TIMOTHY N. W. JACKSON
Venom Evolution Laboratory,
University of Queensland

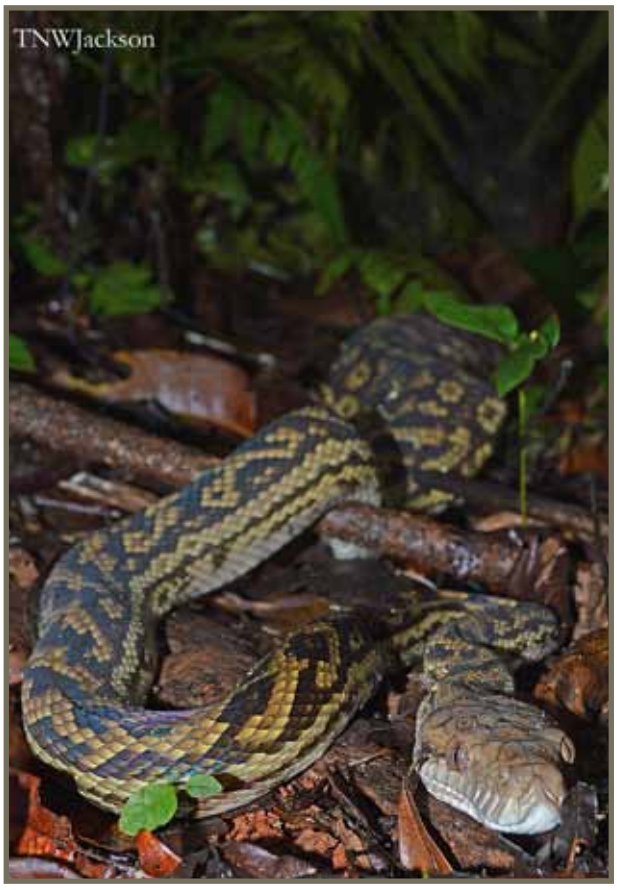
Venomous snakes and horses in Far North Queensland

What is venom?

"Venomous" — the word strikes fear into the heart of many people: but is this a rational response? What exactly does venomous even mean? Are all venomous animals dangerous to humans, or only some? Are bites from venomous animals to humans, livestock and companion animals accidents or are venomous animals really out to get us?

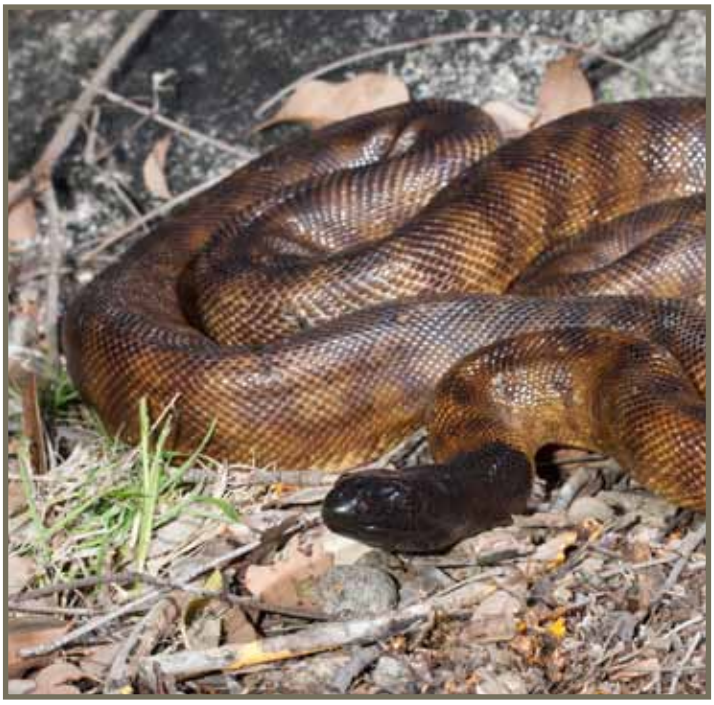
Although there is some controversy amongst specialists as to which organisms should be considered venomous, there is general agreement regarding the definition of "venom" – it's a specialised secretion that organisms deliver with a bite or a sting in order to defend themselves or secure a meal. Venoms are often referred to as "toxic cocktails" because they are complex mixtures of molecules that disrupt the bodily functions of the organisms into which they are injected. Venoms are not necessarily designed to kill, in fact killing is an “epiphenomenon” – an unintended by-product – of venoms that have evolved to aid predators in the subjugation of prey animals. Some venoms, such as those utilised by certain species of wasp, paralyse prey without killing it – a source of fresh meat for the wasp’s larvae. Other venoms, such as those that have evolved for defensive purposes, cause pain but do not kill. Still others delay the clotting of blood in a small area around the bite site, with minimal impact on the victim – if we follow the definition of venom closely, we should consider mosquitoes, lice and leeches venomous.

