

STANDARD

Science & Society

Nature & the Universe



Teachers
Classroom
Resource

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Lesson 7.1

National Curriculum Reference

Module 1 : Science & Society

The Nature of Science 1.1.1.1; 1.1.1.2 and 1.1.1.3

Module 2 : Nature & the Universe

The Environment 2.1.1.1

Animals 2.3.1.1

Learning Outcomes (LO)

A Time Plan for Standard 7 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 and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Process Skills:

Observing, measuring, recording and interpreting information
Predicting, hypothesizing and raising questions about a situation
Planning and conducting science investigations
Communicating scientific information

Lesson 7.1

Adaptation

Review the background information below, before starting the lesson.

ADAPTATION

The natural process giving all plants and animals the physical and behavioural attributes we see today is a process referred to as evolution. Generation after generation, individual living species slowly change and adapt to their natural surroundings - their environment. This process of adaptation usually takes place over many thousands of years, though some species, such as the crocodile, have hardly changed at all in that time.

Evidence of these changes is recorded and found in Earth's 'Fossil Record' and in many living organisms alive around the world today. So far, it has been discovered that humans have changed significantly since the emergence of our very early ancestors some 2.5 million years ago. The first fossils of anatomically modern humans date from approx 200,000 ya. Anatomically there is little difference between these fossils and humans today. The first 'Homo' fossils date 2.5 mya many scientists call Australopithicus ramidus our earliest true ancestor at 4.4 mya.

ADAPTING TO THE ENVIRONMENT

All living things have adapted to survive in the environment in which they live. Species that have been unable to adapt have died out completely, this is called becoming extinct. Adaptation includes physical or behavioural changes in species to help them to better survive and reproduce. In other words, those best adapted to the environmental conditions of a habitat are more likely to thrive and reproduce and in many cases, to become even more adaptable and ever resourceful in that environment over time.

Cheetah have been going through the process of adaptation for millions of years. In that time cheetah has become adapted for running at high speed and are so well adapted that they are the fastest land animal on the planet. While most of the 38 cat species alive today are fast runners the cheetah has specialised as a sprinter. It has developed different adaptive traits that make it distinct from the other cat species.



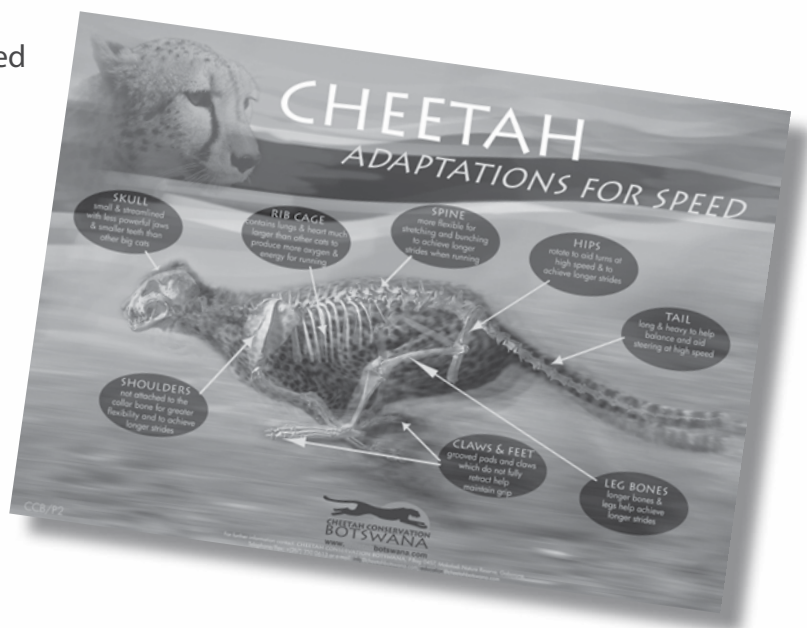
To run at high speed an animal must increase the length of its stride or increase the rate at which it takes those strides. Cheetahs do both; taking extremely long strides very quickly. The adaptation of the cheetah to become a streamlined sprinter involves many adaptive traits such as those that increase stride length such as;

- long narrow legs,
- a flexible spine,
- pivoting hip bones and
- collar bones that aren't attached to shoulder blades.

Additionally cheetah have;

- enlarged organs; such as the heart, lungs and nostrils, to increase oxygen supply,
- a small head and slender body for better aerodynamics,
- a long heavy tail which assists with balance when turning,
- strong, blunt semi-retractable claws to grip the ground and
- black 'tear marks' which reduce the glare and help them see better.

Adaptations for Speed
poster CCB/P2



Having a long stride helps cheetah cover a large amount of distance quickly. The cheetah runs on its toes which effectively make its legs longer. It also has a very flexible back bone which allows it to curl up tightly and stretch its body long to extend each stride. The shoulder blades are not attached to the collar bones and the hip bones pivot and swivel, this allows the cheetah to stretch its front and back legs further. All of these things combined mean that when a cheetah is running a single stride can cover over 8 metres.

