CHEETAH CONSERVATION
BOTSWANA
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Science & Society

6

Nature & the Universe

Teachers
Classroom
Resource

Lesson Contents

Lesson 6.1

National Curriculum Reference

Module 1 : Science & Society
History of Science 1.2.3.2

Module 2 : Nature & the Universe
The Environment 2.1.1.1; 2.1.1.2; 2.1.1.3; 2.1.2.2 & 2.1.3.2

Learning Outcomes (LO)

A Time Plan for Standard 6 is included for your use at the rear of this resource, together with assessments for each lesson.
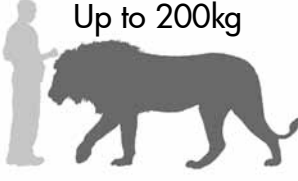
LO2 : The student will know, be able to interpret and apply scientific, technological and environmental knowledge.

Process Skills:
Understanding Information
Generalizing from given facts
Seeing patterns

Lesson 6.1
Introduction to Predators

Briefly introduce the four main feline predators of Botswana. Present a brief background about their characteristics from the information below.

LION	LEOPARD	CHEETAH	CARACAL
Panthera leo	*Panthera pardus*	*Acinonyx jubatus*	*Felis caracal*
TAU	NKWE/LENGAU	LETOTSE	THWANE

Up to 200kg	Up to 95kg	Up to 65kg	Up to 18kg

Southern Africa Range

LION

Social, living in prides of up to 16 individuals

Males larger than females

Females do most of the hunting

Groups are capable of bringing down buffalo-size prey

Individual lions are capable of bringing down wildebeest-sized prey

Mostly nocturnal but can be diurnal

LEOPARD

Solitary

Territorial

Males larger than females

Stocky, muscular and a stealthy ambush hunter

Favours trees and is an excellent climber

Capable of bringing down wildebeest-sized prey

Mostly nocturnal but can be diurnal

CHEETAH

Females are solitary, male siblings stay together

Can range over large distances

Males slightly larger than females

Poor climber

Favours open bush veld

Capable of high speeds to chase down medium-sized antelopes

Mostly diurnal but can be nocturnal

CARACAL

Solitary

Territorial

Males larger than females

Very shy and not often seen

Excellent climber and jumper

Capable of bringing down steenbok-sized prey

Mostly nocturnal but can be diurnal

Lesson 6.2

National Curriculum Reference

Module 2 : Nature & the Universe
    The Environment 2.1.1.1; 2.1.1.2; 2.1.1.3; 2.1.2.2 & 2.1.3.2

Learning Outcomes (LO)

A Time Plan for Standard 6 is included for your use at the rear of this resource, together with assessments for each lesson.

LO2 : The student will know, be able to interpret and apply scientific, technological and environmental knowledge.

Process Skills:
Observation and recall of information
Understanding the use of information
Translating knowledge into a new concept

Lesson 6.2

Habitats

WHAT IS A HABITAT?

All living things need a place to live throughout their lives, a habitat. A habitat is therefore a natural home or environment suited to allow each living thing to live and breed successfully. Habitats range from mountain peaks to ocean floors, from forests to deserts. All living things become adapted to live in certain habitats. For example, Springbok are adapted to living in dry open grassland and live and reproduce very well in this habitat, however in bushy environments springbok do not thrive as well.

WHAT DO ANIMALS NEED FROM THEIR HABITAT?

A habitat must provide the four basic needs of all animals;

- food;
- water;
- space;
- shelter.

Each species of animal has slightly different needs of the four things listed above, therefore many animals may share the resources within a habitat. However, if a habitat does not contain enough of any one of the resources for a species then that species will either move away or die out.

Cheetahs live in open habitats, such as grasslands, savannahs or open bush lands. They use high speed chases to catch their prey, so forests or dense bush would provide too many obstacles to reaching those speeds. They also prefer to live in areas with lower populations of competing predators, such as lions and hyenas. In Botswana, this is one reason why many cheetahs prefer to live outside of National Parks or protected areas. There is just too much competition there.

Activity 6a
Classification of Habitats

Using poster P3 supplied, discuss with the students the six habitats pictured and ask them to list the kind of animal (insects, birds, reptiles, mammals, amphibians) which might live there.

