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### INTRODUCTION

Secretarybirds are truly interesting birds. These strange, but beautiful looking birds effectively look like an eagle on stilts. For any prey, they must look very imposing and they wouldn't be wrong. They are lethal predators with a unique hunting style. They use their long, powerful legs and strong claws to stomp down on their prey, stunning or killing them with a force five times their own body weight.

A group of scientists wanted to measure the strike force (how much force is made during the downward strike of the leg) and speed of contact (the time of contact between the foot and the snake) of a Secretarybird. They used high-speed cameras and a force plate to measure this with the help of Madeleine, a 24-year-old Secretarybird that has lived at the Hawk Conservancy Trust for 23 years and trained to strike a rubber snake for public exhibition displays. The peak force (the instant the foot hits the snake) was very high and very fast.

Secretarybirds perform their strike from a static standing position using only their leg muscles. They angle their head to see the prey well before striking, using their binocular vision to determine the depth and distance of the prey. They have to kick at the snake's head fast and accurately until it is dead otherwise it can be deadly for them. This shows a high level of coordination between the visual brain and muscles. They have exceptionally long legs, twice that of other ground birds of similar body mass. The extra height also helps them to see the prey over the grass. The scientists hope to use this information to develop bio-inspired robotics and prosthetics for rehabilitation.

We know Secretarybirds hunt snakes, but they prefer Arthropods (insects, spiders and beetles) which makes up 87% of their diet. They also don't always stomp down on their prey. Often, they pick up their prey with their bill and swallow it whole.

Secretarybirds are monogamous and will only find another mate if one of them dies. They use the same nest for 3-5 years (or until it becomes too heavy for the tree and starts falling apart) which they build out of sticks on top of trees. The male and female raise 1 to 3 chicks a year and sometimes, under favorable conditions, they even raise another clutch in the same year.

These fascinating birds are iconic and unique. Do yourself a favour and learn more about them, the more you know, the more you will appreciate them.

### VOCABULARY

**Arthropods/Invertebrate:** having exoskeleton, segmented body such as spiders, crabs and insects.

**Binocular Vision:** vision using two forward-facing eyes with overlapping fields of view, allowing good perception of depth.

**Bio-inspired:** ideas inspired by biological organisms.

**Biome:** distinct biological communities that have formed in response to a shared physical climate.

**Brood:** chicks produced at one hatching.

**Ecosystem:** a biological community of interacting organisms and their physical environment.

**Environment:** the natural world, as a whole or in a particular area.

**Force Plate:** measuring instruments that measure the ground reaction forces generated by a body standing on or moving across them.

**Grassland:** a biome dominated by grass, forbs and bulbs.

**Habitat:** the natural home or environment of an animal, plant, or other organism.

**Newtons:** is equal to the force that would give a mass of one kilogram an acceleration of one metre per second per second.

**Prosthetics:** an artificial device that replaces a missing body part, which may be lost through trauma, disease, or a condition present at birth

**Regurgitate:** to bring up food already swallowed.

**Robotics:** interdisciplinary branch of engineering and science that includes mechanical engineering, electronic engineering, information engineering, computer science, and others.

**Speed of Contact:** the time of contact between the foot and the snake.

**Strike Force:** how much force is made during the downward strike of the leg.

## AIM AND PURPOSE OF LESSON

The aim of this lesson plan is to introduce students to the unique behavior of Secretarybirds, especially their hunting behaviour and basic life strategy.

## DURATION OF LESSON

Approximately 60 minutes

## MATERIALS NEEDED

The teacher will need:

1. Lesson Plan 2 – *Unique behavior of Secretarybirds*
2. A computer with internet connection to view the suggested videos.
3. Video 1: *Secretarybird Stomp Snake with a Killer Kick*: [https://youtu.be/LQWlZS\\_zkrM](https://youtu.be/LQWlZS_zkrM) [2:07]
4. Video 2: *Secretarybirds of Africa/Nature*: <https://youtu.be/t1UEneEPZO8> [3:01 min]
5. Video 3: *Secretarybirds/Amazing Animals*: <https://youtu.be/7itwHJiNRz4> [1:46]
6. OPTIONAL – projector and sound system to watch the videos.
7. Answer Sheets in Appendix A found at the end of this lesson plan.