Venomous organisms are ubiquitous in nature, occurring in almost all branches of the tree of life. There are venomous plants, venomous worms, myriad venomous insects and arachnids, reptiles and mammals. The oceans are teaming with venomous molluscs, echinoderms (sea stars, urchins and sea cucumbers), cnidarians (jellyfish, anemones and corals) and a huge diversity of venomous fishes, including sharks and rays. Chances are, even if you live in the suburbs, that right now your garden is infested with venomous critters. Don't be alarmed though, the vast majority of them are small and completely innocuous, at least if you’re a human (which seems a reasonable assumption, given that you’re reading this article!).



The scrub or amethystine python is common in coastal northern Queensland from Townsville up. It is Australia’s largest species of python. All pythons are non-venomous and the majority feed on small mammals, making their presence desirable as a form of rodent control. Photo by Timothy Jackson, Cape Tribulation.

"Venomous" does not mean "dangerous to humans". In fact the classification of an animal as venomous has nothing to do with humans at all and everything to do with how the animal uses its own bodily chemistry

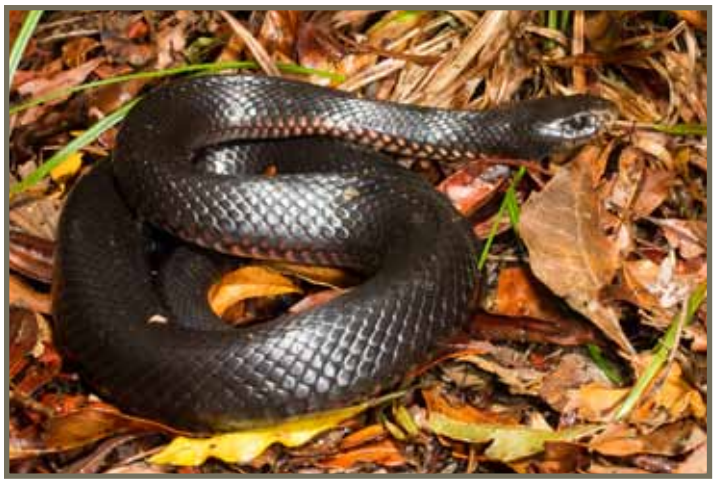


The black-headed python is often mistaken for a venomous species. It is unique among Australian pythons in specialising in feeding upon reptiles, including venomous snakes, which form a considerable percentage of its diet. It should thus be a welcome visitor to North Queensland properties. Although non-venomous, defensive bites from this species occasionally cause in false positive results in snake venom detection kit tests. Photo by Stephen Zozaya, Ravenswood.