Habitats poster
CCB/P3

5
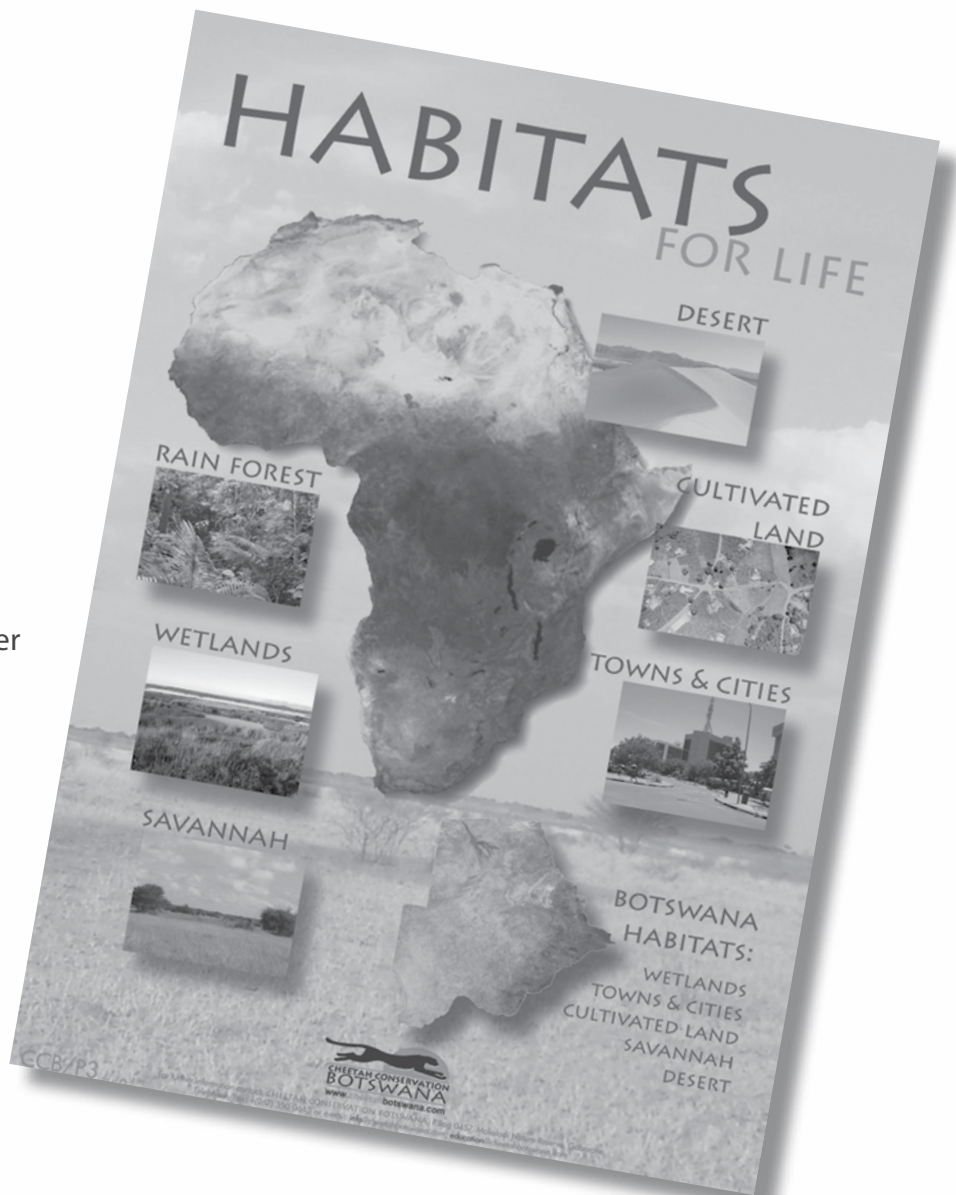
Activity 6b

Elements of a Habitat

Form the students into a circle, front to back and name each student by 'Habitat Necessity' (space, water, shelter and food). Tighten the circle until the students are close enough together to sit on each other's knees.

Remove a student and see what happens to the circle. Remove all the 'water' students and let the students discuss what happens.

