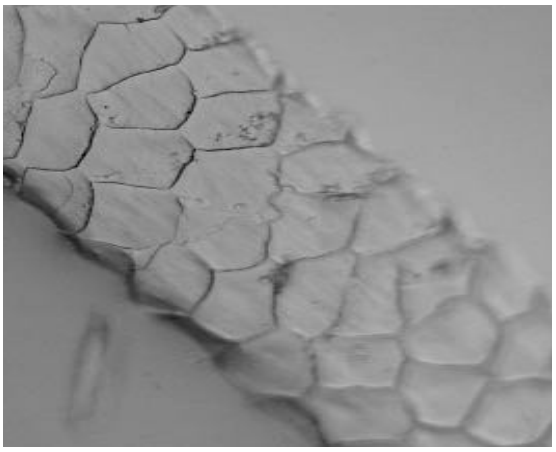


Proximal

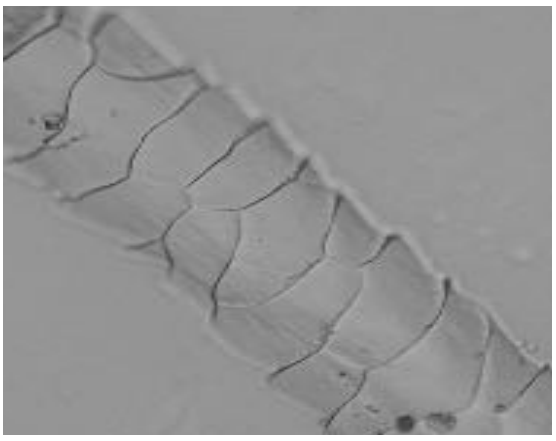
Scat Sample #4



Distal



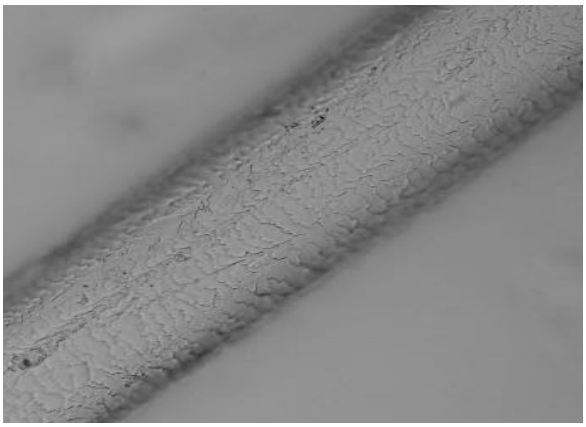
Middle



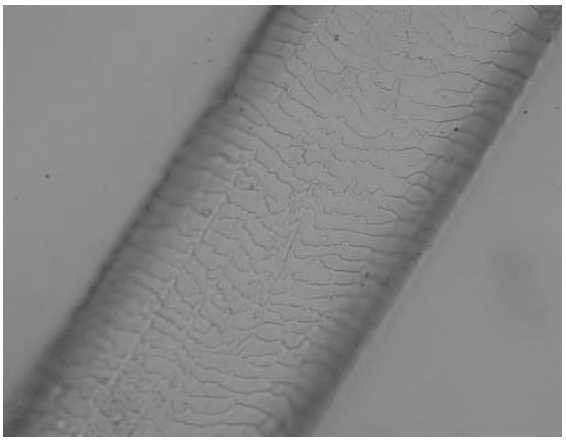
Proximal

Student Page- Cheetah Scat ID: Cheetah 7

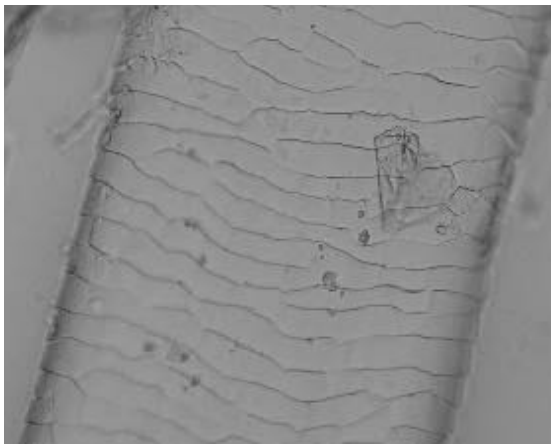
Scat Sample #1



Distal

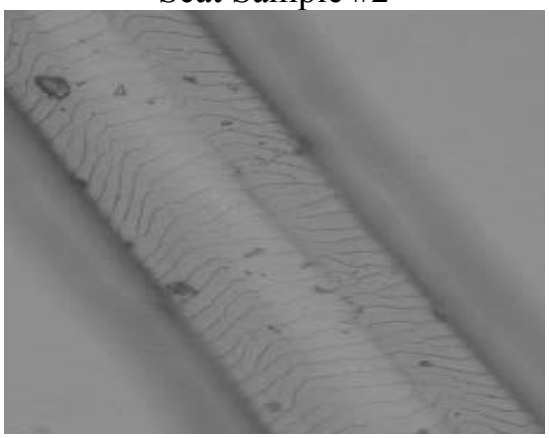


Middle

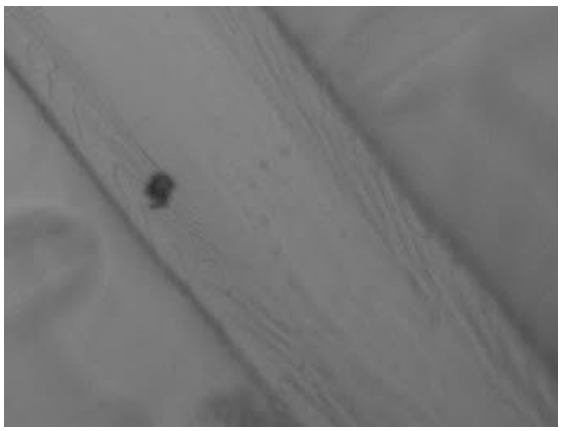


Proximal

Scat Sample #2



Distal



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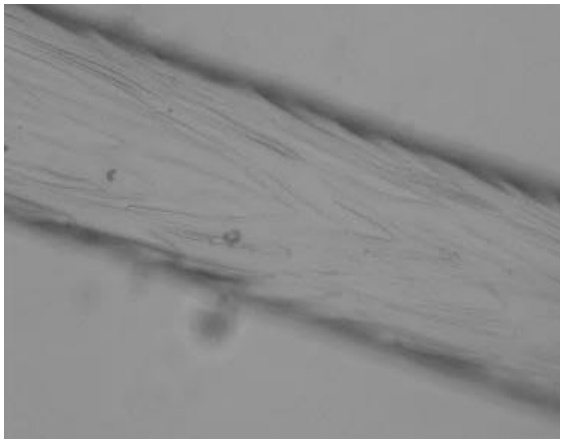
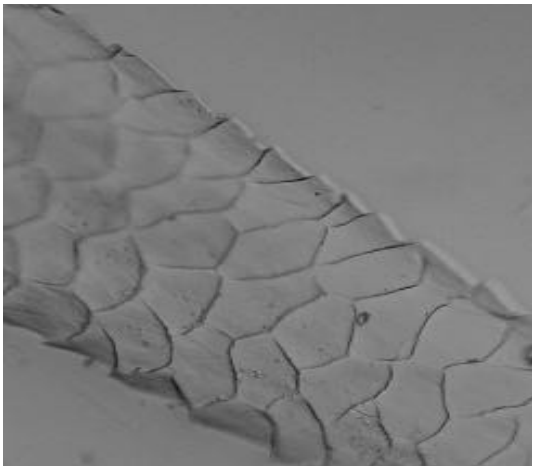


