Slithering diversity:

the remarkable snakes of Western Australia

What is it about snakes that so captures the imagination? Love or loathe them, their horizontal belly-bound life, limbless bodies and staring eyes convey an 'other-worldliness', especially to erect, lanky and blinking mammals such as us.

by David Pearson

Western Australia is blessed (yes, blessed!) with around 110 species of snakes (there are around 2600 species worldwide). New species are discovered occasionally in more remote regions, or through genetic techniques that can distinguish differences, despite similar external appearances. Snakes occur in just about every habitat you can imagine: from tall forests in the south-west to sandy coastal plains, and from rugged mountain ranges to arid spinifex deserts. Many species are also found in marine habitats, some preferring mangroves, and others inhabiting coral reefs or shallow inshore waters. Some sea-snakes even occupy deep oceanic waters.

Origin of snakes

The evolutionary history of snakes is still the source of some debate. As snakes have lots of small delicate bones, they are not well preserved in fossil deposits, so the few fossils that have been located have generated considerable interest. Some palaeontologists maintain that snakes evolved from an aquatic ancestor, such as the plesiosaur of the dinosaur age. This is due primarily to the discovery of a snake-like species with small trailing legs in a marine fossil deposit (the aptly-named *Pachyrachis problematicus*). The more conventional view is that snakes evolved from a terrestrial burrowing lizard during the Cretaceous period around 100 million years ago.

The success of an elongate body form led to the evolution of many species of snakes. The older groups of snakes, such as the pythons and blind snakes, retain remnants of the hind limbs and the pelvis. In pythons, the hind limb remnants form small 'cloacal spurs' which male pythons use to tickle and tantalise females when they are mating. Interestingly, some snakes chose to colonise water and their body shapes evolved to suit an aquatic lifestyle, with a lateral flattening of the body and tail to aid in swimming, nasal flaps to stop water entering the lungs during diving and an ability to accurately control buoyancy.

Australian snakes are derived from two geographic origins. Most have evolved from ancestors that occurred on the supercontinent Gondwana (an amalgamation of Australia, India, Antarctica, Africa and South America). These are the blind snakes (in the family Typhlopidae), pythons (Boidae) and front-fanged venomous species including sea-snakes (the Elapidae). Around 15 million years ago, as Australia drifted towards Asia, other snake species were able to cross the sea and colonise Australia by rafting or swimming between islands, especially snakes in the Family Colubridae (including the brown tree snake and several aquatic species).

Thin compromises

Adopting an elongate body shape posed a number of problems for snakes and they developed some elegant solutions to cope with the lack of body width. Most species have only one lung, the right lung, although often the trachea (or windpipe) is enlarged and also functions to exchange air. The lung is long and can extend up to two thirds of the length of the snake. Some snakes, such as pythons, retain a much smaller left lung. Unlike humans, snakes lack a diaphragm, so air is drawn in and out of the lung using movement of the rib-cage. Other body organs, such as the stomach and liver, are similarly elongate, while the heart must be able to pump blood to the extremities of the body, even when much of the body may be higher than the heart.

