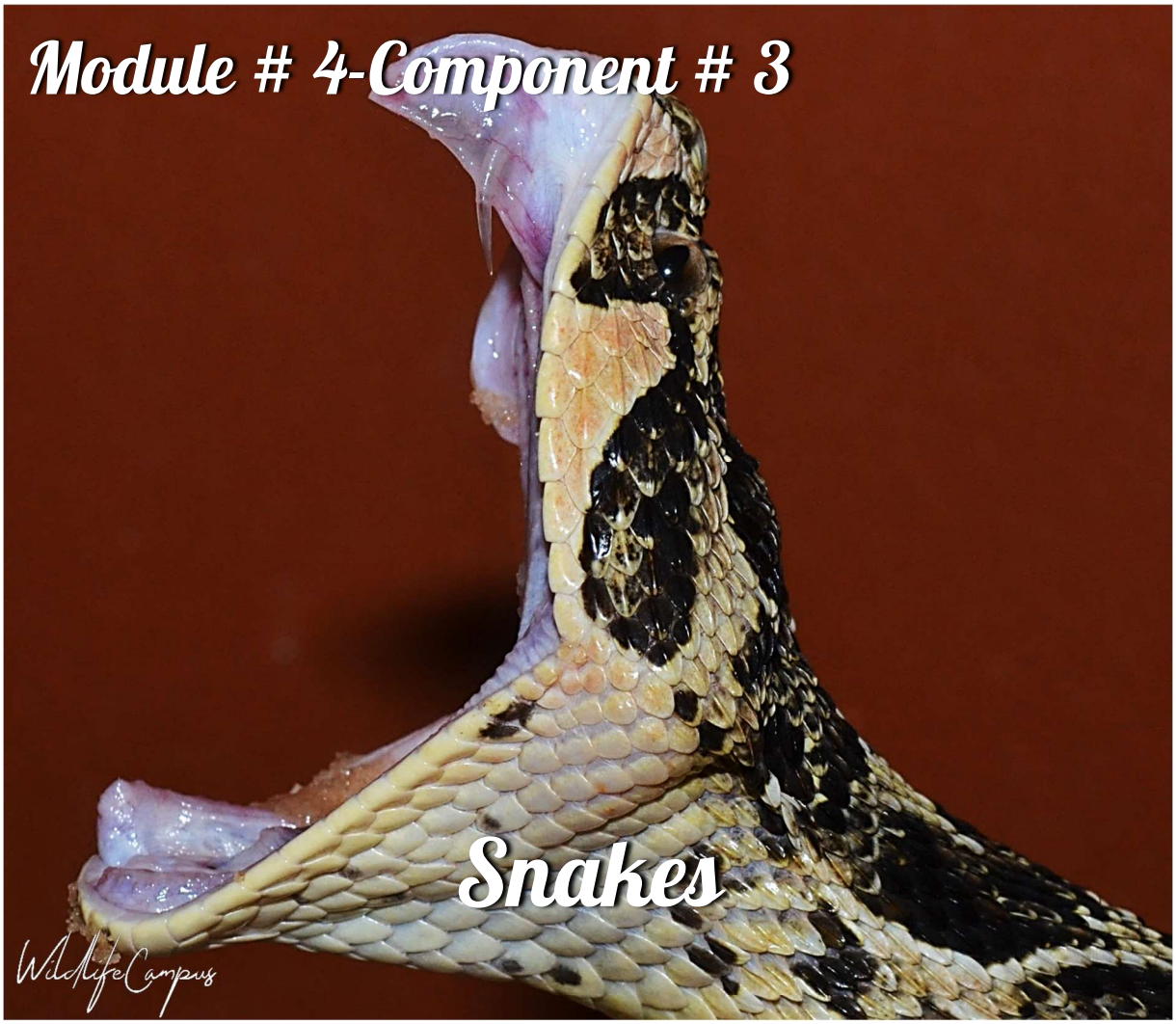


Objective

To get a complete overview of the **suborder Serpentes-snakes**, with a South African perspective.

Expected outcome

- Understand the **taxonomy** of this very diverse suborder.
- Become familiar with the different ways in which snakes can be divided based on their **dentition**.
- Gain an insight into the **highly-developed senses** that make snakes specialist predators.
- Become familiar with the different **types of venom** employed by snakes and their effects.
- Appreciate how well this group is represented in South Africa.

Origins and classification

The earliest fossils of snakes found so far have been dated to the **Upper Cretaceous period** (approximately **100 million years ago**), but it is thought that the group may have originated as early as the **Jurassic** (**150 million years ago**). It is known, however, that snakes **originated from lizards** or a common lizard-like ancestor. **Therefore**, **snakes are just highly specialised limb-less lizards**.

Snakes are **classified** in the following way, as is demonstrated by the example of a **rinkhals**.

Kingdom	Animalia	(Animals)
Phylum	Chordata	
Class	Reptilia	(Reptiles)
Order	Squamata	(Scaled reptiles)
Suborder	Serpents	(Snakes)
Family	Elapidae	(Elapids)
Genus	*Hemachatus*	(Not a true cobra)
Species	*haemachatus*	(Rinkhals)

For a better understanding of classification and taxonomy, please refer to **module # 1, component # 1**.

Snakes are distinguished from other reptiles by **the following combination of characteristics:**

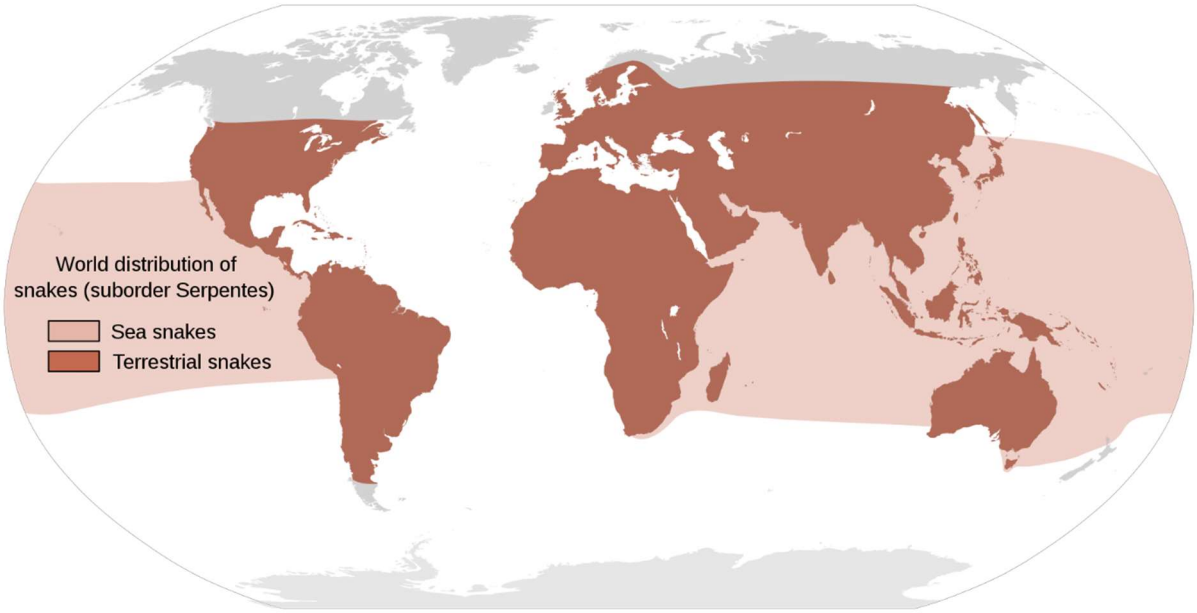
- Great **elongation** of the scale-covered body.
- The **total absence** of limbs.
- **Elongation of internal organs** and often the **loss of the left lung**.
- Increased number of **vertebrae** (**150**-**500**).
- Bones of the **skull** are loosely attached, **not fused**, and reduced in number.
- A ligament joins the **2 halves** of the **lower jaw**, and each is **independently moveable**.
- **Absence of pelvic** and **pectoral girdles**, except for the most primitive species, where the girdles are reduced to **rudimentary spurs**.
- **Loose attachment of ribs** to the vertebrae.
- The **absence** of **external ear openings**. Ears are reduced. **No tympana** or **eustachian tubes**.
- **No moveable eyelids**. Eyes are covered with a transparent scale or 'spectacle'.

