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# How fast can they crawl? Distribution of snakes in Melbourne, Victoria, Australia.

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## ABSTRACT

In spite of Melbourne and environs being Australia's second largest city (population in excess of 4 million people, (CSIRO 2008), inhabited for about 200 years and heavily collected for reptiles, most published information about Melbourne's snakes in terms of what are the locally occurring species is factually incorrect. The basis of this is a regular misidentification of common taxa by persons professing knowledge of them, combined with publication of the same by authors based on this misinformation.

For the first time ever, this paper reports that within a 35 km radius of the Melbourne CBD, there are just six naturally occurring snakes, namely, Tiger (*Notechis scutatus*), Copperhead (*Austrelaps superbus*), Brown (*Pseudonaja textilis*), (the larger taxa) and White-lipped (*Drysdalia coronoides*), Small-eyed (*Cryptophis nigrescens*) and Little-whip (*Unechis flagellum*), (the smaller taxa).

The Red-bellied Black Snake, (*Pseudechis porphyriacus*), often referred to simply as "Black Snake" (including in this paper) is not native to Melbourne and the Eastern Brown Snake does not occur anywhere in Melbourne's south-east, Mornington Peninsula, or adjacent areas, being found generally in a line running due north of the CBD, with some migration south of this line to the city's west.

There is also no real division between Highland and Lowlands Copperheads in the wild state in terms of known distribution in eastern Victoria. Specimens attributable to either taxa are apparently sympatric and freely breed, including producing offspring of either colour variant in the same litter (Hoser 2009). Ranges are ill-defined and clearly continuous and hence *Austrelaps ramsayi* must be regarded as synonymous with *A. superbus* in eastern Victoria unless and until molecular or other evidence to the contrary emerges.

**Keywords:** Melbourne; Victoria; Snakes; Distribution; *Pseudechis porphyriacus*; wrong information.

### INTRODUCTION

I arrived in Melbourne to live at end 1985. My interest in reptiles predated this by about 17 years and had included field trips collecting reptiles to all parts of mainland Australia, including Victoria. I had by that time published papers, virtually completed writing two books and was well experienced in terms of identifying common reptile taxa including all snakes known to be native to Victoria (see list in Coventry and Robertson 1991).

The book, Coventry and Robertson (1991) was acquired by myself at the time of publication and based on anecdotal reports from herpetologists and others, this book in my view was the definitive publication on snakes in Victoria and Melbourne.

In 2001, after a series of fatal and near fatal snakebites involving members of the public, the State Wildlife Authority (known in 2008 as the "Department of Sustainability and Environment" or "DSE") called for applications by interested persons with verifiable expertise to get "snake controller's permits" for Melbourne and Victoria. These permits are for persons to catch and relocate snakes that by their presence have caused fear for persons or fear for their pets.

As I had been the first person issued such a permit anywhere in Australia, when in NSW in 1978, I took advantage of the need for such permits to be issued in light of a recently imposed government ban on public interactions of any forms with wildlife (including snakes), made a formal request for a "controller's permit" and was duly granted such a permit.

This was done at the time (1978) by the NSW National Parks and Wildlife Service having to "invent" such a permit".

For a considerable period post-dating 2001, I was the only licenced snake catcher listed in the Melbourne White pages (the main city phone directory) and due to active touting for business, soon found myself removing snakes from all Melbourne suburbs and areas nearby.

The city has a population in excess of 4 million people according to CSIRO (2008).

Within a short period, I was soon aware of what snakes occurred where and which didn't.

Unlike Sydney, with a huge assemblage of snake species, Melbourne has relatively few, with many suburbs having just one species and most suburbs having only a small number present or dominant.

Hence it soon became possible to safely guess the snake species likely to be caught based solely on location.

It also became apparent that misidentification of snakes by callers, including those who claimed a knowledge of snakes was rife.

In fact, the kinds of misidentifications I got defied the imagination.

How for example could a person confuse a well-banded Tiger Snake with a Red-bellied Black Snake is beyond me, but such misidentifications were common.

It also soon became apparent, that in spite of their abundance throughout many parts of Melbourne, few people had any idea what Copperheads (*Austrelaps superbus*) were, what they looked like and hence when they were seen by the people (including so-called herpetologists), they were invariably misidentified as Blacks, Browns or even Tiger Snakes.

As a government licensed snake catcher, it soon became clear to me what snakes were found where.

Doing live reptile shows from 2004 with the company Snakebusters, I did for two years make major inroads into educating the public about what snakes did in fact occur in Melbourne, safety and other matters.

As a result of media publicity and the judicious use of venomoid snakes at all our live reptile shows, I managed to make Melbourne fatality free in terms of snakebite for the entire period from 2004 to present, a fact I take full credit for

Yet in spite of this knowledge and my best efforts at educating the public, both directly and through my company "Snakebusters", I found from about 2006, myself waging an often losing battle against others who either unwittingly promoted false information, or in some cases knowingly promoted false information so as to be able to (wrongly) claim I had got it wrong (McCarthy 2009).

So as of year 2013, I find that there is in fact a greater ignorance by Melbournians about Melbourne's snakes now and what are in fact the locally occurring species, than there was just ten years earlier!

In the case of this problem a major part comes from, the Victorian Department of Sustainability and Environment (DSE) who in 2005 dropped all expertise requirements in terms of the issuing of reptile licences and displaying permits.

An immediate beneficiary of this largesse was Mr. Sean McCarthy a police protected criminal and relatively newly licenced snake handler who has since 2005 made a career out of spreading hate, lies and dangerous misinformation in order to damage the reputations of other recognized herpetologists to further his own commercial interests.

While it could be argued that his repeated deliberate misinformation on Red Bellied Black Snakes and their alleged abundance throughout Melbourne's suburbs, which is a complete lie (e.g. McCarthy 2009) is not particularly dangerous, other actions of his have been directly responsible for some serious snakebite incidents that should have been avoided (WinTV 2011).

Examples of McCarthy's dangerous misinformation and some serious incidents arising from it, would be so extensive as to be able to fill dozens of issues of *Australasian Journal of Herpetology*, but include for example a widely posted recommendation to inject victims of bites from innocuous white-lipped snakes with Polyvalent antivenom (McCarthy 2011)!

The use of polyvalent anti-venom injected into people is of course a considerably more dangerous action than an effectively harmless bite from a white-lipped snake!

In 2012, McCarthy sought to expand his "snake handling course" enterprise to Tasmania, this being his business where he "educates" people to handle snakes his way, which means with brutal metal tongs that more often than not leave the handled snakes with broken bones and fatally injured and if able, wanting to kill the person that attacked them.

Rather than acting ethically to expand his business, he launched into a scathing attack of Tasmanian handlers Ian Norton and Bruce Munday by posting on a hate forum a Photoshopped image purporting to be of a child free-handling a (dangerously venomous) Tiger Snake at a reptile display, in order to whip up a hysterical hate campaign against them (McCarthy 2012).

McCarthy then used his common tactic of making a false complaint to the wildlife authorities seeking that his competitor get raided and closed down, so that he could then himself move in and take the business (McCarthy 2012).

This he did as well in terms of myself in 2006 (Harrison and McCarthy *et al.* 2011), the ultimate result being numerous illegal raids on myself, my family and my children, including both my young daughters being arrested at gunpoint in their school classrooms on 10 August 2011 and then frogmarched out of the class room for interrogation as well as losses of many hundreds of thousands of dollars fighting frivolous criminal charges laid by his friends employed within the DSE.

Besides the lack of ethics in McCarthy's approach, because of his routine of teaching people cruel and dangerous methods of handling snakes, the snakebite incidence increases along with all the other problems this in turn brings.

The end point, McCarthy's wrong information has led to many people being taught wrong information and getting bitten unnecessarily and people such as myself have had to waste time re-educating people fed a diet of lies, wrong information and dangerous handling methods (Hoser, 2007b).

It is no coincidence that the Australian State where McCarthy has done most of his so-called training courses since 2006, Queensland, is also the State that has seen the largest rise in number of snakebites and snakebite deaths in Australia, many of them involving handlers using metal tongs to handle snakes!

For the record, in the period post-dating Australia's development of antivenoms to treat all the better-known dangerously venomous snakes in the early 1970's, the death from snakebite incidence in Australia dropped to an average of 1.5 per year. Since McCarthy's entry to the "education" (more accurately termed misinformation) business, the bite rate has climbed to an average of about 6 a year, with no less than seven deaths from snakebite so far in 2013 and the this is as of June 2013, with half a year yet to go!

In 2008, when doing a literature search relating to another paper on Melbourne's Copperhead snakes when writing Hoser (2009), I perused my copy of Coventry and Robertson (1991) and was gobsmacked when I saw that information relating to distribution of the large Victorian elapids was so obviously and comprehensively wrong.

