

THE AUSTRALIAN BROAD-HEADED SNAKE *HOPLOCEPHALUS BUNGAROIDES* IN THE WILD

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INTRODUCTION

The Australian genus *Hoplocephalus* includes three species of smallish snakes, the Stephen's Banded Snake (*Hoplocephalus stephensi*), Pale-headed Snake (*Hoplocephalus bitorquatus*) and Broad-headed Snake (*Hoplocephalus bungaroides*). All are restricted to eastern New South Wales and Queensland.

All are slender bodied snakes with distinct broad, somewhat flattened heads set off from the neck. Adults average somewhat between 50 and 70 cm (total length), although 100 cm. species are known. All have smooth dorsal scales. The keeled ventrals are an adaptation for climbing. Other diagnostic characters for the genus are: 19-21 mid-body rows, over 190 ventrals, the frontal shield is longer than broad, internasals present, suboculars absent, anal and subcaudals are single, and two to three solid maxillary teeth follow the fang (Cogger, 1992).

These snakes are relatively unusual for mainly nocturnal species in that they have a round pupil. Most nocturnal species have elliptical pupils.

The three species are easily distinguishable and can be separated at a glance or from photos. Pale-headed snakes are greyish in colour without spots or bands on the body. The back of the nape is light in colour. Stephen's Banded Snakes are usually banded (or a variant thereof), except for a distinctive unbanded morph. They can always be separated from Pale-headed Snakes by the generally dark head and blackish colour at the back of the nape. Broad-headed Snakes have a unmistakably black body with numerous scattered white or yellow scales, usually forming irregular cross-bands, which rarely exceed one scale in width. For general details of all three species see Cogger (1992), or Hoser (1989).

THE BROAD-HEADED SNAKE *HOPLOCEPHALUS BUNGAROIDES*

Broad-headed Snakes are effectively restricted to sandstone habitat within a 200 km radius of Sydney city, New South Wales, Australia. The approximate limits to the distribution of the species is the sandstone escarpment west of Nowra to the south, and outlying sandstone escarpment near Lithgow and Mudgee to the west and north-west (see Swan 1990). They are unknown outside of sandstone habitat, except near Bathurst, NSW, where recently specimens were found some distance from sandstone. Here they were found in forest growing on shale adjacent to conglomerate slopes and bluffs. It should be noted that the conglomerate mentioned here is a common formation on the western edge of

the Sydney sandstone formation in the transition zone to a larger granite belt. The rock also exfoliates in a similar manner to the nearby sandstone formations.

Broad-headed snakes are most commonly confused with the (potentially much larger) Diamond Python (*Morelia spilota spilota*) which occur in the same areas. However, the two snakes may be easily separated by the fact that Diamond Pythons have numerous irregular head shields and labial heat-sensing pits - Broad-headed snakes don't. Furthermore Broad-headed snakes are an even greyish-black colour ventrally, whereas Diamond Snakes have unevenly coloured belly markings.

It has been suggested that young Diamond Pythons have evolved in a manner to mimic Broad-headed snakes. Such mimicry by non-venomous species to look and act like venomous species is well known. Certainly young Diamond Pythons are more pugnacious than the adults, a habit more in line with that of similar sized Broad-headed snakes. A more widely accepted scenario however is that similarities in appearance and habits between the two species are due to convergent evolution to cope with similar environmental problems and so on, rather than a non-venomous species mimicking a venomous one.

IN THE WILD

The overwhelming majority of Broad-headed snakes are found during the day, sheltering under large exfoliating slabs of sandstone and rock crevices in areas of undisturbed bushland during autumn, winter and spring (sometime excluding the coldest parts of mid-winter). During summer these snakes are rarely found during the day.

It is very rare (in cooler months) to find these snakes under cover that is not 'rock-on-rock' in this context also includes crevices in cliff faces and so on. These snakes are rarely found under rocks which have a soil substrate.

In Broad-headed snake areas, collectors often go along the tops of cliffs lifting only rock-on-rock exfoliations, and ignoring any others. Thus the maximum number of likely rocks can be lifted over a given period of time, even though this means much greater distances are travelled. Although other species, including Small-eyed snakes (*Cryptophis nigrescens*) and Red-naped snakes (*Furina diadema*) also occur under rock-on-rock formations these species are likely to also be found under rocks with dirt substrate, which are usually found further behind the cliff-tops where these snakes occur. (Readers should note that sandstone ridges in the 'Sydney basin' run along valleys in a linear fashion, so a given ridge may often run continuously for several miles). The Copper-tailed Skink (*Ctenotus taeniolatus*) is a known food item of the Broad-headed snake. It is particularly common under rocks on soil found at the back of and behind the outcrops where Broad-headed snakes occur.

