

# FURTHER RECORDS OF AGGREGATIONS OF VARIOUS SPECIES OF AUSTRALIAN SNAKES.

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## INTRODUCTION:

Aggregation of numbers of snakes are a common occurrence and well documented in most parts of the world, particularly amongst species of the genus *Crotalus* in the America's where aggregations of over one thousand individuals have been recorded. (Klauber, 1972).

Recorded aggregations for Australian species include:

*Typhlina* sp. presumably *nigrescens*, (Blind Snake) Worrell (1970), *Morelia spilotes variegata*, (Carpet Python), Covacevich and Limpus (1973), *Morelia spilotes spilotes*, (Diamond Python), Webber (1978), *Boiga irregularis*, (Brown Tree Snake), Covacevich and Limpus (1973), Gow (1976), *Dendrelaphis punctulatus*, (Green Tree Snake), Kinghorn (1969), McPhee (1979), *Demansia psammophis*, (Yellow-faced Whip Snake) Covacevich and Limpus, (1972), Gow (1976), *Furina diadema*, (Red-naped Snake) McPhee (1979), *Cryptophis nigrescens*, (Small-eyed Snake) Covacevich and Limpus (1973), Gow (1976), *Hemiaspis signata*, (Marsh Snake) McPhee (1979), and *Pseudechis porphyriacus*, (Red-bellied Black Snake), Kinghorn (1969).

Presented here are recorded occurrences of aggregation in *Typhlina* sp. presumably *nigrescens*, (Blind Snake), *Typhlina wiedii*, *Morelia spilotes spilotes*, (Diamond python), *Boiga irregularis*, (Brown Tree Snake), *Demansia psammophis*, (Yellow-faced Whip Snake), *Furina diadema*, (Red-naped Snake), *Cryptophis nigrescens*, (Small-eyed Snake), and *Pseudonaja textilis*, (Eastern Brown Snake). To my knowledge, aggregation in *Typhlina wiedii* and *Pseudonaja textilis*, have never been previously recorded.

In all aggregations the individual snakes found were typical specimens for their species in terms of health, bodily size, colouration and form. In none of the aggregations were the snakes sexed, nor was it determined how recently any of the snakes in the aggregations had fed.

## SUMMARY AND DETAILS OF THE AGGREGATIONS:

### Aggregation One.

Mr. Craig Bennett and Mr. Alexander Houben whilst carrying out herpetological fieldwork towards the end of January 1978, at Belrose N.S.W. (Lat. 33° 45' S, Long. 151° 15' E) located a large aggregation of Blind Snakes, (presumably *Typhlina nigrescens*). The area in which the aggregation was found was a dry sandstone ridge with much scrubby vegetation around it, in an area of bushland. The site of the aggregation was three quarters of the way up a hillside. The hillside was described as being moderately steep, with a westerly aspect.

The aggregation was located under a large sandstone rock, roughly square in shape with approximate dimensions of 45cm × 45cm × 10cm deep. The rock was covered with approximately 6cm of leaf litter, and was well shaded by a 2m high christmas bush (*Prostanthera lasianthos*). The rock was located on the top of a 2m cliff, which had scrub above and below it. The soil under the rock was moist and sandy. The aggregation was discovered at midday (local time) and the weather was described as being calm mild and sunny, with the average air temperature probably around 25°C.

The aggregation when found initially, consisted of one large knotted mass of blind snakes under the rock. When the aggregation was disturbed, the blind snakes attempted to escape. Twenty seven specimens were actually caught. It was estimated that approximately eight specimens escaped, so this aggregation consisted of roughly thirty five individuals. The size of the specimens ranged from juvenile to large adult, with a fairly even size distribution.

#### *Aggregation Two.*

In January 1976, Mr. Gary Webb located an aggregation of seven Blind Snakes (presumably *Typhlina nigrescens*) in bushland near Glenbrook N.S.W. (lat 33° 46' S, long 150° 36' E). The aggregation was located at approximately 5.30 p.m. (local time). The weather conditions at the time were described as hot, windy and sunny with an average air temperature of 30°C. The aggregation was found near a valley floor on the slope of a hill with a westerly aspect. The local habitat was rocky sclerophyll forest. The aggregation was located under a sandstone rock slab, roughly 60cm long × 40cm wide × 10cm deep, which was fairly well embedded on dry, sandy, loamy soil. The rock was not concealed in any manner. There were six juveniles and one adult specimen in a single cluster. Although they tried to escape, all specimens were caught.