against other organisms. Let me explain: organisms, from the simplest single-celled microbe all the way up to the readers of this very article, are like spectacularly complex chemistry sets. Life is chemistry. Inside you, every second of the day, thousands of tiny chemical reactions are taking place! These reactions maintain the delicate balance in which all the components of your body function (they are that balance). Chemicals are the molecules you're made of. Most of these molecules have evolved to work within the bodies of the organisms that make them, but some are special, some have evolved to work on the outside, often in the bodies of other organisms. These are the exochemicals - "exo" meaning outside, as opposed to "endo" meaning inside. Since chemicals often have specific roles in maintaining the function of an organism's body, it makes sense that introducing these same chemicals into another organism might have a considerable effect. This is why exochemistry is so common in nature. Venom is just a particular kind of exochemistry, one in which chemicals are actively delivered by biting or stinging. Other kinds include poisons, which are passively delivered (e.g. by absorption or ingestion) and are commonly used in defence; and pheromones, which are chemicals that act to change the behaviour of organisms exposed to them, and which are often capable of becoming airborne.

Venomous snakes

I know what you're thinking – sure, maybe the majority of venomous creatures aren't dangerous to humans or horses, but what about snakes? It's true, a few of Australia's venomous snakes are potentially dangerous to both humans and horses. Believe it or not though, the vast majority of Australia's venomous snakes really aren't dangerous to humans at all. Most of them are much more dangerous to small animals like lizards and frogs - the animals they feed on. This is because their venom has evolved to aid them in capturing their prey, not to aid them in battling the human colonisers of their continent! The few species of Australian snake that are dangerous to humans are only dangerous if they bite you and that's certainly not something they have any desire to do. If small animals like snakes went around attacking large animals like humans and horses, they wouldn't live very long. Snakes aren't very smart, but evolution has ensured that they "know" better than that. The truth is that it's easy to go long periods of time in Australia without seeing a single snake, even if you spend a lot of that time in the bush where snakes are plentiful. This is because snakes don't want you to see them and they certainly don't want to interact with you - they either move away when they sense you coming or stay very

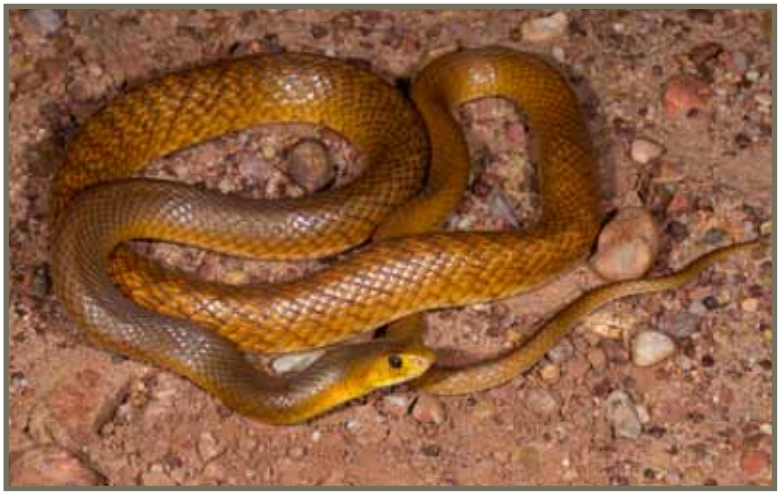


The red-bellied black snake is common in well-watered areas of coastal Queensland. Although a venomous and dangerous species, it is extremely reluctant to bite (unless handled) and its venom is less toxic than that of many other large Australian venomous snakes. No human deaths have ever been recorded as a result of bites from this species. Tiger snake (preferably), black snake or polyvalent anti-venom may be used to treat envenomations. Photo by Stephen Zozaya, Mount Lewis.

still and let you walk right past. You have to be either very unlucky, or very silly (e.g. trying to catch or kill the snake), to get bitten by a snake in this country because snakes never attack people, they only bite to defend

themselves from a perceived threat (the threat may not be real but remember – snakes aren't as smart as you).