Bearing in mind that the book has until now been the major reference source on the subject for many Victorians, it has become clear that I should publish a paper correcting this misinformation.

This is of course the central tenet of this paper ... correcting common and widely disseminated misinformation about the distributions of dangerously venomous snakes and others in Melbourne and nearby areas in Victoria.

The larger taxa (Tiger, Copperhead, Brown and Red-bellied Black) are the central focus of this paper. The three smaller taxa have had their distributions relatively accurately mapped in the past and hence are not of major importance here.

This is particularly as the trio are generally not regarded as medically significant, although I note that in 2007 a DSE licenced snake handler Ron Siggins died after being bitten by a Little-whip Snake and his licence had only been issued after DSE dropped their standards in terms of such licences as already noted above.

I note also that has been one or more recorded deaths attributed to being from a recently described but long recognized Queensland species of Small-eyed Snake (*Cryptophis edwardsi*) a significantly larger species to the one found in and around

Melbourne and other parts of Victoria (Hoser 2012).

Other taxa found in Victoria, but not near Melbourne, are ignored for the purposes of this paper.

**MATERIALS AND METHODS**

The evidence for snakes distributions in this paper is dominantly my own direct collections of reptiles as a licenced snake controller (listed below), when in the field collecting insects (to feed frogs used for our demonstrations) and photographing reptiles and incidental "catches" in the form of road kills and the like.

Excluding the snakes listed in the "controller's list", the unlisted number is similar, but notable in that it is weighted very heavily in favour of the three smaller taxa typically found sheltering under cover in areas not inhabited by people, with the obvious exception of road kills which were of the larger taxa.

In summary this includes collecting in all parts of the Melbourne region and environs.

Museum records have been deliberately avoided as specimens may have been catalogued and wrongly identified. This could only be ascertained via an inspection of each and every specimen, which would logistically be difficult and even if done of dubious worth, because of the next reason.

Snakes, in particular Red-bellied Black Snakes (see later this paper), have a habit of being carried by people vast distances and then escaping into "the wild", be it housing estates, bushland or whatever.

This is because of the common habit of climbing into parked cars (usually the engine area) and then being unwittingly transported to other areas, where they may or may not be detected.

The same occurs in Tiger Snakes to a lesser extent, and even less in Copperheads and even rarely is seen in Eastern Brown Snakes.

Because of this fact, it is assumed in advance that there would be museum specimens (hence records) of specimens of various taxa outside their natural ranges, including all general regions of Melbourne (such as south-east, south-west, etc).

This would be particularly the case for Black Snakes, and probably other taxa, including Carpet Pythons (*Morelia* spp.) which do not naturally occur anywhere near Melbourne, but routinely turn up as escaped "pets".

As it happens in the period post 2010, "Brisbane Carpet Snakes" (*Morelia macdowelli*) are a much more commonly caught snake in Melbourne than Red-bellied Black Snakes and I point out here that no one for a moment is suggesting they are native to here!

As a snake controller, I have caught numerous reptiles "exotic" to Melbourne in suburban areas or nearby bushland, including specimens that appear to healthy and possibly breeding in the Melbourne area.

Taxa included here are Green Tree Snake (*Charlespiersonserpens punctulatus*) and various pythons. Other snake controllers have caught taxa as diverse as Taipans (*Oxyuranus scutellatus*), North American Corn Snakes (*Elaphe guttata*) and Central American Boa Constrictors (*Boa constrictor*).

These taxa are mentioned here as they are clearly not locally occurring and to show that mere capture of a given taxon in Melbourne does not mean it naturally occurs here.

Numbers of snakes quoted in the following section actually understate the total as many specimens were not included.

Included in the omitted snakes were most of those which had been killed prior to my arrival at the address. In some cases these had been dead for some days.

A large number of specimens of smaller taxa (White-lipped, Little Whip and Small-eyed Snakes) were among these snakes, having been killed in mistake for young of larger taxa, which was why I was called to the addresses. The basis of the enquiries to me were usually to ostensibly look for the "mother and father".

This is mentioned as my controller's book records gives little evidence of the three smaller taxa, even though I have managed to sight numerous specimens, (dead and live) and been able to accurately gauge their actual distributions.

Included snakes are all those listed in my "snake controller's record of capture book".

With the exception of about a dozen Tiger Snakes passed to a university student (Heath Butler) for research under a DSE issued permit, and non-local species (including Red-bellied Black Snakes), all were released into areas the species were known to occur as per the permit conditions.

The other reptiles were handed to the DSE where they were either repatriated to where they had come from, owners of escaped pets, passed to zoos or similar or euthanazed and lodged with the Museum Victoria.

I should also mention that a large number of "exotics" and/or "vagrants" passed to the DSE were illegally passed on to other licenced keepers with improper relationships with corrupt DSE officers.

On one occasion I caught what was clearly a Highlands Copperhead (known generally as *Austrelaps ramsayi*) from Parkwood Secondary College in Ringwood North.

As per the rules I handed the snake in to Tom Thuys of DSE. A few days later, Michael Alexander of business "Black Snake Productions" posted a picture on his Facebook page of his illegally and newly obtained snake, being the same animal, complete with tick left on the neck (Alexander, 2012).

The species "*Austrelaps ramsayi*" is known in Victoria as an "unscheduled species" and hence not allowed to be kept by privately licenced reptile keepers including myself and/or Michael Alexander.

I note this to point out that in Victoria the laws and the rules are an optional extra for certain "protected" individuals and the whole system as operated and enforced by the Victorian DSE is a complete and utter farce that not only wastes the time of law-abiding persons such as myself, but is also putting lives at risk by the various actions of DSE staff.

Sick, severely injured or dead reptiles caught by myself under the controllers permit, were lodged with the Museum of Victoria if they were of reasonable preservation to be useful to biologists.

In the period Jan 2001 to end June 2008 in Melbourne and environs I caught the following reptiles on "snake call outs" as recorded in my record book.

Tiger Snake 145

Copperhead 82

Eastern Brown Snake 38

Little-whip Snake 3

Small-eyed Snake 2

White-lipped Snake 0

Carpet Python (*Morelia* spp.) 7

Green Tree Snake (*Charlespiersonserpens punctulatus*) 1

Red-bellied Black Snake 4

Eastern Bluetongue (*Tiliqua scincoides*) 54

Blotched Bluetongue (*Tiliqua nigrolutea*) 12

"Cunningham's Skink" (*Egernia* sp.) 1

Brush-tailed Possum (*Trichosaurus vulpecula*) 1

Based on my own observations, it is clear that the first six snake taxa are local to Melbourne and that the last three are not. The other non-snake animals reported were also native to Melbourne.

I would have added later year records to this paper (first draft written in 2008), but had my DSE record books unlawfully removed from my house, along with a lot of other records, during an illegal armed raid on 17 August 2011, at which time myself, my wife and children were arrested in our own home at gunpoint for a total of nine hours in an eleven person raid.

At the conclusion of the raid, the house, office and reptile keeping facility and even our cars had been smashed and trashed.

During the violent armed raid, three snakes were killed and many others permanently injured.

Of these, some had to be euthanized in order to stop their suffering and others remained permenantly injured for the rest of their lives.

Also taken were masses of files, back issues of Australasian Journal of Herpetology issues 1-8, computer equipment and pretty much everything else of use and value.

A lot was later returned in a generally damaged and unusable condition in breach of a court order on 22 August that year.

My controllers licence was cancelled on the same date as the illegal raid of 17 August 2011 by Glenn Sharp and Emily Gibson of the DSE and four days later I refused a call to remove a Copperhead from Somerton, a northern Melbourne suburb.

The man who had found the snake on his property and phoned me was unable to get any other snake catchers to his residence and begged me to go to his residence.

However not only was I was not legally allowed to go and catch the snake, but furthermore, police and DSE officers were maintaining a 24/7 vigil outside my home to make sure I did not leave to either catch snakes or do wildlife shows as that permit had been cancelled as well.

As would be expected in Australia and in the absence of any licenced snake catcher being willing or able to attend the house on a Saturday, the man decided to kill the snake in order to "protect" his family. In the process, he was bitten, taken to hospital and in a coma for some days.

As a result of this incident, that almost resulted in the death of a Melbourne resident, a direct result of the illegal actions of Sharp and Gibson on 17 August 2011, a government tribunal (VCAT) via Judge Morrish, restored my snake catching and education permits the following Tuesday.

As to why the armed raid by Gibson and Sharp on 17 August 2011 was illegal, it was because they lied in a series of statements they made to Magistrate Marc Anthony Sargent at Ringwood Magistrates Court in order to get the search warrant in the first instance.

**BLACK AND BROWN SNAKES**

Coventry and Robertson (1991) state that both Black and Brown snakes are common throughout metropolitan Melbourne and environs, including all parts of the Mornington Peninsula.