The results will show that while all four habitat elements are present there will be a balanced environment - a slight decrease in one element will result in only a modest disturbance to it. The activity will also demonstrate that completely removing one element (water, for example) will result in environmental/habitat collapse. Allow the students to lead the discussion.

Activity 6c

Habitats for Life

After reviewing the Habitats poster (CCB/P3), ask the students to categorize each habitat and match them with animal needs. Students will need to decide which habitats contain the four needs in a hierarchy of LOW, MEDIUM or HIGH levels of availability in a table which should be drawn on the board from the template on Page 7.

After completing the table to identify the levels of availability of the four essential elements to sustain life in each habitat, the students will then need to determine the preferred habitat of the listed species in the accompanying table on Page 7. Special factors, such as specific abilities and body types may also influence habitat preference. This table should also be drawn on the board for the students to copy from.

6

(Please photocopy this Worksheet or reproduce it on the board for the students to work from)

Student Name: _____ Date: _____

Habitat Needs (Low, Medium or High)

Habitat Factors	Savannah	Rain Forest	Wetlands	City	Desert
FOOD					
WATER					
SHELTER					
SPACE					

Species Needs

Animal	Food	Water	Shelter	Space	Special	Optimum
CHEETAH						
LION						
DOMESTIC CAT						
HUMAN						

An answer Key is reproduced on Page 25 for teacher reference.

When these activities have been completed, the outcomes can be discussed with the students with the following questions:

1. Which habitat has the HIGHEST and which has the LOWEST of the required supporting factors?

2. Which habitat will support the HIGHEST and which will support the FEWEST number of animals and why?

3. What other special factors (other than those listed in the tables) may be important for an animal to be present in a particular habitat? (these could include species adaptations and the presence of predators)

4. What special factors give humans the ability to take advantage of more than one kind of habitat?

5. How do all these factors and elements affect the cheetah and from what has been learned, explain why, for example, the cheetah is sometimes out-competed by the lion for habitat space?

Cheetahs are non-aggressive and avoid confrontation with more powerful predators and large animals. A cheetah's speed is its greatest weapon and any injury which may affect that speed is a direct threat to their survival.

Cheetahs therefore back-down when confronted, which is why they often lose their prey and territory to more powerful lions, leopards and hyenas.

Activity 6d

Cheetah Habitats

After reviewing the Habitats poster (CCB/P3) and the satellite image of the African continent, discuss with the students the vegetation features of the image, including desert, wetlands, rain forest and savannah areas.

Of those identified areas, ask the students where cheetahs could live ONLY taking into account their needs in relation to their physical characteristics and behaviour. The areas of Africa in which cheetahs could live (only taking those factors into account) should be highlighted by shading the chosen areas of Africa on the drawing of the African continent, reproduced on the worksheet included, with reference to the poster image.

The Key, showing what the student estimates of available cheetah habitat should be, is reproduced on page 11 for teacher guidance and reference.

The results should reveal the students estimates of the theoretical habit range of the cheetah on the African continent, given only their habitat needs and preferences.

When the students have compared their results and everyone is satisfied with a consensus about where the cheetah should be able to thrive, they should then be presented with the map on page 12. This illustrates current estimates of the ACTUAL cheetah habitat range today from scientific studies. Why are they strikingly different, given that much more habitat could theoretically sustain cheetahs?

1. What are the other factors limiting the habitat available to cheetahs in modern Africa?

An open discussion with the students should reveal the answers.
Topics for the students to consider should include;

- What changes have occurred in the habitat or the environment?
- What is the prevalence of other predators?
- Are there more competing predators than there used to be, or less?
- What about human development?
- Are there more people than there used to be, more farming, more land or the building of bigger settlements such as towns and cities?
- Can the answers to these questions reveal why cheetah habitats are relatively small even though there is in theory more habitat available that might sustain them?

(Please photocopy this Worksheet
for each student to work on)

Student Name: _____ Date: _____

Given that cheetahs do not like dense rain forest because they are a high speed hunter
and by looking at the habitat types appearing on the satellite image of Africa, there
seems to be plenty of habitat left for cheetahs?

Using a coloured pencil, shade the areas of Africa where you think
the habitat is suitable for cheetahs to live.

10

Activity 6d

Key to Anticipated Student Estimates of Available Cheetah Habitats

Activity 6d

Actual Cheetah Habitats

1. What are the other factors limiting the habitat available to cheetahs in modern Africa and what impact does that all have?