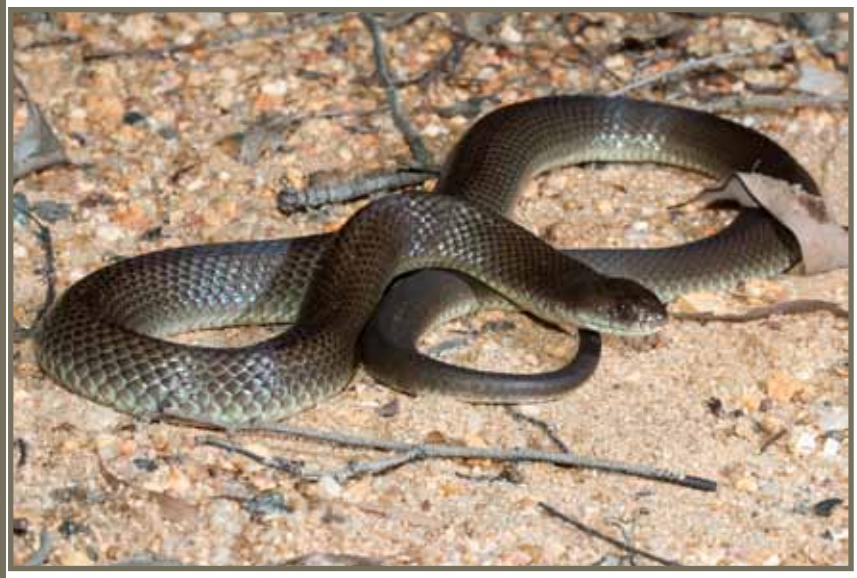
Although we are famous worldwide for the abundance and diversity of our venomous snakes, death from snakebite is extremely rare in this country. Thankfully there are very few bites in Australia in comparison to places like India and Africa. When accidents do happen, we are lucky in that a simple form of first aid, pressure-immobilisation (with which Australians should be familiar), is extremely effective in delaying the onset of adverse effects. This provides the vital extra time to get to hospital in order to receive anti-venom therapy. Australian anti-venoms are the best in the world.



The northern brown snake is also more common to the west of the Dividing Range. Colouration is highly variable. Brown snakes are responsible for more dangerous snakebites in Australia than any other group of snakes. Their exceptionally potent venom attacks the nerves and the blood, and may also damage muscular tissue. Brown snake (preferably) or polyvalent antivenom may be used for treatment. Photo by Stephen Zozaya, Torrens Creek.

Snakes and Horses

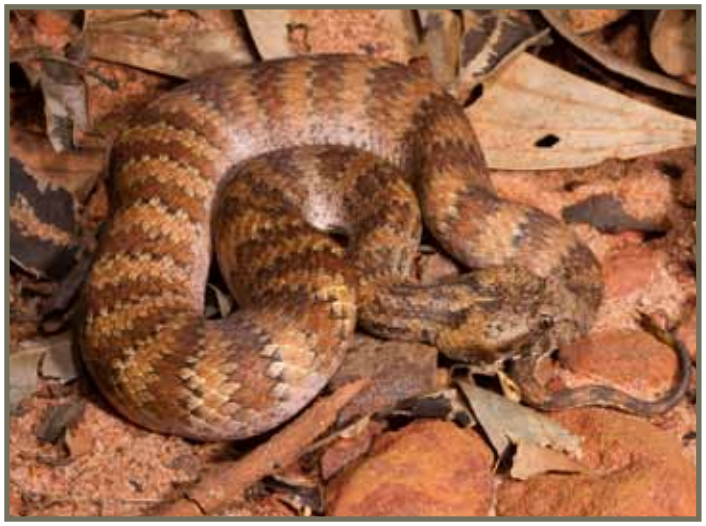
Although it is generally easy to avoid interacting with snakes ourselves, it can be a challenge to prevent them interacting with our companion animals and livestock. Bites to cats and dogs are common, for the obvious reason that naïve predatory mammals often don't know which "prey" is better left alone. Bites to horses are less common but do occur and are of justifiable concern to horse owners.