In fact, Black Snakes are absent from all areas within 35 km of the Melbourne CBD, including all areas south of the CBD, which includes the Mornington Peninsula and running further south to the Victorian south coast.

Brown Snakes are found north and west of the Melbourne CBD being common as close to the city as Footscray North, Preston and Coburb and are also found very slightly south-west of the CBD, but not south of the CBD or on the Mornington Peninsula or environs as stated in the book by Coventry and Robertson.

The basis of the distribution maps in the text are so-called dot maps with "confirmed records" followed by a lighter shading of "probable distribution", which generally overlaps and joins up the dots.

The authors say that the "confirmed records" are derived from reliable records held by the wildlife department in a computer database.

However this in turn is based largely on identifications by field workers who may or may not have herpetological training.

The database is notoriously unreliable with all attributed reports of Black and Brown snakes from south of Melbourne being readily corrected to be Copperheads, which occur in both black and brown colourations (and other colour phases), even within a single locality and are routinely confused by people as being of the wrong taxa.

A record of the same department for a Death Adder on the Murray River at Walhalla Island, North-west Victoria, by Peter Menkhorst (an alleged DSE mammal expert), based on an illustration in a book by Hal Cogger and quoted as accurate for many years (in spite of my repeated protests) was later ascertained to be a record for a Devis Banded Snake (*Denisonia devisi*), previously unknown from Victoria, but since found to be common in the relevant region as also predicted by myself for many years.

**COPPERHEADS**

Further unreliability of the distribution information in the Coventry and Robertson text is seen in their treatment of Copperheads (Genus *Austrelaps*), which gives broadly overlapping ranges for the two identified forms, "lowland" (*A. superbus*) and "highland" (*A. ramsayi*).

The alleged diagnostic feature between the taxa in this book and in the original paper separating the two "species" by Rawlinson (1990), is the differentiation of the white markings on the labial scales (the "highland" Copperhead having more distinct markings and/or white triangles not seen in the lowland form).

It should also be noted that the species "*A. superbus*" and "*A. ramsayi*" were described by two different people and not in the context of knowledge of the other described form. In other words, they were not described as similar species within a single genus as is the placement by Rawlingson in 1991 and herpetological authors since that date.

As it happens, the labial markings as a diagnostic characterc is far more fluid than originally thought and varies between specimens, the result being that field workers in some areas are unable to assign a specimen to either the highland (*ramsayi*) or lowland (*superbus*) "species".

Hoser (2009), showed quite clearly that altitude alone appears to determine the markings on the labials in some populations, making differentiating between one or other "species" problematic.

As there is no gap in the known ranges of either taxa and the only alleged diagnostic character separating the forms (the labials) varies, even between specimens of the same litter, and all obviously interbreed in the wild, there remains at the present time, no firm basis for attempting to split the south-east Australian Copperheads into two species (Hoser 2009).

At best the variation appears to be clinal, rather than based on specific separation.

Hence for the purposes of this paper (and in reflection of my own considered views), all Copperheads in south-east Australia are best presently referred to the species *Austrelaps superbus* and better treated as subspecies.

A separate and geographically isolated form of *Austrelaps* from the Adelaide Hills (South Australia) and south-west of there, referred by authors to the taxon *A. labialis* is not relevant to this paper, save to say that as a cold-climate species, it's distribution is disjunct, reflecting a retraction in range over the past 12,500 years since the termination of the last ice-age.

However I should note that since the publication of Hoser (2009), Pyron, Burbrink and Weins (2013) produced an online paper that gave a molecular basis to separate the species *A. superbus* and *A. labialis*, although their results did not give locality data for their samples.

**THEY WERE HERE ALREADY!**

During the last glacial period, Tasmania was attached to the Australian mainland. As the world warmed about 12,500 years ago and sea levels rose, Tasmania was cut off from Victoria.

It is reasonable to infer that the herpetofauna in both places was the much the same.

Observed in Tasmania now are three snake taxa, namely Tiger (*Notechis scutatus*), Copperhead (*Austrelaps superbus*) and White-lipped Snake (*Drysdalia coronoides*).

All three taxa remain common in the southern half of Victoria,

including all areas south of and including the colder parts of the Great Dividing Range. That includes the region of Melbourne (The State capital of Victoria), and at least 100 km north of Melbourne.

The three taxa are also found in colder parts of NSW including areas as far north as Sydney.

Hence none of these taxa are regarded as northern invaders of Victoria (which for *N. scutatus* is contrary to a view by Rawlinson 1991).

In terms of *N. scutatus*, I do note however that the distribution of the taxon is disjunct in warmer places (such as south-east Queensland) and yet continuous in the south, meaning that the range has contracted southwards since the end of the last glacial maximum and Rawlinson (1991) was wrong to infer the taxon is a recent northern invader.

**THOSE NOT ORIGINALLY FROM MELBOURNE**

After temperatures rose at the end of the last ice-age maximum, northern taxa were able to migrate south to invade new areas.

Melbourne is situated on a large bay in the south of Victoria, Australia (with coast stretching about 100 km further south on both sides), making Melbourne and it's southern environs a logical southern point for northern species to be migrating towards in terms of this paper.

These migrating snakes included species within the main groups of Australian snakes (namely pythons, small elapids (skink feeders as adults) and large elapids (usually just over a metre as adults and also able to feed on rodents)).

These included taxa such as Murray/Darling Carpet Snakes (*Morelia metcalfi*), Diamond Pythons (*Morelia spilota*), as pythons, Small-eyed Snakes (*Cryptophis nigrescens*) and Little-Whip Snakes (*Unechis flagellum*) as small elapids, Eastern Brown Snakes (*Pseudonaja textilis*), Red-bellied Black Snakes (*Pseudechis porphyriacus*) and Death Adders (*Acanthophis antarcticus*) as large elapids.

That the species are recent arrivals is inferred by the fact that,

1 – They are not in Tasmania

2 – Their distributions are effectively continuous to their southernmost points and there are no outlier populations beyond this. That is they are not relictual populations.

This means that these species have invaded Victoria (and/or Australia's south-east) from further north and at the time of settlement by Europeans (when habitat was unbroken by farms, roads and the like), their ranges were probably still expanding.

**THE INNACCURATE RECORDS**

Before continuing, it is worth noting some inaccuracies that have crept into the records, which if taken at face value may confuse the picture given here of snakes invading from further north.

The book, "The Snakes of Victoria" by John Coventry and Peter Robertson (1991) is based on records and specimens at the Museum of Victoria, which while as good as for any other State Museum, have been shown to have defects in terms of reptiles sourced from Melbourne.

Some reptiles lodged as coming from Melbourne may in fact have been stowaways or so-called "vagrants" from elsewhere. This situation has arisen as for considerable periods, curators of reptiles at this Museum have either not been herpetologists, or had a primary interest in reptiles, or alternatively have been appointed from elsewhere and with no immediate knowledge of the local herpetofauna, other than what they have read in the popular literature or identification manuals such as Cogger (2000).

This is mentioned in the context of the Red-bellied Black Snake, a snake that occasionally turns up in Melbourne and hence shows up on the Melbourne Museum's own database, but is not native here.

Another species here the Copperhead (*Austrelaps superbus*), commonly looks identical and is separated by the subcaudal scales being all single as opposed to being mainly or all divided in the Red-bellied Black.

Lay persons see Copperheads that are black with a red belly and then mistakenly identify it as the better known Red-bellied Black Snake.

Even reptile hobbyists and alleged "experts" whom I'd assume would know better routinely confuse the two species on a regular basis.

As recently as June 2008, a Melbourne Zoo reptile keeper Jon Birkitt told a local newspaper that a snake killed in the northern suburb of Roxburgh Park by a resident was a Red-bellied Black Snake (Brown 2008). I later ascertained that in fact it was a Copperhead.

The journalist said to me "surely the man from the zoo would know?"

Add to that the small number of "genuine" Red-bellied Black Snakes lodged in the Museum and there becomes a general perception that Red-bellied Black Snakes are native to Melbourne, even if somewhat uncommon or hard to find. This is perpetuated in the literature and among local herpetologists so that when I arrived in Melbourne in 1985 (after 18 years in Sydney), I was led to believe that Red-bellied Black Snakes were a common species here.

This is also what most books and literature report, including that of myself (e.g. Hoser 1989), which was based on reports I'd erroneously believed as coming from reliable sources and/or based on misidentified snakes.

It is only after catching snakes in all suburbs of Melbourne for many years that it's become apparent that Red-bellied Black Snakes are not a part of Melbourne's fauna.

It's that simple!

The species is however common in areas about 125 km east of Melbourne, starting just east of Traralgon, and about 70 km north of Melbourne (starting north of the Great Dividing Range), beyond either point of which it is a common species.