Although a long stride is important for speed the cheetah must take the strides quickly and be able to keep control at high speed. The cheetah has large nostrils, lungs and heart to provide oxygen to its muscles. Its skeleton is lightweight and it is less muscular than other big cats to reduce the weight that its muscles must move. A long heavy tail acts as a stabilizer and helps the cheetah balance especially during sharp turns at high speed. Semi-retractable claws serve to give better grip and the pads of the paws have longitudinal ridges which work like tyre treads.

All these adaptive traits allow the cheetah to accelerate from 0 to 80 km/h in about 3 seconds and to reach maximum speeds of over 110 km/h. However, top speeds can only be maintained for 400 to 500 metres and after running the cheetah must rest and cool down for at least 30 minutes. This rest is to allow the muscles to recover and to get rid of the heat generated by the muscles working so hard.

EVOLUTIONARY TRADE-OFF

The process of adaption specifically for high speed pursuit has meant cheetah have lost some of the abilities normally associated with most cat species. Cheetah are less muscular and powerful than other big cats and have much less powerful jaws. The claws of cats are normally fully retractable which allows them to be kept razor sharp; useful as weapons and for climbing trees. A cheetahs claws are blunt, more like a dogs. Cheetah are not good climbers and strong powerful predators like most big cats. The cheetah capture smaller faster prey species such as springbok, impala, and hares and when challenged by other predators they must use their speed as their best form of defence.



Activity 7a

Structure, Adaptation & Function

Using poster CCB/P2 'Adaptations for Speed', discuss with the students cheetah adaptations and the relationships between these, physical structure and function. The students may be split into groups, if required.

Then, apply the same considerations about adaptation by introducing another local predator, the leopard and ask the students to consider its adaptations and the relationship between these, physical structure and function. Use the supporting poster CCB/P1 'Spot the Difference' as an aid to student discussion.

The Adaptations and Function of both can then be applied to the chart included as a Worksheet (opposite) for the students to use.

The objective of the exercise is not simply to enable students to point out differences between the two species, but to examine specific adaptations in each and consider why the two cats have evolved differently.

An answer Key is reproduced on Page 28 for teacher reference and guidance.

Spot the Difference
poster CCB/P1









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

Student Name: _____ Date: _____

Using the data provided in posters and below, identify the adaptation and functions relating to the structure given for the leopard and the cheetah.

	LEOPARD		CHEETAH	
STRUCTURE	ADAPTATION	FUNCTION	ADAPTATION	FUNCTION
Body				
Mouth & Jaws				
Legs				
Paws				
Eyesight				

LEOPARD <i>Panthera pardus</i> NKWE/LENGAU		CHEETAH <i>Acinonyx jubatus</i> LETOTSE	
	<p>Stocky, heavy & muscular - a stealthy ambush hunter with powerful jaws</p> <p>Favours trees and an excellent climber</p> <p>Capable of bringing down wildebeest-sized prey</p> <p>Short legs with broad paws and fully retractable claws</p>		<p>Athletic & light- a high speed pursuit hunter with small mouth</p> <p>Favours open bush or savannah and a poor climber</p> <p>Capable of bringing down medium-sized antelopes</p> <p>Long legs with narrow paws and semi-retractable claws</p>
<p>Up to 95kg</p> 		<p>Up to 65kg</p> 	
	Mostly nocturnal (active at night) with excellent night vision but can be diurnal (active in daytime)		Mostly diurnal (active by day) with excellent long range vision. Can be nocturnal (active by night)

Activity 7b

Exploring Adaptation

This activity is designed to develop scientific study skills and to introduce new terminology. The students will investigate adaptation by observing live specimens (insects) collected by the students from their back yards or the school yard. The collection of specimens should be organized ahead of the activity.

The activity will also reinforce knowledge attained during the cheetah & leopard adaptations activity and assist students in developing conclusions based upon investigation and 'informed opinion'.

MATERIALS:

Plastic and transparent containers for insects to be held in;

Spoons and small paint brushes with which to handle the insects;

Large sheet of white paper and a large sheet of black paper;

A metric ruler;

A magnifying glass or hand held lens to aid examination of the insects and their behaviour;

Drawing materials (pencils or coloured pencils)

The insects should be treated humanely at all times and released once the observations and activities are concluded. A range of beetles, roaches, moths and butterflies will be suitable. It is best practice to hold like species together i.e. all moths together. Placing predatory insects in containers with prey species should not be permitted and the collection of potentially harmful species, such as hornets, wasps, bees and scorpions, should be discouraged.