The Students will need:

1. Factsheet 1 – *Secretarybird Lifecycle*
2. Factsheet 2 – *Hunting behaviour and diet*

3. Questionnaires in Appendix B found at the end of this lesson plan.
4. Pen and paper.

All Factsheets and Lesson Plans can be downloaded from the BirdLife South Africa website <http://www.birdlife.org.za/documents/bird-of-the-year>)

## OBJECTIVES AND OUTPUTS

The student will:

- Discuss what they already know about Secretarybirds.
- Watch the videos about the hunting and life strategies of Secretarybirds.
- Read up on the hunting behaviour and life cycle of Secretarybirds in the Factsheets.
- Discuss what they have learned from the videos and reading material in their allocated groups.
- Report back to the teacher in their allocated groups.
- Have a better understanding of Secretarybirds.

## PROCEDURE

1. [Duration 4 min] The teacher should read through the introduction of this lesson plan (Lesson Plan 2), the Factsheets and watch the YouTube videos to prepare for the lesson. [OPTIONAL] The teacher (or students) can also read the introduction to the class, but this is unnecessary.
2. [Duration 5 min] Begin the lesson with an entry task where students can think and discuss what they know about Secretarybirds. Ask the following questions to the whole class and give them a few opportunities to raise their hands and answer the questions (it is not important that they get the answers right at this stage):
  - a. Have they ever seen a Secretarybird?
  - b. What do they think they eat?
  - c. Describe a Secretarybird and how is it different from other birds of prey?
  - d. Where do Secretarybirds live and hunt?
3. [Duration 6 min] Divide the students into discussion groups of 4 – 6 students and hand out to each group Factsheet 2 – *Hunting behaviour and diet*. Allow them 5 minutes to read through the Factsheet and discuss it amongst themselves.
4. [Duration 7 min] Set up the projector / TV / computer and watch Video 1: *Secretarybird Stomp Snake with a Killer Kick*. As they watch, ask them to focus on the following, keeping in mind what they have learned from the Factsheet:
  - a. Try to remember all the facts mentioned in this video.
  - b. What are the scientists hoping to achieve?
  - c. What is the most interesting fact you have learned about Secretarybirds?
5. [Duration 5 min] In their groups, allow the students 5 minutes to discuss what they have learned and remembered from the video. Ask them to write down what they remembered and discussed.
6. [Duration 15 min] Use Answer Sheet 1 to ask the students specific questions based on the video and Factsheet or hand out Questionnaire 1 and give them 15 minutes to answer the questions in their groups or individually.

7. [Duration 6 min] Remaining in their groups, hand out to each group Factsheet 1 – *Secretarybird Lifecycle*. Allow them 5 minutes to read through the Factsheet and discuss it amongst themselves.
8. [Duration 3 min] Watch Video 2: *Secretarybirds of Africa/Nature*. As they watch, ask them to focus on the following, keeping in mind what they have learned from BOTH the Factsheets:
  - a. What was the male Secretarybird doing?
  - b. What did you notice about the nest (what it's made of, what it looks like and where it is built)?
  - c. What did you notice about their hunting behaviour? What did it look like?
8. [Duration 2 min] Watch Video 3: *Secretarybirds/Amazing Animals*. As they watch, ask them to focus on the following, keeping in mind what they have learned from BOTH the Factsheets:
  - d. Notice the landscape the Secretarybird hunts in.
  - e. Notice how it eats its prey. Why do you think it can do this?
  - f. What does the Secretarybird look like?
  - g. Notice where it builds its nest and how it feeds its chick.
9. [Duration 5 min] In their groups, allow the students 5 minutes to discuss what they have learned and remembered from the video. Ask them to write down what they remembered and discussed.
10. [Duration 15 min] Use Answer Sheet 2 and 3 to ask the students specific questions based on the video and Factsheet or hand out Questionnaire 2 and 3 and give them 15 minutes to answer the questions in their groups or individually.
9. [Duration 5 min] Lastly, allow the students to go back to their seats and end the lesson by asking some questions.
  - a. What is the funniest and most unique what you can describe a Secretarybird. Try to encourage the children to be as creative as possible.
  - b. What is the most exciting fact about Secretarybirds for them?
  - c. Do they think Secretarybirds are worth conserving?