The mulga or king brown snake is more closely related to the red-bellied black snake than to the "true" brown snakes. It is more common in open woodland and savannah habitats to the west of the Dividing Range. A large species that delivers large quantities of venom when it bites. The venom is particularly rich in toxins that attack muscular tissue. Black snake antivenom is the preferred treatment, but polyvalent may be used if it is unavailable. Photo by Stephen Zozaya, inland of Townsville.

Snakebite to horses in Australia has rarely been documented in the clinical literature and therefore only a limited amount of reliable information is available. Snakes, along with sharks and spiders, are amongst the most polarising of creatures. We all love hearing and telling dramatic stories and everyone who has ever seen a snake has a snake story to tell. Many people who've lost horses in uncertain circumstances are eager to hold a snake responsible, but without proper clinical examination (including blood and urine analyses if possible) it is often impossible to reliably identify the culprit. Internet forums are awash with anecdotes, and websites, including those of insurance companies and (alarmingly) veterinarians, often publish inappropriate information. Some of this information is copied from American sources describing American snakes with venoms that differ from those of our Australian species and thus cause different signs and symptoms of envenomation.

A survey was distributed by toxinologists to 80 Australian vets in the late 1990s asking them to report the number of snakebites to various companion animals that they had treated in the preceding five-ear period. 27 bites to horses were reported out of a total of 1590 bites to companion animals. Encouragingly this suggests that bites to horses are relatively rare, although the fact that far fewer horses are kept than dogs and cats must be taken into consideration. Less encouragingly, only eight of the 20 horses that received anti-venom, and only one of seven that

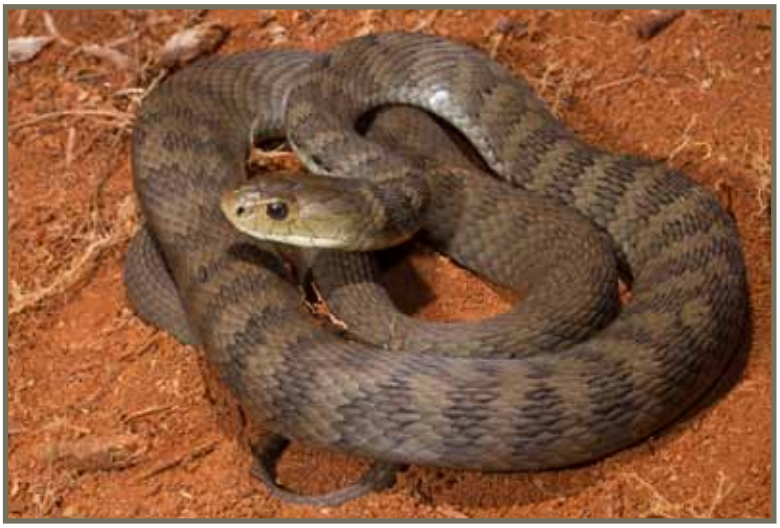


The northern death adder varies considerably in colour and pattern, but its uniquely stout body and triangular head are distinctive. Death adders are unique among Australian venomous snakes in that they are ambush hunters that rely on their camouflage to avoid detection by both their prey and predators. For this reason, unlike other Australian venomous snakes, they will not move off when approached. Death others are extremely sensitive to disturbance of habitat, however, and are unlikely to enter cleared paddocks. The venom attacks the nervous system almost exclusively. Death adder (preferably) or polyvalent anti-venom may be used for treatment. Photo by Stephen Zozaya, Cooktown.

did not receive anti-venom, survived their bites. In contrast the majority of dogs and cats (91% and 75% respectively)

that received anti-venom therapy survived. Although drawing conclusions is questionable when comparing vastly different sample sizes, it's possible that the signs of envenomation were noticed sooner in cats and dogs than in horses and that this influenced the overall survival rate. This possibility emphasises the need for vigilance from owners of horses kept in paddocks that may be visited by snakes.