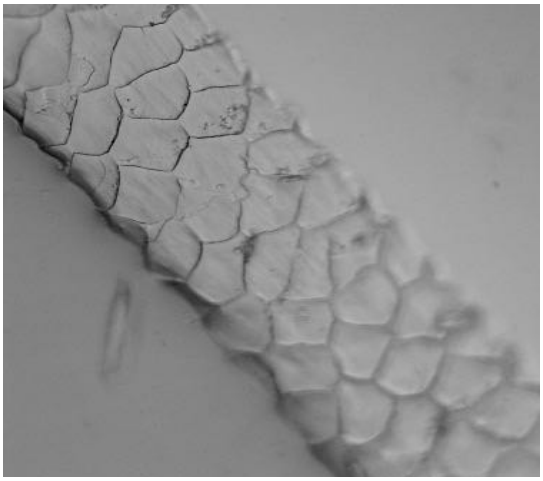
Proximal

Student Page- Cheetah Scat ID: Cheetah 7

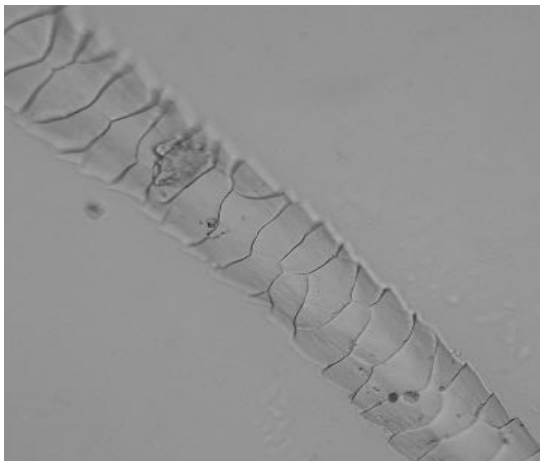
Scat Sample #3



Distal

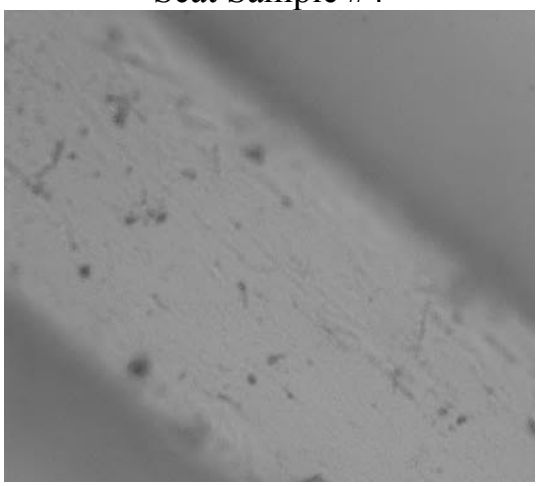


Middle

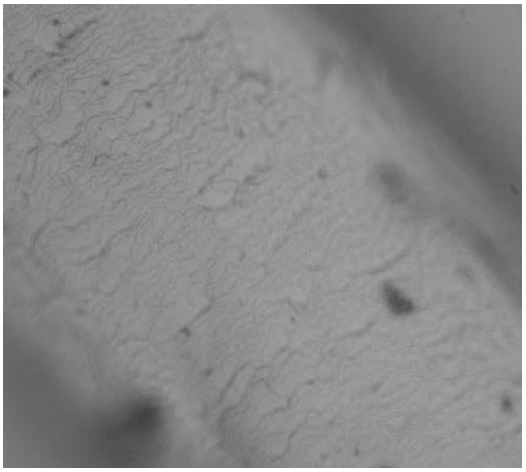


Proximal

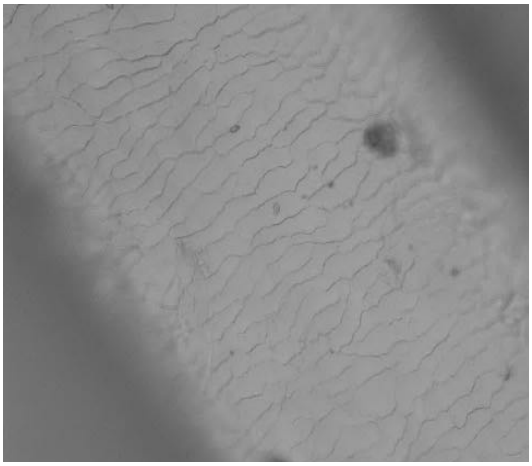
Scat Sample #4



Distal



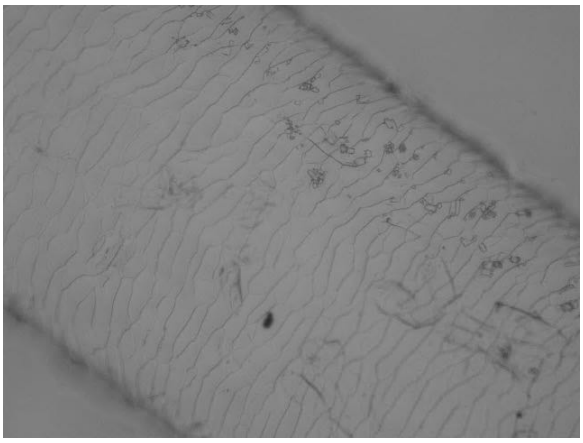
Middle



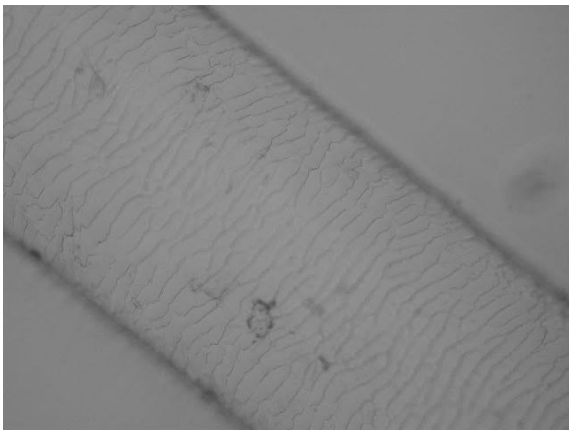
Proximal

Student Page- Cheetah Scat ID: Cheetah 8

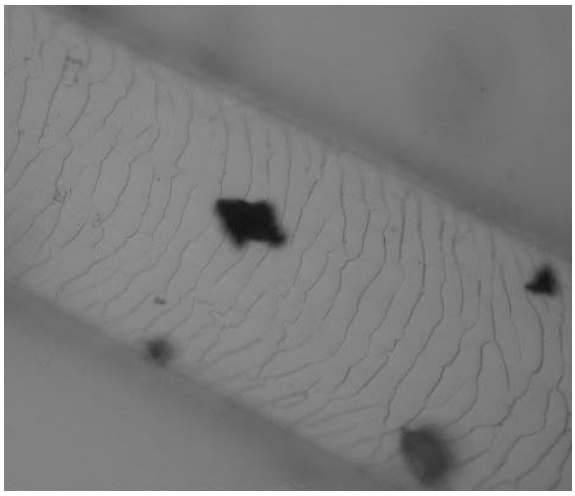
Scat Sample #1



Distal

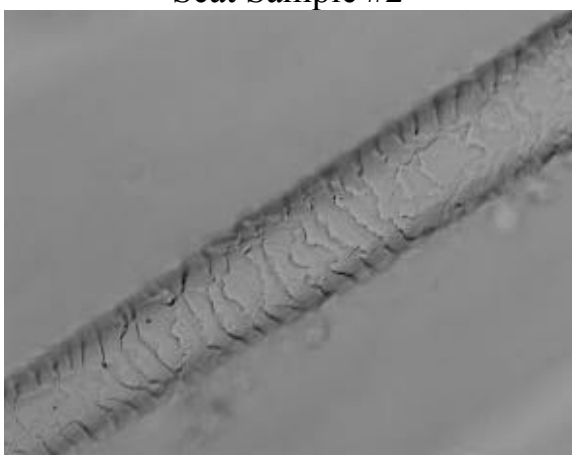


Middle

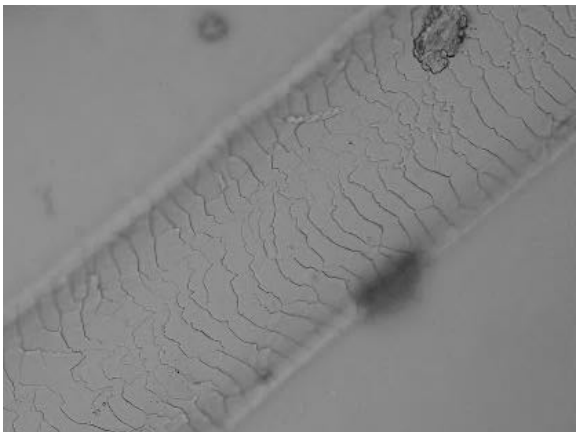


Proximal

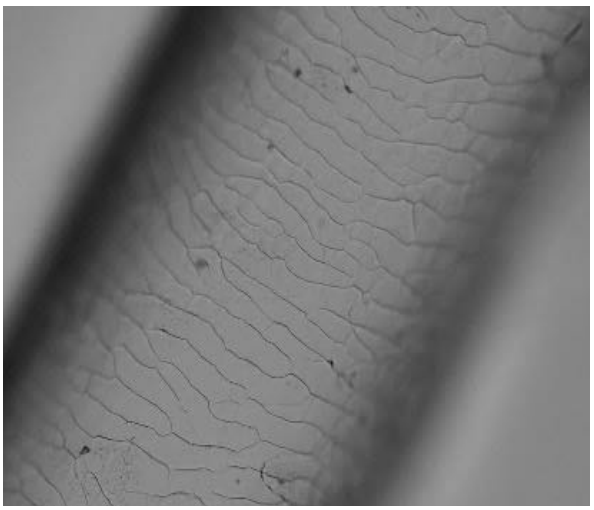
Scat Sample #2



Distal



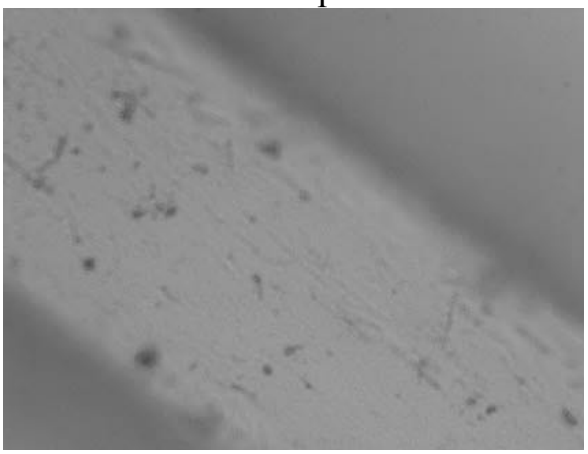
Middle



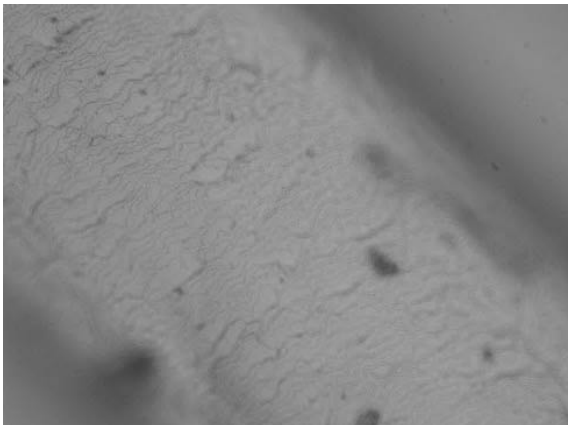
Proximal

Student Page- Cheetah Scat ID: Cheetah 8

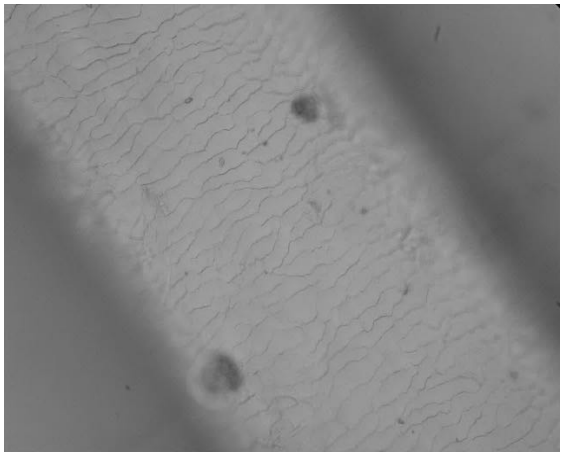
Scat Sample #3



Distal

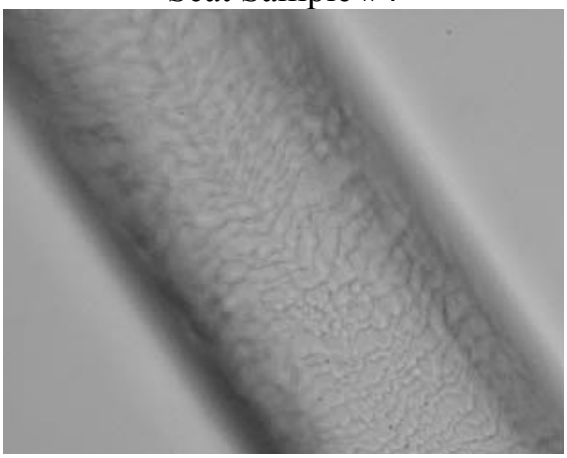


Middle

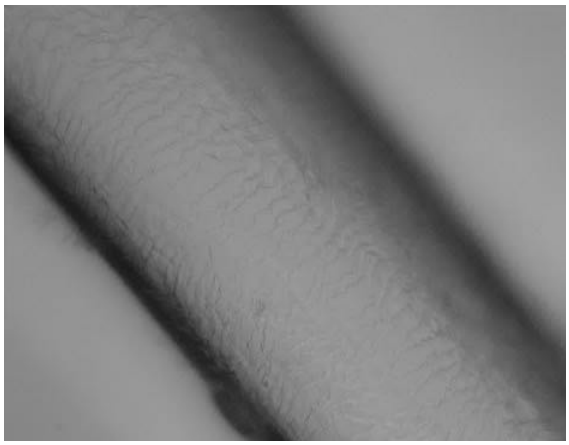


Proximal

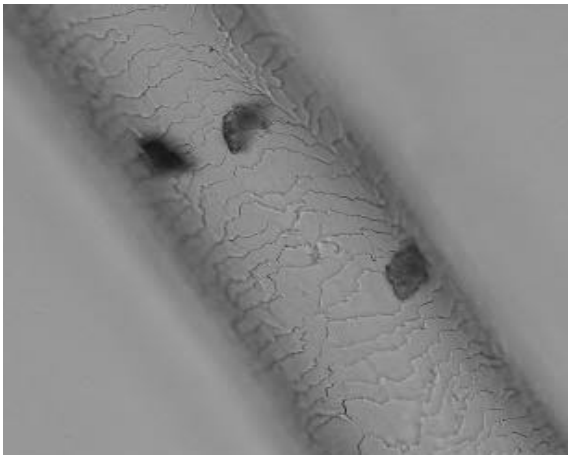
Scat Sample #4



Distal



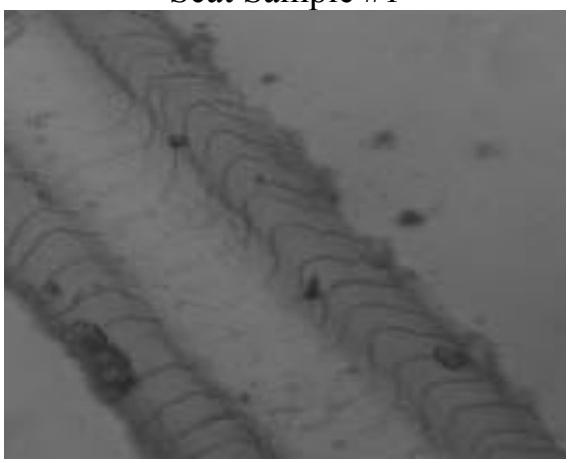
Middle



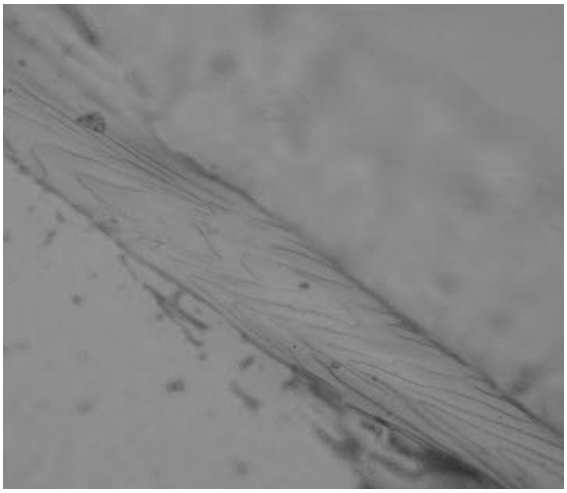
Proximal

Student Page- Cheetah Scat ID: Cheetah 9

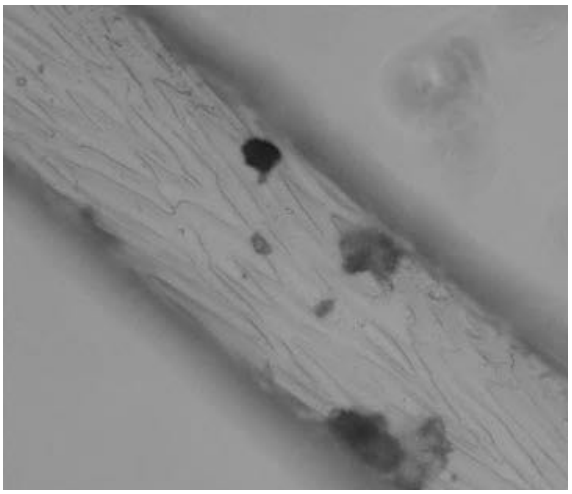
Scat Sample #1



Distal

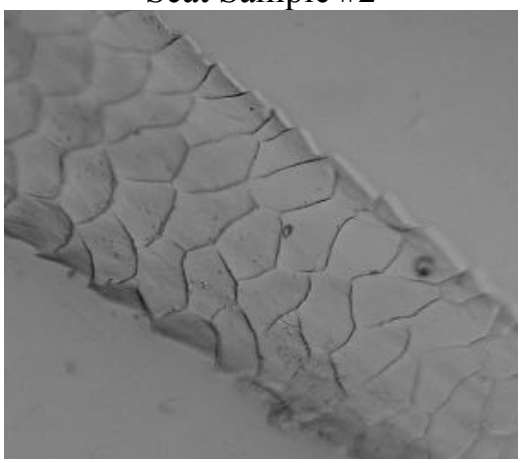


Middle

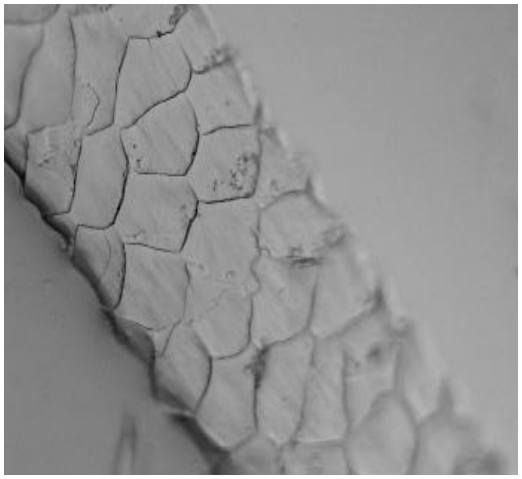


Proximal

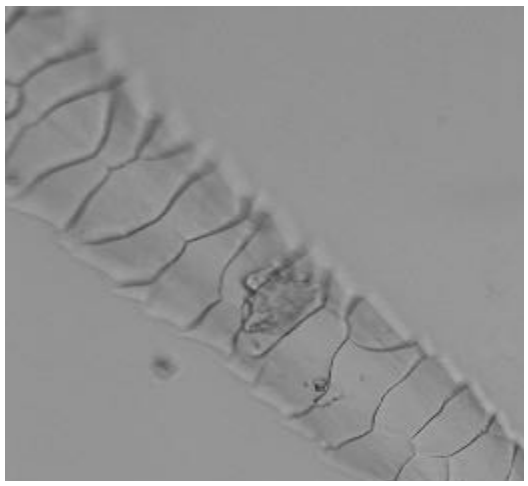
Scat Sample #2



Distal



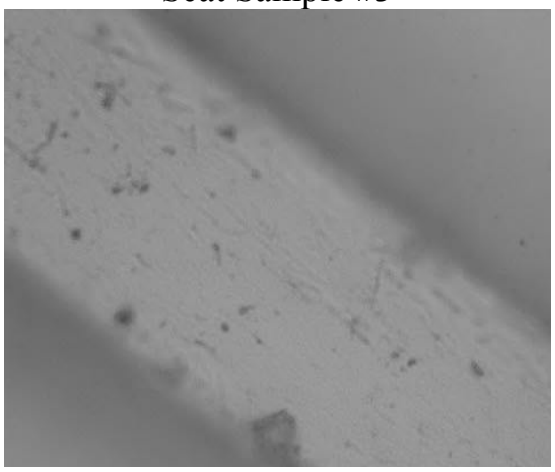
Middle



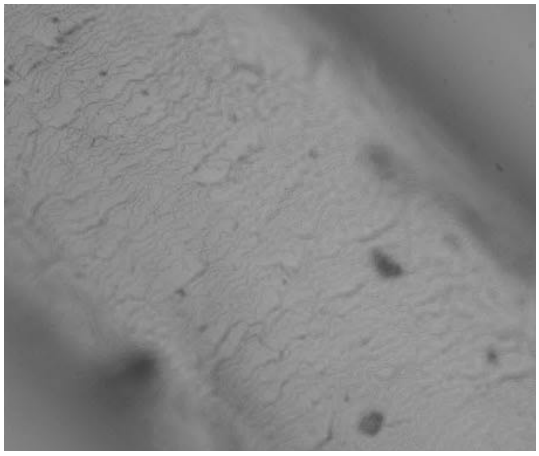
Proximal

Student Page- Cheetah Scat ID: Cheetah 9

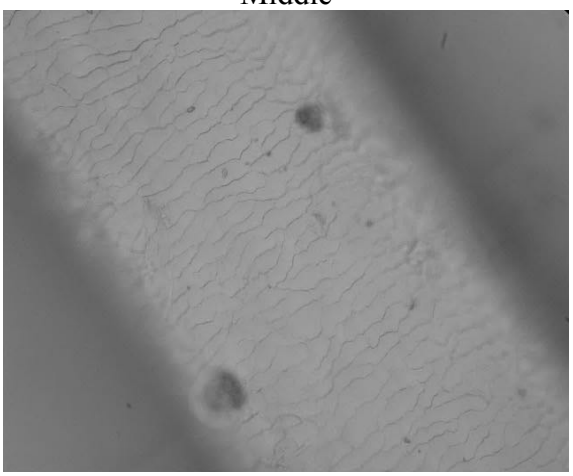
Scat Sample #3



Distal

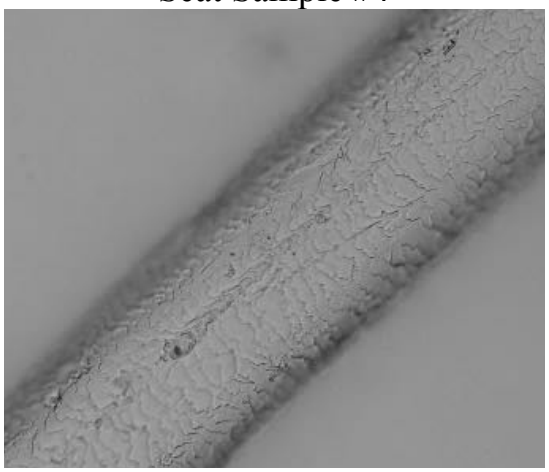


Middle

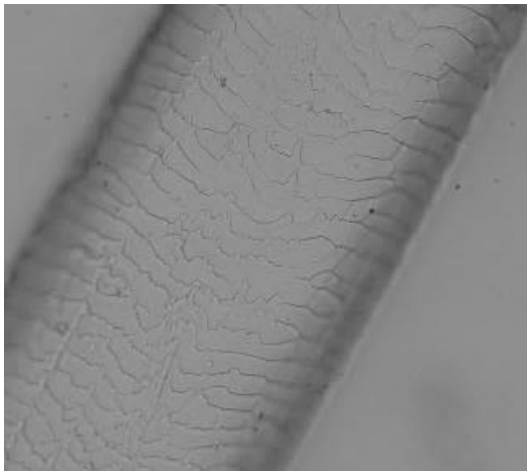


Proximal

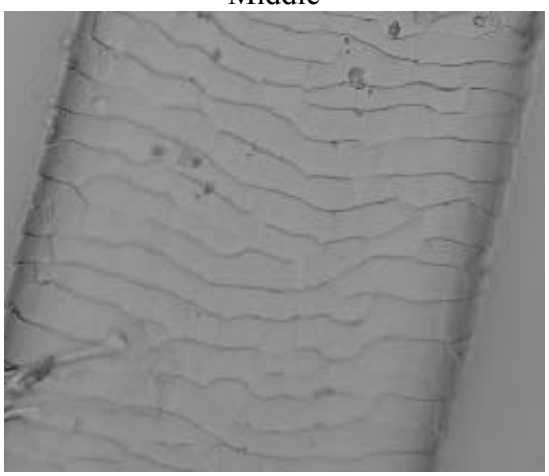
Scat Sample #4



Distal



Middle



Proximal

CHEETAH: AN ANIMAL AT RISK

SUBJECT AREAS:
Science, Environmental Studies

DURATION/TIME:
Activity 1: 20 min
Activity 2: 30 min

RECOMMENDED PREPARATION:
Activity 1:
- Review Appendix B- Reference: 'Endangered'

Activity 2:
- Photocopy of student page 'An Animal At Risk' for each learner

MATERIALS NEEDED:
Activity 2:
- Photocopies of student page for each learner

LOCATION:
- Classroom

KEY WORDS TO REVIEW:
Adaptations
Characteristics
Conserve
Conservation
Endangered
Extinct
Habitat
Species
Threat

OBJECTIVE:

Learners will discover why animals become endangered and what can be done to save the endangered cheetah from extinction.

LESSON ACTIVITIES:

ACTIVITY 1:
Discussion on why species become endangered, why the cheetah is at risk and what we can do about it.

ACTIVITY 2:
Continues discussion with completion of student page 'An Animal At Risk.' Use reference material in Appendix to aid discussion.

Learning Outcomes

In this activity learners will look at the main reasons why many animals become endangered. They will then look specifically at reasons why the cheetah is at risk and what will need to be done to save the cheetah.

Teaching the Lesson

Activity 1 – Discussion

Endangered species are ones that exist in low numbers and could go extinct if they are not protected and managed. Unfortunately, thousands of species are endangered, and each year more species become extinct. The cheetah, pangolin, black rhino, African wild dog and Cape vulture are a few endangered species that exist in Namibia.