#### *Aggregation Three.*

On the 18th May 1980, Mr. Richard Llewellyn located an aggregation of three *Typhlina sp.* (presumably *Typhlina nigrescens*) under a sandstone rock at Belrose N.S.W. (lat 33° 45' S, long 151° 15' E). The aggregation was located at 1.00p.m. (local time) and the weather conditions were calm, cool and sunny with an average air temperature of 18°C. The three specimens were found in a single coiled mass under a sandstone rock, approximately 60cm × 50cm × 15cm deep. The rock was not particularly well shaded, nor was it very well embedded or concealed in any manner. The soil underneath the rock was dry, sandy soil, and the rock was located adjacent to a medium sized rock outcrop, which was sited downhill. All three specimens attempted to escape when disturbed, but none eluded capture.

#### *Aggregation four.*

In November 1978, Mr. Ken Shepperd and Mr. Bill Miles located an aggregation of *Typhlina sp.* (presumably *nigrescens*) at St. Clair N.S.W. (lat 33° 48' S long 150° 48' E). The local habitat was dry, open woodland. The weather conditions at the time were described as relatively hot and sunny, with the air temperature somewhere in the vicinity of 30°C. The aggregation was located around midday (local time).

The specimens were located under a log, which was not hollow, approximately .3m thick, and roughly 2m long. The log was described as relatively heavy and firmly placed on the ground in a horizontal position. The soil underneath the log was dry and loamy in composition. The three sub—adult specimens were in a single coiled mass and attempted to escape immediately when disturbed.

#### *Aggregation Five.*

On the 30th August 1978, Mr. John Scanlen and the author were undertaking herpetological fieldwork 5kms south of Bell in Queensland (lat 27° 5' S, long 151° 26' E) when an aggregation of seven *Typhlina wiedii* was located. The local habitat was relatively flat, open woodland with scattered rock outcrops along a watercourse that traversed the area. The watercourse consisted of a dried up creek bed with some scattered water filled ponds only.

The aggregation was located at 3.00p.m. (local time) and the weather conditions were cool, windy and cloudy, with an average air temperature of below 17°C. There had been light to moderate rainfall in the area on the previous day.

The aggregation was found under a well embedded basalt rock, situated in a dried up section of a creek bed. The rock, not concealed in any manner, was approximately 30cm. × 30cm × 30cm deep. The soil underneath the rock was moist, dense and dark in texture, being a dry silt like soil type. The seven juvenile specimens when initially disturbed were in a single tightly knotted bundle and although they tried to escape when disturbed, none were successful.

#### *Aggregation Six.*

In mid November 1974, Mr. Tony Butz, an honorary ranger, located an aggregation of five Diamond Pythons (*Morelia spilotes spilotes*) in bushland adjacent

to the Hawkesbury River N.S.W. (lat 33° 30' S, long 151° 10' E). The aggregation, situated in a rocky sclerophyll forest was discovered when fighting a low intensity downhill moving bushfire. The aggregation was located during the afternoon (local time), and the weather conditions were hot, sunny and windy. The five snakes were moving downhill, away from the encroaching bushfire when they were located by Tony Butz and other fire fighters. It is assumed that all five snakes emerged from a large 5m long hollow but only partially enclosed log, as they were all captured adjacent to this log. The snakes were not actually seen emerging although it is thought that excessive smoke, fire or both inside the log may have forced the snakes to flee. The log, a fallen gum tree averaged 75m in diameter. Four snakes were adult, each averaging 2m in total length. The fifth snake was approximately 1m in total length.

#### *Aggregation Seven.*

During the mid—winter 1977, whilst undertaking herpetological field work, Mr. Robert Croft, and the author located an aggregation of five Brown Tree Snakes (*Boiga irregularis*) at St. Ives, N.S.W. (lat 33° 43' S, long 151° 16' E). The aggregation was discovered at 11.00am. (local time). The weather conditions at the time were cool, calm and sunny, with an average air temperature of 17°C.

The five snakes, in a single cluster were located in a "honeycomb formation" in a cave which had numerous other "honeycomb formations" and crevices. The cave was approximately 1m high × 2m wide × 2m deep. It was part of a long intermittent sandstone rock ridge encircling the top of a hillside in a wet rocky sclerophyll forest. The location where the snakes were discovered had a north—westerly aspect.

The five snakes consisted of two adults, measuring approximately 150cm in total body length, two sub-adults approximately 90cm long and one juvenile roughly 30cm in length. The five snakes were resting when discovered and made no attempt to escape until actually removed from their resting site.

No other snakes were found in the vicinity of this aggregation, although numerous apparently suitable "honeycomb formations" and crevices were present in the cave and the rock outcrop.