Spotted harlequin snake-*Homoroselaps lacteus*

There are about **3000 species** and subspecies of snakes throughout the world, of which roughly **one-third are venomous** to a greater or lesser degree. Snake species are divided into **450 genera** in **18 families**. There are **151 described species** in **southern Africa**, of which **1**, the **flowerpot snake** (*Ramphotyphlops braminus*), is an **alien invasive species**. Southern African species are divided into **49 genera** and **7 families**, and more will likely be identified in the region.

Except for Antarctica, snakes occur on all continents. However, **no snakes occur naturally in New Zealand**, **Ireland** and **many oceanic islands**, and species diversity is generally low at high altitudes.

Many snakes are adapted to live in the **marine environment**. The **yellow-bellied sea snake** (*Pelamus platura*) is truly pelagic, ranging over **much of the Indopacific Ocean**.



Map showing the approximate global distribution of snakes. Terrestrial snake data based on Ernst (2011) and Cogger et al. (1998); sea snakes data based on Ernst (2011), Campbell (2004), Phillips (2002), and Spawls (1995).

Snakes can be roughly classified into 4 groups according to their dentition:

Group 1-solid toothed (non-venomous)

These species have **no fangs**. Instead, their **teeth are solid**, recurved, cylindrical and sharply pointed. These are **constrictors** and other non-venomous species.

Skull of a boa constrictor species

Solid toothed snakes are also known as **Aglyphous** snakes, meaning the teeth lack grooves. This form of dentition occurs **mainly in non-venomous species** (some might be considered slightly venomous though generally not harmful to humans).

Group 2-rear fanged (moderately to highly venomous)

These species have **1-3 pairs** of recurved, **grooved fangs** situated towards the rear of the upper jaw (generally situated below or after the snake's eye).

Boomslang-*Dispholidus typus* **displaying one of its rear-facing fangs**

Rear fanged snakes are also known as **Opisthoglyphous** snakes (rearward grooved). Opisthoglyphous snakes are found in the **family Colubridae**. The fangs are located in the **back of the mouth**. To envenomate, rear-fanged snakes must '**chew**' some venom into their prey since the fangs are grooved and do not have a hollow tube for injection.

Group 3-fixed front fanged (moderately to highly venomous)

These species have **normal solid teeth** for swallowing prey and a **pair of fangs** situated at the front of the upper jaw. The fangs are **tubular** and allow for the **injection of venom under pressure**. In addition, the fangs of the **spitting snakes** are modified so that venom is forced up and away from the snake's fangs instead of downwards.

Skull of *Naja* species

Fixed front fanged snakes are also known as **Proteroglyphous** snakes (forward grooved). This form of dentition occurs **uniquely** in the **family Elapidae**. The fangs in the front of the mouth are short compared to those of hinged front fanged snakes. Therefore, proteroglyphous snakes are often seen to hang on their prey as they inject their venom.

Group 4-hinged front fanged (moderately to highly venomous)

Hinged front fanged, or **Solenoglyphous**, snakes (pipe grooved) have the **most evolved venom delivery method** of all snakes. The hollow fangs are folded against the roof of the mouth. Upon opening the jaws, muscles contract (at will) to ensure the fangs rotate into bite position.

Skull of *Bitis* species

Some hinged front fanged species open their mouths to about **170 degrees** allowing their sharp fangs to penetrate prey quickly and deeply. This form of dentition is **unique to the Viperidae family**. The teeth and fangs of all species are replaced throughout life. Venomous species are never without a functional set of fangs unless severely damaged by a predator.

External anatomy

The basic appearance of snakes is so familiar to most people that they do not require description. A few anatomical peculiarities are, however, listed here.

- Unlike lizards, **no snakes** can deliberately **shed** their **tails**.
- The **pupils** of a snake's eye can be round, vertically elliptic, or keyhole-shaped, depending on the species. Those with **round pupils** are generally **diurnal**, whilst those with vertically **elliptic pupils** are generally **nocturnal**. The vertically elliptic pupil of snakes expands rather like that of a cat. This is to accommodate the maximum entry of available light into the eye for night vision.
- Some snake species are adapted to a **burrowing way of life** and have a **sharp spine** at the tip of their tail. This spine is anchored to the ground to form a lever for pushing through the soil.
- **Arboreal snakes** (living in trees) frequently have a **prehensile tail** which aids them in holding onto vegetation whilst feeding.
- Some species of snakes are entirely **aquatic** and never venture onto dry land throughout their lives. The **yellow-bellied sea snake** found off the South African coast is an example. This species has a body that is **dorso-ventrally compressed** into a paddle shape to aid it in swimming. It also happens to be one of our **most venomous snakes**.