Before conducting the activity it may be appropriate to review student awareness and understanding of some scientific terms used in the activity. Students should be allowed time to make observations and carry out activities with the insects over a few days.

Students should be asked to prepare a write-up of their observations and findings as a conclusion to the activity.

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

Student Name: _____ Date: _____

In this activity, you will explore insect adaptations, anatomy and behaviour. Follow this work plan, recording your observations and findings before preparing a write-up presenting your methods and observations and the conclusions you have come to about adaptations in different animal species.

Using the spoon and dry brush, work with the specimen you have collected and observe its anatomy and behaviour. Complete this worksheet and use the information to answer the following:

DATA COLLECTION

1. Identify your specimens, using a reference book if possible. If you know the scientific names or it is possible to look them up once you know what specimens you have, then you may include them

Insect Common Name (s) : _____

Scientific name (s) : _____

2. Length of the shortest specimen: _____ mm

Length of the longest specimen: _____ mm

3. How many pairs of legs does the specimen have? : _____ pairs

4. Does the specimen have antennae and how many? _____

5. Does the specimen have wings and how many? _____

6. Describe the wings, including size relative to the body and their shape, colour or patterning :



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

7. Does the specimen have eyes? : _____ (yes/no)

Are the eyes simple (one lens on the outside) or compound (made up of multiple sections of the lens)? :

8. Is the body smooth or covered with tiny hairs? : _____

What colour is the body and is there any patterning? :

9. Does the specimen appear to have an endoskeleton or an exoskeleton?

BEHAVIOUR

10. Is the specimen able to turn over if placed on its back? : _____ (yes/no)

11. Does the specimen appear to prefer being placed on a black sheet of paper or white and does it try to return to the preferred area when moved?

12. If the specimen has wings, does it keep trying to fly? : _____ (yes/no)

13. If the specimen is crawling, what does it do when it reaches the edge of the table?

14. Can the specimen climb up smooth objects (like smooth plastic) or does it need a textured surface (like clothing)?

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

15. How fast can the insect crawl? _____ cm/sec

To measure its speed:

- draw an 'X' in the centre of a big sheet of paper;
- with a ruler, mark out in cm the distance from the x on 4 directions until you reach the edges of the paper;
- someone with a watch recording seconds will need to be ready to time the specimen;
- release the specimen on the 'X' and time it when it crawls to the edge of the paper;
- place another 'X' where it left the paper and measure the distance from the centre 'X' in cm if you want to be very accurate;
- now divide the distance the specimen travelled by the number of seconds it took to get to the second 'X'.

This result of this calculation will give you the specimen's speed in cm/sec.

Now that you have gathered the data on the specimen you need to go through the results carefully and use the information to answer the following questions. Don't forget to release your specimens from their captivity.

1. Why do you think some specimens of the same species were larger than others in size?
2. Why do you think some insects have large and small antennae and large and small eyes?
3. Why do you think some specimens have harder shells and others have softer bodies and why might these bodies be coated in hair?
4. Why do you think some specimens have complex patterning on their wings?
5. Why do you think some specimens are not able to climb up smooth surfaces?
6. Why do you think some specimens have adapted different strengths and weaknesses and what role do you think their behaviour and habitat has to play in this?

Once you have studied your data and answered the questions above, you are now ready to write-up and present your findings about the adaptations of the specimens you examined

Lesson 7.2

National Curriculum Reference

Module 1 : Science & Society

The Nature of Science 1.1.1.1; 1.1.1.2 and 1.1.1.3

Technology in Science 1.3.1.1; 1.3.1.3 and 1.3.1.5

Module 2 : Nature & the Universe

The Environment 2.1.1.1

Animals 2.3.1.1

Learning Outcomes (LO)

A Time Plan for Standard 7 is included for your use at the rear of this resource, together with assessments for each lesson.

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

Process Skills:

Knowledge of major ideas

Understanding information

Interpretation of facts

Relate knowledge from several areas

Lesson 7.2

Animal Behaviours

Review the information on hunting development below, before starting the lesson.

HUNTING DEVELOPMENT IN CUBS

Elements of behaviour are instinctive and inherited. This is particularly noticeable in young cats, including cheetah cubs. Automatic reactions to certain stimuli are pre-programmed in most offspring, including humans. However, certain behaviours are learned and fine tuned during formative years as part of the conditioning which informs and modifies behaviour in later life.

Cheetah cubs instinctively respond to moving stimuli by chasing and catching it, but, as far as hunting skills are concerned, do not know how to restrain prey or deliver a lethal bite to the throat. These skills are learned, by watching the mother's hunting activities and later, practicing when a mother may begin to bring captured prey that is still alive, to the cubs.

Cubs begin accompanying the mother on hunting exercises from as young as 4 months of age. Often, she will control them through a series of vocalizations, short yelps, including indicating to the cubs when it is safe to emerge to join her. Young fawns and hares are the most common cub hunting teaching aids, captured by the mother and then released for the cubs to finish off.