As human populations increase, we change our planet at an ever faster rate, and many species of plants and animals suffer. Extinction has always been a natural process (for example, the dinosaurs went extinct before humans lived on the earth) but the current rate of extinction has increased dramatically. The introduction of exotic species, over-exploitation, and habitat loss are all responsible for the mass destruction of species occurring today. People are responsible for these problems. And people are capable of finding the solutions. But to find effective solutions and implement management programs wisely, we must understand why animals become endangered so that we can change our actions and prevent their extinction.

The number of cheetahs has decreased from 100,000 at the turn of the 20th century to less than10,000 today. The cheetah suffers from habitat loss, declining prey base, a lack of genetic diversity, and conflicts with livestock farming. Few cheetahs thrive in parks and reserves because of the abundant presence of larger predators, and are therefore pushed into farmland for survival. If we learn more about the natural threats posed to the cheetah and work to reduce conflict with the species, we can reverse the current trend and save the cheetah from extinction.

Activity 2 – An Animal at Risk

1. Ask learners to identify problems that face cheetahs in the wild and in captivity. Identify threats that endanger the species in both environments. *(Answers: lack of genetic diversity, high infant mortality, loss of habitat, declining prey numbers, illegal trade or poaching, human development and conflict with livestock and agricultural interests, and low reproduction in captivity all threaten the cheetah. Lack of genetic diversity and high infant mortality affect the species in both the wild and captive environments.)*

2. Discuss with the learners why cheetahs are in trouble and have them complete the student page 'An Animal At Risk.' Reference 'Cheetah Fact Sheet' and 'Cheetahs and Farmers' found in Appendix B.

_____ Limited geographical range	__x__ Habitat Loss
__x__ Lack of genetic diversity	_____ Over-utilization
__x__ Specialized food and habitat needs	__x__ Trapping by humans
__x__ Sensitive to environmental changes	__x__ High infant mortality
_____ Few offspring & long gestation periods	__x__ Poaching
_____ Low population numbers	__x__ Declining prey numbers
__x__ In conflict with humans and development	

1 & 2) How many characteristics did you check? Is the cheetah an animal that is prone to extinction? Do you think the cheetah may need help from humans to survive? Why or why not?
Nine characteristics. Yes, the cheetah is an animal prone to extinction.

Answers will vary: *Yes, many answers are possible.*

3) Which of the characteristics do you think poses the biggest threat to the cheetah?
Conflict with humans and development, sensitive to environmental changes; and lack of genetic diversity.

4) Based on what you know about the cheetah, could it become extinct in the wild?
Yes, the cheetah could become extinct in the wild. The cheetah's survival depends on people and their willingness to manage the population and secure habitat for the species in the wild. The species' lack of genetic diversity makes it susceptible to diseases and viruses. In addition it is less able to adapt to environmental changes. The cheetah is a survivor and has lived on this earth for four million years. But in order for it to survive, the cheetah must have habitat, a healthy prey base, and it's population must be allowed to increase in the wild so natural selection can strengthen the population.

5) What can YOU do to help conserve the cheetah?
Answers will vary:
1) Help protect its' habitat and ensure a place for it on African farmlands; (2) aid in the conservation of the wild prey base; (3) stop the indiscriminate capture and removal of the cheetah; (4) improve livestock management; and (5) educate everyone about the need to conserve biological diversity and the predator's unique role in healthy ecosystems.

Student Page – An Animal At Risk

Name: _____ **Date**: _____

Many animals are endangered because of humans and their activities. In addition to threats caused by humans, some species are endangered because of their special adaptations and/or habitat requirements. Animals and plants that are more likely to become endangered share certain characteristics. For example, they:

- have limited geographical ranges because of growing human expansion
- suffer from overuse or poaching
- live in specialized habitats and eat special foods
- exist in low population numbers
- lack genetic diversity
- come into conflict with humans and development or are affected by human disturbances; are sensitive to environmental changes
- Need large landscapes to satisfy all habitat needs
- have high infant mortality
- have few offspring and long gestation periods

Animals that have one or more of these special biological characteristics listed may not suffer adverse effects until people start to interfere with them by destroying habitat, polluting environments, poaching, over-utilizing through trade, hunting, or eradication because of misconception or interference with development. Many carnivores have become endangered because of human fears and misconceptions about their behaviours, and therefore have suffered adversely from predator control programmes.

Instructions: Mark all of the characteristics that threaten the cheetah.

_____ Limited geographical range	_____ Habitat Loss
_____ Lack of genetic diversity	_____ Over-utilization
_____ Specialized food and habitat needs	_____ Trapping by humans
_____ Sensitive to environmental changes	_____ High infant mortality
_____ Few offspring & long gestation periods	_____ Poaching
_____ Low population numbers	_____ Declining prey numbers
_____ In conflict with humans and development	

1) How many characteristics did you check? Is the cheetah an animal that is prone to extinction?

2) Do you think the cheetah may need help from humans to survive? Why or why not?

3) Which of the characteristics do you think poses the biggest threat to the cheetah?

4) Based on what you know about the cheetah, could it become extinct in the wild?

5) What can YOU do to help conserve the cheetah?

CHEETAHS THROUGHOUT HISTORY

SUBJECT AREAS:
Social Studies, History, Science

DURATION/TIME:
Activity 1: 15 min
Activity 2: 20 min

RECOMMENDED PREPARATION:
Activity 1:
Review Appendix B- Reference: 'The Cheetah's History'

Activity 2:
Make photocopies of the student page- 'Cheetah History' for each learner

MATERIALS NEEDED:
Activity 2: student page-'Cheetah History'

LOCATION:
Classroom

KEY WORDS TO REVIEW:
Evolve
Extinct
Migrate
Prehistoric
Timeline

OBJECTIVE:

Learners will discover the history and movement of the cheetah and predict the cheetah's future.

LESSON ACTIVITIES:

ACTIVITY 1:
Learners will look at prehistoric cheetahs, cheetah history and movement.

ACTIVITY 2:
Learners construct a timeline for the cheetah in the student page- 'Cheetah History.'

Learning Outcomes

Learners will discover the prehistoric history of the cheetah and its movement from North America to its present home in Africa. An activity to create a timeline of cheetah history is also included.

Teaching the Lesson

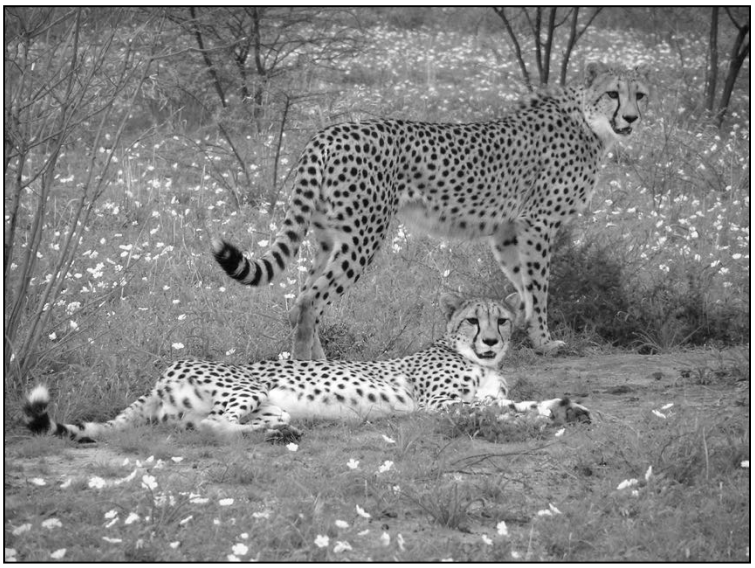
Activity 1 – Discussion on Prehistoric Cheetahs

Cheetahs were once one of the most widely distributed of all land mammals. During the Ice Age they migrated over land and ice bridges from North America into the southern regions of present-day Russia, eastern Asia, and through deserts and steppe regions into the Middle East, southern Europe, and Africa.

Using the map on the following page, discuss with learners the movement of cheetahs in prehistoric times. Make special note of how the cheetah actually evolved in North America, but now has become extinct in all of its former home ranges except for Africa and Iran. Also, ask the learners how they could have made it through the Bering Strait between North America and Asia. (During the Ice Age this was a land bridge of frozen ice).

Activity 2 – Cheetah History

Review with the learners the purpose of a timeline in understanding history. Have them complete the student page- 'Cheetah History' and create a timeline of the cheetah's history. Any other historical events can be added to better integrate it into any time period study.



The Prehistoric Range of the Cheetah
4 Million Years Ago

The Giant Cheetah, A. pardenis, roamed China, southern Europe, and India in large numbers during the Ice Age. It was as big as a lion and ran as fast as the modern cheetah.

Studies conclude that the cheetah originated in North America. This cheetah relative appears to be a common ancestor between the cheetah and the puma (cougar). During the Ice Age, Miracinonyx migrated across continents. Its decedents developed the characteristics that make cheetahs unique today.

Student Page – Cheetah History

Name: _____ **Date:** _____

Instructions: Draw a timeline referencing changes in cheetah history to historic events and scientific discoveries. Start the timeline 4 million years ago.

Events to consider for the cheetah's history:

- 3,500,000 - 4,000,000 years ago, cheetahs first appear.
- 15,000 to 20,000 years ago, during the Pleistocene Epoch, cheetahs cross land bridges from North America into Asia, Europe and Africa and live on all 4 continents.
- 10,000-12,000 years ago, cheetahs become extinct on every continent except Africa and Asia, causing a genetic bottleneck.
- 3,000 BC, African cheetah population splits into East African and southern African subspecies. Sumerians begin taming cheetahs for hunting at court.
- 400's (5th Century), Italians use cheetahs to hunt for sport.
- 1000's (11th Century), over-hunting causes sharp decline in the southern African cheetah, making it more inbred than the East African cheetah.
- 1500's (16th Century), Akbar the Great keeps 9,000 cheetahs in court, during his 49 year reign.
- Early 1900's, India and Iran begin to import cheetahs from Africa for hunting purposes.
- 1952 & 1956, the Indian cheetah becomes extinct and the first cheetah reproduces successfully in captivity.
- 1975, the cheetah is placed on Appendix I of C.I.T.E.S.
- 1990, Namibia gains independence. The Cheetah Conservation Fund is established to help protect wild cheetahs.

WRITING ABOUT CHEETAHS

SUBJECT AREA:
Writing, English, Science, Information & Communication

TOPICS:
Activity 1:
Writing exercises

Activity 2:
Composition topic ideas

Activity 3:
Reading activity & language study

DURATION/TIME:
Activity 1: 40 min
Activity 2: 40 min
Activity 3: 40 min

RECOMMENDED PREPARATION:
Preparation will vary

MATERIALS NEEDED:
Activity 3:
Photocopies of the story 'How The Cheetah Got Its Spots' and student page- 'Language Study'

LOCATION:
Classroom

KEY WORDS TO REVIEW:
Words are listed in Activity 3

OBJECTIVE:

Learners will develop language skills and expand their vocabulary through creative writing.

LESSON ACTIVITIES:

ACTIVITY 1:
The teacher can choose from seven different writing exercises about the cheetah and the environment

ACTIVITY 2:
The teacher can choose from four different composition topics for learners to write about cheetahs and other Namibian predators

ACTIVITY 3:
Read the story 'How The Cheetah Got Its Spots' and complete the student page- 'Language Study'.

Learning Outcomes

These activities are designed to develop language skills and to help learners realize their relationship with nature through creative writing.

Teaching the Lesson

The expression of our relationships with nature is an important way for us to learn more about how we feel toward the natural world and to clarify these relationships. Creative writings, poems, essays, and compositions provide learners with the means to share their attitudes, beliefs, and fears about the environment and the plants and animals with which they share the world. Words and phrases associated with wildlife conservation and environmental issues have implied and emotional connotations as well as literal meanings. Therefore, an understanding of vocabulary words associated with wildlife conservation and the environment is necessary to express these ideas.

Suggested activities in this subject area are focused on the development of communication skills and expansion of the learners' vocabulary. Composition topics are designed to encourage learners to explore their relationships with the natural world, understand their responsibilities as stewards of the land, and appreciate the importance of predators in their ecosystems.

The vocabulary list used in these activities is also located in the Appendix B-Glossary section. Educators and learners may wish to review Appendix A and B for background and reference materials in order to provide background information for essays and compositions.

Activity 1 – Writing & Reading Exercises

1. Write down all the adjectives your class can think of to describe a cheetah. Try to get learners to think of words that show movement, feeling, imagination such as liquid, graceful, swiftness, observant, watchful, high speed and flying. Have each learner write a poem or short paragraph using 10 of the new words.

2. Have your learners write a short story or poem about predators, their habitats, and/or threats to their survival. Have your learners read the poems and stories to the class.

3. Read to your class or have your learners read the story 'How The Cheetah Got Its Spots.' Answer the questions at the end of the story. Have learners create their own creative story about an African animal adaptation such as the elephant's trunk, the rhino's horn or the zebra's stripes.

4. What African folk tales involving the cheetah or other predators do you know? Learners can collect traditional stories by talking with elders and storytellers in their community. You can divide the stories into categories depending on their content. Build a library and share these stories with teachers and learners from other regions. Send copies of myths, stories, and sayings to the Cheetah Conservation Fund (CCF).

5. Chat with a Cheetah:
   By interviewing people and writing articles for newspapers and magazines, we learn more about the world around us. Explain to your learners how journalists find out information about subjects by interviewing people. Have your learners imagine they are reporters interviewing a cheetah. Write down questions that a reporter would ask a cheetah about its habitat, the food it likes to eat, fears about extinction, threats from humans, and how it feels about the misconceptions humans have of the species.

   Have the learners take turns interviewing and being interviewed. While they are being interviewed they will play the role of a cheetah and answer questions about their behaviours, habitats, adaptations, and other interesting topics. As the interviewers asking the questions, your learners can learn more about a particular aspect of the cheetah and its lifestyle. You may want to expand interviews to include other predators, prey species, farmers, and wildlife managers. Allow time for learners to research the cheetah; encourage the use of reference materials, contact with non-government organisations, and government officials. As interviewers they should take notes just like a journalist. After taking turns interviewing and being interviewed, have your learners write articles for newspapers and magazines, draw illustrations, and then publish a cheetah magazine. Send copies of the newspaper to CCF for possible publication in our international newsletter.

6. Complete the student pages 'Composition Topics' and/or 'Language Study.'

Activity 2 – Composition Topics

1. Have your learners write a composition about a cheetah's or another predator's perspective on people.

2. Why should we save cheetahs and predators for the future? Consider some of the following points:

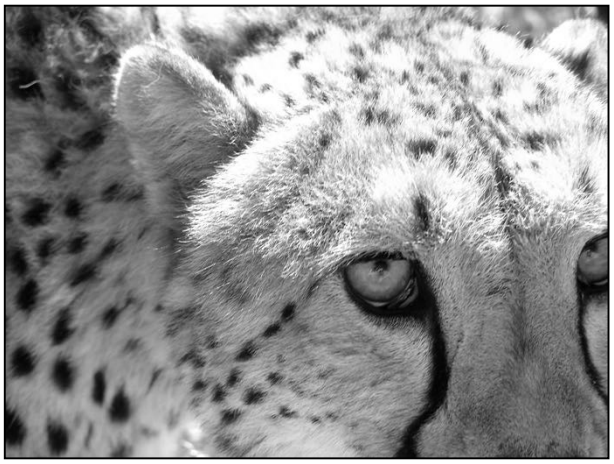
   a) Aesthetic value - beauty and uniqueness of species.

   b) Ethical/Moral value - humans have been responsible for the extinction of many species. Plants, animals, and fungi are each unique and represent millions of years of evolution, but humans can destroy these species in a short time. Because we have caused many problems for these species and threatened their survival, we are obligated to help endangered species recover.

   c) Ecological value - all living organisms fulfil a unique part of delicate, natural systems; humans depend on animals and plants for survival in ways we do not fully understand. Besides their role as food sources, organisms break down wastes and return elements to the system. Without these elements, life on earth would eventually end. The future of our planet is dependent on this important role of plants and animals.

   d) Scientific value - wildlife contributes to human health through medicine, medical research, etc. By destroying plant and animal habitats, we risk an immeasurable loss. The possible benefits to humans could compensate for the cost of their conservation.

   e) Economic value - income can be generated from utilizing wildlife in a sustainable manner. Some say that the best way to save wildlife is to make it pay for itself. What are the good and bad points of this argument? Sustainable utilization requires sound management and planning. Utilizing wild species or developing tourism in wild areas can bring new sources of income to people trying to improve their standards of living and is another reason to preserve wildlife.



3. The following are some famous quotes concerning wildlife conservation and species extinction. You may want to have your learners memorize a few or write an essay or composition using the quote as the thesis.

It is also true that when there is no wildlife left in the land the rain does not come...Because wild animals are Gods animals, if He looks down and sees the animals under the trees without food, He will send rain.

-Herero/Himba belief

Never kill the cat that cries.

-Ovambo saying

When the sky has been swept clean of eagles
And the winds carry echoes of the past,
What will you answer when the children ask,
' Where are the animals? Did you see them go?'

-Tom Knothe

What is man without beasts? If all the beasts were gone, man would die from great loneliness of spirit, for whatever happens to the beasts also happens to man. All things are connected.

-Chief Seattle

Destroyed buildings can be rebuilt; destroyed works of art may possibly be replaced by new creations; but every animal and every flower which becomes extinct is lost forever in the most absolute of all deaths.

-Joseph Wood Krutch

...everyone shares a deep need for meaning. Everyone wants to know where he or she belongs, how he or she fits into the world. I am convinced that some of the essential answers can and must come from the source that shaped our origins and still underpins our lives: nature.