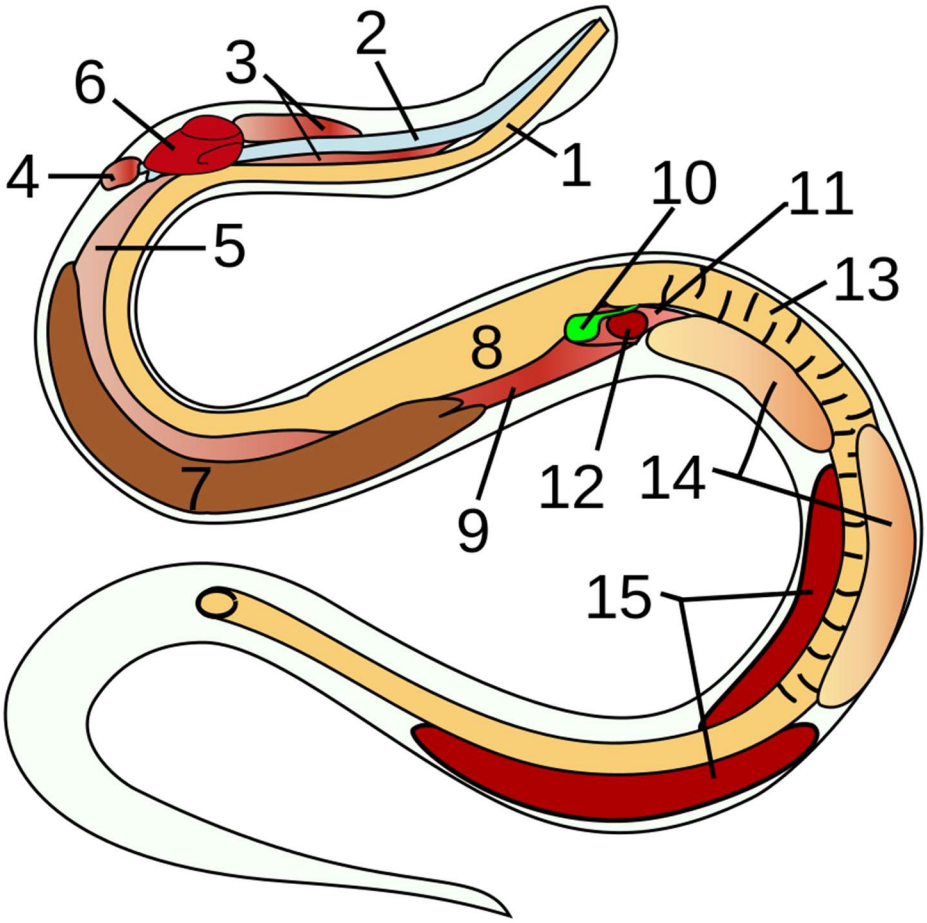
Cape cobra-*Naja nivea*

Snakes regularly **slough** (or shed) their skins since this does not grow along with the snake. Just before sloughing, an **oily secretion** loosens the old skin from the new. It allows the snake to remove the old skin layer, **generally in one piece** that is turned inside out. This oily secretion is why the skin over the eyes becomes opaque just before shedding. The snake hides in retreat since they are very vulnerable during this process. To start the process of sloughing, the snake rubs its nose against a rough surface until a piece of skin comes loose. In older snakes, the shed skin may come off in pieces, but usually, it is shed in one piece.

Sloughing occurs up to **15 times per year** in juvenile snakes and about **3-4 times a year** in adult snakes.

Snouted cobra-*Naja annulifera*

Internal anatomy



Internal anatomy of a snake. Image: Uwe Gille

1. Oesophagus
2. Trachea
3. Tracheal lungs
4. Rudimentary left lung
5. Right lung
6. Heart
7. Liver
8. Stomach
9. Air sac
10. Gallbladder
11. Pancreas
12. Spleen
13. Intestine
14. Testicles
15. Kidneys

Colouration and markings

The colour and markings of most snake species are designed to provide **maximum camouflage** within that species' chosen habitat. The gaudy colours of the **Gaboon adder** conceal it perfectly against the background of the fallen forest leaves. The **green mamba** is almost invisible in the green subtropical forests of the Kwazulu-Natal coast. Some species **mimic** the colouration of others. This phenomenon is usually found in harmless species that are thought to be imitating the colouration of a more dangerous species, thereby **avoiding predation**. **No species of snake can change colour**.

Gaboon viper-*Bitis gabonica*

Size

Snakes are very variable in size. They range from the true giant snakes such as the **green anaconda** (found in the tropical rain forests of South America), which attains a length of up to **8 m** [26 ft] and a mass of up to **220 kg** [485 lb], down to the **flowerpot snake** which seldom exceeds **17 cm** [6.7 in] In length and a mass of a few grams.

Green anaconda-*Eunectes murinus*

The **largest venomous snake** species globally is the **King cobra** of South East Asia (below), which attains a length of **5.5 m** [18 ft]. Africa's **black mamba** attains a maximum length of **4.3 m** [14 ft].

Senses

The **most developed sense** in most snakes is the **sense of smell**. **Nostrils play no part** in this. The **forked tongue** of snakes can **protrude through the lips** without the mouth having to be opened. This is accomplished by a muscle that extends and retracts the tongue at will. The tongue is kept in the hyoid sheath below the trachea when not in use.

The tongue tips **pick up scent particles from the air** and surrounding substrate and transfer these to the **Organ of Jacobson**. This organ is situated on the roof of the mouth and has pockets lined with **sensory epithelial cells**. These cells **absorb the scent particles** and **translate** the sensory message to the snake.

Most diurnal species use sight as the prime means of locating prey. However, the sight of even these species is **not very good**, and most are only able to discern movement. Only the **vine snake** and **boomslang** are thought to be capable of identifying **stationary prey**. All snakes see in **monochrome** (black and white shades).

Snakes are unable to hear airborne sounds (as they lack external ear openings). However, they have **an auditory nerve** to pick up sounds (vibrations) travelling through a dense medium such as the ground or water. So, if you walk towards them, they will feel the vibrations in the ground, usually well before you see them.

Snouted cobra-*Naja annulifera*

Another sensory adaptation of some snakes is that of **heat sensory organs**. The **pit vipers**, **boas** and **pythons** all have these organs. These usually take the form of pits or depressions on the anterior edge of the lips. The **sensitivity** of these pits to heat is remarkable, and a temperature of less than **1°C** [±34°F] can be determined. These organs aid the snake in **locating** and capturing **warm-blooded prey**, even at night. All snakes lack external ears and eardrums but are sensitive to **vibrations** transmitted to the brain via the ribs and, ultimately, the quadrate bone.

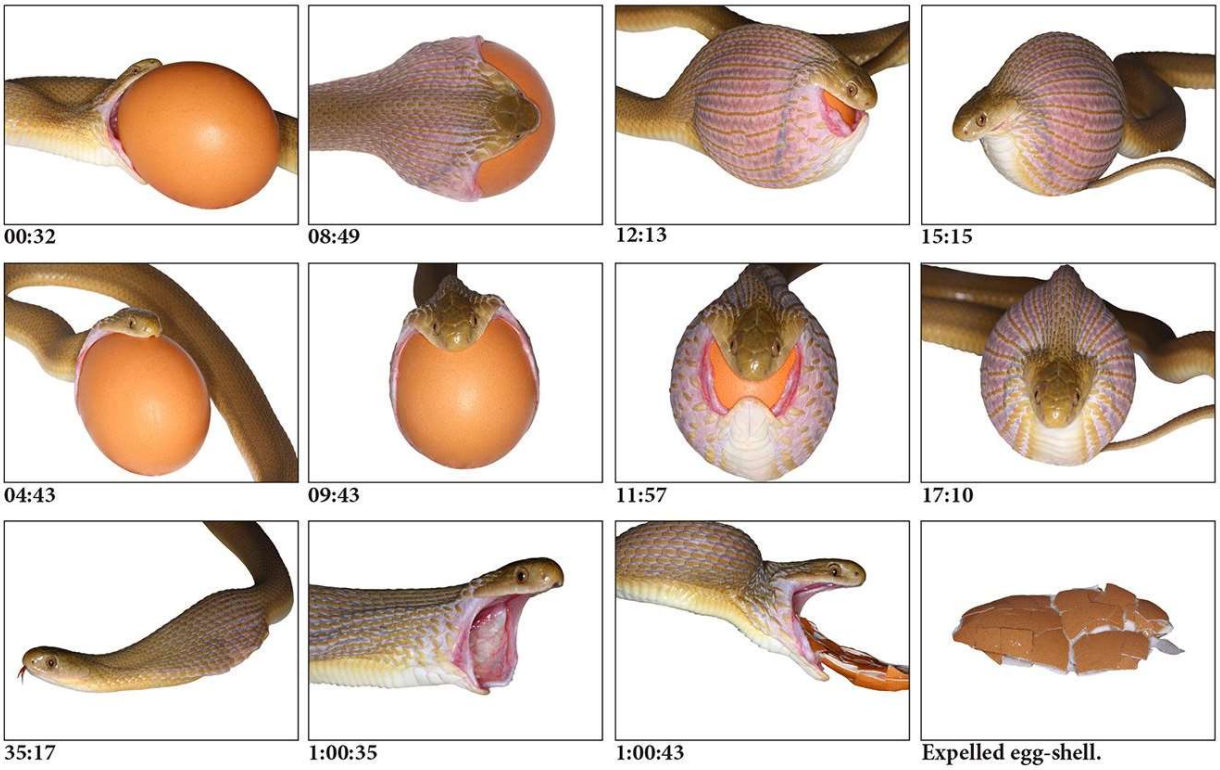
Note the heat sensory organs below the eye and the lack of external ears in this American Western diamondback rattlesnake.