Lesson 6.3

National Curriculum Reference

Module 8 : Sexual Reproductive Health
Human Reproductive System 8.2.3.2 and 8.2.3.3

Learning Outcomes (LO)

A Time Plan for Standard 6 is included for your use at the rear of this resource, together with assessments for each lesson.

LO1 : The student will be able to act confidently on curiosity about natural phenomena, to investigate relationships and to solve problems in scientific, technological and environmental contexts.

Process Skills:
Recording Information in graphical form
Identification of trends
Seeing patterns

6

Lesson 6.3

Life Cycles

THE CYCLE OF LIFE

All living things start life, live for a period of time and then die. During that life living things are born, grow, mature and reproduce to produce new organisms that are then born. This is the Cycle of Life.

As a living organism, the cheetah goes through a similar life cycle to any other animal. Research so far conducted by scientists reveals that a cheetah in the wild may have a life expectancy of about 8 years, though some individuals may survive to become older. Cheetahs in captivity usually live longer and may even survive past 13 years. (though some individuals in captivity may again live a little longer).

Survival and longevity depends upon many contributing factors and life span vary across and within all living species. The life span of a cheetah in the wild is affected by many circumstances and conditions such as,

A cheetahs life expectancy depends upon:

- The availability of suitable habitat,
- Catching enough prey,
- Avoiding other predators,
- Avoiding injury that may prevent or reduce hunting,
- Reproducing successfully without injury,
- A mother being able to protect ,feed and teach her cubs,
- Avoiding genetic abnormalities,
- Avoiding or surviving disease,
- Avoiding or surviving conflict with other cheetah and
- The genetic makeup of the individual.

All of these things will affect how long an individual cheetah may live, however, it still may depend to some degree on luck.
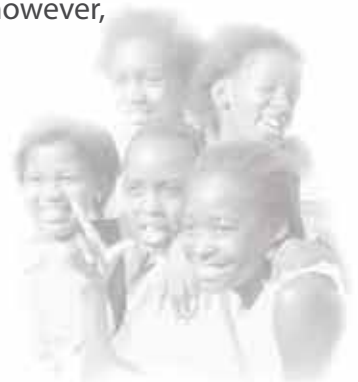
CHEETAH BIRTH & DEVELOPMENT

Male cheetahs tend to stay within a certain area and discourage other male cheetah from using that area. Male cheetahs will often stay together with their brothers from the same litter and form a 'coalition'. A coalition will act as a single animal, so a territory can be held by a single male or a coalition of up to four brothers. Male cheetahs become sexually mature between 2 and 3 years of age. Female cheetahs reach sexual maturity at 2 years of age. Females do not form coalitions and are normally solitary. The females tend to range widely over a large area.

Males and females tend to stay together for a few days during courtship. During this time they may mate several times. The male will then leave the female and have no more to do with raising the cubs. The gestation period is around 90 days and when born there may be 2 to 9 cubs, although 3 or 4 is more normal.

Cheetah cubs are born blind, weigh between 150 - 300g and measure around 300mm in length. Cubs develop more quickly than those of any other big cat, and gain about 50g in weight every day until they are weaned at 4 - 6 weeks. Their eyes are open after around 5 days and they are able to crawl after only 3 days. They get their canine teeth after 3 weeks and full set of milk teeth at 6 weeks, when they begin to eat meat brought back by the mother. For the first 6 weeks of their lives, the cubs will remain stationary and hidden within a den while the mother goes off to hunt.

At 6 - 8 weeks, the cubs will begin to move around and play close to the den, but after 8 weeks will follow the mother continuously and the den is abandoned. Predators, starvation and disease are significant risks to the cubs lives until they are about 4 months old when they have built up a stronger immunity and are exceptionally mobile. Cheetah cub mortality rates are very high, with an average of only 10% surviving the first year.

Cheetah play is very athletic, with sibling games related to stalking and hunting tactics that will be fine tuned by their mother until she leaves them just before they are 2 years old. Cubs usually stay together for up to 6 months after the mother has left, before they all go their separate ways (with the exception of the males forming their coalition).

Activity 6e

Birth & Development

This activity will enable students to draw comparison between the development of cheetah cubs and human babies.