As we work to reinforce connections in the environment, so we build connections of our own. As we care for natural communities, so we strengthen our own communities' sense of well-being. As we heal the living world around us, so the healing begins inside. All this, too, is part of biodiversity. What I don't understand is why the hope held out by environmentalism has not captured more attention...Here, in plain sight, is a means of restoring a sense of wholeness.

-Douglas Chadwick

4. The management of natural resources to provide for future generations requires long-term planning; otherwise, animals that are endangered today may be extinct by the time our children or grandchildren are adults. While we may have legal ownership of some resources, for example wildlife and land, and control of their use during our lifetimes, ethically we are not the owners of these resources, but rather stewards for future generations. As stewards of the African environment, how will you provide a future for predators and other wildlife on farmlands and in rural areas?

Answer key to student page- language Study- 'How The Cheetah Got Its Spots' Note: Answers will vary

1. Use the following words or expressions in sentences:

running faster than
out of fear
savannah

Examples:
The cheetah was running faster than a sports car.
People kill predators out of fear.
The savannah is full of wild prey for the cheetah to hunt.

2. For the following words, write a word that has the same meaning and a word that has the opposite meaning.

Examples:

abrupt -	sudden, hasty, hurried (synonyms)
	gradual, slow (antonyms)
conceal-	hide, mask, camouflage (synonyms)
	expose, reveal (antonyms)
retract -	withdraw, recede, take back (synonyms)
	reveal, expose, bare (antonyms)
timid -	shy, quiet, apprehensive (synonyms)
	brave, unafraid, confident (antonyms)

3. Find three words or phrases on the first page that describe the cheetah.

Slender, long legs, coats were the colour of dry grass, they seemed to be crying, long black lines on their faces, tear marks, etc.

4. No specific answer to this question.

5. Change the following sentences from the past tense to present tense:

Moffet, did you see how fast those cheetahs ran? And how well their coats concealed them in the thick bush?

Moffet, can you see how fast those cheetahs run? And how their coats conceal them in the thick bush?

6. Example:

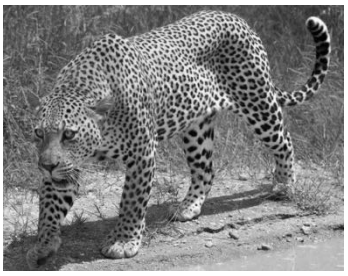
Cheetah
Spotted Sphinx
Swift African Hunter
The cat that cries
Unique

Story – How The Cheetah Got Its Spots

Stories are important tools for learning. They teach us about our past and share how we feel about our world. This story is based on an African tale on how the cheetah got its spots. Words underlined in the text are in the vocabulary list at the end of the story.

One day two children, Moffet and Elisabeth, were walking in the bush. In the distance they saw a water hole where three big cats were drinking. In order to get a better look at the animals, they tried to approach the water hole. As soon as they stepped closer, the predators saw the two children and ran away.

Leopard



Elisabeth said, "Moffet, did you see how fast those cheetahs ran? And how well their coats concealed them in the thick bush?"

"Those were not cheetahs," Moffet exclaimed, "they were leopards! You better stay away from them, they are very strong animals."

The two argued all the way back to their village. Elisabeth was sure the three cats were cheetahs. Moffet insisted they were leopards. The two children decided to speak with the headman to find out about cheetahs and leopards. Hopefully, he could help put an end to their argument.

The headman, a wise old man, wanted to help the two children. He asked Moffet and Elisabeth about the animals at the water hole. Elisabeth described them in great detail.

"The bodies of the three cats were slender with long legs. Their coats were the colour of dry grass and black spots covered their bodies. Their heads were small and they seemed to be crying. When we approached them, they sprinted away, running faster than any animal I have ever seen."

"Crying?" exclaimed Moffet "They were not crying."

The headman, being very wise, asked, "Why do you think they were crying, Elisabeth?"

Cheetahs

Elisabeth answered, "Because, wise headman, the long black lines on their faces looked like tear marks."

Moffet agreed with her description of the animals. But, he thought "tear marks" was a silly way to describe the black lines. The headman told the children that they had seen three cheetahs drinking at the water hole. Elisabeth could not help saying, "I told you so, Moffet."

The headman continued, "The cheetah is one of the most unique animals found on this earth. Thousands of years ago, we could find cheetahs throughout the world; in North America, Asia, Europe, and of course, Africa.

There were a great many cheetahs all over Africa. Today, the populations have declined because people feared big cats and hunters killed cheetahs for their beautiful skins."

"Where do most of the cheetahs live?" Elisabeth wondered.

"Namibia is the cheetah capital of the world; it has more cheetahs than any other country in Africa. Even here, our cheetahs are becoming less and less. Humans and cheetahs live on the same land. Most humans do not want to share the land with the cheetah. Farmers remove cheetahs from their land if they think the cheetahs are eating their young livestock. And people kill cheetahs even when the cats are not eating livestock."

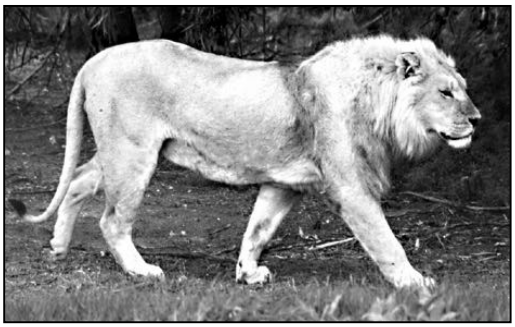
"Cheetahs are beautiful animals. It seems wrong to kill them out of fear," Moffet said. "Headman, could you tell us how the cheetahs that Elisabeth and I saw at the water hole got their spots?"

"I will be happy to tell you how the cheetah got its spots," the headman said. And this is his story:

A very long time ago when the earth was first created, all the animals came down onto the savannah. The animals, birds, and insects were all different shapes and different colours. When the cheetah first came to earth, just like all the other animals, it shook its body and stretched its legs, and took a deep breath of the new clean air. The cheetah thought it felt very good to be alive. Each animal had to get used to its own body, so the cheetah started running and found out that it could run very, very fast.

The cheetah ran and ran across the vast plains of the world. After a time of wandering the plains alone, the cheetah became lonely and decided to look for friends of its own kind. One day, the cheetah, with its great eyesight, spotted some large cats off in the distance and eagerly went running as fast as she could toward these cats. As she was running toward them, one of the cats, which was much, much larger than the others, stood up and roared. The loud noise frightened the cheetah and she dug her claws into the dirt and came to an abrupt halt. The cat was a big male lion, and he roared out to the cheetah in a very low booming voice, "Who are you and what do you want?"

Lion



The cheetah, which is much smaller in size than a lion and who by nature is a very shy and timid animal, said, "I am lonely and have been searching the savannah trying to find friends of my own kind."

The lion roared, "Well, you are not a lion! Look at your legs and body; you are much thinner than we are. And look at your feet; you have claws like a dog's. Your claws do not retract all the way back into your feet like ours do. You are not a cat, you are a dog. So, you better run away fast and try to find someone in your own family."

The cheetah lowered her head and put her tail down, and crept away feeling a bit discouraged. She thought big cats were very unfriendly. The cheetah continued her search, looking for a friend of her own kind. The days went by. Then one day, the cheetah saw a pack of wild dogs playing in the sun. The cheetah went racing up to the pack. The whole pack was yelping and barking furiously. The cheetah stopped immediately, and the pack leader yelped at her, "Who are you and what do you want?"

The cheetah began to tell the wild dogs her story about trying to find a family of her own. During her search, she was scared by a lion and saddened when he told her that the cheetah was not a cat but a dog. The whole pack of wild dogs howled in laughter, and barked at her, "You are not a dog at all. Look at your round head and ears, and your rough tongue. They are like a cat's. Your tail is long just like other cats. You are not a dog at all!" The pack chased the cheetah off, biting at her heels.

This time the cheetah raced away very fast because she was scared. After running a safe distance from the dogs, the cheetah laid down to rest under a big camel thorn tree. She felt sad. She thought about how the lion roared and did not want her, and how the wild dogs yelped and bit at her feet, and she felt sadder and sadder. The cheetah felt so sad that she started to cry. She was very lonely.

African Wild Dog

The cheetah did not realize that any other animals were near her. A giraffe had walked up quietly while the cheetah was crying. The giraffe, looking down at the cheetah with its big brown eyes, asked, "Why are you crying?" The cheetah was very surprised when the giraffe spoke. The cheetah looked up tearfully at the giraffe and proceeded to tell her sad story about the lions roaring and telling her she was not a cat, and the wild dogs chasing her and saying she was not a dog.

Sniffling, the cheetah said, "I have been sitting here crying, and I have cried so long and so hard. Look at my beautiful face, the tears have burnt marks in my face."

The giraffe, hearing the cheetah's story, also began to cry. And the giraffe's tears fell so far that they burnt spots in the cheetah's coat.

A bird, which was flying by the camel thorn tree, saw the beautiful cheetah and chirped, "I have travelled throughout this land. And you, cheetah, are the most splendid and unique of all the cats I have seen."

The headman concluded his story and said, “The cheetah has had spots ever since that lonely day. And it chirps like a bird to show how proud it is of being the most unique of all cats.”

How the cheetah got its spots’ discussion ideas:

1. What can you tell about the cheetah from the story?
2. Why do you think the cheetahs ran away when they saw Moffet and Elisabeth?
3. What marks on the cheetah’s face made Elisabeth believe that the cheetah was crying? In the headman’s story how does the cheetah say it got these markings?
4. What reasons did the headman give for why there are fewer cheetahs in the world today?
5. Which country has the most cheetahs in the world? Can you name other countries where cheetahs are found?
6. What characteristics of the cheetah made the lion say that it was a dog? And what features did the wild dog say made the cheetah a cat? Is the cheetah a dog or a cat?
7. What markings of the cheetah help it hide in the dry grass?
8. Why do you think humans are fearful of predators?

Vocabulary List:

Abrupt	sudden
Approach	to come near or nearer to
Cheetah	the fastest land mammal on earth; today, it is found only in 26 African countries and Iran (in Asia); the cheetah has a thin body with long legs
Chirp	a short high-pitched sound, as of a small bird
Conceal	to hide, to keep from discovering or seeing
Crept	moved slowly
Describe	to tell about in detail
Decline	to slowly become less in number
Frighten	to make suddenly afraid, cause fear
Leopard	solitary cat found in Africa and Asia; it is a powerful, stocky cat with muscular limbs and a coat with small black spots and spots in a circle
Predator	an animal that hunts and kills another animal for food
Proceed	to continue on
Realize	to understand or be aware of
Retractable claws	nails on an animal's foot (claws) which can be pulled back into the animal's foot
Savannah	a large treeless area, grassland
Species	a group of animals or plants of the same kind, that give birth to young like themselves. The leopard and cheetah are two different species of cat
Slender	thin or lean
Sprint	to run very fast; a short run at top speed
Surprise	to occur without warning, something that is not expected
Timid	shy, fearful
Wise	having knowledge, knowing much information
Yelp	a short bark or cry

Activities: Choose One

1. Make up your own story or poem of how the cheetah got its spots. Act out the story with your friends. Draw pictures to illustrate your story.
2. Ask elders and community leaders about stories they were told about cheetahs or other predators, their beliefs about the species, or if they have ever seen cheetahs. Write down the stories you're told.
3. Tell a story about being kind to animals. Discuss why it is important for humans to conserve animals.
4. Write to environmental groups asking about a specific animal and what you can do to help conserve the species.
5. Write to your President and the Minister of Environment and Tourism. Thank them for their commitment to protecting Africa's environment and encourage them to maintain southern Africa's cheetah population.

Student Page- Language Study- 'How The Cheetah Got Its Spots'

Name: _____ **Date:** _____

1. Use the following words or expressions in sentences:

running faster than
out of fear
savannah

2. For the following words, write a word that has the same meaning and a word that has the opposite meaning.

abrupt
conceal
retract
timid

3. Find three words or phrases on the first page of "How the Cheetah Got it Spots" that describe the cheetah.

4. Make up the conversation between the cheetah and giraffe as you think it might have sounded.

5. Write an Animal Cinquain. A cinquain is a five-lined poem that will help you describe a cheetah or other predator in a few words.

Cinquain Form

Line 1

_____
Animal Name

Line 2

_____ _____
Two words that describe the animal

Line 3

_____ _____ _____
Three action words or words expressing one action

Line 4

_____ _____ _____ _____
Four word phrases that tell how or what the poet feels about the animal

Line 5

_____
Word that sums up the animal

IDEAS FOR ART ACTIVITIES

Learning Outcomes

Learners will be introduced to the natural world, animals and animal behaviour through arts, drama, and music.

Ideas for arts activities:

1. Act out the story of 'How The Cheetah Got Its Spots'. The story can be found in the Agriculture & Conservation section of this book. Present the story to your school.

2. Write a song about the cheetah and sing it at your school's morning assembly.

3. Write a song about the cheetah and use traditional instruments and dance to tell the story. Perform the song and dance at your school.

4. Create drawings and illustrations of cheetahs and share these drawings at a school art show. Invite parents and community members to the event and have someone give a speech on conservation and the plight of the cheetah.

5. Write and decorate a poem about the cheetah. Send the poem to the Cheetah Conservation Fund and to a local government official.

6. Host a 'cheetah day' at your school. Have learners dress in 'spots' and host an Olympic competition with running contests. International Cheetah Day is December 4th! Visit the Cheetah Conservation Fund's website for International Cheetah Day activities. www.cheetah.org

7. Make a cheetah sculpture out of materials found in your village or town.

8. Make a poster about good livestock management techniques (refer to the 'Farmer and Cheetahs' lesson in the Agriculture & Conservation section of this book.) Share these ideas with parents, community members, farmer's associations and conservancies.

9. Design a t-shirt (with a cheetah on it!) for your school's environmental club

10. Make a mobile with images of a cheetah and its habitat. Hang the mobiles on your classroom.

11. Paint a cheetah mural on a wall at your school.

CONSERVATION ACTIVITIES

Learning Outcomes

Learners will go beyond simply 'knowing' about the cheetah and instead will take ACTION to help save the cheetah and its habitat for future generations.

Ideas for conservation activities:

1. Start an environmental club at your school. Meet weekly to discuss and plan environmental and conservation activities for your school and community.

2. Collect newspaper articles about wildlife conservation issues in your community and host a community discussion of problems and come up with possible solutions.

3. Write letters to students at other schools or to students in other countries asking them about the wildlife in their area. Ask about what their government has done to help protect wild species. Share with classmates your favourite animal and why you think protecting them is important.

4. Start a school garden or outdoor classroom for fellow learners to enjoy.

5. Host a cheetah and/or wildlife art contest and give prizes for the winners.

6. Write letters to government officials or non-governmental organizations (like the Cheetah Conservation Fund) telling them about your concerns and perspectives on conservation. Ask what you can do to help.

7. Organize a Conservation Fair and create projects, songs and artwork to educate others about conservation issues around the world. Present the problems facing wildlife and their habitats and come up with your own solutions to the problems.

8. Read conservation/wildlife/environmental facts every morning at your school's morning assembly to better educate the learners at your school.

9. Prepare songs and have them ready to perform for any school event (awards ceremonies, sports activities, farewell parties, etc.)

10. Coordinate and plan activities for your entire school on Arbour Day (29 April), Earth Day (22 April), and International Cheetah Day (4 December). Plan in advance and raise funds, if necessary.

11. Become involved in your school's sciences and agriculture classes and hold regular discussions and forums on conservation issues.

Appendix A

Background Information

Background – Introduction to the Cheetah (*Acinonyx jubatus*)

History

The cheetah is Africa's most endangered big cat and is a protected species in Southern Africa. It is considered endangered under the United States Endangered Species Act and is listed on CITES Appendix 1. (CITES: Convention on International Trade in Endangered Species is an international treaty that monitors trade in wild species. 'Appendix 1' indicates that the species is threatened by trade and is in danger of extinction.)

Characteristics

Cheetahs are the oldest cat species on earth with fossil remains dating back 3.5- 4 million years. The cheetah is a highly specialized animal adapted for speed and at a top speed of 110-112 km/h the cheetah is the fastest land animal. Cheetahs are of light build, weighing around 35-45kg for females and 45-55kg for males, making them the lightest of the big cats. They have long streamlined bodies and long, slim legs. Their size and build is one of the ways that they can be distinguished from Africa's other spotted big cat, the leopard. The leopard, in comparison, is short and stocky, with a large, heavy bone structure and a lot of muscle mass.

Cheetahs have on average, 3,000 solid black spots covering their entire body; together with their short tan fur this creates camouflage. Leopards have brown spots surrounded by incomplete black circles called rosettes on their backs and sides. One of the most prominent, distinguishing features of the cheetah is the tear marks running from their eyes to their mouths. These marks help reflect the glare of the sun when they are hunting during the day. They work just like the black marks that football players put under their eyes during the games. The marks also work like the sights on a rifle, to help the cheetah "aim" and stay focused on their prey when hunting.

Behaviour

Cheetahs are predators, meaning they kill other animals for food. The cheetahs' primary hunting adaptation is speed which requires them to be day hunters. They must be able to see where they are running so they are also mostly found in open savannah / grassland. Cheetahs are normally solitary animals, sometimes forming groups amongst brothers. Mothers spend up to two years with their young, teaching them how to hunt and to avoid other predators, which is not an instinct for a cheetah and must be taught to them by their mother. Due to their slight build, they prefer to run from a threat, so as not to risk unnecessary injury.