Specimens commonly turn up in Melbourne after climbing into parked cars that are then driven from the relevant areas back to Melbourne, or alternatively in boxes of fruit and vegetables shipped from the growing regions in northern Victoria where these snakes dominate.

As a licenced snake catcher (Hoser 2007a) who catches many snakes a year, I catch an average of one Red-bellied Black Snake a year in Melbourne, all of which so far have had their original (non-Melbourne) source identified with a reasonable degree of certainty.

In recent years however, I have caught a gravid female at Toorak, passed by myself (by law) to the DSE, who then in turn illegally gave the snake to another "protected" licenced keeper who then later masqueraded as having "bred" the snake.

He then advertised for sale all 20 offspring at $200 a pop to other less fortunate hobbyists unable to legally obtain snakes from wild-caught sources or catch their own, as to do so is highly illegal in all Australian states.

A year later, I caught a newborn Red-bellied Black Snake within the grounds of a Primary School in Seaford. This was located immediately adjacent to a large industrial estate and so it can be assumed with confidence that this snake or it's mother had been brought in with materials into the estate in the recent past.

In 2003 or thereabouts, I caught a large female Red-bellied Black snake that had apparently stowed away in a car returning from near the Victorian town of Omeo in the north-east of the state that had set up a home in a back yard compost bin within the most heavily built-up part of the suburb of Langwarrin in Melbourne's outer south-east.

When I caught the snake I noted she had just given birth to a litter of young. Most were not recovered.

In the decade since, several other Red-bellied Black Snakes have been caught in the same heavily populated part of Langwarrin by myself and other licenced snake catchers.

However the species has never been found in Langwarrin away from this pocket and is clearly not a part of the native fauna in the local reserves.

In terms of large elapid species, these reserves have only Copperheads and Tiger Snakes, in line with the rest of Melbourne's south-east and Mornington Peninsula.

As another note of interest, I did until about 2009, catch an average of two Queensland Carpet Pythons (*Morelia macdoweli*) a species not found within 1,000 km of Melbourne, per year, all obviously being either escaped pets or "stowaways".

I mention this as no one has yet claimed these to be native to Melbourne, even though they turn up here.

Since 2009, to 2013 the number has escalated to an average of 6 a year (for myself), with other snake catchers also getting ever increasing numbers of pythons as well, and added to this list is a newer influx of other python species such as Black-headed Pythons.

Most are clearly escaped pets!

In line with other large elapids, Red-bellied Black Snakes are as a rule, very common where they occur naturally. There are no such sites in Melbourne, again indicating they are not from here.

However at the southern and eastern limits of the range of these snakes, this is the very case.

These snakes are common.

The same applies for other taxa "invading" from the north, be they Death Adders, Carpet Snakes or Eastern Brown Snakes.

Notwithstanding the fact that almost all the specimens of Red-bellied Black Snakes that are caught on "call outs" tend to come from the most heavily urbanised areas in Melbourne or otherwise settled areas lacking snakes, the fact is that in the last decade it's become apparent to myself and all the other licenced snake catchers in Melbourne that the species is not native to Melbourne and that there is no place or suburb that the snakes can be found and caught.

All other elapids native to Melbourne (six species), are common where they occur and easily found.

With rare exceptions as noted above, regular "call outs" for Red-bellied Black Snakes invariably turn out to be Copperheads.

**RED-BELLIED BLACK SNAKES ... THEY HAVE NEVER BEEN NATIVE TO MELBOURNE**

For all taxa moving south in Australia there is a pattern whereby at the leading edge of their southernmost limits they are very common, readily found and readily caught. This is seen for Green Tree Snakes (*Charlespiersonserpens punctulatus*) south of Sydney, Brown Tree Snakes (*Boiga irregularis*) north of Sydney Harbour, Death Adders (*Acanthophis antarcticus*) around Bega in southern NSW, Murray/Darling Carpet Pythons in the Warby Ranges 10 km south of Wangaratta, Brown Snakes on Melbourne's northern fringe and so on. The same is seen for the Red-bellied Black Snakes around Tallarook at about the southernmost limit of their known distribution, roughly 70 km north of Melbourne on the north-side of the physical barrier of the Great Dividing Range (a zone infested with cannibalistic Copperheads, preventing or making difficult migration of invading northern species further south).

For Black Snakes this abundance is not seen in Melbourne. It's simply not possible to go anywhere in Melbourne to find a Black Snake on demand.

Hence it's unlikely the species has ever been native to Melbourne (except as stowaways or similar) since at least the beginning of the last glacial period!

As it happens, and based on the northern limits of the species (north Queensland), it is reasonable to assume that the species is recent, as if it had been around for a long period, it'd have invaded New Guinea at times of cooler climate (lower sea level) as recently as 12,500 years before present, which simply hasn't occurred.

Hence there has probably never been a time when Red-bellied Black Snakes have been native to Melbourne.

The sometimes mooted idea that the species may be rare and cryptic in Melbourne is also laughable, based on what is well-known about the species.

The fact is that they are large and hard to miss where they occur.

**FURTHER MISINFORMATION ON RED-BELLIED BLACK SNAKES**

On the Museum Victoria website at:

http://museumvictoria.com.au/DiscoveryCentre/Infosheets/Snakes-found-in-Victoria/Red-bellied-Black-Snake/ is an account for the species.

Under the heading "Distribution and habitat" it reads:

"It is widespread in eastern Victoria; north of the Dividing Range it is often associated with water courses. It is also relatively common in Melbourne's east and has been recorded around Bacchus Marsh, Park Orchards, Bayswater, along the Plenty River in the South Morang area and around the Merri Creek in the Campbellfield to Somerton area."

The Bacchus Marsh record is credible in that the Lederderle Gorge north of there, broadly equates with the known south-west limit for the species (near Melbourne), but also happens to be well outside of the suburban Melbourne boundary. This area is about 40-45 km west/north-west of the CBD.

The other records, all well within the Melbourne metropolitan area (broadly along the 25 km line from the CBD running from the north (Somerton) to the east (Bayswater)) are clearly erroneous and based on Copperheads of identical colour, which are the dominant species, in all these areas.

Such specimens (black with red belly) are regularly caught by myself in all these areas and invariably are misidentified by others as "Red-bellied Black Snakes".

The mention of Park Orchards as a location for Red-bellied Black Snakes is perhaps the best evidence of a general misidentification of Copperheads.

This is the suburb I have lived in over the last 12 years. It is semi-rural and in that time, of dozens of snakes I have seen here, none have been Red-bellied Black Snakes.

However again Copperheads of the same colour are common here and even more-so along the ridgeline running from the Maroondah Highway ridge, along North Ringwood, Warranwood and Wonga Park. Beyond that area, to the upper Yarra Valley (north or east) amelanistic (as in plain red) Copperheads become the more common colour phase for the species.

As of 2008 and in the years immediately prior, the reptile curator at the Museum Victoria was Jane Melville a professional herpetologist.

Not resident of Melbourne before she took up the position, her own actual collecting experience of Melbourne's snakes was effectively nil, which is a situation she happily concedes. Her herpetological experience and training is extensive, including with regards to central Asian agamids, but not in terms of Melbourne's snakes.

Hence her only real knowledge of snakes in Melbourne is what others have told her, including the general view that Red-bellied Black Snakes are native to Melbourne.

Her predecessor, Diane Bray, had her main interest in fish and managed the reptile collection in the absence of a "dedicated" curator, the position being vacant on the retirement of John Coventry some years prior.

Her main role was to catalogue and file specimens as lodged by the public and in response to public requests to examine specimens and the like.

This of course was in addition to her main line of work which was studying and classifying fish.

As all the relevant taxa, (Copperheads and Black Snakes) are

common in the south-east Australian region, get moved about people often and as a result turn up all over the place, it isn't surprising that until now, no one has ever actually tried to resolve the southern-most distribution limits of the Black Snake taxon.

I also plead guilty to aiding the misinformation about Red-bellied Black Snakes in Melbourne until recent years (e.g. Hoser 1989). I was advised by herpetologists and others of the fact and repeated it in good faith, including in printed material.

I now know this information to be erroneous and generally based on misidentified Copperheads, aided at times by the occasional "stowaway" Red-bellied Black Snake, giving apparently credible evidence of the concept of Red-bellied Black Snakes in Melbourne.

Obviously an important reason to publish this paper is to correct the continued misinformation once and for all.

Noting that in the event of a snakebite a misidentification can have fatal results if the wrong anti-venom is administered, it is a matter of life-and-death that the misinformation about Red-bellied Black Snakes as a Melbourne native is corrected before a life is lost as a result of a human error.

**GENUINE RED-BELLIED BLACK SNAKE CALL OUTS**

For the record, I shall identify here, where myself or fellow licenced snake catchers have found (genuine) Red-bellied Black Snakes in Melbourne on reptile call outs in the period 2003-8 and their original source.