The activity should begin with a student discussion about animal and human infant development rates and student estimates relating to cheetah cub characteristics verses those of a human infant.

Work towards creating a relationship chart for Weight & Age and for Development, featuring data for a cheetah cub and a human baby for comparison.

The charts will then reveal plotting data which the students can convert to graphical form. The graph will assist the students in answering the following questions:

How much weight did the cheetah cub gain at each interval from birth, to 4, to 12, to 24 months?

How much weight did you gain during the same period?

How many times more weight did the cub gain during the period?

Activity 6e

Birth & Development

Table of Weight v Age.

CHEETAH CUB	
Age	Weight
Birth	0.3 kg
2 months	3 kg
4 months	7 kg
6 months	12 kg
12 months	25 kg
18 months	30 kg
24 months	35 kg
adult	35 - 60 kg

HUMAN INFANT	
Age	Weight
Birth	3.5 kg
2 months	5.5 kg
4 months	6.5 kg
6 months	8 kg
12 months	10 kg
18 months	11 kg
24 months	12 kg
4 years	16 kg
8 years	26 kg
12 years	43 kg
16 years	60 kg
adult	63 + kg

Table of Physical Development.

STAGE OF DEVELOPMENT	CHEETAH CUB	HUMAN INFANT
Gestation	90 days	9 months
Eyes open	5 days	from birth
First teeth	3 weeks	6 months
Milk teeth	6 weeks	30 months
Permanent teeth	8 months	13 years
Weaning	6 weeks	+6 months
Walking	3 weeks	12 - 16 months
Life span	8 - 12 years	70 years

(Please photocopy this Worksheet
for each student to work on)

Student Name: _____ Date: _____

Using the data developed from the **Table of Weight v Age**, plot a line graph using two colours, one to represent the cheetah cub and the other to represent the human infant. Then, using the graph you have drawn, try to answer the questions below.