Cubs start actively participating in hunting at around 7 months and will attempt to join in chases. Early attempts normally result in mistakes and confusion which need to be corrected. By 12 months of age, cubs are usually able to kill prey themselves and by 15 months, when they are almost as large as their mother, they begin taking the initiative to hunt. By 18 months, when almost fully grown, cubs have usually had enough practice to have perfected their hunting skills to survive on their own and at this point, the mother will recognize the fact and be preparing to leave them.

Common early blunders made by cubs learning to hunt include;

- not being properly concealed from prey;
- not paying attention and becoming easily distracted;
- stalking animals much too large for them to take on.



Activity 7c

Student Research Project

This activity is designed to develop students' ability to extract useful information from a range of sources and use that information to answer a question. It will enhance their reading and literature review skills as well as their ability to make decisions either individually or in groups.

The students will investigate one of two questions and prepare illustrated documents to answer them. The activity will also reinforce knowledge and assist students in developing conclusions based upon investigation and 'informed opinion'.

TOPIC QUESTIONS

1. How do cheetah cubs display instinctive behaviour and how do they learn to hunt?
2. How does a cheetah mother teach her cubs to hunt and to avoid other predators?

One question is posed from the cub's perspective and the other, from the mother's perspective and as such, will focus on the mothers behaviour. The documents should be submitted in the form of a written and illustrated portfolio and include relevant background data, charts, maps and some information presented in graphical form. Together, the collated information should answer either of the above questions. Some basic instructions have been provided in the Worksheet.

Students should be directed to suitable resource reference material and have access to a library, the internet, nature videos, magazines or information produced by zoological or conservation organizations.

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

Student Research Project

For your Research Project, choose one of the following subjects:

TOPIC SUBJECT

1. CHEETAH CUB BEHAVIOUR & LEARNING TO HUNT
2. TEACHING CUBS TO HUNT & TO AVOID OTHER PREDATORS

Prepare a document for submission in the form of a written and illustrated portfolio and include relevant background data, charts, maps and some information presented in graphical form. Together, the collated information should answer either of the above questions.

Students should utilize suitable resource reference material and have access to a library, the internet, nature videos, magazines or information produced by zoological or conservation organizations.

If you choose Topic 1, your document should answer the question 'How do cheetah cubs display instinctive behaviour and how do they learn to hunt?' The focus of the document will therefore be on the cubs and can include information about instinct, why cubs play and how their behaviour changes when they have to learn to hunt.

If you choose Topic 2, your document should answer the question 'How does a cheetah mother teach her cubs to hunt and to avoid predators?' The focus of the document will therefore be on the mother and can include information about decisions she makes during caring for them and teaching methods and how her role as a mother changes as the cubs become good at hunting.

All students will need to write an **Introduction** about what the topic is about and the question their document is answering and contain some **background information** related to the subject, including something on diseases and threats and should include information presented in, **charts, photographs, illustrations/drawings** and **graphs**. It may be split into sections covering different stages of the family development until the mother leaves her cubs. The document should be thorough and no more than 12 pages plus the cover.

Your teacher is here to help guide you as you work on your topic.

Lesson 7.3

National Curriculum Reference

Module 1 : Science & Society

The Nature of Science 1.1.1.1; 1.1.1.2 and 1.1.1.3

Module 2 : Nature & The Universe

The Environment 2.2.2.3

Module 6 : Health & Safety

Food & Nutrition 6.1.1.1

Learning Outcomes (LO)

A Time Plan for Standard 7 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.

LO3 : The student will be able to demonstrate an understanding of the interrelationships between science and technology, society and the environment.

Process Skills:

Translating knowledge into a new context
Observation and recall of information
Interpreting information
Predicting

Lesson 7.3

Nutrition

Review the information below regarding nutrition, before starting the lesson.

THE FOOD CHAIN

The sun is the source of energy within a food chain or web. Plants are one of the few organisms that can transfer the sun's energy to make their own food. Plants are classified as 'Producers' and therefore support all life on Earth, whether directly or indirectly.

Herbivores (primary consumers) are the next step in the food web. They consume only plants in order to get their energy. Herbivores include rodents, antelopes, sheep, goats and cattle. All are especially adapted to gathering, grinding and digesting plants and some concentrate on only parts of plants, such as leaves, seeds, bark or roots.

Carnivores and omnivores are secondary consumers. Carnivores are those animals that eat only other animals in order to get their energy and include cats, dogs, bears, birds of prey, some sea life such as sharks and some snake species. Omnivores obtain energy from a variety of sources, both animal and plant, and include pigs, porcupines and humans.

The organisms in the final classification in the food web are the decomposers. These include insects, fungi and bacteria, which feed on the remains of dead organisms. They extract the energy that remains within them and release the nutrients back into the soil so they may be used again.