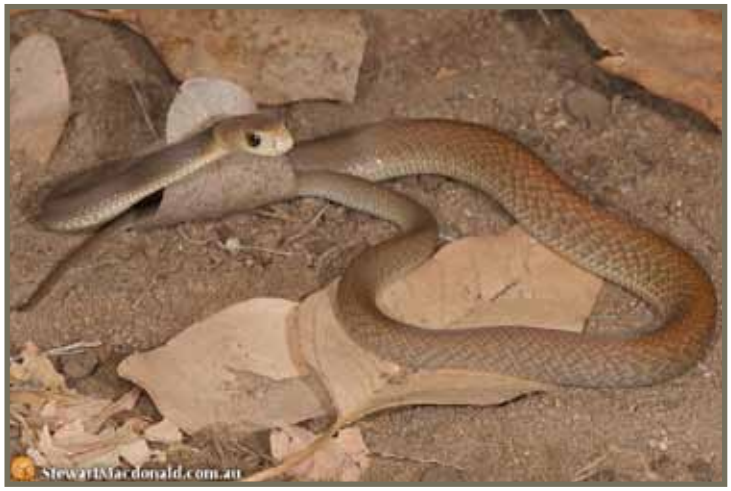
All detailed reports in the clinical literature of snakebite to horses in Australia concern either brown snakes or tiger snakes. Tiger snakes do not occur in North Queensland and brown snakes, while they do occur here, are less common than further south. These reports remain relevant, however, due to similarities in the expected clinical sequelae (signs and symptoms) of bites from locally abundant species. As with paralysis ticks, early detection of a bite accident will significantly improve the chances of a positive outcome. **Signs and symptoms of bites from Australian snakes to horses include restlessness, excessive sweating, muscle tremors and spasms, fixed dilated pupils, drooling, difficulty breathing due to tongue and/or pharyngeal paralysis, and ultimately generalised paralysis starting with the hind limbs.** In cases of severe envenomation by brown snakes or taipans (and possibly rough-scaled snakes and red-bellied black snakes), bleeding from the gums and orifices may also occur. Some or even most of these signs may be present in other situations, such as paralysis tick envenomation or ingestion of poisonous plants (e.g. Phalaris or Trachyandra grasses). Any suspected snake envenomation must be treated as an emergency situation and the horse immediately taken to a veterinarian. Accurate diagnosis of severe envenomation can typically be made using a snake venom detection kit (sVDK), which will determine the appropriate anti-venom to be used for treatment. In the unlikely event that it is able to be located, a swab taken from the bite site is ideal for venom identification. Failing this a urine sample should be used in preference to a blood sample, as venom



The rough-scaled snake is largely confined in North Queensland to rainforest habitat at altitude. It is present in the Paluma Range and certain parts of the Atherton Tableland. Its venom is very similar to that of tiger snakes (which do not occur in North Queensland), to which it is closely related. The venom attacks the nervous system, blood and muscles. Tiger snake (preferably) or polyvalent anti-venom maybe used for treatment. Photo by Stephen Zozaya, Ravenshoe.

remains detectable in the urine long after it leaves the bloodstream. False negatives are rare with the sVDK, although a positive result does not necessarily indicate the need for anti-venom, which should be determined based on the observation of relevant clinical sequelae. It is vital to stress, however, that rapid administration of anti-venom is the only effective way to treat severe envenomation; although vitamin C and other treatments are often recommended, there is no reliable evidence to suggest that they have any positive impact.