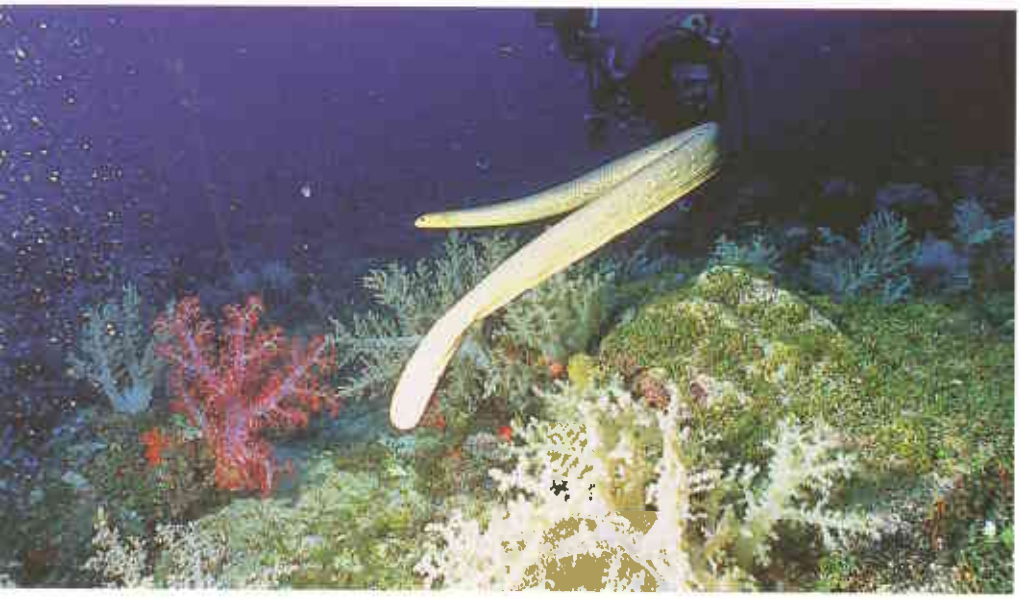
Reproductive organs have also been compromised. Testes are paired, but are small and flattened until the onset of breeding, when they swell with sperm. Female snakes have two ovaries, which continually form ova during their adult life. If they are not fertilised, then the ova can be reabsorbed, and the nutrients saved for other body functions.

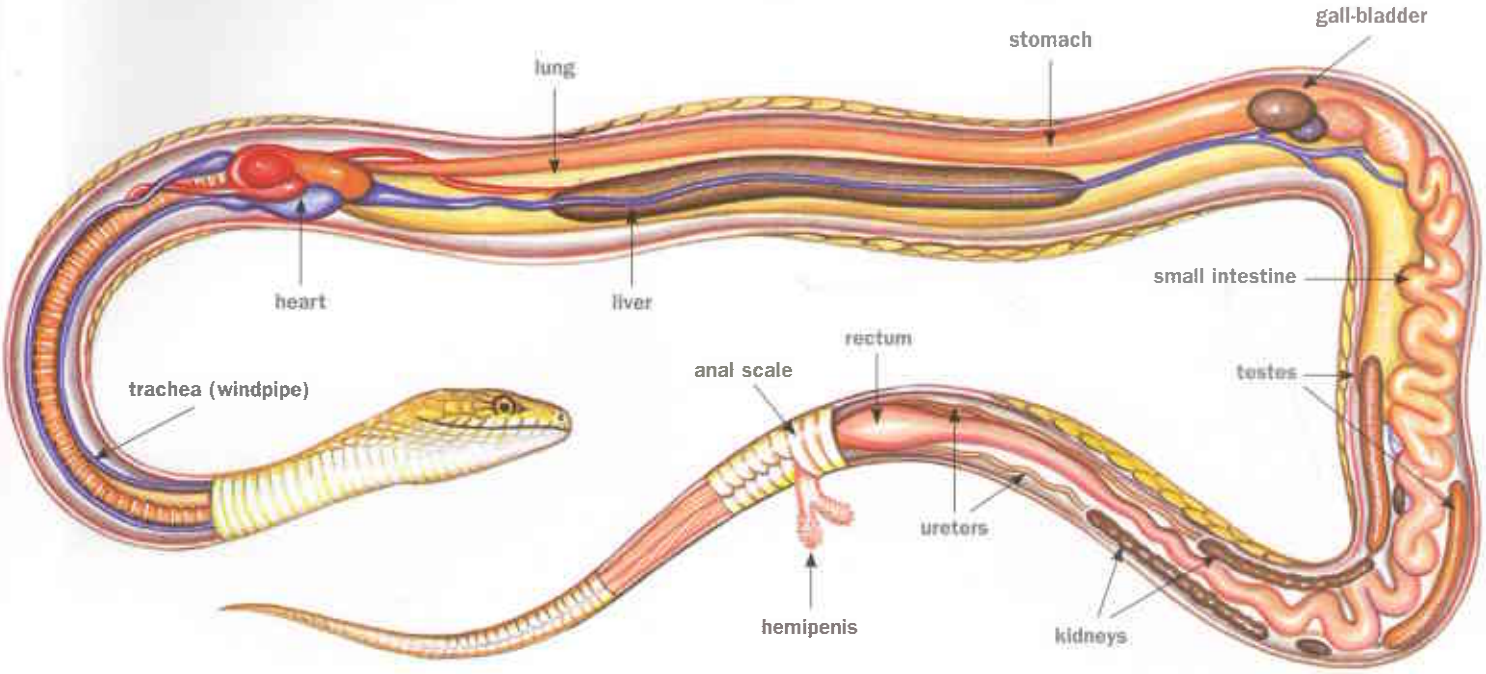
Long bodies require different support systems. Some snakes have in excess of 500 vertebrae. The vertebrae and ribs are linked by muscles, typically with each vertebra attached to several adjoining ones and, in turn, to ribs and skin. These complex overlapping