WHY ARE THESE RELATIONSHIPS SO IMPORTANT?

The process vividly illustrates the important role of every creature and their interdependencies. Disrupting or even removing components of the food web has serious consequences for the balance of nature.



Activity 7d

Nutritional Value

This activity is designed to introduce the concept that different foods have a different nutritional value. Before conducting the activity, review with the students animal classifications such as omnivores, herbivores and carnivores and the differences of dietary value (i.e. 1 kg of meat is not equal to 1 kg of grass).

For this activity the class of students are divided into three unequal groups. In a class of 30 students, there should be 20 grass; 8 rabbits and 2 cheetahs. Each student should wear a label - grass, rabbit or cheetah.

Select an area in the school yard or field and pace it out to measure 30 x 30 metres.

RABBITS:

The rabbits will line up on the edge of one side of the area, but facing away from it.

GRASS:

The students representing grass should randomly sit within the area. Each student should mark their spot with their names on a piece of paper. These spots represent the rabbits' stomachs.

RABBITS:

Then the rabbits lined up on the edge of the area should turn around and have 10 seconds to 'tag' as much grass as they can.

GRASS:

Once tagged the grass should move off the area and line up on the edge in the position of the rabbit that ate them.

RABBITS:

When the 10 seconds is up, the rabbits will return to their spot on the side line and count how much grass they have.

RABBITS:

After the counting of grass, the rabbits must then randomly position themselves, standing, within the 30 x 30 m area.

CHEETAHS:

The two cheetahs now chose a spot on the opposite side of the square to where the grass is sitting and mark their positions. The cheetahs now have 20 seconds to catch rabbits.

RABBITS:

When the cheetahs enter the square the rabbits can run within the area to try to avoid them, but once tagged by a cheetah they must go and sit at the cheetahs starting position on the side line.

CHEETAHS:

When the 20 seconds is up, the cheetahs leave the square and count how many rabbits they have caught.

The results should be recorded in the table reproduced below, which should be drawn on a board or flip chart and the data entered. From this, the students should be able to see for themselves that, even if the cheetahs only caught two rabbits, those two rabbits represent a lot of grass and illustrating that an equal amount of meat does not have the same nutritional value as the equal amount of grass.

Have the students discuss how this will affect animal behaviour (a herbivore will need to spend much more time feeding to get an equal amount of energy/nutrition when compared to a carnivore, for example).

	Amount of grass consumed	Amount of rabbits consumed
Rabbits		
Cheetahs		



Lesson 7.4

National Curriculum Reference

Module 1 : Science & Society

The Nature of Science 1.1.1.1; 1.1.1.2 and 1.1.1.3

Technology in Science 1.3.1.2

Module 2 : Nature & The Universe

The Environment 2.1.1

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

LO3 : The student will be able to demonstrate an understanding of the interrelationships between science and technology, society and the environment.

Process Skills:

Recording & interpreting information

Predicting & raising questions about a situation

Reporting

Utilization of resources and the impact of humans on the environment

Ethics

Lesson 7.4

Population Change

Review the information below regarding population change, before starting the lesson.

Why Do Populations Fluctuate?

A population is a group of the same species living within a set area or boundary e.g. the human population of Botswana. For it to be a true population the members of that population should more readily interbreed with each other than with members of other populations i.e. a Motswana is more likely to marry another Motswana than a Namibian. There are many interesting things that can be looked at within a population; its size, the ages of the individuals the proportion of each gender, the number of births and the number of or age of death.

The population size (the number of individuals within a population) of an area may change or fluctuate for many reasons. There may be an increase or decrease in the number of young born or the proportion of those that are born that survive to become adults. There may be an increase or decrease in the number of adults that die or the length that they live before they die. It is also possible that there may be a change in the numbers of individuals that enter or leave a population by travelling to or from elsewhere. All of these things will affect the overall population size.

The habitat that a population lives in has a major input into the size of the population. The habitat is the area where a population lives and it must provide all the things that the individuals within a population need to survive i.e. shelter, food, water and space. As the habitat in an area can change over time then the population size will change overtime. This fluctuation in population size is directly linked to habitat health and is normal. It is also possible for a population to affect the habitat health and in turn affect its own population size and those of other species living in the same area e.g. if the number of cows grows to large then they will eat all the grass, this will affect the future cow population but also the populations of antelope living in the same place. Sometimes the habitat will go through such a big change it will mean the population can no longer survive and will either need to move or will die out.

Activity 7e

Population Change

Objective

To enable students to understand how population size can influence and be influenced by habitat.

Materials

- Large cards with FOOD, SHELTER, SPACE and CHEETAH written on them. You will require enough cards to have one per student in your class.
- A playing space; either a cleared area of your classroom or a defined space outdoors
- A chalk board or flip chart.