·- Alphington, came in with shipment of paper (myself).

·Broadmeadows, found next to railway yard where goods from northern Victoria are shipped in (myself).

·- Toorak Road, Glen Iris, on footpath, apparently having alighted from a car that had recently travelled to North-east Victoria (Scott Eipper).

·- Langwarrin (X 2), both snakes having alighted from cars driven to the Omeo region of North-east Victoria. Both snakes in the same street came from cars driven to the region on a weekly basis over several years and had lodged in the two houses either side of the man who did the trips, with both snakes taking up residence in "compost bins" (both caught by myself and one being a female that had recently given birth as evidenced by the folds of skin at the posterior end of the body).

- ·Mount Martha shopping strip, for two specimens apparently imported with fruit and found in a fruit shop (Barry Goldsmith).

·- Montmorency, where a snake was removed from a car that had been driven back from a fishing trip at Barmah Forest, northern Victoria (myself).

·- Hampton Park shops. Came in with box of fruit from Goulbourn River Valley as reported in the local newspaper.

Notable is that none of the above locations were near any bushland or likely refuges for the species, indicating all had been brought into the localities by human means.

This contrasts sharply with the usual snake catching call outs for the native Melbourne species which almost always occur in residences and businesses that immediately abut bushland reserves or similar situations.

As to how often snakes get into cars and then get driven to other locations, is seen from my own capture records. I get about 2 calls a year for such snakes.

However in northern and eastern Victoria, where Black Snakes are common, this species is clearly the one most commonly seen entering cars or engines, with snake catchers in these regions reporting a much higher incidence of this.

By way of example, twice when doing snake shows at agricultural shows (Swan Hill and Orbost), I have had to adjourn proceedings to remove a Red-bellied Black Snake that had lodged underneath a car's bonnet on top of the engine. Please note that in these situations, I have literally been passing through these towns for one or two days only and not been employed as the local snake catcher.

Also worth noting is some malicious misinformation posted on the internet about these snakes.

A website controlled by convicted serial wildlife smuggler David John Williams (also with convictions for animal cruelty to reptiles) and side-kick Shane Hunter, reported in 2005-2008 that Red-bellied Black Snakes were common in Melbourne until I, Raymond Hoser exterminated them all for illegal venomoid surgery experiments.

The claims are a lie.

As it happened, as of early 2008, the only Red-bellied Black Snakes I had owned in the last 30 years were a trio, given to me by Bob Gleeson of Campbelltown (Mount Annan), New South Wales in early 2004, made venomoid shortly thereafter (see Hoser 2004) and still alive in mid 2013! The handful caught by myself, (referred to above) were all handed into the government authority (calling themselves Department of Sustainability) to be repatriated where they originated from, which is a term and condition of my catch-release permit, for non-native reptiles whose origins can be ascertained.

As mentioned already, the DSE themselves don't comply with their own laws and rules and treat handed in reptiles as something to trade illegally!

In April 2008, I acquired some newborn juveniles from a Cranebrook, NSW keeper, Dean Carroll, which later bred 3 years later and those retained by myself remain in good health as of 2013.

**SOUTHERN LIMITS FOR THE OTHER TAXA**

In terms of their southward migration, the Eastern Brown Snakes have a continuous distribution from Melbourne's northern outskirts (where they are very common) right through Australia and into New Guinea (also cut off from Australia by rising sea levels during present interglacial).

However no Brown Snakes are found south of the Melbourne CBD or beyond into areas such as the Mornington Peninsula, Wonthaggi or West Gippsland.

This is spite of the distance being small and habitat perfectly suitable for these snakes, with the species being found in identical habitat (and climate) elsewhere in Australia.

As for Red-bellied Blacks and the other large taxa, where Brown Snakes occur, they are common and highly visible. That they could be "hiding" from myself and other licenced snake catchers in the Mornington Peninsula, most notably Barry Goldsmith is simply not plausible.

Put simply, the snakes are not there.

I should mention that in 2012, Goldsmith caught one on the Mornington Peninsula that clearly derived from elsewhere, this snake being exceptional among hundreds of Tiger Snakes and Copperheads he had caught in recent years.

The Little-whip Snake (*Unechis flagellum*) mirrors that of the Brown Snake in terms of distribution to the north and west of Melbourne, although at the southern limits west of Melbourne (and up to 200 km west) in some areas one or other taxon is found up to 20 km further south than another.

As noted earlier, the Red-bellied Black Snakes have a similar distribution to that of the Browns in South-east Australia, the only obvious difference being that they are not quite as far south.

East of Melbourne the main ridge of the Great Dividing Range is higher (often capped with snow). Due north of Melbourne the height of the ranges is lower and this remains the case further west.

This is mentioned because for both Blacks, Browns and Little-Whip Snakes, all seem to have had more success in crossing the Great Dividing Range west of Melbourne than from the east. In fact the Red-bellied Black Snakes are only found south of the Great Dividing range in a small area about 80-100 km north-

west of Melbourne in the general vicinity of Castlemaine with reliable reports of the species from the nearby Lederderle Gorge, north-west of Bacchus Marsh.

That river in turn runs into the Werribee River (on Port Phillip Bay), giving the species a long-term route into Melbourne and environs.

Carpet Pythons never got as far south as the Great Dividing Range. If one draws a horizontal line through the Warby Range 10 km south of Wangaratta, in turn about 200 km north of Melbourne and runs it across Victoria to include regions north of this line you find the Murray/Darling Carpet Pythons (*Morelia metcalfi*).

Further north again and on the NSW side of the Murray River, you find Death Adders (see below).

While the highest and coldest mountains of the Great Dividing Range are north-east of Melbourne, and for one reason or other have formed a largely impenetrable barrier to invading snakes from further north, a second invasion front has been along the coastal strip running from NSW and into Victoria, with the most mobile species getting to the eastern edge of the Latrobe Valley at around Rosedale.

Here we find the western limit (on that front) for Brown and Black Snakes.

Diamond Pythons (*Morelia spilota*) the coastal equivalent of the Murray Darling Carpet (*Morelia macdoweli*) made similar progress to the Carpets and also crossed the border to Victoria (here being further south), but only made it about 50 km (at best) over the border) giving it similar penetration south.

Death Adders, as already mentioned never quite got as far as the Victorian border.

All the taxa referred to so far reflect a suite of species who's current range is centred on about the latitude of mid NSW, about 800 km straight line north of Melbourne.

That is the faunal suite characteristic of the modern day Murray/Darling basins and NSW coastal plains and ranges, each invading south via the logical lowland routes.

Other taxa whose ranges come from further north (as the center of distribution) have also migrated towards Victoria, either just crossing the border, or not quite. Included here, but not considered in the context of this paper are taxa such as *Pseudonaja aspidorhyncha* (southern form of Western Brown Snake and recently reclassified as a different species to *P. nuchalis*, by resurrection of the name first proposed by McCoy in 1879), Coral Snake (*Simoselaps australis*), *Denisonia devissi* (Devis Banded Snake) and Mulga (King Brown) Snake (*Cannia australis*), all of whom have a centre of distribution about 800 km straight line north of the other suite of species or perhaps even further north.

**NO DEATH ADDERS IN VICTORIA**

For Death Adders, the situation is that there are no known extant populations of Death Adders in Victoria. There are old (1800's) records of Death Adders along the Murray River of Victoria, in the vicinity of Swan Hill in North-west Victoria.

There are no known museum specimens to back up these records, only notes!

Bearing in mind that locations given for specimens in the 1800's were often inaccurate in that the locations given often related to point of shipping, rather than point of capture, it is possible that the specimens referred to may have come from some distance north of that given.

The region has long been degraded for agriculture to such an extent that the snakes are likely to be extinct from the exact localities given.

Nearby areas of suitable habitat (including for example Sunset Country), lack Death Adders (ascertained from extensive searching by herpetologists for the species in the areas), leading to a general view that the old records may be inaccurate due to the fact that otherwise it would make sense for Death Adders to be in areas such as Sunset Country Victoria, (North-west of the state), where they are not.

However, for the purposes of this article it makes little difference whether or not the north-west Victorian records are accurate as Death Adders have also migrated south along the NSW coast and ranges to within about 100 km of the Victorian border, where they are very common. I also note that on that score, this is very well known and backed up by extensive numbers of specimens in the Australian Museum in Sydney. However none have been recorded on the Victorian side of the border in identical bushland and in spite of extensive collecting by herpetologists.

If they were there, they would certainly have been found by now and they haven't been!