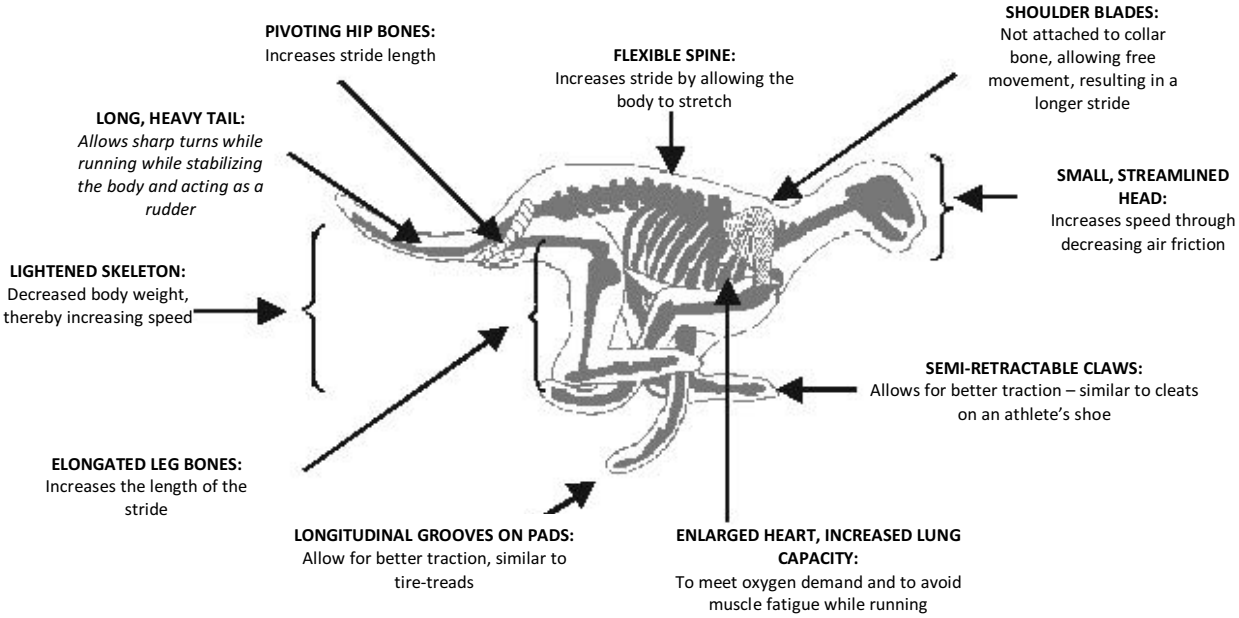
Background – Adaptations

Cheetahs are the fastest animal on land, with a maximum speed of 110 - 112 km per hour and an acceleration rate of 0 – 80 km per hour in 3 seconds. Their top speed can only be maintained for 400-500 meters resulting in a short burst of speed for 20 – 30 seconds. They then need to rest for about 30 min. Running is a cheetah's main form of defence, its speed allows it to hunt and escape from danger.

Speed equals the distance covered in a specific time period. Increasing the distance covered during a certain time increase speed. Over generations the cheetah has evolved many adaptations to facilitate a specialization for speed. The cheetah is aerodynamic (stream-lined) for decreased wind resistance while running. The leg bones are longer in comparison to the other cats and they run on their toes, giving them a longer stride. The cheetah also has a very flexible backbone, which allows it to stretch its body out further. Its shoulder blades are not connected to the collarbone, but directly to muscle thus allowing the shoulders to move freely and helping increase the length of the forelegs while running. The hip bones pivot in their sockets, allowing for greater length of the hind legs while running. All these adaptations result in a stride of 8 meters at full speed. Additionally, the lightened skeleton and reduced muscles mass aid the cheetah in running faster by decreasing the weight carried.

The long tail stabilizes the body and acts as a rudder which helps the cheetah to balance and make sharp turns when running. A cheetah's foot shows several modifications which allow for greater grip. The pads on the bottom of the foot have grooves like the treads on a tire. The cheetah also has semi-retractable claws, which serve a function similar to cleats on a track/soccer shoe. Both of these adaptations help provide traction while running.
It takes a lot of energy to sustain the top speed of a cheetah, and therefore the cheetah has several adaptations to allow more effective delivery of oxygen to the muscles. In comparison to the other large cats, the cheetah's heart, lungs, nostrils and sinuses are enlarged to increase oxygen supply to the muscles.

Cheetah's adaptations for speed:



Background – A Cheetah's Life Cycle

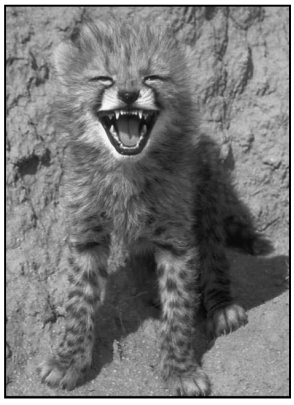
The average life expectancy for cheetahs in captivity is 12-16 years, although some may live longer. In the wild there has not been much research done regarding life expectancy, though it is thought to be slightly less, possibly only 7-10 years. Longevity and survival of the cheetah depends on availability of suitable habitat and ability to hunt successfully.

Female cheetahs reach sexual maturity between 20-24 months and males between 4-5 years. Cheetahs do not have a particular breeding season. The sexes have a courtship period of up to 3days. After breeding the male will leave the female. Gestation period is between 90-95 days. Litters vary in size from 1-8 cubs, with an average of 3 cubs. Birth takes place in bushy thickets, tall grass, rock cavities or "borrowed" burrows. Cheetah cubs are born blind and helpless and are between 150-300 grams and up to 30 cm long. New born cubs can move enough to reach mother's teats and suckle, turn their heads, spit and give soft purring calls. Cheetah cubs develop more quickly than the young of any other big cat, gaining about 50 g daily. Cubs open their eyes between 4 and 14 days (average 10 days), crawl in 2 to 3 days and walk at 3 weeks.

For first 6 weeks of their lives, the cubs are hidden in dense vegetation. The mother returns at night to suckle and groom the cubs. Cubs get their upper and lower canines at 3 weeks, full set of milk teeth at 6 weeks and their permanent set of teeth by 8 months. Cubs will nurse from 2-3 months with weaning usually beginning around 6 weeks. Cubs begin eating meat at 4-6 weeks. At 6 weeks cubs begin to follow their mother, but hide in dense cover when their mother is off hunting until about 8 weeks. After 8 weeks they will follow her continuously, bedding down for the night wherever they are. The period of 6 weeks to 4 months is the most vulnerable time for cubs, with predation and starvation being the major causes of death. Cubs also succumb very easily to disease.

The mortality rate amongst cubs is very high. On average only 10 % survive the first year. Young cheetahs play spirited, athletic games consisting of stalking, pouncing, chasing, boxing, wrestling, and tug-of-war. Play is more related to hunting tactics than fighting. When cubs are about 18 months old the mother leaves them. They usually remain in a sibling group for another 6 months. At around 2 years the female cubs come into oestrous and leave the group. Young males may separate or they remain together, forming a life-long coalition.

When a cheetah cub reaches 1 year of age it weighs about 25 kg. A mature cheetah weighs 34-54 kg and has a shoulder height of 73+ cm. The male tends to be slightly larger than the female.



What is a habitat?
All living things need a home, or *habitat* in which to live and find the resources they require to survive. Scientist call this an animals' *habitat*. A habitat is the environment, or place, in which the animal lives throughout its life. Humans also have habitats; this is bigger than just the house in which we live. It includes the entire environment that we come in contact with; where we go to school, shop or go on holiday. It is all still our habitat. Humans can live in a variety of habitats, while animals generally have specific resource requirements found in specific habitats based on their unique physical and behavioural adaptations.

What do animals need from their habitat?
A habitat provides the four basic resource needs that all animals share: food, water, shelter and space. Food and water supply the energy needed to live. Shelter protects from the weather and enemies, and provides a place to raise young. All animals need space in which to find their food, water and shelter. If there is not enough space for the living things within a habitat, there will not be enough resources for those animals to survive. Due to their speed, cheetahs need to live in large, open spaces, such as grassland, savannahs, and, woodlands where they have the space for a high speed sprint without risk of running into obstacles. Cheetahs prefer to live in areas with low populations of competing predator species such as lion, leopard, and hyena. This generally means that they live outside of protected areas where the populations of other predator species are usually high.

What is the predators' role?
The African savannah is inhabited by top predators like lions, leopards, hyenas, and cheetahs. These predators help maintain herbivore populations. Predators maintain the health of many herbivore populations by feeding on the sick and weak animals, ensuring that the healthiest and strongest will pass on their genes to future generations. Predators also play a role by keeping herbivore numbers from exceeding the amount of grass and forage available. In turn, the amount of available prey controls the top predator populations. The savannah ecosystem, like all other ecosystems, is maintained in a delicate balance where every living thing depends upon another for survival.

Habitat resources such as food, water, and shelter change naturally over time. As these resources change, they directly impact animal populations within the habitat. For example, on a good rain year habitat resources can be abundant and animal populations will thrive. Herbivore species will have plenty of grass and forage to eat and reproduce. Predator populations will grow as there is plenty of prey to eat and lots of food for predator young. If habitat resources decline however, the health and density of populations will also decline. Limited habitat resources will lead to less prey and fewer predators. This is known as carrying capacity.

Cats and the Energy Cycle

The speed of a cheetah and the strength of a lion aid them in catching their prey. Big cats are predators and play an important role in the energy cycle, fitting in with the overall balance of life. Every animal needs to get its energy from somewhere; food chains illustrate where a plant or animal gets its energy from within its habitat. A single food chain does not show all the sources of energy for an organism, merely examples. A food web, which is more complicated, takes into account all sources of energy between organisms within a given habitat. Therefore one can say that a food web is a compilation of all the food chains within a habitat.

Food Web & Food Chain

The sun is the primary source of energy within a food chain or web. Plants, one of the few organisms on earth that can transfer the sun's energy to make their own food, are called **producers**. The producers support all other life on earth, whether directly or indirectly.

Herbivores (primary consumers) are the next step in the energy cycle; they consume only plants in order to get their energy. Herbivores include giraffe, antelope, many rodents, sheep, goats and cattle and are especially adapted to gathering, grinding and digesting plants. Some concentrate on only certain parts of the plants such as leaves, seeds, bark or roots.

The next step in the energy cycle is the **carnivores** (secondary consumers). Carnivores are animals that eat only other animals to get energy and include cats, dogs, birds of prey, sharks, most snake and lizard species and spiders.

Omnivores are designed to obtain energy from a variety of sources, both animal and plant. Some examples of omnivores are pigs, badgers, and humans! When plants and animals die, the energy still contained within their bodies is fed on by **scavengers** who begin the process of decomposition. Other organisms known as **decomposers** (insects, fungi, and bacteria) recycle dead organisms back into nutrients and soil. The energy cycle then begins anew as the plants use the nutrients and soil to grow. Thus the food web is the cycle of energy through a habitat.

Food Pyramid

While food chains and food webs depict energy interrelationships, food pyramids show the relative amounts of producers, herbivores and carnivores within a habitat. Plants are the most numerous organisms; they have a permanent source of energy in the sun. Producers collectively weigh the most and hold the most energy, thereby forming the base of the food pyramid. Herbivores form the next level of the food pyramid as they obtain their energy directly from the producers. Due to the fact that energy is lost at each step of the pyramid, there will always be fewer herbivores than producers and fewer carnivores (the top step of the pyramid) than herbivores. Energy is lost at each step as some is not consumed, some is not digested and some is used to carry out bodily processes.

Why are these relationships (food webs and pyramids) so important?

Food webs and pyramids stress the important role of every creature by illustrating the interdependencies which exist in nature. Remove a part of the web of pyramid and the balance of nature will break. Each component depends on the other in the cycle of energy.

Background – Cheetah Hunt

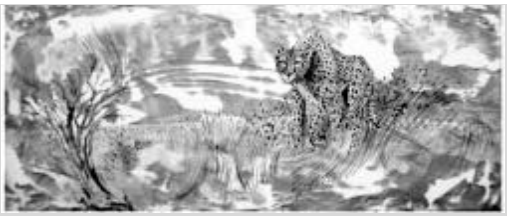
To achieve a successful hunt, a sequence of behaviors occurs. If the sequence is interrupted, the hunt will be abandoned. If it is successful, the cheetah may not have to hunt again for several days.

Visual Contact

The cheetah climbs termite mounds or trees as vantage points to locate potential prey.

Approaching Prey

The cheetah may either select or stalk prey from a hidden position or approach the prey at a walk or slow run.



Chase

The cheetah bursts into full speed after its prey. If the chase is unsuccessful, the cheetah will need to rest before another hunt is attempted.

Trip

Running at full speed the cheetah uses its front foot and dewclaw to strike at the hind legs of its prey, tripping and knocking it down

Killing Prey

Prey is killed by suffocation when the cheetah takes hold of the throat, closing off the windpipe.

Rest

The cheetah will sometimes be too exhausted to eat after a high speed chase. It may rest for up to 30 minutes before eating or hunting again.

Feeding

Cheetahs often drag their kills to a shaded area and begin eating from the hindquarters and body cavity, carving a bowl out of the carcass to ensure the meat is clean.

Background – Threats to Survival

The cheetah is facing many threats to its survival, including the high death rate of cubs, loss of habitat, a reduction in its prey base, conflict with livestock farming and a reduced ability to survive in game parks and reserves due to the presence of larger predators.

The cheetah's ideal habitat is open grassland and they occupy large territories. People want this land for livestock farming, leading to an obvious conflict resulting in the cheetahs' survival being in doubt as an increasing amount of land is converted for human use. Furthermore, as a predator, the cheetah is seen as a threat to livestock and is frequently trapped and shot by farmers under the perception that the cheetah is having an excessive economic impact. In some instances large corporate companies eliminate the wild herbivores to make space for livestock. This removes the cheetah's natural prey, resulting in the need to look for alternative prey and/or starvation for many.

If the farmer employs effective livestock management practices, they suffer little or no livestock loss to cheetahs due to their hunting behaviour. The cheetah is not generally a livestock predator because it relies on speed and does not have the weight and strength for an ambush attack. Livestock generally do not run, therefore the cheetah is not stimulated to chase and kill. If desperate however, the cheetah has been known to go for the easier kill, such as goats and sheep. This is generally when the cheetah is old, ill, injured or has no other alternative prey available. The problem has been a lack of education about cheetahs and other predators. Some farmers do not understand the nature of the cheetah and often blame it for livestock kills because it is a day hunter and is therefore more easily and commonly seen.

In the past, one solution to conservation issues has been to put animals in protected areas such as game parks and nature reserves. This, however, is not an ideal situation for a cheetah due to the presence of larger predators such as lion, leopard, hyena, etc. These predators will kill cheetah adults and cubs since they are seen as competition; they will also steal their kills. If a cheetah loses too many kills they will starve to death. The loss of too many cubs as well as an increase in loss of kills results in cheetah numbers decreasing in game parks and nature reserves. This means that most of Namibia’s cheetahs live outside of protected areas, mostly on livestock farms, where people are the threat. Through education, it is possible to bring about a sharing of land between farmers and cheetahs and thereby increase the chance for the survival of this species.

Background- Tools for Ecological Research

CCF investigates the movement of the cheetah to determine:

- home ranges (habitat and territories)
- habitat preference (savannahs, bush, or desert)
- preferred prey species
- numbers of wild cheetahs in specific areas

CCF researchers are also looking to see if cheetah movements are affected by:

- seasonal use (wildlife or livestock calving season & rainy season vs. dry season)
- territoriality (male cheetahs defend a territory while females do not)
- fences
- human-wildlife conflict

CCF implements non-invasive monitoring methods to ensure there is a sustainable, wild population and gathers information on the status of those wild cheetahs.

Cheetah Population Research

Due to their secretive nature and their large home ranges cheetahs are very difficult to count using common population counting methods like game drives and counting individuals. CCF has implemented various population counting and monitoring methods including, camera traps, tracking collars, spoor (footprints) counts, scat identification and questionnaires.

Camera Traps

Camera traps allow researchers to monitor animals without disturbing them or even being present. Also, unlike people, camera traps can be on day and night, 24/7. Memory cards are placed in the cameras and a motion and heat detector on the camera snaps a photo whenever there is movement. The photos are downloaded to a computer and the animals seen in the photos are identified. The data is used to inform researchers as to the species and density (numbers) of animals in the area of study.

GPS/VHF Tracking Collars

GPS location data can be collected using a GPS/VHF tracking collar placed on a cheetah. Researchers use specially made collars that do not hurt the cheetah or affect it in a negative way. The collars are made to be just the right weight so the cheetah is not weighed down or bothered by the tracking collar. The collars that researchers use at CCF have a GPS on them that can send location points to the computer as often as the researcher needs. These points can make a map of where the cheetah has traveled and tell researchers plenty without ever seeing the animal in the wild. By looking at the cheetah's movements between the GPS points, researchers can tell if a cheetah has made a kill, how large their territory or home range is, and if a cheetah is breeding or caring for young. Researchers can also visit a GPS point where they think a cheetah made a kill, to find out what the cheetah is eating and how effectively it is killing prey.

The collars CCF researchers use also have a VHF receiver inside. The VHF receiver allows researchers to track cheetahs in the bush. Researchers can look up the cheetah's last GPS point on the computer and go to that area. From there they can try to track the cheetah on foot using the VHF receiver that will begin beeping the closer they get to the cheetah and its collar. Seeing a wild cheetah is very difficult, they will usually run away if they hear or see someone approaching. Finding a collared wild cheetah can sometimes be difficult but occasionally it is necessary to do if researchers suspect the cheetah might be injured or dead.