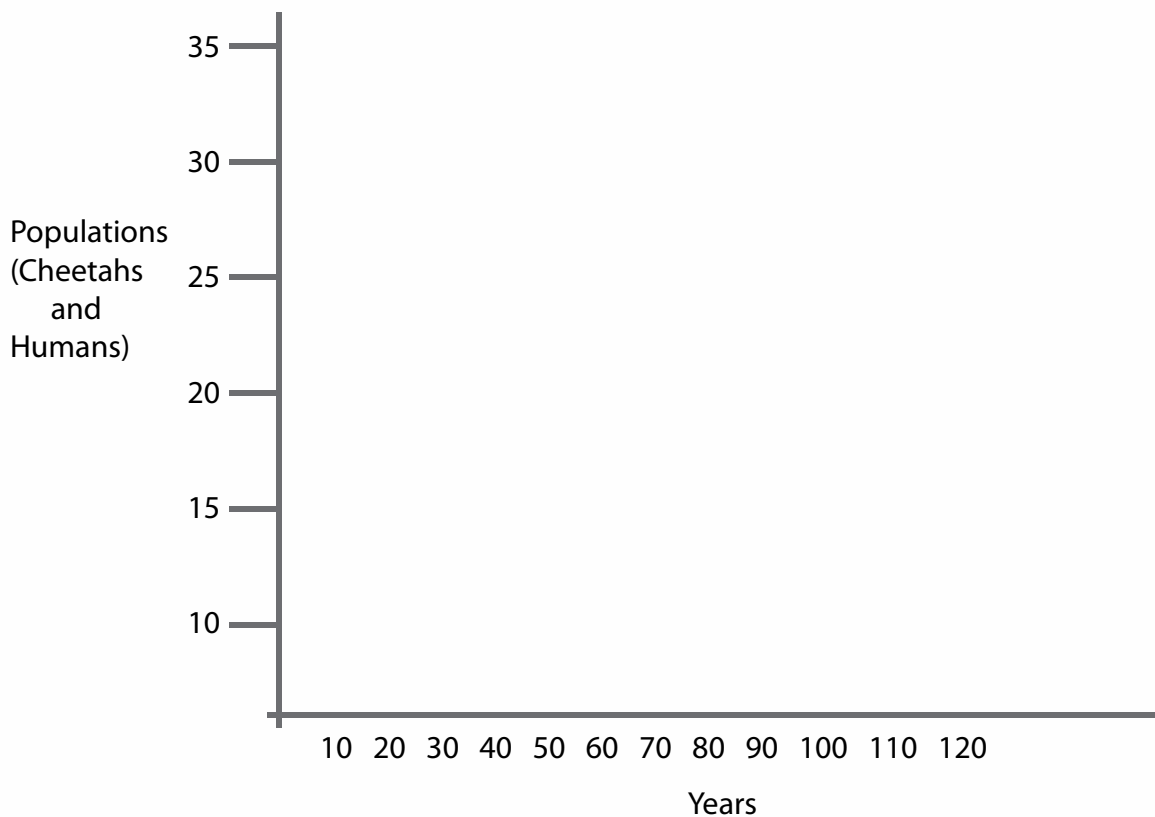
Activity

- Split the class into 5 even groups.
- Make one group the 'farmers'. These go and stand to one side facing away from the rest of the group.
- The other 4 groups represent 3 habitat resources (food, shelter and water) and a conflicting predator (cheetah). They collect a corresponding card and mix themselves in the playing space holding their cards up so they can be seen.
- The remaining cards should be shuffled and one each given to the farmers.
- When everyone is ready the farmers look at their cards and must collect the habitat resource that is on their card by finding a student with the corresponding card. Once the resource has been captured the farmers takes it back to their starting point. The farmer then has the resources to reproduce and the student that was the habitat resource becomes a farmer. If the farmer captures a cheetah then they leave the cheetah and take only the card back as a trophy. The cheetah becomes a habitat resource.
- For the next round collect all of the cards, except the captured cheetah cards. Shuffle them and give them randomly to each of the farmers and the habitat resources. The farmers then go and collect their resources as before. If a farmer can not find the resource that they need then they return to the place but are not able to reproduce. If a farmer goes two rounds without finding their resource then they die and become habitat resources themselves.
- Continue for about 10 minutes. At the beginning of each round count the number of farmers and cheetah.

At the end of the activity write the data recorded beginning of each round on a flipchart or chalk board. The students should make a graph of the data, with each round representing 10 years and a separate line for the number of FARMERS and the number of CHEETAH.

GRAPH:

10 Year HUMAN POPULATION GROWTH V CHEETAH POPULATION DECLINE



Discussion

Hold a class or group discussion with the class based on the following questions

- What is happening to the cheetah population and why?
- What is happening to the farmer population and why?
- What is happening to the number of habitat resources in the environment and why?
- How do population and habitat health influence each other?