## APPENDIX A

### ANSWER SHEET 1: SECRETARYBIRD WITH A KILLER KICK

- 1. The scientist says Secretarybirds eat anything that is small enough to chase down, kicked, disabled and swallowed? Name a few.**  
Insects, spiders, rodents and other small mammals, lizards, birds, bird eggs, snakes, etc.
- 2. What group of animals does the Secretarybird eat the most? Hint: Look at Factsheet 2.**  
Arthropods are its preferred prey item which includes insects, spiders, crustaceans and beetles.
- 3. What was the maximum force of the Secretarybird's kick? Choose two.**
  - a. 10 Newtons of force [False]
  - b. 20 kg of Force [True]
  - c. 10 times her own body weight [False]
  - d. 195 Newtons of Force [True]
- 4. What takes just 15 milliseconds (a 10<sup>th</sup> of the time it takes to blink an eye)?**
  - a. The contact time between the bird's foot and the snake. [True]
  - b. The time it takes for the Secretarybird's foot to stomp down after it has identified its prey. [False]
  - c. The time it takes for the foot to move from a bent position down to the prey. [False]

### ANSWER SHEET 2: SECRETARYBIRDS OF AFRICA

- 1. True or false: The female does everything; gathers the material and builds the nest**  
False, the male gathers the material and transports it to the female. She builds the nest.
- 2. What material is the nest made from including the lining? Also refer to the Factsheet.**  
It makes the nest from sticks and twigs and lined with grass, wool and dung.
- 3. What does the nest look like and where is it built?**  
It is a large, flat, disk-shaped nest built on top of an Acacia tree.

### ANSWER SHEET 3: SECRETARYBIRDS/AMAZING ANIMALS

- 1. Where are Secretarybirds found and what is their preferred habitat?**  
They are found in Sub-Saharan Africa (south of the Sahara) in open grassland or savannah.
- 2. They can grow up to 4 feet tall. How tall is this in centimetres? Choose one answer.**
  - a. 300cm [False]
  - b. 20cm [False]
  - c. 122cm [True]

3. Once it has captured its prey, how does the Secretarybird eat it?

The swallow it whole. If it is too big, they will tear it into smaller pieces using their feet and bill.

4. How does it feed its young water and food?

Through regurgitation.

5. How far do Secretarybirds sometimes walk in a day while hunting for food? Choose one answer.

a. 100 miles (160km) [False]

b. 10 miles (16km) [False]

c. 20 miles (32km) [True]

## APPENDIX B

### QUESTIONNAIRE 1: SECRETARYBIRD WITH A KILLER KICK

5. The scientist says Secretarybirds eat anything that is small enough to chase down, kicked, disabled and swallowed? Name a few.
6. What group of animals does the Secretarybird eat the most? Hint: Look at Factsheet 2.
7. What was the maximum force of the Secretarybird's kick? Choose two.
  - a. 10 Newtons of force
  - b. 20 kg of Force
  - c. 10 times her own body weight
  - d. 195 Newtons of Force
8. What takes just 15 milliseconds (a 10<sup>th</sup> of the time it takes to blink an eye)?
  - a. The contact time between the bird's foot and the snake.
  - b. The time it takes for the Secretarybird's foot to stomp down after it has identified its prey.
  - c. The time it takes for the foot to move from a bent position down to the prey.

### QUESTIONNAIRE 2: SECRETARYBIRDS OF AFRICA

1. True or false: The female does everything; gathers the material and builds the nest
4. What material is the nest made from including the lining? Also refer to the Factsheet.
2. What does the nest look like and where is it built?

### QUESTIONNAIRE 3: SECRETARYBIRDS/AMAZING ANIMALS

1. Where are Secretarybirds found and what is their preferred habitat?
2. They can grow up to 4 feet tall. How tall is this in centimetres? Choose one answer.
  - d. 300cm
  - e. 20cm
  - f. 122cm
3. Once it has captured its prey, how does the Secretarybird eat it?
4. How does it feed its young water and food?

5. How far do Secretarybirds sometimes walk in a day while hunting for food? Choose one answer.
- d. 100 miles (160km)
  - e. 10 miles (16km)
  - f. 20 miles (32km)