Previous page
Main Black-headed python.
Photo – Jiri Lochman

Left Carpet python scales.
Photo – Michael Pelusey

Below A paddle-like tail helps sea-snakes propel themselves through the water.
Photo – Ann Storrie





The internal structure of a male snake

muscles act like a set of ropes and pulleys, allowing snakes to move in their characteristic sinuous fashion.

Remarkable ecologies

The lack of limbs limits how snakes can handle their food. Think about it for a moment. Imagine having to manipulate and break up your food with your hands tied behind your back! Since they lack teeth to tear or rip food, the diet of snakes is constrained to what they can pass whole through their mouth. As a consequence, smaller snakes tend to eat smaller prey, but some species, especially the pythons, are able to consume huge prey relying on some amazing features in their jaws. Python jaws are very flexible and can open to a huge size; the lower jaw can be disarticulated to allow it to separate sideways. Large prey is scooped up, with the python using one upper jaw and then the other repeatedly to ratchet itself over the top of the prey.

Body coils are used to crush and expel air from the lungs of prey, to make the task of swallowing easier. The trachea is reinforced and can be extended so that snakes can continue to breathe while they are swallowing large items (it can take up to an hour for a python to swallow a wallaby!).

Above right A dugite with her eggs.
Photo – Babs and Bert Wells/DEC

Right A Pilbara olive python disarticulates its jaw to swallow a rock-wallaby.
Photo – David Pearson/DEC

Above Several male carpet pythons coil together around a female in an effort to mate with her.
Photo – David Pearson/DEC

Snakes have been so successful in Australia because of their abilities to cope with seasonal food shortages caused by droughts, fires and the low densities of prey. If food is limited, snakes will retreat to a shelter site such as a burrow, log or hollow limb to coil up and wait. The body's metabolism is slowed and various parts of the body not in use (such as the stomach and reproductive organs) are 'shut down', with their blood flow greatly reduced.

Most species of snakes, including those in the tropics, reduce their activity during the cooler months of winter. South-western carpet pythons, for instance, retreat to logs or tree hollows in May. There they remain relatively immobile and do not eat until September, only tempted to emerge to bask close to their shelter on warm days.

Serpentine reproduction

Snakes display a range of reproductive tactics. Females typically attract males using pheromone trails, which males follow using their strong sense of smell. In some species, males fight to gain access to females, often resulting in elaborate wrestling displays. In other species, males may coil together around the female in a mass of writhing bodies. However, we have little or no information on the reproductive behaviour of most species.

Some species lay eggs. Pythons, for example, coil around their eggs and keep them at a stable temperature until they hatch. Other species, such as many of the elapid snakes and all sea-snakes, give birth to live young that are independent at birth.