#### *Aggregation Eight*

During November 1979 Mr. David Cary located an aggregation of four Brown Tree Snakes (*Boiga irregularis*) near Wyong, N.S.W. (lat 33° 15' S, long 151° 15' E). The snakes were caught at 10.30 am. and the weather conditions at the time were described as calm, mild and sunny with the air temperature in the vicinity of 24°C. The aggregation was in a sandstone rock outcrop near the top of a hill, with a south easterly aspect. The local habitat was wet, rocky, sclerophyll forest. The four snakes were located in a rock crevice, 6cms high × 3m wide × 2m deep. The four snakes when initially located were resting in a single group. The crevice which held these four snakes was the largest and perhaps the most favourable for snakes on the entire rock outcrop. The snakes only attempted to escape, or move away when poked with a stick. Two of the snakes were adult, one was a sub—adult, and the fourth specimen was a juvenile.

#### *Aggregation Nine.*

During July 1977, Mr. Alex Dudley and the author, located an aggregation of five juvenile Yellow—faced Whip Snakes, (*Demansia psammophis*) at Terrey Hills N.S.W. (lat 33° 43' S, long 151° 17' E).

The aggregation was in an area of moist rocky sclerophyll forest 200m from a main road. The site was on a hillside with a south—easterly aspect. The aggregation was located at 4.30 pm. (local time ) and the weather conditions were calm, cool and cloudy, with an air temperature of approximately 15°C.

The five snakes were found in a single cluster under a small sandstone rock on a secluded rock outcrop. The rock which was well embedded in loose, moist, dark

though sandy soil, measured about 30cm. × 20cm × 10cm deep. The rock was well covered by leaf mould, mosses and lichens and although it was situated on a rock outcrop it was relatively well concealed.

The five snakes when initially disturbed made no attempt to escape. No other snakes were found in the vicinity of this aggregation.

#### *Aggregation Ten.*

Mr. Alex Dudley, whilst conducting herpetological fieldwork in mid winter 1978, located an aggregation of five juvenile Yellow-faced Whip Snakes (*Demansia psammophis*) at Kenthurst N.S.W. (lat 33° 38' S, long 150° 57' E). The area was dry, rocky, hilly sclerophyll forest and the aggregation was located near the top of a hill with a north-westerly aspect. The snakes were discovered in the early afternoon (local time), with the weather conditions being described as cloudy and cool but not raining.

The five snakes were situated under a sandstone rock in a single cluster, the rock measuring about 60cm × 30cm × 10cm deep. The rock was not very well embedded, and the soil underneath it was dry and sandy. The rock was not concealed in any manner and was sited on top of a well exposed rock ridge. The snakes were in a cool inactive state when discovered.

#### *Aggregation Eleven.*

During mid winter 1975, Mr. Garry Webb, located an aggregation of two adult Yellow-faced Whip Snakes (*Demansia psammophis*) and one adult Red-naped Snake (*Furina diadema*) at Glenbrook N.S.W. (lat 33° 46' S, long 150° 36' E).

The aggregation was located on top of a hill in dry, rocky sclerophyll forest. The three snakes were discovered at roughly 10.00am. (local time) and the weather conditions were described as being simply cool, dry and mild.

The aggregation was located under a single well embedded sandstone rock measuring approximately 60cm × 90cm × 15cm deep. The soil underneath the rock was dry, sandy and loamy. The rock was not on, or immediately adjacent to any outcrop, simply being sited in an open section of ground in bushland. The three snakes when discovered were coiled up in a group, in a state of apparent torpidity.

#### *Aggregation Twelve.*

During early May 1977, the author located an aggregation of twenty nine Small-eyed Snakes (*Cryptophis nigrescens*) at Darkes Forest N.S.W. (lat 34° 11' S, long 150° 56' E). The aggregation was discovered at 10.00am, and the weather at the time was cool, calm and sunny, with an average air temperature of around 14°C.

The local habitat was a mixture of sclerophyll forest and farmland and the aggregation was located adjacent to the remains of a demolished house. The remains of the house consisted of a few large slabs of concrete, blocks of wood, sheets of corrugated iron etc., in a partially cleared patch of land. The aggregation was located in a pile of approximately twenty sheets of corrugated iron. The snakes were not all located together, but in clusters ranging from one to four individuals sometimes with more than one cluster between two sheets of corrugated iron. The sheets were positioned directly on top of one another in a tight fitting manner, with only limited amounts of debris between each sheet of tin. The pile of corrugated iron was sitting on moist rich dark soil, typical of the local area. No snakes were located under the bottom sheet of the iron. The regions between each sheet of iron were generally slightly moist, and contained no other snakes besides the twenty nine Small-eyed Snakes. The snakes ranged from juvenile to large adult, with the majority of the snakes being adult. The snakes appeared to be inactive and in a state of hibernation when found.