Feeding habits

Snakes are **incapable of chewing** or swallowing prey in the usual way associated with other animals. The consumption of entire large unchewed meals is a digestive challenge. Additionally, digestion is limited by low body temperatures. The ability to inject venom is probably a primary adaptation for dealing with unchewed meals. **Venom is a type of saliva with an impressive digestive function**. The injection of venom into meals means that **digestion occurs inside the prey**. Therefore, it is not surprising that a higher than average proportion of snakes in **cold climates are venomous**.

Egg-eaters have a unique solution to the digestive challenge. They consume only birds' eggs, cracked and squeezed in the egg-eater's throat to empty the liquid contents into the stomach, allowing for rapid and easy digestion. The eggshell is spat out afterwards.

Feeding sequence in the Plain Egg-eater *Dasypeltis inornata*



Approximately 61 minutes from beginning of ingestion to expelling of egg.

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To enable them to swallow such large prey:

- Snakes have developed a **very wide gape** (up to **130 degrees** in pythons).
- The **bones of the skull are loosely attached** to allow the passage of prey through the jaws.
- The **jawbones are loosely articulated** in the middle, which allows them to expand independently around very large prey items.
- The throat and body walls are **highly distendable** to allow for the passage of prey.
- The **trachea can be extended out** of the mouth to prevent suffocation whilst the snake is swallowing.

The wide gape of a southern African python-*Python natalensis*
Note how clearly you can see the trachea

Most snake species can swallow prey up to **25% of their body weight**, but others such as the pythons may swallow prey weighing as much as they do.

All snake species are **carnivorous** and prey on a wide variety of animals. **Amphibians**, **mammals**, **birds**, **fish**, **insects**, **bird's eggs**, **other snakes**, and **reptiles** all form prey for various snake species. Some species are **highly specialised** and will only prey on a single type of prey item such as **birds' eggs**, **slugs**, or **centipedes**.

Puff adder-*Bitis arietans*

The digestive juices of snakes are **very strong**, and most matter is digestible, including bones and teeth. **Hair**, **feathers**, and **horn** are not digested, and these are egested with the faeces. Because **venom is modified saliva**, it **aids in the digestion** of prey. Since snakes are very vulnerable to damage, most have developed ways of overcoming their prey as quickly and effectively as possible.

Many of the **non-venomous species constrict their prey**. This is accomplished by the snake securing a good grip on the prey and rolling it back and into several coils of the body wherewith muscular contractions, the snake **prevents normal breathing until suffocation occurs**. Constriction is mainly used on **mammalian prey** since they expire quickly without oxygen.

A southern African python-*Python natalensis* **feeding on a bushbuck**

On the other hand, **amphibians** can withstand constriction since they can **respire through their skins**. Some snakes do constrict amphibians, but this is instead a means of restricting the struggles of the prey whilst it is eaten alive. Most snakes commence eating from the prey's head to prevent problems such as **scales**, **limbs**, **feathers**, and **hair** from **folding back** and making swallowing difficult.

A female boomslang-*Dispholidus typus* **takes a flap-neck chameleon as a meal**

Most of the **rear-fanged species** hang onto their prey after biting without constricting. They chew forward to bring the fangs into operation and therefore **paralyse** the prey animal. The **front fanged species** such as **cobras** and **mambas** often bite their prey and hold onto it, but since their **venom is so effective**, the prey has little time to retaliate before succumbing. **Adders**, on the other hand, most often bite their prey and **release it immediately**. They allow their venom time to incapacitate the prey, after which they follow the scent trail, locate, and swallow it.

Snakes are susceptible to a variety of diseases like **pneumonia**, **neurological disease**, and **salmonellosis**. Parasites include **nematode worms** and **ticks**.

Reproduction

Snakes locate partners using the Jacobson's organ to **follow scent trails** of glandular secretions from the skin and cloaca of females. In addition, male snakes have **paired copulatory organs** known as **hemipenes**. These lie on either side of the tail just behind the cloaca and are retracted into the body when not in use. Before copulation, the **hemipenes are projected forwards**. **Then**, **they are turned inside out** by a muscle attached to the end of each organ.

A mating pair of Mozambique spitting cobras-*Naja mossambica*

Copulation takes place with only **1 of the pair of hemipenes penetrating** the cloaca of the female. Mating may last from a **few minutes to a couple of hours**. All snakes are **essentially hatched from eggs**. In most species, eggs are laid and left to **incubate** under natural conditions. These species are **oviparous**. Other species, however, **retain their eggs** within the body cavity until incubation is complete and, after that, give birth to live young. This is known as **ovo-viviparous reproduction**.

Examples of snakes that produce live young:

- **Berg adder**-*Bitis atropos*
- **Common slug-eater**-*Duberria lutrix*
- **Gaboon adder**-*Bitis gabonica*
- **Horned adder**-*Bitis caudalis*
- **Mole snakes**-*Pseudaspis cana*
- **Puff adder**-*Bitis arietans*
- **Rinkhals**-*Hemachatus haemachatus*
- **Some blind snakes**

Juvenile mole snake-*Pseudaspis cana*

Snake eggs have a shell unlike that of birds. It is formed from a **parchment-like substance that is deposited in 9-10 layers**, each at right angles to the next. The shell is therefore soft and pliable. Eggs are generally laid from **4-6 weeks after mating** and may take **2-7 months to incubate**. Once the eggs have been laid or the young produced, most snakes show no further interest in their offspring, except for a few species such as pythons which assist with incubation.

A boomslang-*Dispholidus typus* **hatches from its egg**

Before hatching, juveniles develop an **egg tooth** that grows on the tip of their snouts. This allows them to slit the eggshell and escape. This tooth is shed shortly after hatching.

An American corn snake-*Pantherophis guttatus* **hatches from its egg**
Note the egg tooth which is lost shortly after

The **females** of some species may **carry viable sperm** for up to **4 years** after mating and produce several batches of fertile eggs. **Ovo-viviparous species** usually give birth to their young after a **gestation** of anything from **15-24 weeks**. Young are encased in a thin membrane that is quickly broken by the efforts of the newborn snake. Snakes usually lay only **1 clutch of eggs per season**, but in warmer tropical and subtropical areas, this may increase to several clutches a season.