Lesson 7.5

National Curriculum Reference

Module 1 : Science & Society

The Nature of Science 1.1.1.1; 1.1.1.2 and 1.1.1.3

Technology in Science 1.3.1.2

Module 2 : Nature & The Universe

The Environment 2.1.1

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Process Skills:

Recording & interpreting information

Predicting & raising questions about a situation

Reporting

Utilization of resources and the impact of humans on the environment

Ethics

Lesson 7.5

Threats & Opportunities

Review the information below regarding threats and opportunities, before starting the lesson.

SURVIVAL OF THE FITTEST?

The lessons in the Standard 5, 6 and 7 resources you and your students have been working through have touched upon numerous threats to the future survival of the cheetah and the delicate nature of habitats and environmental health. Lesson 7.4 in this resource and the associated activity has vividly illustrated the potentially catastrophic consequences that the piecemeal destruction of species, habitats and of the environment on a global scale, has been having upon natural life on Earth during only the last 200 years.

The global human population has doubled, according to the United Nations in 2011, in only the last 25 years. The pressure upon natural resources has therefore also doubled in the same time and yet the Earth's natural resources are finite. As the exercise in 7.4 of this resource dramatically illustrates, the model of the effects played out by your students is, regrettably, all too accurate and as may have quickly become clear at the end of the activity, the consequences are yet destined to come back to us, our children and our grandchildren.

The imbalances and consequences created by the removal of predators, such as the cheetah, from habitats as illustrated throughout these guides, is not at first easily noticeable. The effects are cumulative however - what is sometimes analogized as 'the thin end of the wedge'. When all the cheetahs have been removed, attention turns to other predators, the wild dogs, lions, leopards all perceived as damaging to 'human interests'.

However, solutions are at hand and the key to maintaining healthy habitats and a balanced environment containing all the elements (including predators) lies with responsible and organized farm management practices. These include measures that have been proven to deter predators from taking livestock. Most are affordable and result in fewer livestock losses to farmers and a healthier habitat - for wildlife and for livestock.

LIVESTOCK GUARDING ANIMALS

During the last 10 years, trials and studies in Namibia, South Africa and recently in Botswana have been successfully exploring the use of other animals to deter predators and protect livestock. The studies have focused upon female donkeys (tried to protect calves) and dogs, to protect cattle and small stock such as sheep and goats.

Livestock guarding dogs are increasingly used in Botswana. A livestock guarding dog is raised from a puppy with the livestock it is to guard which forms a very strong bond between the livestock and the dog. When the livestock is threatened by predators the dog protects the livestock by barking and scaring off the predator. The dogs do not need to be a special breed; in fact local breeds cope better with the Botswana environment. Livestock guarding dogs are not pets or playmates, but working dogs with a single very important job; to protect livestock from predators.

Predators are opportunists. If they see an easy meal, they will attempt to take it and unfortunately, the majority of livestock in Botswana is largely unprotected by people or by dogs. It has been shown on farms within Botswana, that the presence of noisy dogs is enough to deter predators from attempting to take the 'easy meal'. The dogs are reversing the odds in favour of the farmer in Botswana and of the passing predator, which soon gives up and moves on. This decreases the number of livestock taken by predators which benefits the farmer who is less likely to want to kill the predators which is better for the environment.

CCB is now working closely with the national farming community and it is hoped that news of the successful use of guard dogs will continue to spread.

Activity 7f

The Guard Dog's Tail

This activity will enable students to see how livestock guard dogs can scare off predators.

The activity needs 9 student volunteers. 1 cheetah; 2 guard dogs and 6 goats. It should be explained to the class that they are going to demonstrate what happens when the goats are left unattended. Select the cheetah first and send him out of the room. Go with him and explain that when signalled, he is to quickly enter the room and grab a goat from the cleared area.

With the cheetah student outside, place the goats in the space for a few minutes, then signal for the cheetah. The cheetah will simply enter and grab a goat! It was that easy and discuss how quick and easy it was for the cheetah with the students. Then, tell everyone that you are going to do it again.

The cheetah knows what to do, how easy it is and so leaves the room again to wait. With the cheetah student out of the room, and the goats back in the space, quietly select, without the cheetah knowing or the rest of the student audience, two of the biggest and noisiest male students in the class and take them to quietly explain what you want them to do this time. These two students are the new livestock guarding dogs and are to be instructed to look out for the cheetah - they know where he'll come from of course and so will be ready. Tell the 'dogs' that the moment the cheetah enters they should immediately step towards him waving their arms and barking and snarling and making a fuss. The goats will run away out of the other side of the room.

The student (cheetah) and everyone else is in for a **big shock** and will probably not know how to react. The cheetah may even withdraw, forced and intimidated by the dogs back from where he came (they must not touch or grab the cheetah, but make a huge fuss). That's it!