GRAPH: WEIGHT & AGE RELATIONSHIPS FOR A CHEETAH AND ME

WEIGHT

Birth   6   12   18   24

AGE (months)
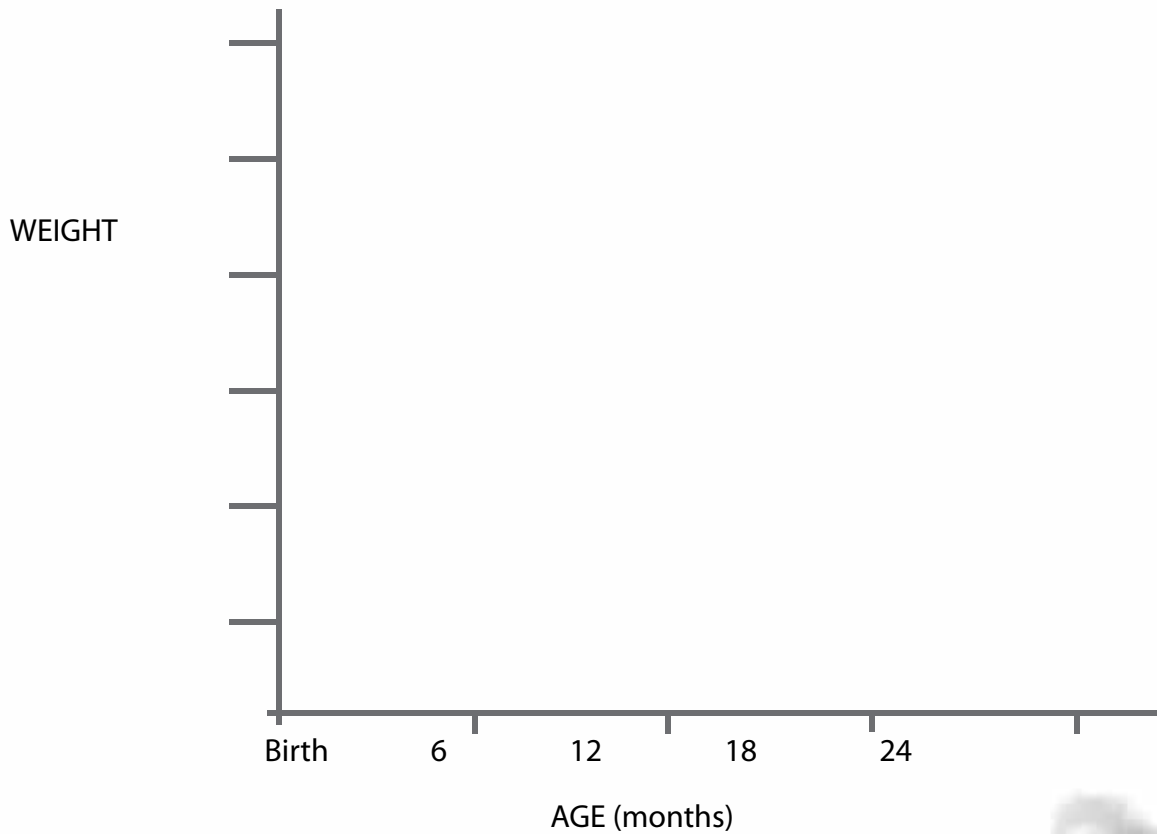
Lesson 6.4

National Curriculum Reference

Module 2 : Nature & The Universe
        The Environment 2.1.1.1, 2.1.1.2 and 2.1.1.4

Learning Outcomes (LO)

A Time Plan for Standard 6 is included for your use at the rear of this
resource, together with assessments for each lesson.

LO1 : The student will be able to act confidently on curiosity about natural
phenomena, to investigate relationships and to solve problems in scientific,
technological and environmental contexts.

Process Skills:
Communicating scientific information
Recording information
Interpreting data

6

Lesson 6.4

Population Change

Population Fluctuation and Community Change?

The population of a species within a certain area will fluctuate over time. The fluctuation is due to changes in the environment that may make the area a better or worse place to live. These changes in the environment are normal and may be caused by the amount of rainfall. However, large changes in the environment may mean that the species can no longer survive their and individuals must move away or die.

The fluctuation in the population of a certain species is likely to affect other species that depend on it. As most of the plants and animals within a community interact in some way a change in the population of one species will cause a change in the entire community. If an environment becomes dryer the plants that require more water will reduce in number, the animals that feed on those plants will not do well allowing other animals that feed on drought tolerant plants to thrive. This situation will reverse when more rain falls.

The change in communities is normal and normally does not last. However, a large change may cause some species of a population to move away or die. This may mean the community is permanently changed. These changes may be so large that it causes an imbalance in the community which has a large affect on all the species within the community.

Activity 6f

Population Change

This activity will enable students to see how habitat components directly affect populations, using the cheetah as an example. Ask the students first to identify the four components of a habitat - water, food, shelter, space.

The activity should begin with students split into four groups, of cheetahs; food; shelter and space. For the exercise, there is plenty of water in the habitat to drink so there is no need to represent water. The objective is for all the cheetahs to find enough food, shelter and space to survive.

The cheetahs will face the wall on one side of the room and individually decide what they want to look for at the beginning of each round:
Those choosing to put their paws on their heads mean SHELTER;
Those choosing to put their paws on the stomachs mean FOOD;
Those choosing to cross their paws in front of them mean SPACE.

Then, they will turn around to face the other groups. After turning around, individual cheetahs cannot change their mind after seeing what is available.

While the cheetahs are deciding, the students within the three other groups will each decide if they are going to be shelter, food or water at the beginning of each round and in deciding, then each make the same signs with their hands. (The students will normally display a variety of shelter, food and space signs and it is ok for them to confer with each other what they are going to be. If they all decide to be shelter, this could represent a drought year).

When everyone is ready, say "cheetah challenge!" The cheetahs will then turn to face the rest of the students and must find those displaying the same sign. When they have 'captured' a habitat student, they take them to their own side. It has met its needs and successfully reproduced. The cheetah arriving first at a student representing what it needs survives. Any cheetah failing to find a habitat need dies and instead, becomes a habitat component.

Record the number of cheetahs at the start and at the end of every round. Continue for about 15 minutes and ask the students what is happening to the cheetah population as the activity progresses.

At the end of the activity, post the data recorded at the end of each round on a chalk board or flip chart from which the students can make a graph. Each round represents one year, so make a note of what was affecting the cheetah population at each round (too many cheetahs wanting food or a few cheetahs wanting shelter when there was nothing but space).