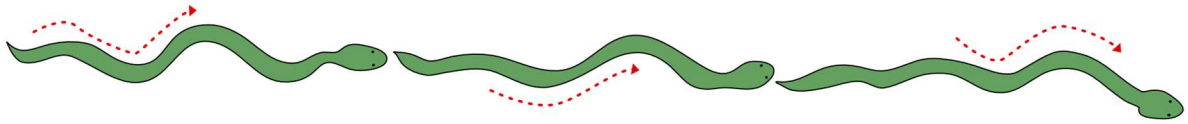
Southern African python-*Python natalensis* **hatchlings**

Locomotion

Snakes move in **several different ways** and sometimes use more than one of these, depending on the situation.

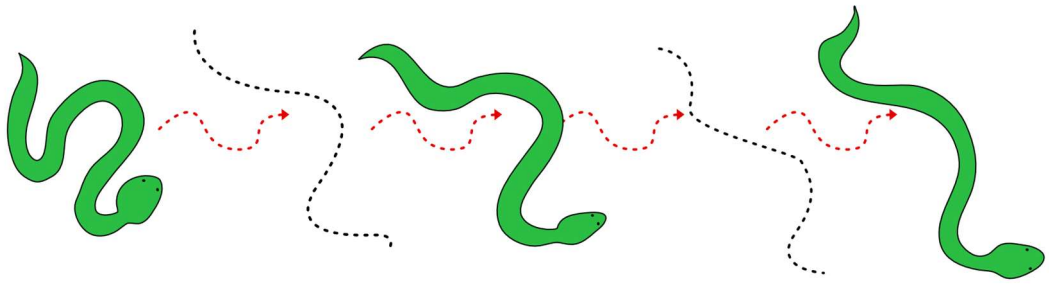
Snakes have never been recorded to exceed a speed greater than **24 kph** [15 mph]. It is unlikely that a fast-moving snake like a **black mamba** would ever exceed **20 kph** [12.4 mph]. Snakes and most reptiles do not receive a very good supply of oxygenated blood and tire easily when forced to exercise more vigorously than usual. One of the fastest known snakes is the **yellow-bellied sand snake**.

The most commonly used method of locomotion is **serpentine motion** (**or lateral undulation**). This is achieved by the snake **undulating horizontally** to force the lower rear edges of the body against any projections on the ground. This pushes the snake forward.

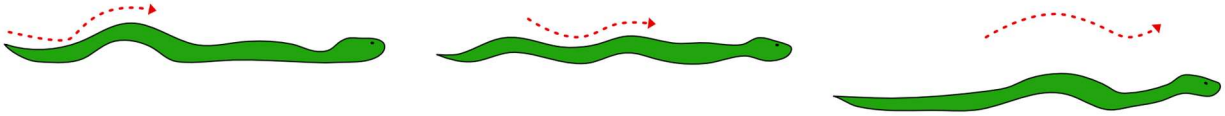


All snakes can swim. Swimming is accomplished in much the same way as described above. Here, a **harmless herald snake** takes a swim across a dam in Gauteng.

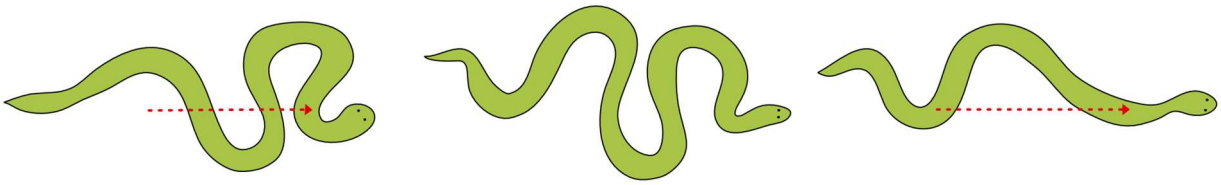
Sidewinding is a specialised form of serpentine motion. It is used only by some species of **desert snakes** to facilitate movement across shifting dune sand. Only **2 sections of the body touch the sand at a time**. A section of the body is virtually thrown sideways, followed by the next section. One advantage is that most of the body does not touch the hot sand while the snake moves.



Rectilinear motion (**caterpillar-like movement**) is frequently seen in **heavy-bodied snakes** such as **adders** and **pythons**. The snake's body is oriented in a straight line, and the motion is accomplished by the ventral scales being pushed forwards in waves. The ventral scales in contact with the ground grip and pull the snake forwards. The ribs have nothing to do with this method of locomotion.



Concertina motion is simply a more extreme form of rectilinear motion. It is usually only demonstrated when **movement is restricted**, as in tight spaces such as holes or difficulty navigating smooth branches.



Defence

The most common form of warning is **hissing**, which is accomplished by **loud inhalation and exhalation of air**.

Snouted cobra-*Naja annulifera*

Another warning sign is for the **neck to be expanded** to exaggerate the snake's size and show the **vivid colours** often found on the interstitial skin of the neck. This warning behaviour is often found in **arboreal species** such as the **boomslang**, **vine snake** and **variegated bush snake**. Other warning signs in snakes are the **spreading of a hood**, as is demonstrated by the **cobras** and, to a lesser extent, the **black mamba**.

Black spitting cobra-*Naja nigricincta woodi*

Hibernation

During the cold winter season, **most snakes hibernate**, surviving on **large reserves of fat** that have been built up during the warm summer. Hibernation is characterised by a **reduction in all body functions' speed**, i.e., their metabolism slows down radically. In the **warmer areas** of the country, some species of snake do not hibernate but are **simply inactive** on the very coldest or overcast days.

Black mamba-*Dendroaspis polylepis*
Highly neurotoxic

Snakes can endure long periods of fasting, living off fat reserves that are stored after large meals. Because the digestive system is in a quiescent state much of the time, many species undergo a 'down-regulation' of the digestive system between meals. This atrophy causes the digestive system to become reduced in size and non-functional, helping with metabolic energy savings. It also allows the partial atrophy of supporting organs like the heart, liver, and kidneys, all contributing to metabolic savings. However, when a meal is ingested, the digestive system needs to become active again quickly, requiring much energy. Overall, the down-regulation benefits snakes that feed infrequently, but not snakes that frequently feed, since the cumulative start-up costs exceed the energy saved by down-regulation.

Snake venom

Of the **3000 or so species worldwide**, only **300 are dangerous to humans**. In southern Africa, there are approximately **160 species** and subspecies of snakes. Of these, **only 18 are known to be potentially fatal to humans**.

These species are:

- **Berg adder**-*Bitis atropos*
- **Black mamba**-*Dendroaspis polylepis*
- **Black necked spitting cobra**-*Naja nigricollis nigricollis*
- **Boomslang**-*Dispholidus typus*
- **Cape cobra**-*Naja nivea*
- **Coral snake**-*Aspidelaps lubricus*
- **Forest cobra**-*Naja melanoleuca*
- **Gaboon adder**-*Bitis gabonica*
- **Green mamba**-*Dendroaspis angusticeps*
- **Mozambique spitting cobra**-*Naja mossambica*
- **Puff adder**-*Bitis arietans*
- **Rinkhals**-*Hemachatus haemachatus*
- **Savanna vine snake**-*Thelotornis capensis*
- **Shield-nosed snake**-*Aspidelaps scutatus*
- **Snouted cobra**-*Naja annulifera*)
- **South-western black spitting cobra**-*Naja nigricollis woodi*
- **Western barred spitting cobra**-*Naja nigricollis nigricincta*
- **Yellow-bellied sea snake**-*Pelamis platurus*

Savanna vine snake-*Thelotornis capensis*

Venom types

Snake venom is a viscous, usually yellow liquid consisting of a **solid content** of **25-35%**, comprised of **polypeptides** and **proteins**. The chemical composition of these venoms is highly complex and is still not fully understood.