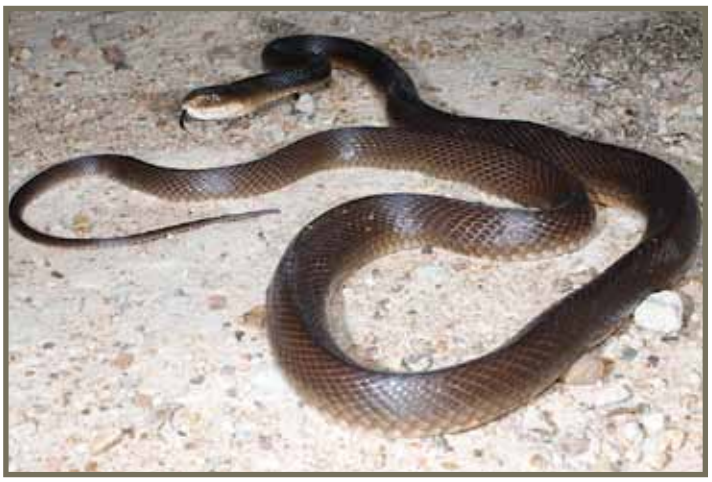
It goes without saying that prevention is far better than cure when it comes to snakebite. The best way to ensure that your horses do not come into contact with snakes is to make their paddocks unattractive to snakes. Snakes are extremely secretive creatures and prefer not to cross wide open spaces as this makes them vulnerable to predation attempts, particularly from birds. If the grass is kept short, therefore, and cover (e.g. piles of wood and debris) removed, snakes will be unlikely to cross paddocks. Bush paddocks of course come with a higher risk. In the dry season snakes may also visit water troughs looking for a drink and for this reason placing water sources on the edge of paddocks surrounded by suitable snake habitat is less sensible than situating them in the middle of open paddocks (required shade for horses and water can be provided by man-made structures if need be). Keeping barns and stables clean and free of rodents is also an important preventative measure – taipans and brown snakes are far more interested in rats and mice than they are in horses.



The coastal taipan is one of the most feared snakes in Australia. In reality, it is a shy species that is sensitive to disturbance of habitat and rarely comes in contact with humans. If threatened, however, it may bite repeatedly. Taipans vary in colour and may retain the light shades of this juvenile into adulthood, or become dark like the pictured adult. Taipan venom is extremely potent and attacks the nervous system, blood and muscular tissue. Rapid administration of Taipan (preferably) or polyvalent anti-venom is critical. Photo by Stewart Macdonald, Townsville.

Venomous snakes of FNQ

Like much of Australia, Queensland's far north is home to a considerable diversity of venomous snakes. Fortunately, the majority of these species are completely innocuous to both horses and humans. The primary species of concern are taipans, brown snakes, death adders, mulga (king brown) snakes and red-bellied black snakes (see picture captions for additional information on each species). In some areas (e.g. the Paluma Range) rough-scaled snakes may also be present. Snakes are typically more active during the wet season and the buildup – the wet is a primary foraging and feeding period for most species, and the buildup is when male snakes are particularly active in the search for mates.



Dark adult taipans such as this specimen are difficult to differentiate, in southern Queensland, from large eastern brown snakes. In northern Queensland, there may be differentiated from all other species by the light colouration around the face, and their exceptionally fast movement. Taipans are most common in forest at the base of mountain ranges in eastern Queensland. In the north, much of the former taipan habitat has been converted into sugar cane plantation, in which taipans may still occasionally be found. Taipan venom is extremely potent and attacks the nervous system, blood and muscular tissue. Rapid administration of Taipan (preferably) or polyvalent anti-venom is critical. Photo by Stewart Macdonald, Townsville.

North Queensland is a beautiful place to live, and what makes it beautiful is the region's stunning biodiversity. Snakes are part of this biodiversity and are an important part of all Australia's terrestrial ecosystems. If we choose to live in beautiful natural surroundings, we must accept and celebrate the proximity of wildlife, including those few species that may be dangerous to us (or our companion animals) in exceptional circumstances. As sensible people, we should not allow our natural love of dramatic anecdote to subvert our rationality when it comes to subjects like snakes. There are many risks for horses and humans in the world and snakes are truly one of the least of these, particularly in Australia where (despite the abundance of venomous snakes) bites are rare and the anti-venom is of exceptionally high quality. If we are unable to accept the slightly increased risk associated with living in such a beautiful region….. there's always Melbourne (the lattes are great!).