Post Release Monitoring

CCF tries to re-release cheetahs back into the wild whenever possible. Many of the cheetahs CCF cares for arrived as orphans. These cubs are often too young to care for themselves and they missed out on the vital training from their mothers on how and what to hunt and, how to interact with other predators. These cheetah cubs needed human help to survive, they then lose their natural fear of humans and can not be released back into the wild as they may become a threat to people and livestock.

There are some cheetahs that come to CCF later in their life and have the possibility of being released into the wild. These cheetahs may have been injured, trapped by a farmer and need to be relocated, or confiscated because someone was keeping them illegally. These cheetahs are assessed to see how successful they might be in the wild. CCF animal staff look to see if the cheetah is healthy, fearful of humans, and physically fit enough to hunt their own prey. If a release location is found and there is a cheetah that is fit to be re-released, it will be fitted with a GPS/VHF tracking collar. CCF has successfully re-released many cheetahs into the wild. One reason CCF has been successful is that they undertake post release monitoring. This means CCF researchers track the released cheetah and determine if they are surviving and thriving on their own in the wild. Researchers can give support to the cheetah when needed and make sure they are transitioning well to their new life in the wild.

Spoor (Footprint) Tracking

Researchers can study animals by looking at the footprint they leave behind. Scientist call an animal's footprint a *track* or *spoor*. Animals can leave their spoor in the sand, mud, and snow. From an animal's spoor researchers can identify the animal species and density (number) in a study area. They can identify if the track is small, average, or large in size and sometimes tell if it was from a male or female based on the size of the spoor. Animal spoor can also tell researchers a story. The spoor can tell if an animal was running, walking, or got into a confrontation with another animal.

Scat (poop) Detection Dogs

Dogs trained to sniff out cheetah scat (poop) are used by CCF researchers to find cheetah scat without ever seeing a wild cheetah. As cheetahs are scared of people and keep hidden it is often difficult for researchers to study a cheetah. Dogs have a greater sense of smell than humans. Where humans experience the world visually, dogs experience the world through detailed scent. Humans have approximately 5 million scent receptors in our noses; dogs can have more than 220 million. Researchers are able to use scat-sniffing dogs to find cheetah scat in the bush and can then take the scat back to a lab to get information about the cheetah without ever seeing it. At the CCF genetics lab, technicians can get DNA from the scat and identify the individual cheetah as well as, determine what the cheetah is eating. This results in a better understanding of the wild cheetah population.

Hair Burning and Hair Identification

Cheetah scat contains hair from the prey species they have eaten. Every prey species has a unique scale pattern on their hair. Through identification of the hair that is present in the scat, researchers can find out what the animal ate. This information tells researchers what prey different predators prefer and if they are eating livestock, which could lead to human-wildlife conflict issues.

CCF's research has shown that the more wildlife traveling through and living on the land the fewer predator problems farmers have with livestock. Over-grazing and harvesting can cause wild game to move off farms as they need to find food and water elsewhere. This means that the resident carnivores will need to find alternative food which could be livestock. Sheep and goats are a similar size to wild game the cheetah hunts, such as springbok, steenbok, duiker, warthog, and young oryx, kudu, and red hartebeest. Namibian farmers are generally either livestock or game farmers but in some cases they raise a mixture of both and rely on the income from selling the animals for meat. The farmer's income is directly tied to their animals, so if even one animal is lost this can have serious financial consequences and reduce the tolerance level of the farmer towards carnivores being present on their farm.

Ways to minimize conflict:
Education

- CCF gives educational presentations to schools, universities, farmers and communities
- Development of educational materials designed to educate people about healthy and balanced ecosystems
- Understanding of predator behaviour
- Understanding of how predators can be helpful to ecosystems and people
- Development of better livestock management practices
- Healthier livestock
- Use of livestock guarding animals
- Good record keeping
- Happy and healthy workers (willing to take extra precautions to keep livestock safe)

Predator Mitigation Techniques:

- Improved livestock management practices
- Bringing animals in at night to a kraal or boma
- Added protection for livestock about to give birth & young less than 4 months.
- Monitoring the health of the livestock
- Using a herder that goes into the bush with the livestock
- Use of guarding animals with the livestock (dogs for small stock & donkeys for cattle)
- Keeping some or all livestock with horns to protect themselves from predators

Appendix B

Reference Pages

CHEETAH FACT SHEET

Status	Protected species in Namibia. Endangered under the United States Endangered Species Act. List on C.I.T.E.S. Appendix I
Description	The cheetah has a slender, long-legged body with blunt semi-retractable claws. Its coat is tan with small, round, black spots, and the fur is coarse and short. The cheetah has a small head with high-set eyes. Black "tear marks," which run from the corner of its eyes down the sides of the nose to its mouth, to keep the sun out of its eyes and aid in hunting.
Size	Adult body length 1.8-2.2 m; tail length 60-80 cm; shoulder height 73+ cm; weight 35-60 kg. The male is slightly larger then the female.
Specializations	The cheetah's flexible spine, oversized liver, enlarged heart, wide nostrils, increased lung capacity, and thin muscular body make this cat the swiftest hunter in Africa. Covering 7-8 meters in a stride, with only one foot touching the ground at a time, the cheetah can reach a speed of 110 km/h in seconds. At two points in the stride, no feet touch the ground.
Habitat	Cheetahs thrive in areas with vast expanses of land where prey is abundant. In Namibia cheetahs have been found in a variety of habitats, including grasslands, savannahs, dense vegetation, and mountainous terrain. Ninety-five percent live on farmland.
Range	Once found throughout Asia and Africa, the species is now only scattered in Iran and various countries in sub-Saharan Africa. Home ranges in Namibia for males can be up to 1500 square km and for females, 1200-1500 square km.
Behaviour	Cheetahs have a unique, well-structured social order. Females live alone except when they are raising cubs. The females raise the cubs on their own. The first 18 months of a cub's life are important - cubs learn many lessons because survival depends on knowing how to hunt wild prey species and avoid other predators such as leopards, lions, hyenas, and baboons. At 18 months, the mother leaves the cubs, which then form a sibling group, staying together for another 6 months. At about 2 years, the female siblings leave the group. Males live alone or in coalitions made up of brothers from the same litter. Some coalitions maintain territories in order to find females with which they will mate. Territories are often located in areas where there is a rich supply of wild game and/or water. Fierce fights between male coalitions, resulting in serious injury or death, can occur when defending territories. Cheetahs hunt in the early morning and early evening. They capture their prey by stalking - until the prey is within 10-30 meters - before chasing. The prey is suffocated when a cheetah bites the underside of the throat. Chases last about 20 seconds, and rarely longer then 1 minute. About half of the chases are successful. In Namibia, cheetahs use play-trees (trees with sloping trunks and large horizontal limbs, usually camelthorns) to observe their surroundings and mark the area. Cheetahs make chirping sounds, and hiss or spit when angered or threatened. They purr very loudly when content. **Cheetahs do not pose a threat to humans.**

Reproduction	Sexual maturity occurs at 20-24 months females. The gestation period is about 95 days, and the average litter size is 4-6 cubs. Cubs are smoky-grey in colour with long hair, called a mantle, running along their backs; they are up to 30 cm long and weigh 250-300 grams at birth. The mantle has several purposes: it is thought to camouflage the cub in dry grass, hiding it from predators, and to work as a mimicry defence, causing the cub to resemble a honey badger (ratel).
Population	Namibia has been dubbed the Cheetah Capital of the World, yet we still have only an estimate of our cheetah population, despite years of research by the Cheetah Conservation Fund (CCF) and others aimed at answering this tricky question. Currently it is estimated that 6,700 cheetahs remain in 25 African countries, and 80 cats survive in Iran. Namibia has the world's largest number of cheetahs, estimated at about 3,000 cats.
Life Expectancy	7-10 years is the average life-span of a cheetah in the wild; 12-16 years is average in captivity. Cub mortality is high for the species in both captivity and in the wild. On average 30 percent of all cubs born in captivity die within one month of birth, and in Tanzania's Serengeti National Park, about 90 percent die before reaching 3 months of age.
Diet	Small antelope, young of large antelope, warthog, hare, and game birds.
Natural History	Cheetahs have been kept in captivity for some 5,000 years. However, they breed poorly, and the captive population has been maintained through wild collection. Cheetahs suffer from a lack of genetic diversity, making them more susceptible to disease and decreasing reproduction. The many parks and reserves of Africa offer protection for only a small amount of cheetahs. In these parks, lion and hyena numbers increase, and the cheetahs cannot compete with these large predators which kill cheetah cubs and steal their prey.
Survival Threats	Decline in prey, loss of habitat, poaching, and indiscriminate trapping and shooting threaten the survival of the cheetah throughout its range.
Legal Protection	As a protected species in Namibia, people are allowed to remove cheetahs only if they pose a threat to livestock or human life. Unfortunately, some people will capture cheetahs indiscriminately (the "problem" animals may not be singled out), often removing or killing those that have not taken any livestock. Limited international trade in live animals and skins is permitted from Namibia, Zimbabwe, and Botswana. Illegal trade in other parts of Africa and indiscriminate capture and removal in southern Africa continue to threaten the survival of this species.
Conservation	To help this sleek hunter of the African wild win its race against extinction, we must (1) help protect its habitat and insure a place for it on Namibian farmlands, (2) aid in the conservation of the wild prey base, (3) halt the indiscriminate capture and removal of the cheetah, (4) improve livestock management, and (5) provide education about the need to conserve biological diversity and the predators' unique role in a healthy ecosystem.
Captivity	CHEETAHS ARE WILD ANIMALS. Capture of wild cheetahs threatens the survival of the species in two ways. First, the removal of individuals reduces the species' genetic diversity in the wild. And secondly, cheetahs do not breed well in captivity. Special dietary requirements, special needs, and unpredictable behaviour make the cheetah a poor pet. Wild instincts remain intact even with 'tamed' and captive raised animals.

CHEETAH SPEED

If a human and a cheetah were to run the 100 meter sprint in the Olympics, who would win?

The cheetah is the fastest land mammal on earth and can easily outrun the world's fastest human sprinter. It can reach speeds of up to 110 km/h in seconds; however, it can only maintain this speed for 400-500 meters before it must stop and rest for up to 30 minutes.

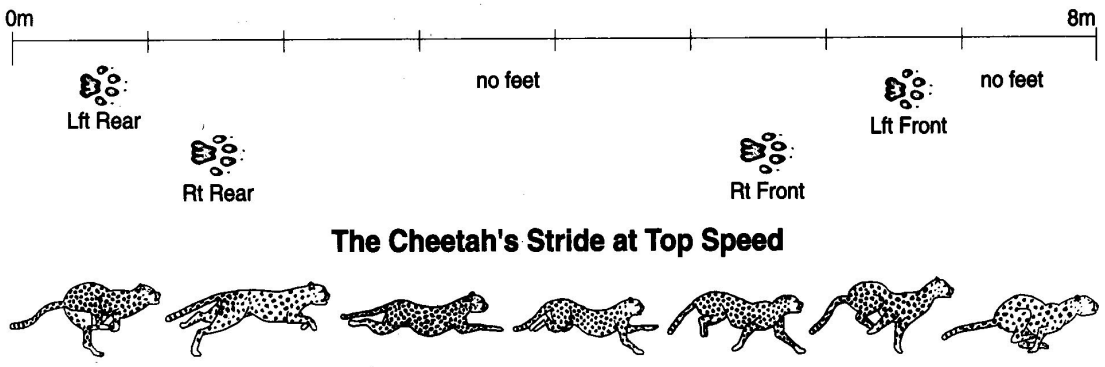
Without rest its body would overheat just like the engine of a car. While its speed is impressive, the cheetah's ability to accelerate is overwhelming. The cheetah can go from a complete standstill - or 0 km/h - to nearly 80 km/h in three seconds. It can actually out perform a sports car - a Ferrari needs four seconds to reach that speed!!

But how does the cheetah achieve this amazing speed?

The key to the cheetah's success is its increased stride length and stride frequency. A stride is one cycle of sequential footsteps, and the stride distance is measured between where one foot leaves the ground and the place where it touches the ground again. At top speed, the cheetah covers 7-8 meters in a single stride, and completes four strides per second.

The unique body structure -long legs, flexible spine, semi-retractable claws, and long tail- allows the cheetah to achieve this incredible speed. Its slender, long, light body creates less wind resistance when it runs. The cheetah's shoulder blades are not attached to its collar bone, allowing the shoulders to move freely and help increase the length of the stride. Its flexible spine allows for more extension and flexion during running. This helps the cheetah increase its stride length because its front and rear legs stretch farther apart when its body is fully extended, and its hips and shoulders move closer together when its feet are crossing. The cheetah's hip bones pivot during its stride for greater length. The tail helps the cheetah make sharp turns when running by stabilizing its body and acting as a rudder. Its claws, which are semi-retractable, grip the ground for traction during chases.

Even the cheetah's heart, lungs, and liver have evolved for speed. Enlarged nostrils and sinuses increase the amount of air exchanged. The cheetah has large lungs to move oxygen into its system quickly and a big heart that increases its respiratory rate, enabling the blood to move from the lungs to the muscles rapidly so the cheetah does not get tired while running. During a chase, the cheetahs breath at a rate of 60 to 150 breaths per minute.



The Cheetah's Stride at Top Speed

HUNTING DEVELOPMENT OF CUBS

Chasing prey may be instinctive, but cubs must learn how to bring prey down, how to direct a bite at the throat, and how to hold the prey until it stops kicking and breathing, all from watching adults. Cubs learn the stranglehold from watching their mother kill and practice it through play by biting napes of siblings. Cubs will sometimes stop eating to practice stranglehold on dead prey. Mother cheetahs use every opportunity to teach offspring how to hunt by sometimes releasing stranglehold of prey not yet dead and letting cubs finish it and also by bringing small live animals (fawns, hares, etc.) back to cubs as young as 4 months old to kill.

Cubs begin accompanying mother on hunts from 3 to 4 months of age. She conceals them when prey is spotted and prompts them through vocalizations to remain hidden. If the hunt is successful, she calls the cubs to the kill.

Occasionally, cubs will alert the prey by standing up or moving forward too soon. Cubs start taking a more active role in the hunt from 6 to 7 months of age and will sometimes follow mother during chase, not staying behind to be called. While mother is strangling prey, they may help by holding the animal down with paws or with a bite to the flank.

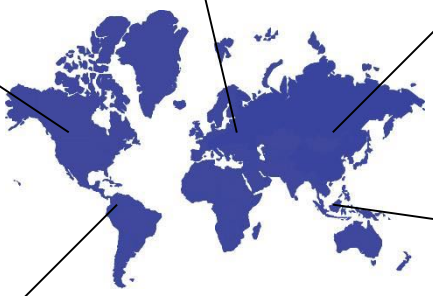
Cubs will attempt catching and killing small animals on their own from 7 months of age with little success. They may occasionally catch and kill hares they have flushed out of bushes. By 12 to 14 months of age, cubs are capable of killing prey themselves. At 15 months, cubs are as big as their mother and often take initiative in the hunt though they may still need assistance with the actual kill. By 16 to 18 months, cubs are almost fully grown and can usually survive on their own.

Mistakes made by cubs learning to hunt on their own include:

- Not being properly concealed from prey.
- Not watching prey closely enough.
- Stalking animals too large for them.

During this time period the mother will also be teaching the cubs to avoid other predators in the area such as lion, leopard, baboon etc. Due to their delicate build for running, cheetah are very vulnerable to injury in a fight and so will prefer to avoid confrontation with a larger predator.

CATS OF THE WORLD



Europe

European Wildcat
Eurasian Lynx

Asia

Chinese Mountain Cat
Iriomote Cat
Pallas Cat
Snow Leopard

North America

Bobcat
Canadian Lynx
Cougar

IndoMalaysia

Asian Golden Cat
Bornean Bay Cat
Clouded Leopard
Fishing Cat
Flat Headed Cat
Jungle Cat
Leopard Cat
Marbled Cat
Rusty Spotted Cat
Tiger

Central & South America

Andean Mountain Cat
Geoffroys Cat
Jaguar
Jaguarundi
Kodkod
Margay
Ocelot
Oncilla
Pampas Cat

Africa

African Golden Cat
Black Footed Cat
Caracal
Cheetah
Leopard
Lion
Sand Cat
Serval
Wildcat

There are 37 cat species!

CHEETAH CONSERVATION FUND

CHEETAH CONSERVATION FUND - NAMIBIA
Namibia is home to a quarter of the world's cheetahs, making this the world's largest population of cheetah. If we want to save the species we need to save this population because 95% of Namibia's cheetahs do not live in protected areas like game parks and reserves. Instead, cheetahs are found on the farmlands where there can be human and predator conflict. Dr. Laurie Marker is the Co-founder and Director of the Cheetah Conservation Fund (CCF) that was established in 1990. CCF has research, conservation and education programmes that work to ensure the long term survival of the cheetah. CCF also works with farmers trying to provide the cheetah with a safe habitat by reducing farmer and predator conflict.

The cheetah is not naturally a threat to livestock due to its adaptations for running and hunting. Other predators which hunt habitually at night are livestock threats and are mostly to blame for livestock losses on the farmland. The farmer however, does not always see the problem predator, and it is the predator that hunts by day, the cheetah, which has in the past received the blame instead. One solution to the farmer's problem is to find a way to reduce predation on the livestock without killing the predator. In order to accomplish this, CCF initiated a programme, Non-Lethal Predator Control, in 1998, using a specific breed of livestock guarding dog, the Anatolian Shepherd. This dog has been used in Turkey for over 5000 years as livestock protection against bears and wolves. The dogs have been specifically bred for this purpose and need minimal training. CCF breeds the Anatolians at their research farm and gives the puppies to various farmers and institutions in Namibia to protect livestock. Through intimidation techniques, this large dog will deter predators from attacking livestock, reducing livestock loss and removing the reason for shooting the predators.