#### *Aggregation Thirteen*

During early winter 1979, Mr. David Cary located an aggregation of eight adult

Small-eyed Snakes (*Cryptophis nigrescens*) at Kangaroo Valley N.S.W. (lat 34° 43' S, long 150° 33' E). The aggregation was located at midday and the weather at the time was cold and raining lightly, with an average air temperature of around 15°C.

The aggregation was located half way up a moist, rocky sclerophyll forest hillside with an easterly aspect. The snakes were located underneath a very large well concealed sandstone rock, covered with roughly 9cms of leaf litter. The rock was well shaded by shrubbery and had the approximate dimensions of 120cm × 120cm × 25cm deep. The rock was on fairly dry, loose, sandy soil. Adjacent to the rock was a cliff face roughly 3m high, with the rock being situated on top of the cliff. The eight adult snakes were in a single cluster, and in a state of torpidity when found.

#### *Aggregation Fourteen*

In late Autumn 1972, Mr. Garry Webb located a large aggregation of Eastern Brown Snakes (*Pseudonaja textilis*) between Rooty Hill and Mount Druitt N.S.W. (lat 33° 43' S, long 150° 45' E). The snakes were located in the late morning (local time) and the weather conditions were described as relatively sunny and mild for that time of year. The habitat in the area consisted of a mixture of open woodland and farmland with flat topography.

The aggregation was located in and around a demolished house, of which the only remnants were large slabs of concrete where the house had initially stood. Little vegetation other than grasses and the occasional tree was in the vicinity of this aggregation. The main part of the aggregation consisted of thirteen Brown Snakes in a single group, coiled up next to one another, underneath a large concrete slab measuring roughly 5m × 3m × .2m deep. With these thirteen snakes, one adult Eastern Blue-tongued Skink (*Tiliqua scincoides*) was found. The slab was moved from its original site in a piecemeal manner. This concrete slab was the largest single piece of cover in the vicinity. Other pieces of ground cover, including smaller concrete slabs, within a radius of 20m, yielded a further seventeen Brown Snakes (*Pseudonaja textilis*) in groups of one to four. All thirty snakes were adult except for two juveniles and were resting when found. Mr. Garry Webb, who has carried out much herpetological fieldwork in the region of Rooty Hill and Mount Druitt N.S.W. over the years has found several smaller aggregations of Brown Snakes (*Pseudonaja textilis*) and Red-bellied Black Snakes (*Pseudechis porphyriacus*) numbering up to 6 individuals under a single piece of cover. These particular aggregations have always been found in the colder months of the year, particularly in early spring.

#### *Aggregation Fifteen.*

During late October 1976, Mr. Gary Stephenson located an aggregation of ten Brown Snakes (*Pseudonaja textilis*) near Windsor N.S.W. (lat. 33°35' S, Long 150° 50' E). The local habitat was fairly flat in topography. The aggregation was found in mid afternoon (local time) and the weather conditions at the time were described as being cloudy and mild for that time of year, with an air temperature in the vicinity of 24°C. The snakes were located coiled up, in more than one cluster underneath a very large sheet of tin of unknown size. The sheet of tin was slightly embedded into the ground. The aggregation consisted of ten specimens, six juveniles and four adult. Gary Stephenson reports having found numerous smaller spring time aggregations of Eastern Brown Snakes (*Pseudonaja textilis*) in the same area, but the case above is the largest single aggregation found by Gary to date.

#### **DISCUSSION AND CONCLUSIONS.**

##### *Reasons for Aggregation.*

The reasons for aggregation in snakes are manifold and would almost certainly differ from case to case. With the possible exception of aggregations two, five, nine

and ten, it is unlikely that any of the aggregations resulted from new born snakes failing to move away from their birth or hatching site. It is also unlikely that any of the fifteen documented aggregations arose from high uniform density occupations of one area. *Amphiesma mairii* (Freshwater Snake) has been found to be extremely abundant in moist habitats in South East Queensland (Lyon 1973), (Limpus 1973). *Pseudechis porphyriacus* (Red-bellied Black Snake) has been observed as being extremely common along tracks in closed forests at Danbulla Queensland and Barrington Tops N.S.W. (Limpus 1973). I have found that *Notechis scutatus* (Tiger Snake) and *Austrelaps superba* (Copperhead) are extremely common in certain swampy parts of Southern N.S.W.. Worrell (1970), reports that both *Notechis scutatus* and *Austrelaps superba* can attain very high population densities.