Venom—just modified saliva!

The venom glands possessed by some groups of snakes are related to the salivary glands of other vertebrates. Venoms are a complex mixture of enzymes. They work on the body of prey in many different ways, including interfering with nerve-pulse transmission, which causes the heart and lungs to fail. Others damage blood vessels, leading to haemorrhaging, and others prevent blood from clotting. Venom has an important role in immobilising prey rapidly, so that the potential meal cannot inflict damage on the snake or get away.

A secondary use of venom is for protection. When people are bitten by snakes, it is almost always because the snake feels threatened and acts to defend itself. The best way to avoid being bitten is to leave snakes alone. Never attempt to kill them and give them space so they can escape.

Frog hunter extraordinaire

Tiger snakes are frequent inhabitants of margins of swamps and waterways in the south-west, where they are able to obtain frogs, one of their preferred foods. They can hunt effectively during cooler times of the year and at low night-time temperatures, but consequently are often seen basking to warm up in the morning. Where tiger snakes occur away from swamps, they must rely on other prey. On Garden Island, near Rockingham, tiger snakes feed mainly on spiny-tailed geckos and introduced house mice and only reach a small size. In contrast, on nearby Carnac Island, adult tiger snakes are nourished on an abundant diet of seagull chicks and grow to substantial lengths in excess of one metre.

Camouflaged patience

Death adders are incredible masters of camouflage and are rarely seen unless crossing a road. They lie motionless in

Right A southern death adder lies in ambush position under leaf litter.

Below A sign at Greenough implores drivers to watch out for carpet pythons. *Photos – David Pearson/DEC*

leaf litter or on the margin of a shrub waiting for a passing lizard or small mammal, sometimes for days at a time. At other times, they may be more proactive about obtaining their prey, and lift their unusually thin tail over their heads and wave it to and fro in a mesmerising display. Animals approach to investigate and are rapidly dispatched with a lightning-fast strike and a strongly neurotoxic venom injected by long fangs. Death adders are very slow-moving snakes and need a strong venom so that prey cannot move too far once injected. Four species of death adders occur in Western Australia, with the Pilbara death adder only recognised as a new species in 1998.

Lover of mice

The dugite is one of the most commonly encountered snakes in the Perth metropolitan area (and Rottnest Island), as well as many other urban and rural areas through south-western Australia. It is a species of brown snake unique to WA that has benefited in some areas from changes brought about by people. It is an active hunter of lizards and small mammals, exploring burrows to ambush its prey. The abundance of house mice near people—and shelter provided by sheets of tin, other discarded building material, aviaries and sheds—have provided conditions which suit the lifestyle of dugites. They have a nervous disposition and will attempt to escape when encountered but, if cornered, will raise the body into a double s-shape, then hiss and strike. They are potentially dangerous and should be discouraged from living around homes by keeping lawns short, removing rubbish and controlling introduced rodents.

Threats to snakes

Human activities pose many threats to snakes. Clearing of habitat, the loss of prey (such as native mammals), the presence of exotic animals and road deaths all impact to some degree on snake populations. Nonetheless, no snake species in WA has become extinct as a result of human activities, and only three (the Pilbara olive python, Rottnest dugite and pygmy dugite) are listed as threatened. Several species are known from only a handful of records, so further survey work is required to determine their conservation status.

You can help to conserve snakes by supporting the retention of native bush and its wildlife, preventing domestic pets from roaming in bushlands and driving carefully on country roads. Most snakes (and other wildlife) that are killed on roads are hit at night. Avoid driving at night in the country if you can—it is safer for both you and for snakes!

David Pearson is a Principal Research Scientist with the Department of Environment and Conservation's (DEC's) Science Division. His research interests include threatened reptiles and mammals and fire impacts on wildlife. He has recently written a full-colour, pocket-sized Bush Book on *Snakes of Western Australia* that is available from bookshops, DEC offices and other outlets for $6.50.

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contents

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