It is thought that these snakes shelter under smallish and/or exposed rocks in winter to enable them better opportunities to 'bask' while remaining under cover during the day. Clear sunny weather is typical of winter months where these snakes occur. To further support this assertion, this species been observed basking in the open in sunny winter weather (Adams, 1973). On 21 May, 1966, (later autumn) he found a male specimen basking at Kanangra Walls, National Park (about 100-150 km. west of Sydney) on a track down a steep mountain side. The weather was very cold and sunny and it had even snowed the night before.

It is also thought that Broad-headed snakes can and do move about under these rocks during the day to actively thermoregulate. This indicates that diurnal activity dominates during winter months, while nocturnal activity is prevented by excessive cold at that time of year. The practice by which the snakes regulate their body temperature during the day, while remaining under cover is sometimes called 'indirect basking'. Usually these snakes are found under rocks with a fairly 'tight fit' to the rock substrate below, indicating highly

restricted micro-habitat requirements for this species. Broad-headed snakes are largely nocturnal in warm weather.

A feature sometimes noted in wild and captive Broad-headed snakes is the potentially low metabolic rate. This is reflected in a sometimes lower than usual food intake, when compared to other snake similar sized species. Marian Anstis had a captive specimen fast for over 12 months - without apparent ill effect - remember this is only a small species of snake, so much a fast is of far greater significance than in a larger snake such as a ten foot python.

Early references such as Anstis (1973), Hosmar (1952), Kingshorn (1969), Ormsby (1947) and White (1973) only tended to give vague information as to what wild Broad-headed snakes eat, using broad categories such as 'frogs', 'lizards' etc. Other *Hoplocephalus* are known to opportunistically feed on frogs, agamid and skink lizards, small mouse-like mammals (including mice), bats and birds when in the wild.

Besides the habitat requirement for exfoliating sandstone in undisturbed habitat, Broad-headed snakes usually only seem to be found in areas with large numbers of Lesueur's Geckos (*Oedura lesueurii*), which according to a number of sources including Wells, Wellington and Williams (1988) are this snake's preferred food in the wild. Areas of apparently suitable habitat without this food lizard rarely appear to have Broad-headed snakes, even though they are known to opportunistically feed on other reptiles. In my own experiences, the best spots for Broad-headed snakes are those areas which have absolutely HUGE numbers of Lesueur's Geckos.



Foto 1: *Hoplocephalus bungaroides*. Blue Mountains, New South Wales.
Foto: Raymond Hoser.

Captive specimens freely take mice and birds. However Shine's dissection of 52 museum specimens only revealed lizards in the diet of (what were presumed to be) wild specimens (inside 4 snakes only - the other 48 had empty guts). Although Shine suggested that this paucity of food items reflected a low metabolic rate in this species, it has since been suggested that the method of sourcing the snakes themselves (how they came to be in the museum) could offer a partial explanation. A disproportionate number of snakes could have been sourced from captivity (after death), which could perhaps explain the empty stomachs.

White (1973), Wells, Wellington and Williams (1988) and others have actually noted that their captive specimens fed mostly in winter and spring. This could well be a reflection of ease in finding food during those months (in wild specimens), setting the biological 'clock' to feeding mode at that time of year or perhaps related to breeding activity.

Shine's study of wild Pale-headed snakes indicated that sexual maturity in that species occurred at 3-4 years of age. It is assumed that a similar situation occurs for wild Broad-headed snakes. Captive specimens however are noted to mature far quicker when food intake and temperatures are raised.

Vitellogenesis (egg formation) commences in late autumn/winter and continues until mid spring (about September/October) with ovulation around October. This would necessitate a higher than usual food intake for females, particularly in view of the fact that they usually cease feeding for at least two months prior to giving birth. Acheson and Shearim noted year-round feeding in their Broad-headed snakes but with no strong seasonal biases. Males tended to go off food when mating.

Wild snakes in this genus appear to reproduce only every second year. Those who have bred Broad-headed snakes in captivity haven't indicated whether or not it is the same or different snakes reproducing each year, (they tend to hold several reproductive specimens). However a single large female held by Charles Acheson did reproduce in successive years. As yet, there is no indication as to how rare such a scenario (yearly reproduction) is in Broad-headed snakes, although such clearly isn't the norm.

Whether reproduction every second year in this species (in the wild) is determined by genetic or environmental factors isn't known. Shine notes that less than annual reproductive frequency is fairly common in cold climate snakes, including species with relatively high survivorship of young. Broad-headed snakes fit this pattern.

Worrel (1970) and others have stated that these snakes shelter in trees during the summer months. However this assertion has recently been (in part) challenged by some herpetologists.

Rick Shine and a student of his, Jonathon Webb, at the University of Sydney, have recently commenced a detailed study into Broad-headed snakes, including radio-telemetry. They hope to further establish where these snakes go during warmer weather. Certainly some specimens range a substantial distance from rocks. Furthermore some are known to have taken shelter in hollow limbs of large Eucalypts (*Eucalyptus* sp.) some distance above the ground. This habit is in line with known habits of the closely related Pale-headed snake. That species is caught by collectors near Rockhampton in Queensland who drive along roads at night shining strong lamps onto adjacent tree trunks.