The (old) alleged inland Victorian locations for Death Adders, broadly equate with the latitude known for the taxon along the coast, and based on mobility of the taxon as compared to the known distribution limits for other invading taxa (Diamond/Carpet Snakes and Red-bellied Blacks), there is a remote possibility that the old records may represent a historical southern inland NSW/Victoria limit for the Death Adder taxon.

Accepting this proposition does also allow for the prospect that the species (obviously) did not travel the extra few hundred kms to the zone of excellent habitat to the west and south-west of there in north-west Victoria.

**DISTRIBUTIONS EXPANDING – EASTERN BROWN SNAKES**

While 200 years of European settlement is a split second in geological time, and in that time a lot of movement of reptiles has been arrested due to the building of broad acre farms, major highways, towns and the like, some southern migration of the above taxa has continued.

Brown Snakes were in the 1980's confined to Melbourne's north, north-west and Maribynong Valley, although also common due west of Melbourne at Melton, Bacchus Marsh and nearby.

Few if any were seen south of the Yarra River.

By 2000, records south of the River were increasingly common and in areas of the city of Manningham formerly only known to have Tiger Snakes (including Westerfolds Park), Brown Snakes started to become common.

Likewise for parts of Ivanhoe that previously never had snakes other than Tigers.

These are all heavily urbanised suburbs at the limit of the known range of Brown Snakes.

In 2007, a Brown Snake was caught in the You Yangs about 60 km south-west of Melbourne, about 20 km straight line south from Bacchus Marsh, due west of the city of Melbourne.

Collectors from the area expressed surprise that a Brown Snake had turned up so far south.

South of the You Yangs is Lara and Geelong, with Brown Snakes unknown from these areas or south of there.

However there are no physical barriers preventing the snakes invading these regions.

Inspections of the animals from north-west Melbourne, reveal they are the same taxon as those from the southern Murray/Darling basin, namely (*Pseudonaja textilis bicucullata*), distinguished by several traits from other subspecies. The most notable trait is the common presence of one or more single subcaudals. No other subspecies of *P. textilis* is known to have specimens with this trait

**LITTLE-WHIP SNAKES**

Coventry and Robertson 1991 state that the species is found in all Melbourne suburbs. Put bluntly, they are not!

Broadly the distribution of the taxon mirrors that of the Eastern Brown Snake in the region north and west of Melbourne. However, they appear to have penetrated all of south-west Victoria where suitable habitat exists in the form of stony plains and similar nearby environments, including granite hills, basalt

rises and the like.

They are not as a rule found in the heavily forested regions east and south of Melbourne, meaning that in Melbourne the eastern limit for the taxon is about the Plenty River Valley with none naturally occurring at any time in the region running south of the same line that limits the modern distribution of Eastern Brown Snakes.

In other words, this taxon does not occur in any of the wetter eastern suburbs or anywhere south or south-east of Melbourne in any area beyond the eastern shoreline of Port Phillip Bay.

North of the Yarra River, Little-whip Snakes appear to be found no further east than the Plenty River Valley. Beyond that point, Small-eyed Snakes appear to take over the ecological position of the species.

This indicates that both taxa compete directly and may limit one another's (or one or other's) distributions. I do note however that in some locations such as the western side of the Plenty River Gorge the two species are in fact sympatric, this being an area at the boundary of the known ranges of both species.

Brown Snakes by contrast are found east of the Plenty Valley to the very edge of the colder parts of the main Great Dividing Range, which is within a few kms of Yarra Glen/Healesville.

**SMALL-EYED SNAKES**

These are found in hilly areas north and east and even south of Melbourne, where I have caught them.

There are also records from hilly areas on all sides of Melbourne in National Parks, but I have no direct experience of the taxa at locations west or south-west of Melbourne.

They have migrated into Victoria using the eastern side of the Great Dividing Range (and possibly also the wetter parts of the western edge) as their main line of movement into the region.

They are cold tolerant and able to invade areas devoid of numbers of other taxa.

**WHITE-LIPPED SNAKES**

The distribution of the taxon broadly mirrors that of Copperheads in Victoria. Hence it is found in cooler regions on all sides of Melbourne.

It is typically found in "pockets" where they are very abundant and easily found. Other areas of apparently similar habitat often lack the species.

As for Copperheads, numerous colour morphs may occur at the same locality.

**DISTRIBUTIONS EXPLAINED, IT'S NOT TOO COLD ... AT THE MOMENT**

That these taxa moved south during the recent interglacial is not really in dispute.

A perusal of any relevant reptile book sets out the distribution maps for each taxon and for each there is a distinctly southern limit. With temperature being an obvious limiting factor on reptile's distributions, there has until now been no questioning of the doctrine that temperature alone has been the main limiting factor for the distributions of these taxa.

Surely as you go south it gets colder?

However perusal of these species at ground level reveals a starkly different picture.

With the exception of *Unechis flagellum*, all the invading taxa are found in the vicinity of Sydney, NSW. However species in the same genus are also found around Sydney NSW, including for example *Unechis dwyeri*.

All the invading taxa, including *Unechis dwyeri* are found in the Blue Mountains and/or nearby hilly regions that are higher in altitude and significantly colder than either Melbourne, coastal Victoria south of Melbourne or the plains and ranges north of Melbourne, and anywhere else between where they are found and these co-joined regions.

Furthermore, in the case of Victoria, it is not as one moves south it gets colder, or at least in terms of a form of cold that matters to the survival of the reptiles.

By contrast, the reverse is true. North of Melbourne where many of these invading taxa occur, the elevation is higher and hence the temperatures cooler. Beyond the great dividing range, further north again is inland and so considerably colder for the winter months, which include at least three months of cold weather from June to end August. Heading south, elevation drops and temperatures rise (including in the critical cooler months, where the near sea influence occurs) and so lack of heat cannot be a limiting factor in terms of these species moving south.

In other words it is not cold that prevented any of the invading taxa from getting to Melbourne or beyond.

I ignore consideration of temperature for the warmer months as within Melbourne this sits well within what the snakes can cope with and while heat is thought of as desirable for snakes, the fact is that inland areas to the north have an excess of this in the summer months (forcing snakes to hide from it in any event), and again cannot be treated as a factor keeping species out of Melbourne and other southern parts of Victoria.

While all invading taxa have certain habitat requirements or preferences, observations of these taxa (those discussed in this paper) in their known ranges shows that they are adaptable and invasive of habitats and can apparently tolerate habitats beyond their known distribution limits.

This we know because they survive and thrive in the same habitats within their known ranges!

While it may be possible to argue that taxa like Death Adders require virgin bushland and that perhaps aboriginals in years past burnt and degraded too much bush to prevent their southern migrations, this argument cannot possibly be used to explain failure of wide-ranging habitat liberal taxa like Black, Brown or Carpet Snakes to get further south.

The large elapid taxa in particular live in all kinds of habitat, including severely degraded as seen by their abundance in the most intensively farmed regions and in all other habitats in their known distribution ranges.

With climate or "cold" being eliminated as a factor stopping the spread of these species south, one must look at other possible factors.

The most obvious thing seen by comparing the invading taxa and where their southernmost limits of distribution are, is that the more mobile taxa got further south.

Brown Snakes, the most mobile of the large elapids, got furthest south. Black Snakes also quite mobile, broadly shadowed the Brown snakes, except in western Victoria, where the Brown snakes got about 50 km further south (on average).

Less mobile, the Carpet Snakes, crossed the Victorian border, but only just, making it an average of about 100 km north of the Black Snakes, while the Death Adders, (based on known distributions along the NSW coast), didn't quite get as far as the Victorian border.

As for whether or not these taxa can survive in Melbourne, the result is already known. They can!

Escapees thrive here!

All the Black Snakes, Carpet Snakes and Diamond Snakes that I catch in Melbourne tend to be well-fed on local food and in good general health.

**ANOTHER FACTOR – OTHER SNAKES**

However, how fast a snake can crawl can't be the whole explanation.

Studies of invasive species, such as Cane Toads (*Bufo marinus*) in Northern Australia have shown travelling speeds of several km a year for the invasion front. We also see that not far behind the invasion front these animals become numerous to what is commonly described as plague proportions.

The same is seen with the snakes migrating south as documented above.

Just inside the known outer limits of the range of these snakes in southern Australia, numbers of the relevant species are high, or at least relatively speaking.

Bega is one of the best areas in New South Wales to find Death Adders and sits just behind the southern leading edge of the southernmost part of the species range.

Brown Snakes are in huge quantity in the Sunbury/Bulla area, again just 25 km from the leading edge of the southernmost point in the species range near Melbourne.

Blacksnakes are in plague proportions at Tallarook/Seymour, an area probably within 20-30 km of the southernmost point in the species range due north of Melourne.

Now these newly introduced feral Cane Toads are radically different to the snake taxa that have evolved in this continent and so it'd be expected that factors may be wildly different for them as opposed to taxa that have co-evolved over millions of years.