Snake venom is produced and stored in modified salivary glands, roughly on either side of the head behind the eyes.

Green mamba-*Dendroaspis angusticeps*
Highly neurotoxic

Neurotoxic venom

Act on the nervous system in such a way that they **block the transmission of nervous impulses** to muscles in the body. The result of this is ultimately the **paralysis** of the **respiratory muscles** and, therefore, the **death** of the victim

This venom is associated with **fixed front-fanged snakes**. It is found in all the **mambas** and most of the **cobras except for the spitting types**, which have a **combination** of **cytotoxic** and **neurotoxic** venom.

The most **common symptoms** of neurotoxic envenomation are dizziness, vomiting, sweating, nausea, drooping eyelids, respiratory distress, agitation, salivation, and impaired vision.

Western green mamba-*Dendroaspis viridis*
Neurotoxic

Cytotoxic venom

The effect of these venoms is **tissue destruction** and **haemorrhaging**. How this is caused is still not completely understood, but it is known that **death** from these bites occurs because of **hypotensive shock** caused by **fluid loss** at the site of the bite. These venoms are commonly found in **hinged front-fanged snakes** like the **adders** but also in the **spitting cobras**.

Puff adder-*Bitis arietans*
The most common culprit of cytotoxic snake bites in South Africa

Typical **signs of envenomation** are extreme pain, swelling, haemorrhage, blistering of the skin and necrosis.

Haemotoxic venom

This venom is **extremely dangerous to humans**. Bites from these snakes **cause massive haemorrhages** (rupturing of blood vessels). **Death** is likely to occur because of a **brain haemorrhage**, **blood loss and kidney failure**. Found **only** in the **boomslang** and the **vine/twig snake**, which are rear-fanged. These snakes are not aggressive, however, unlike mambas and some adders. Snake envenomation, diagnosis, symptoms, and management of snake bites are fully described in **module #11**, **component 4**.

Savanna vine snake-*Thelotornis capensis*

Venom-type summary:

Snake group	Tooth structure	Venom	Main symptoms
Pythons and other constrictors	Solid-toothed no fangs	None	Pain from the bite, secondary infection.
Adders and vipers	Hinged front fangs	Cytotoxic	Tissue destruction around the site of the bite, localised bleeding.
Cobras and mambas	Fixed front fangs	Neurotoxic	Paralysis, difficulty breathing, nausea, panic and vomiting.
Boomslang and vine snake	Back-fanged	Haemotoxic	Bleeding, drop in blood pressure.

Antivenom

2 antivenoms are currently produced by South Africa's National Health Laboratory Service:

- **A polyvalent antivenom** that is effective against **most** of the venomous snakes (including the **puff adder**, **Gaboon adder**, **rinkhals**, **green mamba**, **Jameson's mamba**, **black mamba**, **Cape cobra**, **forest cobra**, **snouted cobra**, and **the black-necked spitting cobra**), **but not** the **boomslang**, **vine snake**, **yellow-bellied sea snake** and **small adders**.
- **A monovalent antivenom** that is only effective against the **boomslang**.

Antivenom is usually administered with intravenous cortisone, adrenaline, and antihistamine and is **only done by medical professionals**.

Most bites are treated symptomatically. First aid treatment is covered in **module # 11component # 4**.

Thermoregulation

Snakes are all **ectothermic** in that their body temperature is determined by conditions outside of their body. Therefore, **temperature regulation is** carried out by the snake positioning itself in situations allowing it to adopt the ideal body temperature. This is done through **basking** to **heat the body**, and **hiding from the sun** to **reduce the body temperature**.

Southern African python-*Python natalensis*

Most species of snakes prefer conditions ranging from about **21-32°C** [70-90°F]. At temperatures below **21°C** [70°F], snakes become inactive and are seldom found in areas where the average temperature is much below this point. Snakes **can seldom tolerate body temperatures** above **32°C** [90°F], and most will die before reaching a temperature of **40°C** [104°F].

Snake families in southern Africa

Blind snakes- *Typhlopidae*

Primitive snakes with a toothless lower jaw. They show the remains of a pelvic girdle. A bullet-shaped head, smooth cylindrical body, spiked tail and tightly overlapping scales are adaptations to a burrowing way of life. Most feed on **termites**.

8 native species occur in southern Africa, and **1 alien invasive**, **the flowerpot snake**. Interestingly, the flowerpot snake is the only parthenogenic snake known to science (only rare cases of apparent parthenogenesis has been reported in other snakes).

*** Parthenogenesis** is a natural form of asexual reproduction. The growth and development of embryos occur **without fertilisation by sperm**.

Bibron's blind snake-*Typhlops bibronii*

Worm snakes-*Leptotyphlopidae*

Primitive, thin, and tiny snakes, having **no teeth in the upper jaw**. They show the remains of a pelvic girdle. They have a bullet-shaped head, smooth cylindrical body, spiked tail and tightly overlapping scales as adaptations to a burrowing way of life. Feed mainly on **termites** and **produce pheromones that prevent soldier termites from attacking them**.

12 species occur in southern Africa.

Leptotyphlops species

Pythons-*Pythonidae*

An ancient family comprising the **largest snakes in the world**. Species show vestiges of a pelvic girdle in the form of spurs visible at the base of the cloaca. All are **oviparous**. All have heat-sensing organs on the lips. All species **constrict their prey**.

There are 2 species in southern Africa:

- **Angolan python** or **Ancieta's dwarf python**-*Python anchietae*
- **Southern African python** or **African rock python**-*Python natalensis*

Southern African python-*Python natalensis*

African burrowing snakes -*Atractaspidinae*

A small, essentially African family of snakes occurring throughout most of sub-Saharan Africa. These are small to medium cylindrical snakes with small heads that are not very distinct from the body. They have **no loreal scale** (a scale between the preocular and nasal scales); only **African burrowing snakes** and **elapids lack this scale**. Most species are **fossorial** with small eyes, smooth, shiny scales, and short tails. A wide variety of fang types occur in this family, ranging from fangless species to grooved rear fangs, fixed front fangs and moveable front fangs.

This family includes at least **66 species**, **19 in southern Africa**.

- **Centipede-eaters: 4 species**
- **Harlequin snakes: 2 species**
- **Natal black snakes** and **purple-glossed snakes: 5 species**
- **Quill-snouted snakes: 4 species**
- **Stiletto snakes: 3 species**

Cape centipede-eater-*Aparallactus capensis*

Typical snakes-*Colubridae*

A very large family of mostly **medium-sized snakes** worldwide. No species show vestigial limbs. None have functional left lungs. Species may have no fangs, rear fangs or hinged front fangs, with **2 species** being potentially lethal to humans.