GRAPH: ANNUAL CHEETAH POPULATION FLUCTUATIONS

Number of Cheetahs

35 —
30 —
25 —
20 —
15 —
10 —

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Year
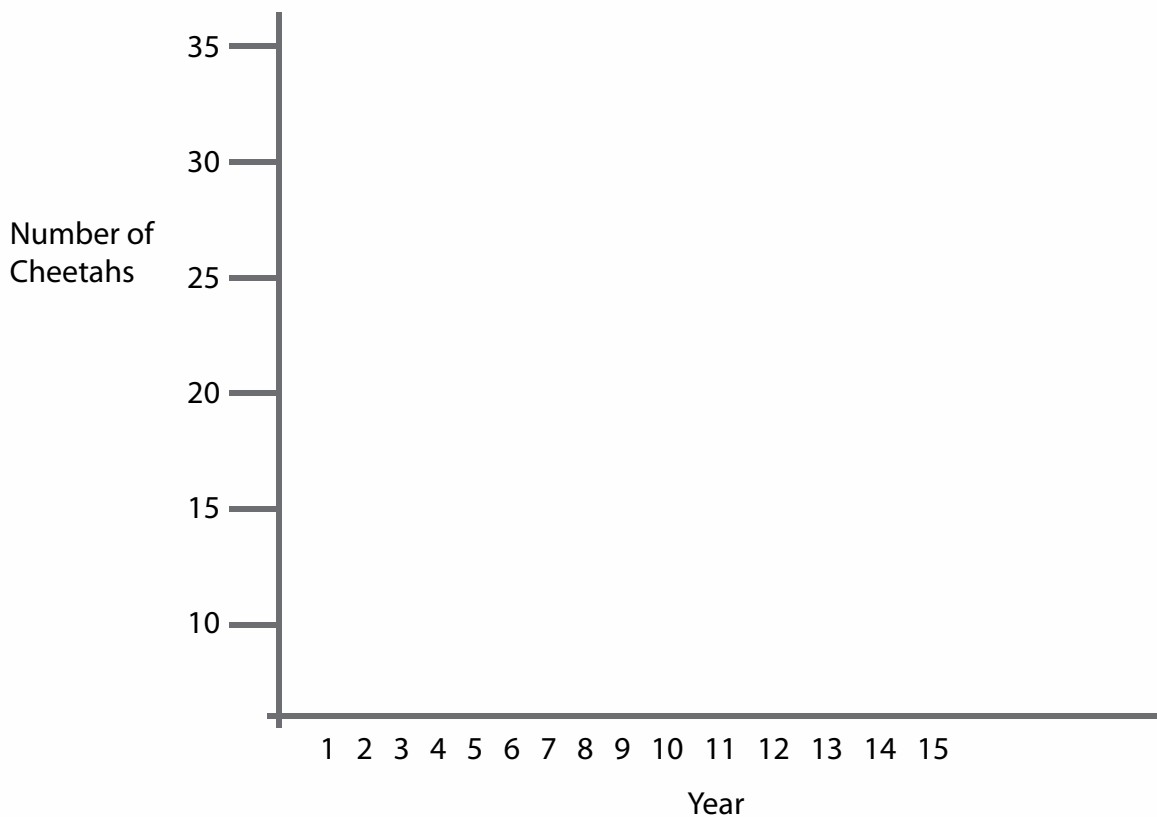
With the graph completed, ask the students to assess what was happening to the cheetah population as a result of habitat changes.

Is the population stable and coping with habitat changes?

Does the population crash or explode and why?

What would happen if one of the four habitat components was to be permanently removed?

Student Assessment

Lesson 6.1 Introduction to Predators

Assessment Rubric for Feline Predators of Botswana

1	2	3	4
The students could not fully distinguish similarities or differences and showed no reasoning for their grouping. Labelling and layout were confusing.	The students could not fully distinguish similarities or differences between the cats. Groupings showed some reasoning, but labels and layout are poor.	Students could distinguish similarities or differences. Cats were grouped showing good reason, but the layout is poor and labels confusing.	The students exceeded expectation in distinguishing similarities and differences. They showed good reasoning for groupings and the layout and labelling was good.