Assuming the last glacial period to have ended about 12,500 years BP, it would appear that short of some unknown calamity, even at just 1 km a year, any of the invading taxa could have covered all habitable parts of Victoria by now, if invading a new area was as simple as moving in.

I have of course omitted "mini-ice ages" that may have impacted on migrations and for good reason.

The small elapid species, namely *Unechis flagellum* and *Cryptophis nigrescens* as a species pair, have in sharp contrast to the large species managed to successfully colonise almost all possible areas of suitable habitat that can support them, or at least all that in which they obviously prefer.

That these invaders haven't been knocked out by a calamity, would indicate that none has been big enough to affect the overall picture.

Also the speed and success of the invasion of the smaller elapids (as opposed to the larger ones) would indicate that what has slowed the invasions of the larger species hasn't affected them in the same way.

Hoser 2005 detailed a well-defined pecking order in terms of snakes. That paper showed that a major determinant of snakes distributions in given localities was other snakes.

Since that paper was published, further research here has shown that the key factors indicating likely dominance of taxa (between snakes and/or lizards) identified here are in order of importance listed as:

- Egg-laying versus live-bearing
- Ambush versus stalking (in feeding)
- Lack of cold tolerance
- Potential mobility of snake

Habitat partitions and adaptations are also important in the real world situation, but were excluded from testing at our facilities for several reasons, including difficulties in standardising tests for this.

Perhaps a major impediment to the successful colonisation of regions south was other snakes of other species, as in those already there.

Two of three were large elapids.

This may mean that in terms of the invading snakes and in a world devoid of modern human influences, unless and until the invading snake taxon gets sufficient numbers in the region of the invading front, then they cannot push their species to new regions.

The end-point of the argument being that competition for already occupied habitat by invading taxa may greatly slow the migration of these taxa.

As an alternative explanation, most snakes being forced to new habitat (by whatever means) do, for a variety of factors (but mainly due to already resident snakes) fail to survive.

A similar scenario is seen for translocated reptiles and other animals (see Hoser 1995).

This is particularly so for sedentary and less mobile taxa as seen in the Death Adders and Pythons.

In the case of the high mountain barriers north and east of Melbourne referred to earlier, one part of this barrier starts at about Kinglake and runs around through just east of Healesville, through the Dandenong Ranges, Warragul and into the Stresleki Ranges. Another runs through the high country and into Victoria.

In the high country of NSW and into Victoria, Black and Brown snakes have made progress but not in terms of the high mountain barriers skirting the north-east of Melbourne.

These mountains are (naturally) covered in dense forests and the dominant species here are Copperheads.

Copperheads are strongly cannibalistic of other snakes and when numerous literally eat out all competing snakes!

Hence where Copperheads are strongest forward migration of other snakes would seem to be slowest.

In the case of Melbourne this is readily seen.

Running due east of Melbourne from Kew (about 5 km east of the CBD) is a long ridge running along the Maroondah Highway to the Dandenongs.

Except around the Yarra River at Kew (the start of the ridge), where there are Tiger Snakes associated with the Yarra Valley, the only snake native to the ridge-line are Copperheads.

The same pattern repeats in the region south of here, although further south along major waterways and the Port Phillip Bay where the Yarra drains, Tiger Snakes are again found.

North of this ridgeline is the Yarra Valley, where Tiger Snakes dominate and as mentioned earlier, Brown Snakes are found as far south as here.

Historically it seems that this ridge of dense forest, with its copperheads was a sufficient barrier to prevent southward movement of Brown Snakes.

However with the urbanisation of the area and a general drop in snake numbers overall, this ridge is now open to movement of other snakes, the result being that for the first time, in 2008, a young Brown Snake was found at the summit of the ridge in Ringwood.

Areas formerly only with Copperheads have also had Tiger Snakes turn up.

This is significant as in the backdrop of urbanisation, Copperheads numbers usually increase relative to Browns and Tigers, where all three taxa occur.

Because Black Snakes aren't native to Melbourne, no comparisons can be made. However in Sydney, the Black Snakes dominate urban areas and nearby rural areas as well, with their relative position improving against the competing taxa Browns and Tigers.

However of note in Melbourne and in spite of suburbs full of people killing snakes, the fact is, that a decrease in density of Copperheads has enabled the northern invaders an easier means to invade new areas to the south.

What also needs to be noted, is that even in the heavily urbanized human environment, snakes are often able to traverse suburbs undetected and also to mate and breed in refugia, parks and the like in sufficient numbers in order to maintain viable populations.

Bushland pockets in the most urbanized parts of inner Melbourne still maintain healthy and self-perpetuating populations of snakes (usually Tigers), but in relevant suburbs, also Copperheads, Browns and the three smaller species.

**SAME FACTORS OTHER REPTILES?**

Looking at lizard/lizard inter-relationships and pecking orders between taxa has been beyond the scope of my own investigations and this paper.

For lizards the picture is considerably more complex. While, as for snakes there are distinct size classes here in Australia, the picture is made more complex for several reasons, including a less rigid adherence of taxa to size classes (as adults), more species diversity, greater differentiation of taxa in terms of physical attributes and adaptations, habitat partition and so on. Yes, snakes are conservative in that all are long, thin, legless and (in Australia) tend to seek out the same preferred hiding spots, food (other smaller vertebrates), watering points and the like.

However in terms of snakes and lizards one thing has become clear.

While large lizards eat small snakes and vice-versa, and this is a common situation, when both are of similar size the trend is for lizards to submit and move on.

The best example of this is seen in Bluetongues (*Tiliqua* spp.) versus snakes of the same size. When they meet, it is the lizards that will move on.

This has been tested and shown many times.

As to why, the reason appears to be related to the same factors as for the snakes. The Bluetongues are live-bearers for a start. Secondly, in that they have legs, they are inherently more mobile than the snakes without.

Using the criteria given above for predicting pecking orders, it's obvious that most snakes would outrank most of the lizards.

Hence the seen outcome could have been predicted using the criteria given above.

Looking at modern (present) distribution of Bluetongues, what was postulated for snakes is also seen in the Bluetongues.

The Eastern Bluetongue (*Tiliqua scincoides*) is not found in Tasmania, and hence it can be inferred that they are also a recent (from the north) arrival into the southern half of Victoria in the post glaciation period (since about 12,500 YBP).

Blotched Bluetongues (*T. nigrolutea*) are found throughout Tasmania (alone for the genus), and in Victoria are found in cooler regions, but not warmer ones, with the climatic boundary line being around Melbourne's climatic features.

In Melbourne, the trend is that for cooler suburbs, such as the outer east to have Blotched Bluetongues, while the warmer ones have eastern Bluetongues.

While Blotched Bluetongues form part of the cold climate suite of species including Copperheads, White-lipped Snakes (*Drysdalia coronoides*) and others, versus the Eastern Bluetongue's position as a part of the northern invading suite species such as eastern Brown Snakes, Red-bellied Black, Lace Monitor (*Varanus varius*) and so on, both Bluetongues are sympatric where their general ranges meet.

The two Bluetongue taxa are sympatric across wide parts of Melbourne including Belgrave South, much of the Mornington Peninsula and Park Orchards.

The picture becomes blurred in other parts of Melbourne due to the large number caught, relocated and released by private individuals.

However what is obvious is that in the environment unaffected by people, Blotched Bluetongues have a competitive advantage in the coldest regions (seen by their exclusive occupation of these habitats) and Eastern Bluetongues where it is warmer (seen by their exclusive occupation of these areas). There is obviously a strong overlap in survival ability in terms of intermediate temperature zones, which is why both taxa persist indefinitely in such zones.

However in terms of the southern migration of the Eastern Bluetongues, what is obvious is that unlike the invading snakes from further north, Eastern Bluetongues have been able to penetrate much farther south than the snakes from the same faunal suite, enabling them to colonise (virtually) all areas of suitable climate in the state, including areas well south of Melbourne, that have yet to be reached by even the relatively mobile Eastern Brown Snakes.

The ridgeline of Maroondah Highway that formed either an effective barrier (so far) to southward migration of Brown Snakes (or was in any event the southern limit), has been breached by the Eastern Bluetongues.

The ridgeline itself remains exclusively Blotched Bluetongues (save for perhaps the odd escaped Eastern Bluetongue pet and similar), indicating that historically at least, the barrier was never breached by Eastern Bluetongues. However it seems that via the most logical route, (the lower Yarra River valley and basalt plains to the west, and then along the shoreline of Port Phillip Bay), eastern Bluetongues have moved south in all directions to populate the Mornington and Bellarine Peninsulas, Barwon Valley and even the south-eastern suburbs running parallel to the south-eastern freeway, (Dandenong, Berwick, Pakenham, Belgrave South), where they now dominate large areas.

Put simply, these lizards were able to move faster into new areas to colonise them than the snakes.