CCF also conducts research into behaviour, disease, mortality, territory size, etc., in the wild. The more information gathered about the wild cheetah, the more programmes that can be developed for their protection. This information has been gathered by GPS/radio-collaring released individuals so that they can be tracked and their movements and behaviour monitored.

CCF provides education programmes for schools, institutions, and farmers, educating the public on the nature of the cheetah. They work with the farmers on improving farm practices to better protect the livestock. In addition to the introduction of the Anatolian Shepherd, CCF encourages integrated livestock and wildlife farming techniques to reduce predation on livestock, such as keeping young animals near the homestead until they are large enough to avoid becoming prey.

For more information please visit our website: **www.cheetah.org**.

A PLACE FOR PREDATORS

Imagine a cheetah sprinting after a steenbok, a bird of prey diving out of the sky after a mouse or an ant colony feeding on a beetle. All of these animals catch, kill, and eat other animals: they are predators. There are different degrees of predation. Some animals, such as the cheetah, leopard, and lion are strict predators, called carnivores, and eat only meat. Other animals, such as the jackal, are omnivores. They catch prey when they can, but also eat fruits, nuts, and other plants. Animals can be both predators and prey. The cheetah hunts small antelope, the young of large antelope, hare, warthogs, and game birds; however, the cheetah, especially when it's young, can also become prey to other predators, such as the hyena, lion, leopard, and baboon.

Predators are an important part of a healthy ecosystem. Predators remove (prey upon) vulnerable prey, such as the old, injured, sick, or very young, leaving more food for the survival and prosperity of healthy prey animals. Also, by controlling the size of prey populations, predators help slow down the spread of disease. Predators will catch healthy prey when they can, but catching sick or injured animals helps in natural selection and the establishment of healthier prey populations as the fittest animals are left to survive and reproduce.

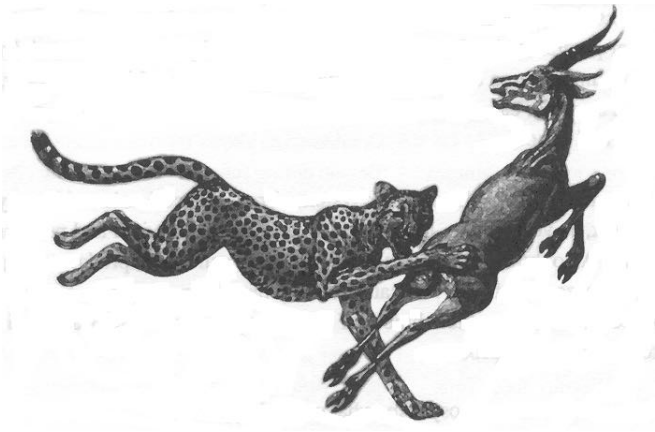
If predators were removed from an ecosystem:

1. Antelope herds would grow and grow.
2. Only bad weather such as a drought, or disease such as rabies, would slow down the herd growth.
3. Large antelope herds would overgraze their food source, and as the food disappeared, the herd would begin to starve.

Lion at kill

Ecosystems where cheetahs or other predators are <u>not</u> present

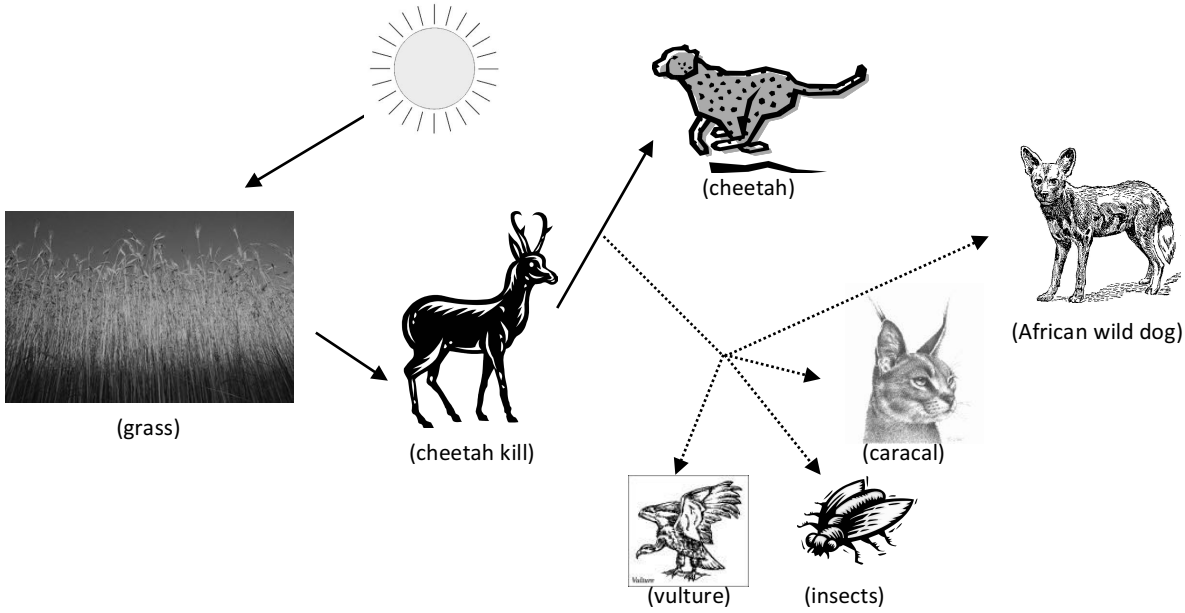
Cheetahs and other predators help limit the growth of prey populations and prevent overgrazing of habitats. While human hunters can sometimes replace predators in the control of antelope populations, they generally do not remove the injured, sick, or older animals. Predators play an important role in maintaining healthy prey populations.



Ecosystems where cheetahs are present

The cheetah is a valuable member of its community. In addition to its role as a predator, cheetahs feed other animals, such as vultures, jackals, beetles, and other scavengers. After a cheetah kills an animal it usually begins eating at the hind quarters, which provide the greatest amount of meat. Because the cheetah is not an aggressive carnivore, larger predators, as well as jackals and vultures, can scare the cheetah off its kill.

By leaving the remains of a carcass, the cheetah feeds other animals in the ecosystem.



A RACE FOR SURVIVAL

Cheetahs have existed on earth for at least 3.5 – 4 million years - long before any of the other big cats alive today. About 20,000 years ago, cheetahs were common throughout Africa, Asia, Europe, and North America. Through the dating of fossil remains, it appears that the cheetah originated in the United States of America in the present-day states of Nevada, Texas, and Wyoming. Approximately 10,000 years ago, at the end of a time called the Pleistocene Epoch, also known as the Great Ice Age (a geographical time period from approximately 2 million to 10,000 years ago), the world's environment underwent drastic changes in climate. Over a few thousand years, 75 percent of the mammal species in North America and Europe died. When mammals began to die, so did all the cheetahs in North America and Europe and most of those in Asia and Africa. Cheetahs may have migrated to a more suitable environment as ice covered a large part of the northern hemisphere and sea levels fell.

The cheetah survived the mass extinction of the Pleistocene Epoch, but its numbers were greatly reduced. Brothers were left to reproduce with sisters and parents with siblings, who led to the founding of the next generation and inbreeding. This occurrence - a severe reduction in population - is called a "bottleneck." Every cheetah alive today appears to be so inbred that genetically they are as closely related as twins (two offspring, or individuals born at the same time).

Cheetahs have been kept in captivity since 3,000 BC when Sumerians, people who lived in present-day Iraq, began taming cheetahs for pets. In Egypt, during the time of the pharaohs, the cheetah was considered a goddess named "Mafdet." Pharaohs kept cheetahs as close companions, which symbolized protection by Mafdet. Symbols of the cheetah are found on ritual and magic knives, statues, and in paintings on royal tombs. The ancient Egyptians believed that the cheetah would carry the Pharaoh's soul to the after-world. The cheetah was admired for its speed, hunting ability, and beauty, and was honoured as a symbol of royalty and prestige.

As early as the fifth century, cheetahs were used by Italian nobles to hunt for sport. Adult cheetahs were caught in the wild, and tamed within a few months of capture. With their heads covered by a hood so they could not see the prey, cheetahs were led to the hunting area on a leash, in a cart, or on the back of a horse, sitting on a pillow behind the rider. The cheetah was taken near the prey, and the hood was removed. It then sprinted after the prey, and after catching it, the trainer rewarded the cheetah with a piece of meat. Cheetahs were commonly known as "hunting leopards," as people often confused the cheetah and the leopard. The use of this term may account for some of the confusion between the differences in the two cats: the cheetah and the leopard are two distinct species.

Russian princes in the 11th and 12th centuries also hunted with cheetahs. During the Renaissance (the time period from the 14th through the 16th centuries), every Italian family of nobility and many French nobles kept cheetahs for hunting. The Crusaders observed cheetahs being used to hunt gazelles in Syria and Palestine during this time. Marco Polo, the famous Italian explorer, brought back accounts of the hundreds of cheetahs kept by Kublai

Khan, the Founder of the Mongol dynasty in China, during the 13th century. Akbar, a Mongolian ruler of the 16th century, was said to have owned 9,000 cheetahs during his 49-year reign. He kept detailed records of his collection, which showed the birth of only one litter. Unfortunately, cheetahs do not reproduce well in captivity, and cubs suffer high mortality - none of Akbar's cubs lived. It was not until 1956 that the first cheetahs were born and raised in captivity. Because of the continuous wild capture of the Asian species of cheetahs for royalty and their failure to breed in captivity, the Asiatic cheetahs were sharply reduced, and cheetahs had to be exported from Africa to supply hunting cheetahs at Court. In India, the cheetah was considered a prerequisite for royalty - in 1952 the cheetah was declared extinct. The Asiatic cheetah, which was distributed widely throughout the continent in eleven countries, is now nearly extinct. Today only 80 cheetahs are found in Asia, in the country of Iran.

The number of cheetahs has decreased from 100,000 at end of the 19th century to approximately 10,000 today. The cheetah has suffered from inbreeding, high infant morality, loss of habitat, a reduction in its prey base, conflicts with livestock farming, and a reduced ability to survive in parks and reserves due to the presence of larger predators. Despite all these problems, the cheetah is the oldest of the big cats, and has survived the longest. If we can provide a habitat and a rich prey-base for cheetahs on the livestock farmlands of southern Africa, the cheetah's race will be one of survival, not extinction.

"A Cheetah Ready for the Hunt"
For centuries, Southwest Asian royalty trained cheetahs to hunt. The cats (like falcons) were fitted with leather hoods en route to hunting to minimize distraction. The cloak was for warmth.

A SINGULAR SPECIES

The cheetah, *Acinonyx jubatus*, is the sole member of its genus. Twenty thousand years ago, cheetahs roamed throughout the savannahs and plains of four continents: Africa, Asia, Europe, and North America.

About 10,000 years ago - because of climate changes during the Ice Age all but one species of the cheetah*, A. jubatus*, became extinct. With the drastic reduction in their numbers, close relatives were forced to breed, and the cheetah became genetically inbred, meaning all cheetahs are closely related. Inbreeding occurs when members of the same family or close relatives breed only among themselves. For example, when you look around, you see different skin colours, eye colours, and heights. If you took blood from everybody in the room, and looked at the proteins in the blood, you would see proteins also vary between each person, just like hair colour. When you look at the proteins in the blood of cheetahs, they are very similar; it looks as if they are identical twins of one another, meaning they are closely related.

The study of biological inheritance is called ‘genetic research.’ Genes, which are composed of DNA, store the information that an individual inherits from his or her parents. Genes in one animal vary from the same genes in another animal of the same species. By looking at the amount of variation existing in genes, scientists, called "geneticists," can begin to understand the relationships of animals within a population, and how infectious diseases may affect that population. Also, by comparing the amount of variation between different species, geneticists can help us understand the evolutionary process.

When geneticists looked at the amount of variation within the genes of the cheetah, they found that cheetahs exhibit much lower levels of variation than other mammals. In most species, related individuals share about 80 percent of the same genes. With cheetahs, this figure rises to approximately 99 percent. The genetic inbreeding in cheetahs has led to low survivorship (a large number of animals dying), poor sperm quality, and greater susceptibility to disease. Inbred animals suffer from a lack of genetic diversity. This means cheetahs lack the ability to adjust to sudden changes in the environment, such as disease epidemics, and have unusually high susceptibility to certain viruses. For example, if a virus gets into a healthy population of leopards, not every animal dies; just some do, because leopards are genetically diverse. But if every animal is genetically the same, like the cheetah, and one gets infected, all of them may become infected and die off. Because of their lack of genetic diversity, a deadly virus could wipe out all of the worlds' wild cheetahs instead of just the susceptible animals. It depends on a species' genetic differences.

Evolution eliminates traits in organisms that are least suited for survival. Some of the decline in the cheetah's genetic diversity is accounted for by its specialization through natural selection. The decrease in genetic diversity resulting from natural selection has benefited the species' survival as it has made the cheetah better adapted to its environment. The effects of this occurrence are small when compared to the effects of the inbreeding that occurred 10,000 years ago from a population bottleneck.

To increase genetic diversity in captivity, zoos take great care to make sure that only unrelated animals mate. Scientists are working on ways to enhance breeding through artificial insemination and in vitro fertilization (IVF). Because of genetic inbreeding, male cheetahs have poor sperm quality. Abnormal sperm cannot swim properly, reducing the chance of fertilizing eggs and producing offspring. Artificial insemination (A-I) is a laboratory technique in which scientists place sperm in the reproductive tract of a female. This means the sperm have less distance to swim before reaching the eggs. Mating between male and female animals does not take place. Artificial insemination has produced cheetah cubs in the United States. Using these technologies, A-I and IVF, semen and eggs can be collected from wild Namibian cheetahs for use in captive breeding programs. Because Namibia has the largest population of cheetahs, the genes represented in this population are important to captive cheetah survival worldwide.

CHEETAHS & FARMERS

Cheetahs are considered "top predators" - relatively large animals that are strictly meat eaters and are usually not preyed on by other animals. Cheetahs need a lot of room to find food and mates, and to raise their young. In Namibia, a male cheetah's range is 800 km^2 to 1,500 km^2 and a female's 1,500 km^2 to 3,000 km^2. Because they need so much space, many predators are having trouble surviving as habitat is converted for human use.

With the development of agricultural farms in southern Africa, most of the large predators were eradicated. Today, of the large carnivores, only cheetahs and leopards are naturally found on livestock farmlands, and some farmers are still battling against these species because of their fear and misconceptions. Ninety-five percent of Namibia's, South Africa's, Botswana's and Zimbabwe's cheetahs live on agricultural farmlands. The species' adaptation to farmland is due to the absence of other large predators and the increased water availability, which attracts wild prey populations. The cheetah's attraction to agricultural land and livestock poses a direct threat to the species' survival. Local declines in the cheetah population continue as farmers indiscriminately capture and remove cheetahs as vermin or "livestock killing" animals.

Farmers perceive cheetahs as having an excessive economic impact on their livestock and wild game; however, research indicates that less livestock is taken by cheetahs than is thought. Farmers who employ effective livestock management practices and/or own farms with abundant wild game suffer minimal or no livestock loss to cheetahs. Unfortunately, not all farmers have implemented predator control methods reduce their predator problems in a non-lethal manner.

Cheetahs prefer wild game to livestock, but if cheetahs are unable to find or catch wild game they may hunt livestock. When the cheetah's natural prey populations decline, due to loss of habitat and/or increased livestock on lands, it may turn to catching goats, sheep, and calves. Livestock are easier prey than wild animals because the domestic animals are much slower and not as capable of escaping a predator's attack.

Indiscriminate capture and killing of cheetahs may actually force some young cheetahs to prey on domesticated animals because of their lack of skill in capturing wild prey. For example, juvenile cheetahs are poor hunters, and they rely on their mother to teach them to capture wild game. If they are separated from their mother (when cheetahs are indiscriminately captured, a mother may be separated from the juveniles), the young cheetahs may not be able to hunt wild prey and could turn to livestock as a food source.

Cheetahs are territorial animals. Male cheetahs will fight, sometimes to the death, to protect their territories. If a farmer has a cheetah on his/her property that does not kill livestock, it is better to keep the animal on the farmland. By removing cheetahs, farmers create vacuums in an area causing other cheetahs to fight for possession of the territory. Where previously only one cheetah had lived, two or three may now come to fill its place. Furthermore, a "problem" animal that is regularly hunting livestock may replace the one that was removed.

Social groupings among male cheetahs are also important to hunting behaviour. Male cheetahs from the same litter live in coalitions for their whole life, which increases breeding and hunting success. If any are live-trapped or killed and removed from the coalition, those remaining may begin to hunt livestock because of the reduction in their coalition number.

LIVESTOCK GUARDING DOGS

For the cheetah to survive, it must have habitat to live and a healthy wild prey base to eat. In addition, a holistic approach incorporating land use, livestock and wildlife on farmlands is key, as this is where most of Africa's cheetahs survive. Due to competition with other predators in protected areas, cheetahs survive on agricultural lands where they enter in conflict with humans and their livestock. This sometimes results in livestock loss by predation. Many Namibian farmers perceive cheetahs as having an excessive economic impact on their livestock and wild game industries; however, few farmers know the facts about the cheetah and few attempts to control predators in a non-lethal manner. Farmers hold the future of the cheetah in their hands, so one of the Cheetah Conservation Fund's (CCF) key programs is Human-Wildlife Conflict Resolution.