DECLINE AND DISTRIBUTION OF BROAD-HEADED SNAKES

This species was once common over a wide area that has now been built upon. The Australian Museum in Sydney hold specimens from heavily built up inner Sydney suburbs such as Randwick, which now lack anything resembling natural bushland. Kreff (1869), stated that in 1969 Broad-headed snakes were still common along the rocky coastline from the



Foto 2: *Hoplocephalus stephensi*. Mount Glorious, Queensland.
Foto: Raymond Hoser.



Foto 3: *Hoplocephalus stephensi*. Volwassen exemplaar uit
Mount Glorious, Queensland. Adult from Mount Glorious,
Queensland. Foto: Raymond Hoser.



Foto 4: *Hoplocephalus bitorquatus*. Moonee, Queensland.
Foto: Raymond Hoser.



Foto 5: *Hoplocephalus bitorquatus*. Volwassen exemplaar uit
Moonee, Queensland. Adult from Moonee, Queensland.
Foto: Raymond Hoser.

entrance of Port Jackson to Botany Bay. This includes the suburb of Watson's Bay, Bondi, Bronte, Coogee and Maroubra which are all totally built over. Although multi-story units are built over the sandstone cliffs overlooking the Pacific ocean, it is clear that prior to European settlements the habitat near these cliffs, with their associated 'seas of rock' immediately adjacent, would have closely paralleled that in the hills/cliffs of Yalwal (near Nowra) which is probably one of the best remaining locations for large numbers of Broad-headed snakes. Furthermore similar habitat exists in the Royal National Park (south of Sydney), which still has Broad-headed snakes.

Kreffft also stated that the species occurred along the shores of Middle Harbour, Lane Cove and Parramatta Rivers, all of which have since also been built over. Without offering any direct facts to dispute what Krefft said in 1869, I have my doubts as to how far north (if at all) of Port Jackson/Parramatta River, Broad-headed snakes spread in light of the present day distribution of the species.

Bushland remaining in the above water catchments is all but destroyed for many species of reptile with the exception of the upper reaches of Middle Harbour, much of which remains largely intact. This area directly connects with the Kurringai Chase National Park between St. Ives and Terry Hills along with the Oxford Falls/Deep Creek reserve to the north.

These reserves are huge and bushland within them is virgin. There is no evidence at all of decline in reptiles within these reserves and all existing populations of all species appear to be stable and healthy. Other than Port Jackson/Parramatta River itself, which acts as a significant north/south boundary (having its source in the flat clay-based Cumberland Plain which totally lacks sandstone), there are no other natural barriers to sandstone dependent wildlife. Within Kurringai Chase and other unnamed reserves which also run onto it there are no Broad-headed snakes. However there is no evidence of or no records of herpetological collecting within the Kurringai Chase or adjoining National Parks in any way capable of wiping out just this one species. Furthermore, Hersey (1980) documented minimal impact in this species numbers by collectors in any area.

Broad-headed snakes also do not occur in the vast National Parks immediately to the north of the Hawkesbury River (just beyond Kurringai Chase). This is in spite of almost the entire areas of all these reserves containing excellent Broad-headed snake habitat (including the obligatory Lesueur's Geckos).

I therefore conclude that Broad-headed snakes have not occurred in the near coastal National Parks north of Post Jackson as far as the New South Wales central coast since prior to European settlements. Any previous records from these areas should therefore be treated as either doubtful or possibly based on individual released specimens.

Furthermore I note here that the Royal National Park and adjoining Heathcote State Park to Sydney's South is of similar area and of identical habitat to that of Kurringai Chase. It has been demonstrably more heavily collected by reptile people in the last 30 years, and suffered far more intensive recreational development, but still holds populations of Broad-headed snakes.

A number of people have speculated that *Hoplocephalus* is a relictual genus. Such may be the case and it may be in long term decline as evidenced by the patchy distribution of all three species.

As far back as 1869, Krefft noted that gardeners taking sandstone exfoliations from the bush appeared to be causing a decline in numbers of this species. In spite of this pressure, urbanization, and the possible threat of collection by hobbyists, most remaining populations of this species do not seem to be in decline. They also tend to be within National parks and other government controlled land.

No feral animals are believed to place undue pressure on the species, nor do they appear to be overly vulnerable to bushfires. Parts of the Blue Mountains and Royal National

Parks subjected to repeated and fierce bushfires still have stable populations of Broad-headed snakes.

Based on records of previous collections of specimens by hobbyists from the Royal National Park on Sydney's immediate southern boundary, the Blue Mountains National Park to the west and sites near Nowra, responsible hobbyists clearly don't threaten populations.

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