Given time, it seems that the likely end point (and barring major climatic shifts and similar), will be taxa such as Eastern Brown Snakes occupying much the same areas. Taken further, and perhaps a few hundred years beyond present, it seems likely that even Red-bellied Black Snakes would (and without human assistance) also colonise these more southern regions including all suburbs of Melbourne.

Obviously the exact time frame would depend on how fast the invasion front moves.

**DIFFERENT STARTING POINTS**

A counter-argument to the proposition put here in terms of southward migrating taxa is that perhaps the relevant species of snake (or lizard) were either in the southern Victorian region before the others in the same faunal assemblage arrived, or alternatively had a further south starting point.

This may be the case for a number of species with a more northern centre of distribution as mentioned earlier in this paper.

However in terms of the relevant taxa to this paper as named at the outset, these arguments do not appear to hold.

All appear to have similar climate tolerances and a similar adaptability to all relevant habitats, as evidenced by their modern day distributions, particularly further north in NSW where in high altitude regions the taxa survive in areas cooler than those presently occupied in Victoria.

**MORNINGTON PENINSULA AND SOUTH-EAST SUBURBS**

This includes all areas south of the line running from the CBD to the Dandenong Ranges and all areas south of the main dividing range through Warragul to the Latrobe Valley and including all areas including and east of the Streslecki Ranges, south of here and to Port Phillip Bay's Eastern shoreline.

In summary, the only large elapids here are Tiger and Copperhead.

There are no red-bellied Black Snakes or Brown Snakes.

All snakes locally identified as such are simply Copperheads. The only potential exceptions are stowaways or their offspring, which may occasionally turn up.

While stowaway Black Snakes are occasionally seen, stowaway Brown Snakes are rare as the species rarely climbs and hence they rarely enter cars and get driven around.

I do note however that firewood collection and transport remains a major source of vagrant snakes of all kinds, with hollow logs always being a favoured resting place for snakes.

Adding to the confusion are newly licenced snake handlers who haven't a clue about snakes or their identification and should never have been licenced by the DSE.

One such pair are Sean and Stacey McCarthy who at end of 2005 and with no meaningful expertise in reptiles bought a business name "Snake handler".

Business names can be bought for about $70 from the Office of

Fair Trading Victoria.

Making false claims about their alleged expertise they sought media opportunities to tout their knowledge and business. In doing this they made statements to newspapers claiming that Brown snakes were native and common in the South-eastern Suburbs.

With alleged "experts" stating that Brown Snakes are common in the south-eastern suburbs, it is not surprising that persons with no real knowledge of snakes would readily identify any large brown coloured snake as an "Eastern Brown Snake" if they saw one.

The most common colour phases for Copperheads in the relevant area are Black (with red or yellow belly), usually misidentified as "Black Snakes", yellowish brown (being misidentified as Brown snakes) and orangeish red to red, also usually misidentified as a Brown snake.

Thick-set adult male Copperheads that tend to flatten out their head and neck are also commonly misidentified as Tiger Snakes.

In 2009, Sean McCarthy was posting on Facebook that Red-bellied Black Snakes were a common native in the Melbourne suburb of Eltham. The statement was another of his fabrications!

After I corrected his mistake, instead of saying "thank you" McCarthy sponsored a Facebook hate page called "Ray Hoser, Melbourne's biggest Wanker", which besides saying something significant about McCarthy's ethics, was also a good reason to never correct wrong information posted on the web about reptiles!

Little-whip Snakes are not found in the Mornington Peninsula region, which is contrary to the position stated by Coventry and Robertson 1991. In Melbourne, the range of that species ends with the basalt to the north and west.

White-lipped Snakes are found in the Mornington Peninsula region and common in pockets, these usually being in coastal heath type habitats (such as Tootgarook) and hilly areas.

There are records of Small-eyed Snakes in the region, with the taxon common throughout all parts of the Dandenong Ranges, including Beaconsfield.

While I haven't personally caught Small-eyed Snakes at likely parts of the Mornington Peninsula (e.g. around Arthur's Seat), their presence could be anticipated, especially in view of the absence of limiting or competing species like Little-whip Snakes.

**CONCLUSION**

In light of the above, the only remaining conclusion to be drawn in terms of modern day distributions of invading snakes in southern Victoria as named, is that what's seen is a direct result of the relative mobility of the relevant taxa. This means the more mobile taxa were able to colonise further south faster and not as a result of any added pre-adaptation to the invaded habitat or innate ability to survive there.

Due to the apparently slow speed of the invasion fronts of all snake taxa in Eastern Australia, as compared to feral invasive species introduced to Australia within the last 200 years, it appears that there are one or more factors at play greatly slowing the forward invasions. The most obvious factor worthy of investigation appears to include snake/snake interactions and how resident and dominant snakes (in particular Copperheads) are able to block successful colonisation by invaders, which may themselves be mainly individuals forced out of their habitat by others of the same or similar species.

Of note is that in south-west Western Australia, where there are no Copperheads, equivalent invasive species such as Brown Snakes, Carpet Snakes and Death Adders are found literally to the furthest points south, indicating a considerably different situation in that state in the post-glacial maximum period.

As Copperheads are the only obvious difference in the two situations, they appear to be a major likely culprit that slowed the southern migrations of large elapid species in Victoria.

**REFERENCES CITED**


Alexander, M. 2012. Post on Facebook Wall of Black Snake Productions, 17 February 2012.

Anonymous 2008. Red-bellied Black Snake *Pseudechis porphyriacus.* Museum Victoria webpage at: http://museumvictoria.com.au/DiscoveryCentre/Infosheets/Snakes-found-in-Victoria/Red-bellied-Black-Snake/ downloaded on 3 July 2008.

Brown, K. 2008. Snakes a risk in Hume even in cold. *Hume Leader*, 18 June.

Cogger, H. G. 2000. *Reptiles of Australia.* Reed Publishing, Chatswood, NSW.

Coventry, J. and Robertson P. 1991, *Snakes of Victoria*, Department of Conservation and Environment, East Melbourne, Victoria.

CSIRO (Anonymous 2008). Melbourne. Webpage at: http://www.cossa.csiro.au/lb/lbbook/urban/urban6.htm

Harrison, T., McCarthy, S. *et al.* 2011. Ray Hoser, Melbourne's Biggest Wanker. Facebook hate page May-July 2011.

Hoser, R. T. 1989. *Australian Reptiles and Frogs*. Pierson and Co., Mosman, NSW, Australia:238 pp.

Hoser, R. T. 1995. Release into Hell. *Monitor:Journal of the Victorian Herpetological Society* 7(2):77-88.

Hoser, R. T. 2004. Silcone snakes cause sensation in Australia and elsewhere. *Hard Evidence* (November 2004) 4(6):25-29.

Hoser, R. T. 2005. Pecking orders in large venomous Snakes from South-east Australia … ecological and distributional Implications. *Boydii* (*Journal of the Herpetological Society of Queensland*), Spring 2005.

Hoser, R. T. 2007a. The Snakebuster: the trials of a licenced snake catcher in Melbourne (Australia). *Bulletin of the Chicago Herpetological Society* (March, 2007) 42(3):50-51.

Hoser, R. T. 2007b. Call to outlaw the use of Tongs for catching and handling deadly snakes. *Bulletin of the Chicago Herpetological Society* (June, 2007) 42(6):92-95.

Hoser, R. T. 2009. One or two mutations doesn't make a new species … The taxonomy of Copperheads (*Austrelaps*) (Serpentes:Elapidae). *Australasian Journal of Herpetology* 1:1-28.

Hoser, R. T. 2012. Some new small-eyed snakes from Australia and New Guinea (Serpentes:Elapidae). *Australasian Journal of Herpetology* 13:3-7.

McCarthy, S. 2009. Internet posts claiming Red-bellied Black Snakes are long-term natives to Melbourne and common in Melbourne bushland reserves at: http://www.aussiepythons.com/forum/australian-snakes/red-bellied-blacks-around-melbourne-103027 dated 11 February, 15 February and others.

McCarthy, S. 2011. Facebook post, White-lipped snake bite. 11 January 2011.

McCarthy, S. 2012. Ten pages of posts on Aussie Pythons Internet Chat Forum at http://www.aussiepythons.com/forum/general-reptile-discussion-42/stupid-act-187762/ dated 14 June onwards in June 2012.

Rawlinson, P. A. 1991. Taxonomy and distribution of the Australian tiger snakes (*Notechis*) and copperheads (*Austrelaps*) (Serpentes, Elapidae). *Proceedings of the Royal Society of Victoria* 103(2):125-135.

WinTV 2011. Snake Wrangler, 21 Jan, news article re snake bite of Paul Fisher posted at: http://www.wintv.com.au/central_queensland/news/item/38571


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