Livestock guarding dogs have been used in Europe for centuries to protect livestock. The many breeds originated across Europe share the same basic characteristics, but have been selectively bred for efficiency under local conditions. These different breeds share not only physical traits such as large size and a threatening bark, but also important behavioural characteristics, showing attentive, trustworthy and protective behaviour to the livestock with which they were raised. They are not bred to herd or move the stock, which can trigger a predator to attack, but instead place themselves between the livestock and the threat, barking loudly. If the predator persists the dog will attack, but often the mere presence of an intimidating guardian is enough to make the predator leave.

CCF began its Livestock Guarding Dog programme in 1994, using the Anatolian shepherd dog, and later the Kangal shepherd, that have been used in Turkey for 6,000 years to protect sheep and goats from wolves and bears.

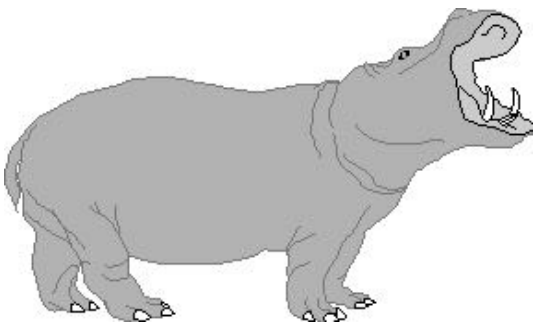
The Kangal and Anatolian shepherd breeds were chosen in preference to other livestock guarding dog breeds as they are able to work unsupervised in vast open spaces, are short-coated (making them well adapted to working in a hot, arid climate) and are large, imposing dogs that bark loudly.

CCF breeds, places and monitors the dogs, scoring for effectiveness using methodologies developed for guarding dog behaviour. Monitoring includes investigating livestock losses from predators on farms with and without guarding dogs. CCF supports the veterinary and medical care of puppies by vaccinating and sterilising them prior to placement. After placement, CCF monitors all dogs at 3 months, 6 months, and annually thereafter.

The objectives of the program are to continue evaluating the dogs' effectiveness and monitor how they adapt to the Namibian environment over time. To examine their effectiveness, CCF monitors the reduction of livestock losses, and thus develops an appropriate method for diminishing the level of conflict with farmland predators, in order to foster a sustainable co-existence of predators and people. The hypotheses being tested are that traditional farmers are amenable to changes in livestock management practices to mitigate predator conflict and that guarding dogs will reduce livestock loss to predators, thus reducing the numbers of predators killed by farmers.

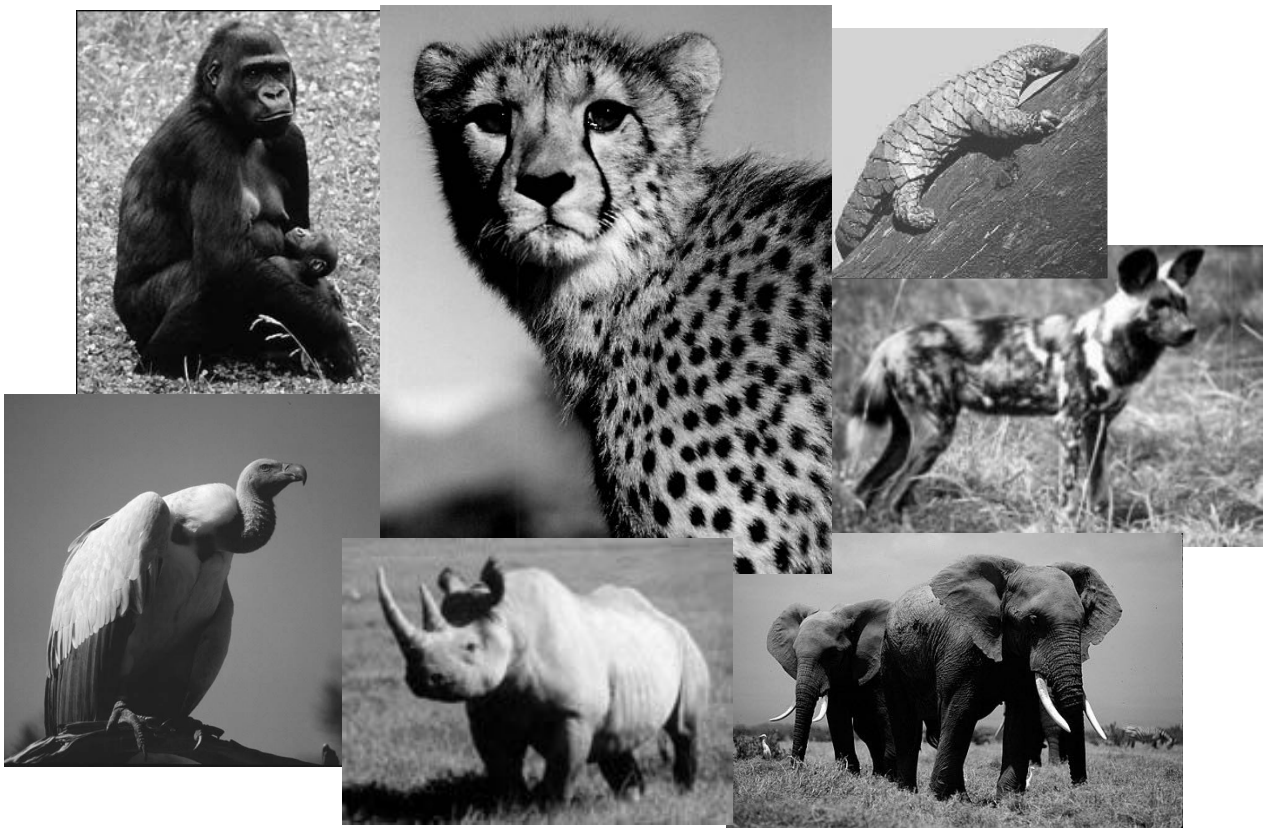
Due to the success of this programme in Namibia, CCF is assisting in the development of Livestock Guarding Dog programmes in other countries where large carnivores are in conflict with livestock.

WHY DO SPECIES BECOME ENDANGERED?



Habitat loss
Introduced species
Pollution
Population growth
Over-consumption

Some examples of endangered animals...



GLOSSARY

ACCELERATION – the act of increasing speed.

ADAPTATION - changes in a structure, behaviour, body form or function, which help an animal or plant exist or survive in its environment. For example, the cheetah's claws do not fully retract so that they have better traction while running. The cheetah is the only cat species whose claws do not fully retract.

AERODYNAMIC- the qualities of an object that affect how easily it is able to move through the air

BEHAVIOUR – the manner of behaving (to act, react, function, perform) in a particular way.

BIOLOGICAL DIVERSITY (BIODIVERSITY) - the full variety of life on earth and all the processes and interactions that sustain it.

BINOCULAR VISION - eyes both looking forward. Aids in judging distances and depth perception.

BOTTLENECK - a severe population reduction, often resulting in inbreeding of the remaining animals.

BREED – (v) to produce offspring, to give birth

BUSH ENCROACHMENT - thick scrub growth that takes over areas of land, making them unsuitable for farming or grazing; caused by poor land-use practices.

CAMOUFLAGE - the colour or patterns of an animal's coat, its smell, or a noise that help it blend into or hide in the natural surroundings from predators or prey.

CAPTIVITY – the state or period of being confined or restrained.

CAPTIVE ANIMAL - any wild animal that lives inside a zoo or animal park or is kept as a pet.

CARACAL- Small, long-legged, African cat with long, black ear tuffs and solid tawny coat.

CARNIVORE - a meat-eating animal.

CARRYING CAPACITY - a wildlife management term for the amount of living matter that can be supported by an area. It is usually expressed as a number indicating the population of any organism a designated area can support. The carrying capacity of an area can vary throughout the year and from year to year depending on conditions within the species habitat, such as food sources or climate.

CHEETAH - a long-legged, swift-running, slender, spotted wild African cat.

CHEETAH CONSERVATION FUND (CCF) - a registered Namibian Trust established in 1990 to conduct conservation research and education programs on the cheetah throughout its range. CCF strives to: (1) identify important components of farmland ecosystems that are necessary to sustain healthy cheetah populations; (2) develop conservation management plans that are beneficial to both cheetahs and farmers, thereby ensuring the species' survival on livestock farms; and (3) promote farm management practices that reduce livestock losses from predators.

C.I.T.E.S. - Convention on International Trade in Endangered Species of Wild Fauna and Flora. A treaty that monitors international trade in animals and plants. Over 115 countries have signed the treaty. Namibia, Botswana, Zimbabwe and South Africa are member nations, or "parties," to C.I.T.E.S.

COMMUNITY- Any group living in the same area or having common interests.

CONFLICT – a battle, struggle, clash or disagreement

CONSERVATION - the act of protecting and preserving the environment and wild species.

CONSERVE - to make use of natural resources wisely and well, so as not to overuse them.

CONSUMER- ecological consumers are plants and animals of a food chain which receive energy by consuming other plants or animals.

CONSUMPTIVE USE - any use of a plant or animal that involves an activity resulting in the loss of an individual organism. Examples include hunting, fishing, and trapping as well as indirect impacts such as habitat loss.

CUB – the name of some young carnivorous animals such as cheetahs, leopards and lions.

CULTIVATE – to promote the growth of, to improve and repair

DEPLETABLE RESOURCE - a natural resource, such as rainforests and soil, that takes thousands of years to be renewed.

DEPREDATION - in relation to wildlife damage, the act of destroying people's crops or domesticated animals.

DESERT – a dry region rendered barren due especially to low rainfall.

DISTRIBUTION – to divide and dispense out in portions

DIURNAL - animal that is active during the day.

DIVERSITY – the way in which things are different

DNA - Deoxyribonucleic Acid. A chemical found in the chromosomes of every cell. DNA is organized into genes, which form the genetic code. An individual receives half of his or her DNA from the mother through her egg and half from the father's sperm.

ECOLOGY - the study of the relationships between animals, plants, and the environment.

ECOSYSTEM - a system of plants, animals, and other organisms together with the non-living components of their environment.

ENDANGERED SPECIES - a group of animals or plants in immediate danger of disappearing (becoming extinct) from the earth due to changes in their environment, loss of habitat, commercial trade and/or inability to adapt. Protective measures must be taken immediately or the species will become extinct. The cheetah is an endangered species.

ENDOSKELETON – an internal supportive skeleton; characteristic of vertebrates

ENVIRONMENT - all the physical, chemical, and biological factors that affect or make up an organism's surroundings.

EVOLVE – to be part or subject to a natural process of change and evolution

EXOSKELETON – an external, protective skeleton or supportive structure; characteristic of invertebrates such as insects.

EXTINCT - no longer found on the earth, no longer living, gone forever.

FACTOR – an item, thing or part that actively contributes to a result

FELIDAE - the scientific name for the family of animals that includes all cats.

FOOD CHAIN - the relationship between species where one species relies on another for its food. Herbivores are at the bottom of the chain and are preyed upon by animals called carnivores or predators.

GAME ANIMAL -legal designation for animals that may be hunted under regulation.

GENE - a unit of DNA responsible for determining a specific heritable trait (for example, brown hair). Mammalian DNA contains about 100,000 genes.

GENERATION – the single stage of descent/ancestry; offspring having common parents

GENETIC DIVERSITY - the variety of genes in an organism or in a population.

GEOGRAPHICAL RANGE (also called RANGE) - the area where an individual species of plant or animal population lives.

HABITAT - the place where a species lives, the environment where a plant or animal naturally occurs.

HABITAT DESTRUCTION - changing an animal's natural habitat so that it can no longer survive there.

HERBIVORE - an animal that eats only plants.

HOME RANGE - the area where an animal roams during its normal activities; different than an animal's territory.

HUMAN-WILDLIFE CONFLICT- refers to the interaction between wild animals and people and the negative impact on people and their resources, or wild animals and their habitat.

HUNT – to search through an area, as for game or prey

INBREEDING - occurs when close relatives (father and daughter, or brothers and sisters) mate. After several generations of inbreeding, animals may exhibit poor reproductive traits, ill health, and short life spans.

INTERSPECIFIC COMPETITION - competition between two different species for habitat, food, and other resources shared in common.

INSTINCT – the innate part of behaviour that is not learned

LEOPARD – a large feline mammal that lives in Africa and Asia. It has spots that are brown in the middle with black spots surrounding it and is often seen in trees.

LEATHAL- sufficient to cause death, very harmful or destructive.

LIFE CYCLE - the continuous sequence of changes undergone by an organism from one primary form to the development of the same form again.

LIMITING FACTORS– Resources are environmental conditions that limit the growth, abundance, or distribution of any plant or animal in a habitat.

LION – a large carnivorous feline mammal of Africa that has tawny colour and males have a thick mane around their face.

LITTER - all the offspring of an animal produced at one birth.

LIVESTOCK – domestic animals such as cattle, goats, horses or sheep that are raised for home use or for profit.

MAMMAL - an animal that has hair on its body and is warm-blooded; most species bear live young instead of laying eggs. The young get milk from their mother's body until they are old enough to eat other food on their own.

MIGRATE – to move from countries or regions to settle in another

NOCTURNAL - an animal that is active at night.

NONCONSUMPTIVE USE - any use that does not directly kill an individual plant or animal, such as hiking or photographing.

NONGAME - all wildlife species that are not commonly hunted, killed, or consumed.

NUTRITION – the process of nourishing or being nourished; a living organism assimilates food and uses it for growth.

OFFSPRING – the progeny (children) of a person, animal or plant

OMNIVORE - an animal that eats plant material as well as meat.

OPPORTUNISTIC- taking advantage of opportunities as they arise, feeding on whatever food is available

ORGANISM - any life form, plant or animal, made of mutually dependent parts that maintain vital biological processes.

OVERGRAZE - grazing too much or allowing too many animals to graze on one area, thus damaging the soil and the future growth of plants and animals.

OVERSTOCK - putting too many animals in an area; exceeding the area's carrying capacity.

POACHING - the illegal catching or killing of animals, or the illegal collecting of plants.

POPULATION - the total number of individuals of a species that share the same geographic area.

PREDATION - the act of hunting and killing other animals for food.

PREDATOR - an animal that hunts and kills other animals for food.

PREFER – to select in preference of another; to value more highly; to like better

PREHISTORIC – belonging to the era before recorded history

PREY - an animal hunted by another for food; food for a predator.

PRODUCER- are mainly green plants that produce their own food through energy they get from the sun.

PROTECT – to keep from harm, attack or injury; to guard

RAINFOREST – a dense evergreen forest in a tropical region with an annual rainfall of at least 100 inches.

RARE - a species not currently in danger of extinction, but of concern because of its low numbers.

REGION – a large and undefined portion of the earth's surface

RESERVE - an area of land set aside to conserve and protect animals and plants.

RUDDER- a flat, movable piece usually of wood or metal that is attached to a ship, boat, airplane, etc., and is used in steering

SAVANNAH - grassland with scattered trees or groups of trees.

SCAT- droppings or poop, especially those of carnivorous mammals.

SCAVENGER - an animal that feeds on dead animal flesh or other decaying organic matter.

SEMI-RETRACTABLE CLAWS - claws that can only be partially drawn back into sheaths.

SHELTER – something that provides cover or protection from the weather.

SLENDER – having little width in proportion to the height or length; thin

SPECIES - a group of animals or plants of the same kind that reproduce young like themselves. All organisms of the same kind. The leopard and cheetah are two different species of cats.

SPEED – the rate or a measure of the rate of motion.

SPOOR - the track or footprint of an animal.

SPRINT – a short race at top speed.

STEWARDSHIP - the concept of responsible caretaking of the environment; based on the premise that we do not own resources, but are managers of resources and are responsible to future generations for their condition.

STRIDE – a 'step'; a single movement of the four legs of an animal completed when the legs return to their original position.

SURVIVAL – something that survives, endures or lives**.**

SUSCEPTIBLE – especially sensitive, highly impressionable.

SUSTAINABLE USE - the use of a plant, animal, or other life form in a way and at a rate that does not lead to the long-term decline of biological diversity, therefore maintaining the species' potential to meet the needs of present and future generations.

TERRITORY - the area of land in which an animal lives and defends as its home. Animals may have fierce fights over territorial land.

THREAT – an intention to inflict pain, injury, or harm on a person or thing.

THREATENED SPECIES - a species decreasing in numbers and range. Such animals and plants face serious problems and may become endangered if we do not help.

UNIQUE – being the only one of its kind; something special.

VEGETATION – the plants of an area or region.

VULNERABLE SPECIES - a species that is limited in numbers or area but is not yet threatened or endangered.

WARM-BLOODED - animal whose body temperature remains relatively constant. Animal that derives the heat energy it needs from the food it eats.

WILDLIFE - the natural fauna and flora of an area. Animals that are not tamed or domesticated.

WILDLIFE CONSERVATION - the wise use of our world's natural resources, including minerals, plants, and animals, to prevent destruction of these resources and species extinction.

WILDLIFE MANAGEMENT - the application of scientific knowledge and technical skills to protect, conserve, limit, enhance, or extend the value of wildlife and its habitat.

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Cheetah (Acinonyx jubatus)

Lion (Panthera leo)

Leopard (Panthera pardus)

Caracal (Caracal caracal)

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Wild Dog (Lycaon pictus)

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Spotted Hyena (Crocuta crocuta)

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