When the class has calmed down and reassembled, discuss with the students what just happened. The reaction of the dogs and the cheetah will be similar to that of the real situation. The goats got time to escape, the cheetah was shocked by the dogs and soon gave up and moved away and the cheetah will now think twice before trying anything like that at the farm again. The serious note of course is that the farmer didn't lose any goats and the cheetah, though shocked, didn't lose his life.



Student Assessment

Lesson 7.1 Adaptations

Assessment Rubric for Adaptations

1	2	3	4
The student was unable to design the hypothesis and struggled to collect data.	The student's recording was only partially complete and of only partial relevance and was not fully aligned to the questions or collecting data.	Student's recording was complete and relevant to the questions. The student was able to collect the data and prove/disprove hypothesis.	The student exceeded expectation, showing a deeper understanding of implementation and data collection and suggested further steps.

Language Links

LEARNING OUTCOME	ASSESSMENT STANDARD
LO2: SPEAKING	Communicates experiences, more complex ideas and information in more challenging contexts. Applies interaction skills in group situations.
LO4: WRITING	Writes informational text expressing ideas clearly and logically
	Develops and organizes ideas through a writing process
LO5: THINKING & REASONING	Processes information and uses language to think creatively

Lesson 7.2 Animal Behaviours

Language Links

LEARNING OUTCOME	ASSESSMENT STANDARD
LO3: READING & VIEWING	Selects relevant text from information needs and from a variety of sources
LO4: WRITING	Writes informational text expressing ideas clearly and logically for different audiences. Develops and organizes ideas through a writing process. Presents work with attention to neatness and enhanced presentation
LO6: LANGUAGE STRUCTURE & USE	Works with texts

Lesson 7.3 Nutrition

Assessment Rubric for Nutrition

1	2	3	4
The student was unable to understand the concept of differing food nutritional values	The student understood nutritional values, but showed no logical reasoning behind predictions on how this might influence animal behaviours	The student understood nutritional values of vegetation and meat and could predict their influence on animal behaviors	The student exceeded expectations, showing a deeper understanding of the effects of different values on agriculture and animal behaviours

Lesson 7.4 Population Change

Assessment Rubric for Population Change

1	2	3	4
The student could not explain data	The student could partially understand the processes behind the data	The student could understand the effect of humans on the 'balance of nature' and was able to predict the causes of fluctuation in a population	The student exceeded expectations, showing a deeper understanding of information and data and volunteered conclusions.

Answer Keys (7.1 Adaptations)

	LEOPARD		CHEETAH	
STRUCTURE	ADAPTATION	FUNCTION	ADAPTATION	FUNCTION
Body	stocky, heavy & muscular	power & climbing	athletic & light	speed & agility
Mouth & Jaws	powerful jaws	holding prey while climbing	small mouth	streamlined head
Legs	short & muscular	power & climbing	long & slender	lengthening stride/running
Paws	wide with retractable claws	stealthy & silent on foot	narrow & semi-retractable claws	grip for acceleration
Eyesight	excellent night vision	nocturnal stealth	excellent long range vision	spotting prey by day at long range

Standard 7 Time Plan

Lesson 7.1 Adaptations

TIME FRAME	LO:1	LO:2	LO:3	LO:4	ASSESSED BY
2 classes (45-50 minutes)	Sub-Skills				Teacher/Peer/ Rubric/Checklist
	Developing hypothesis				
	Observing & measuring				
	Identifying trends & drawing conclusions				
	Reporting				

Lesson 7.2 Animal Behaviours

TIME FRAME	LO:1	LO:2	LO:3	LO:4	ASSESSED BY
1 class (45-50 minutes)	Sub-Skills				Teacher/Peer/ Rubric/Checklist
		Knowledge of major ideas			
		Understanding information			
		Interpret facts			
		Relates knowledge from several ideas			
		Reporting & time management			

Lesson 7.3 Nutrition

TIME FRAME	LO:1	LO:2	LO:3	LO:4	ASSESSED BY
1 class (45-50 minutes)	Sub-Skills				Teacher/Peer/ Rubric/Checklist
		Translating knowledge into new context	Utilize & manage resources		
		Observation & recall			
		Predicting			

Lesson 7.4 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 interpreta- tion	Knowledge of major ideas	Utilization of resources		
	Drawing conclusions	Translate information into new context	Human impact on the environment		
	Reporting	Interpret facts	Ethics		
	Predict consequences				

Lesson 7.5 Threats & Opportunities

TIME FRAME	LO:1	LO:2	LO:3	LO:4	ASSESSED BY
1 class (45-50 minutes)	Sub-Skills				Teacher/Peer/ Rubric/Checklist
			Impact of man on the environment		
			Ethics		





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