In some of the aggregations documented here it appears that hibernation is not the sole or primary reason for aggregation. These are aggregations one, two, four, six, eight and fifteen, all of which were found during the warmer months of the year. Evidence of aggregation for hibernation purposes is seen in most of the fifteen cases, and it is particularly obvious in the cases where the snakes were found in torpid states. Klauber (1972) postulates that aggregations for hibernation purposes are most prevalent and obvious in cooler regions. This is supported by the significant proportion of the fifteen aggregations which were found in colder regions.

Aggregations appear to serve more than one purpose. Mehrtens (1959) provides evidence of much mating activity in an aggregation of Western Diamondback Rattlers (*Crotalus atrox*) which was primarily a hibernation aggregation. The aggregations in the warmer months, or ones centered around spring in many cases probably serve a reproduction function.

Other reasons for aggregation in these documented cases are harder to ascertain. They may include moisture conservation reasons, energy conservation and predator protection (Klauber 1972). These last three reasons for aggregation would lessen the need for the aggregating snakes to be of one species. In only one case documented here, did the aggregation consist of more than one species, namely aggregation eleven. However, numerous other cases of multiple species aggregation have been reported in the past, including Covacovich and Limpus (1973), Klauber (1972).

The reasons for the juvenile and immature snakes aggregating during the warmer months (periods associated with activity) are hard to ascertain. One reason could be that the chances of survival of the individual is larger when it is one of a large group, than when it is on its own. This hypothesis, like most others which endeavour to explain why snakes aggregate is very difficult to test.

#### *Advantages and Disadvantages of Aggregation.*

The advantages include protection and conservation of limited resources. The main disadvantage of aggregation is that a calamity may kill many snakes in the aggregation or the entire aggregation might die. Klauber (1972) reports on entire groups or "dens" of rattlesnakes (Genus *Crotalus*), dying due to abnormal or unusual circumstances, such as climatic conditions, or predation by other species including man. Community egg laying species of snakes such as *Demansia pasammophis* (Covacevich and Limpus 1972, McPhee 1979, Scanlen, personal communication) often lay eggs communally for similar reasons to those of aggregating snakes i.e. to gain various advantages. The failure of communally laid eggs to hatch, or the death of all snakes in a single large aggregation could have a catastrophic effect on a local snake population.

#### *Aggregation Stimuli and Patterns.*

Where aggregation in reptiles has been studied in detail, it has been found that snakes aggregate in response to various stimuli, particularly temperature related stimuli (Klauber 1972). Excluding the cases of aggregation documented for *Typhlops* species, it appears that aggregations in the other snake species follow fairly well

defined seasonal patterns. For example *Pseudonaja textilis* appears to aggregate during the mating season, namely spring. It is possible that the seasonal temperature changes might be the dominant stimulus involved in making many Australian snake species aggregate. Other stimuli may include photo—period length, and other environmental stimuli such as flood or drought.

In North America, it is well known that in many cases, snakes aggregate at the same points year after year, (Klauber 1972, Mehrtens 1959, Wagner 1969). So far there is little if any evidence of this occurring in Australia, although this could be due to the lack of observation and research in this field. In North America it has been found that most winter snake aggregations are sited in places with sunny aspects. In hilly areas this often means being on hillsides facing the equator, (Klauber 1972). From the documented cases in Australia, this trend also appears valid in this country.

Many of the fifteen aggregations tended to be well concealed, a trend also found in other countries (Klauber 1972, Wagner 1969). How a snake seeing at ground level only can determine if a rock or crevice is well concealed relative to other organisms such as man is one area presently lacking in research.

#### *Evidence and records of Aggregation in Snakes in Australia.*

As stated by Webber (1978), the recorded occurrence of aggregation in snakes in Australia is only documented for a few species and by remarkably few actual cases. From my own inquiries amongst people who have been involved in herpetology, mainly in the Sydney region, it appears that aggregation in Australian snakes is far more frequent than is widely believed. I believe that most aggregations of snakes found in Australia are not recorded due to the belief that they are not particularly important or significant in herpetological studies. Most records of aggregation in Australian snakes are found in popular published literature, and are generally the author's own personal records. Surely these people are not the only people in Australia who find aggregations of snakes! With the upsurge of herpetological activities in Australia recently, more aggregations of various species of snakes will probably come to light in the near future.

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