Lesson 6.2 Habitats

Assessment Rubric for Habitats

1	2	3	4
The student was unable to categorize levels of requirements for habitats and unable to predict where animals would be found based on categorization.	The student could only partially categorize the levels of requirements for habitats, but unable to correctly predict where the animals would be found.	The student could recall habitat requirements and correctly categorize as well as predict where animals would be found based on this.	The student exceeded expectations, showing increased understanding of habitat requirements, shown in answers to reflective questions.

Lesson 6.3 Life Cycles

Assessment Rubric for Life Cycles

1	2	3	4
The student could not complete the exercise and was unable to transfer information given onto a graph.	The student could only partially complete the graph, showing some ability, but also inaccuracy.	The student could complete the exercise and convey the information in graphical form neatly and accurately.	The student exceeded expectations, showing a deeper understanding of information given and volunteering conclusions.

Lesson 6.3 Life Cycles
Language Links

LEARNING OUTCOME	ASSESSMENT STANDARD
LO3: READING & VIEWING	Interprets and discusses more complex visual texts and can change text from one form into another.
LO4: WRITING	Converts information from one form into another
	Understands and responds appropriately to information in texts
LO5: THINKING & REASONING	Processes information from different sources

Mathematical Links

LEARNING OUTCOME	ASSESSMENT STANDARD
LO1: NUMBER OPERATIONS AND RELATIONSHIPS	Solves problems that involve comparison.
	Estimates and calculates by selecting operations appropriate to solving problems.
LO5: DATA HANDLING	Draws a variety of graphs to display and interpret data.

Lesson 6.4 Population Change
Assessment Rubric for Population Change Questions

1	2	3	4
The student could not complete the exercise and was unable to interpret data in terms of the processes at work.	The student could partially transfer data into the graph, but showed a lack of understanding of the processes at work.	The student could record and convey the information in graphical form, showing a good understanding of the processes at work.	The student exceeded expectations, showing a deeper understanding of information given and volunteering conclusions.

Mathematical Links

LEARNING OUTCOME	ASSESSMENT STANDARD
LO1: NUMBER OPERATIONS AND RELATIONSHIPS	Solves problems in context, including that which builds awareness of other learning areas and environmental issues.
LO5: DATA HANDLING	Draws a variety of graphs to display and interpret data.

Answer Keys (6.2 Habitats)

Habitat Needs (Low, Medium or High)

Habitat Factors	Savannah	Rain Forest	Wetlands	City	Desert
FOOD	H	H	M	L	L
WATER	M	H	H	M	L
SHELTER	L	H	M	H	L
SPACE	H	L	M	L	H

Species Needs

Animal	Food	Water	Shelter	Space	Special Factors	Optimum
CHEETAH	H	L	M	H	Fast, small mouth, solitary	Savannah
LION	H	M	M	H	Powerful, large mouth, group hunter	Savannah
DOMESTIC CAT	L	L	M	L	Dependant upon human support, but can turn feral	City/ Cultivated Land
HUMAN	M	M	H	L	Modifies habitats to meet their needs	Various

Standard 6 Time Plan

Lesson 6.1 Introduction to Predators

TIME FRAME	LO:1	LO:2	LO:3	LO:4	ASSESSED BY
1 class (45-50 minutes)	Sub-Skills				Teacher/Peer/ Rubric/Checklist
		Understanding information			
		Generalizing from facts			
		Seeing Patterns			

Lesson 6.2 Habitats

1 class (45-50 minutes)	Sub-Skills				Teacher/Peer/ Rubric/Checklist
		Observation & recall			
		Translate knowledge into new context			
		Understand & use information			

Lesson 6.3 Life Cycles

TIME FRAME	LO:1	LO:2	LO:3	LO:4	ASSESSED BY
1 class (45-50 minutes)	Sub-Skills				Teacher/Peer/ Rubric/Checklist
	Graphical interpretation				
	Identifying trends				

Lesson 6.4 Population Change

TIME FRAME	LO:1	LO:2	LO:3	LO:4	ASSESSED BY
1 class (45-50 minutes)	Sub-Skills				Teacher/Peer/ Rubric/Checklist
	Graphical interpretation	Knowledge of major ideas			
	Drawing conclusions	Translate information into new context			
	Reporting	Interpret facts			
		Predict consequences			

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