Within southern Africa, there are **27 genera** and **78 species in this family**. (A Guide to the Reptiles of Southern Africa by Alexander and Marais).

A herald snake (**or red-lipped herald**)-*Crotaphopeltis hotamboeia*
A common visitor in suburban gardens and homes. To humans, they are **HARMLESS**.

- **Aurora house snake**-*Lamprophis aurora*
- **Bark snakes-2 species**
- **Beaked snakes-2 species**
- **Boomslang**-*Dispholidus typus*
- **Brown house snake**-*Boaedon capensis*
- **Cat-eyed tree snakes-2 species**
- **Dwarf whip snake is also known as Dwarf sand snake**-*Psammophis angolensis*
- **Egg-eaters-3 species**
- **File snakes-3 species**
- **Green snakes-5 species**
- **Lesser house and rock snakes-3 species**
- **Many-spotted and mountain snakes-2 species**
- **Marsh and swamp snakes-3 species**
- **Mole snake**-*Pseudaspis cana*
- **Olive grass snake**-*Psammophis mossambicus*
- **Olive house snake**-*Lycodonomorphus inornatus*

Spotted bush snake-*Philothamnus semivariegatus*

- **Sand** and **whip snakes-11 species**
- **Shovel-snouts-7 species**
- **Skaapstekers-3 species**
- **Slug-eaters-2 species**
- **Spotted rock snake**-*Lamprophis guttatus*
- **Tiger snakes-2 species**
- **Tropical water snakes-2 species**
- **Vine snakes-2 species**
- **Water snakes-4 species**
- **Western keeled snake**-*Pythonodipsas carinata*
- **Wolf snakes-8 species**

Dwarf sand snake-*Psammophis angolensis*

Cobras, mambas, and their relatives-*Elapidae*

All have **well-developed fixed fangs** at the front of the mouth. Many show defensive threat displays. Most have round pupils.

16 species occur in southern Africa.

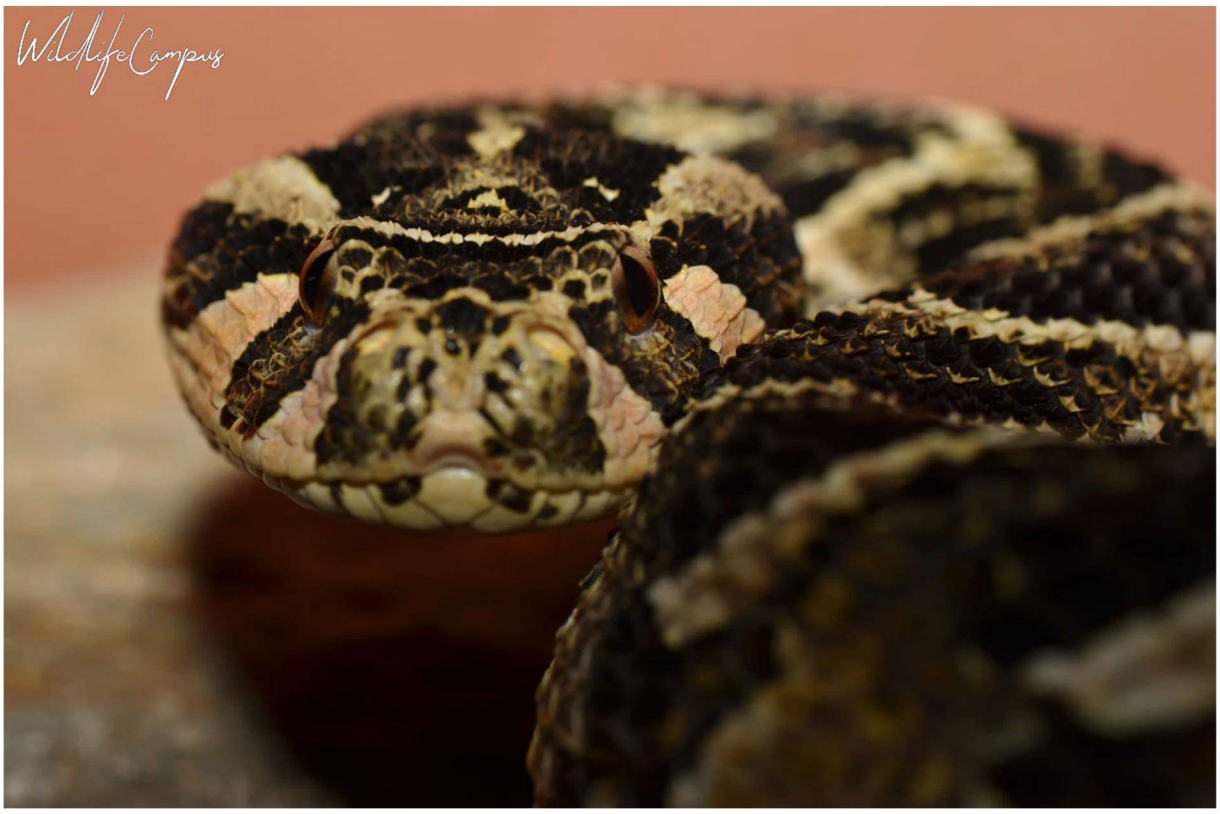
Black mamba-*Dendroaspis polylepis*

- **African garter snakes-4 species**
- **Black mamba**-*Dendroaspis polylepis*
- **Bushveld cobras-2 species**
- **Cape cobra**-*Naja nivea*
- **Coral shield cobra**-*Aspidelaps lubricus*
- **Forest cobra**-*Naja melanoleuca*
- **Green mamba**-*Dendroaspis angusticeps*
- **Rinkhals**-*Hemachatus haemachatus*
- **Shield cobra**-*Aspidelaps scutatus*
- **Spitting cobras-2 species**
- **Yellow-bellied sea snake**-*Hydrophis platurus*

Vipers and adders- *Viperidae*

Most are short, stocky snakes with a head that is quite distinct from the neck. All have large, hinged fangs at the front of the mouth. Most have vertically elliptic pupils. Most are **ovoviviparous**.

15 species are found in southern Africa.



Puff adder-*Bitis arietans*

- **Berg adder**-*Bitis atropos*
- **Dwarf adders-6 species**
- **Dwarf dune adders-2 species**
- **Gaboon adder**-*Bitis gabonica*
- **Horned adder**-*Bitis caudalis*
- **Night adders-2 species**
- **Puff adder**-*Bitis arietans*

Common snakes to be studied

It is important to know interesting facts about **at least 10 species** of snakes from your area of operation.

Group of snakes	Name	Level of danger
Viperidae (adders and vipers)	Puff adder	Very dangerous-cytotoxic venom
	Gaboon adder	Very dangerous-Cytotoxic venom
	Berg adder	Dangerous-Neurotoxic venom (unusual for the group)
	Horned adder	Dangerous-Cytotoxic venom
	Rhombic night adder	Mildly venomous-Cytotoxic venom
	Snouted night adder	Mildly venomous-Cytotoxic venom
Elapidae (mambas, cobras, and relatives)	Black mamba	Very dangerous-Neurotoxic venom
	Green mamba	Very dangerous-Neurotoxic venom
	Cape cobra	Very dangerous-Neurotoxic venom (most potent of any African cobra)
	Snouted cobra (previously the Egyptian cobra)	Very dangerous-Neurotoxic venom
	Mozambique spitting cobra (M'Fezi)	Very dangerous-Cytotoxic and slightly Neurotoxic venom
	Rinkhals	Very dangerous-Neurotoxic venom
	Coral snake	Dangerous-Neurotoxic venom
	Yellow-bellied sea snake	Very dangerous-Neurotoxic venom
Colubridae (back-fanged) and **other venomous snakes**	Boomslang	Very dangerous-Haemotoxic venom
	Vine snake	Very dangerous-Haemotoxic venom
	Southern stiletto snake	Dangerous-Neurotoxic venom
	Kalahari sand snake	Mildly venomous-no harmful effect on humans
	Western stripe-bellied sand snake	Mildly venomous-no harmful effect on humans
	Spotted skaapsteker	Mildly venomous-no harmful effect on humans
	Herald snake	Mildly venomous-no harmful effect on humans
	Black-headed centipede-eater	Mildly venomous-virtually no effect on humans

Fangless and **non-venomous snakes**	Southern African python	Dangerous-constrictor
	Brown house snake	Harmless-constrictor
	Common brown water snake	Harmless-constrictor
	Mole snake	Harmless-constrictor
	Spotted bush snake	Harmless
	Green water snake	Harmless
	Common wolf snake	Harmless
	Southern file snake	Harmless
	Common egg-eater	Harmless
Blind and **worm snakes**	Delalande's beaked blind snake	Harmless
	Schlegel's beaked blind snake	Harmless
	Bibron's blind snake	Harmless
	Cape worm snake	Harmless
	Peters' worm snake	Harmless

Delalande's beaked blind snake-*Rhinotyphlops lalandei*

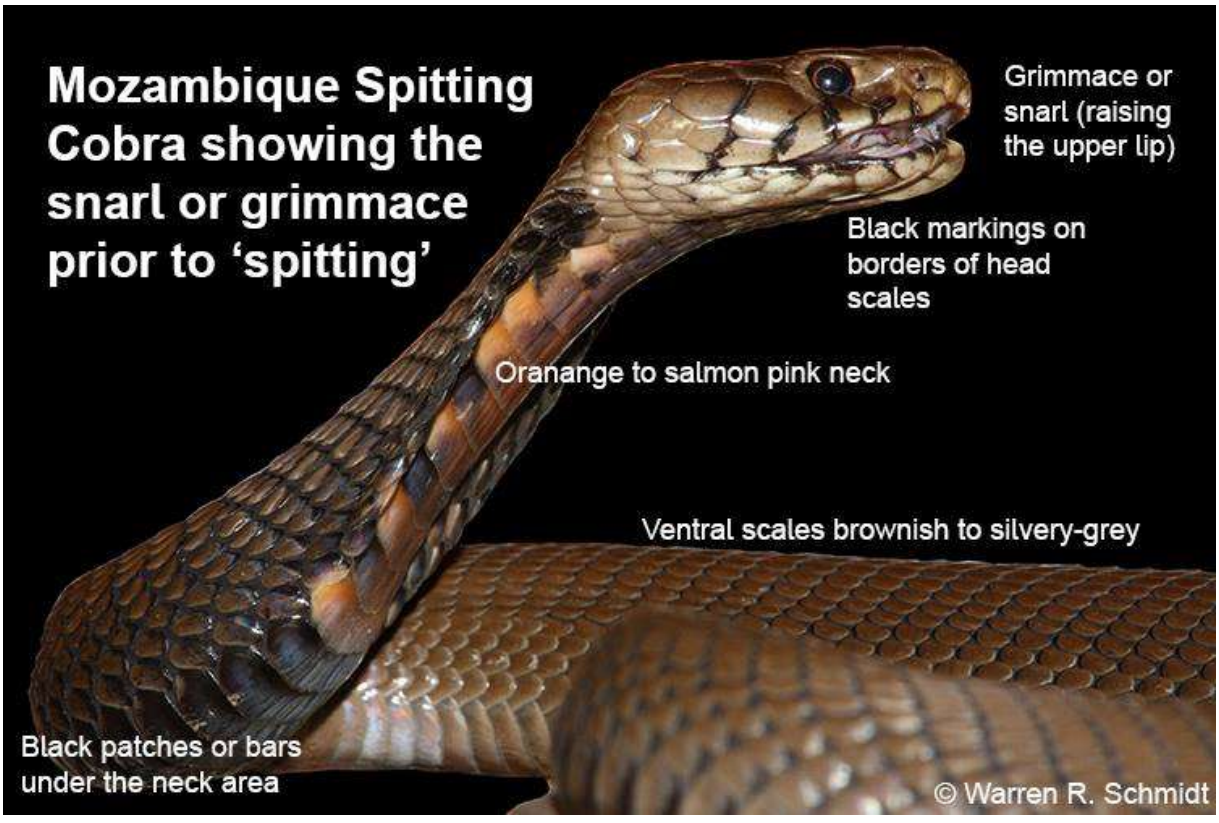
Example of species case study: Mozambique spitting cobra (M'Fezi)

Length: Adults average **1-1.2 m** [3.3-3.9 ft] rarely growing longer than **1.5 m** [4.9 ft].

Colour: Above slate grey to olive-brown, with each scale being dark-edged. Below is salmon pink or sometimes yellowish with black cross-bars and blotches on the throat- sometimes forming a band across the ventral scales. Has medium-sized eyes with round pupils.

Preferred habitat: Mainly found in moist savanna and lowland forest where it favours broken rocky country, hollow logs, termite mounds and animal holes, often close to permanent water.

Habits: may bask near an accessible retreat or forage on overcast days. Otherwise, they are usually more active at night, although juveniles are quite active during the day. It is a retiring snake, very seldomly standing its ground. If cornered, it may spread a hood but will not hold the pose for very long. Other than going into hiding, its primary means of defence is to eject or spit its venom. The fangs are specially modified for spitting: the venom canal openings at the tips of the fangs are directed forwards and at right angles to the fangs. This enables the snake to eject its venom over **2 m** [6.6 ft]. This snake may not necessarily spread its hood before spitting and may only open its mouth slightly before doing so. It can spit effectively from a concealed position within a rock crevice. The venom supply is seemingly inexhaustible. Unless the venom lands in one's eyes, it generally poses no threat. In the eyes, it causes an immediate burning sensation. It should be washed immediately with lots of water or any other bland liquid. This snake may play dead (**thanatosis**).



Similar species: May be confused with other cobras, the **mole snake** and the **rinkhals**.

Enemies: Other snakes prey on it.

Food and feeding: Preys on **toads, small mammals, birds, lizards, insects**, and **snakes**, including the **puff adder**. May be found searching for food in **poultry runs** and the vicinity of houses.

Reproduction: Oviparous, laying **10-22 eggs** in midsummer. Hatchlings measure **23-25 cm** [9-9.8 in].

Danger to humans: a common snake with a potent venom. Accounts for many bites in KwaZulu-Natal and Mpumalanga.

Venom: predominantly cytotoxic, causing severe local tissue damage that often requires skin grafts. Only slight neurotoxic symptoms like drowsiness can occur, and fatalities are rare. The early administration of antivenom may reduce the extent of tissue damage.