

**Proposal for wild harvest and export of venom, blood and body parts
from
Australian native snake species submitted for approval under the
Environment Protection and Biodiversity Conservation Act 1999 (EPBC
Act)**

1. Title and introduction

The applicant submitting this proposal is operating as Venom Supplies. Hereafter, the applicant is referred to as Venom Supplies. This proposal relates to the harvesting and breeding of snakes for the purpose of the export of snake venom, venom derivative or venom product, naturally sloughed skins, blood and other biological material.

Snake derived venom, blood and tissue have been used internationally for medical research into therapeutic compounds, production of human therapeutics and diagnostics, pure research and development of biological reagents. The current application proposes to continue this work.

Specimens covered:

Native Australian venomous snakes, except those listed under the EPBC Act as threatened (excluding the conservation dependent category), legally held by Venom Supplies (see Appendix 1 for full species list). Specimens may have been taken from the wild or captive born. All wild snakes including parental stock must have been legally harvested under collection permits issued by the relevant state or territory government.

The snakes are held at the premises of Venom Supplies, and the venom, venom derivative or venom product, naturally sloughed skin, from these snakes can be legally exported for research and medical purposes. Export permits are required with the exception of venom, venom derivative or venom product or a naturally sloughed skin for the following species for which an existing exemption is in place:

Common Death Adder	<i>Acanthophis antarcticus</i>
Northern Death Adder	<i>Acanthophis praelongus</i>
Desert Death Adder	<i>Acanthophis pyrrhus</i>
Lowlands Copperhead	<i>Austrelaps superbis</i> South Australia and Victoria)
Pygmy Copperhead	<i>Austrelaps labialis</i> (Kangaroo Is. only)
Stephens Banded Snake	<i>Hoplocephalus stephensii</i>
Peninsular Tiger Snake	<i>Notechis ater niger</i> (Kangaroo Island)
Western Tiger Snake	<i>Notechis ater occidentalis</i>
Eastern Tiger snake	<i>Notechis scutatus</i>
Inland Taipan	<i>Oxyuranus microlepidotus</i>
Coastal Taipan	<i>Oxyuranus scutellatus scutellatus</i>
King Brown Snake	<i>Pseudechis australis</i>
Collett's Snake	<i>Pseudechis colletti</i>
Spotted Black Snake	<i>Pseudechis guttatus</i>
Red-bellied Black Snake	<i>Pseudechis porphyriacus</i>
Dugite	<i>Pseudonaja affinis</i>
Peninsula Brown Snake	<i>Pseudonaja inframacula</i>
Western Brown Snake	<i>Pseudonaja nuchalis</i>
Common Brown Snake	<i>Pseudonaja textilis</i>
Rough-scaled Snake	<i>Tropidechis carinatus</i>

Venom Supplies is applying for export approval for products from the species listed in Appendix 1 of this proposal.

Species status under state legislation

All species listed are protected under the relevant state legislation. The status of the population of each species is taken into account by the respective state or territory government before approval to collect specimens is granted.

The keeping and movement of native snake species in South Australia is regulated, monitored and enforced by the Department of Environment, Water and Natural Resources (DEWNR), SA. Permits are required for the keeping and movement of animals and regular reports are submitted to the department.

2. General Goal/Aims

The aims and goals of Venom Supplies is to establish a sustainable source from which to access biological samples from a wide range of venomous snake species, particularly from the Australian Elapidae family. Snake venoms are unique blends of biologically active proteins and peptides that have potential applications in medical research, the understanding of physiological processes and in the development of human therapeutics and medications.

Venom Supplies has ties with many domestic and international academic institutions and collaborates closely with these to help facilitate various research projects.

Below is a selected list of published work relating to these aims:

Correlation between ontogenetic dietary shifts and venom variation in Australian brown snakes (*Pseudonaja*) V Cipriani, J Debono, J Goldenberg, TNW Jackson, K Arbuckle, J Dobson, I Koludarov, B Li, C Hay, N Dunstan, L Allen, I Hendrixx, H F Kwok, B G Fry *Comparative Biochemistry and Physiology Part C: Toxicology & Pharmacology* 197 2017

How the Cobra Got Its Flesh-Eating Venom: Cytotoxicity as a Defensive Innovation and Its Co-Evolution with Hooding, Aposematic Marking, and Spitting N Panagides, TNW Jackson, MP Ikononopoulou, K Arbuckle, R Pretzler, D C Yang, S A Ali, I Koludarov, J Dobson, B Sanker, A Asselin, R C Santana, I Hendrixx, H v d Ploeg, J Tai-A-Pin, R v d Bergh, H MI Kerckamp, F J Vonk, A Naude, M A Strydom, L Jacobsz, N Dunstan, M Jaeger, W C Hodgson, J Miles, B G Fry *Toxins* 9 (3), 103 2017

Rapid radiations and the race to redundancy: An investigation of the evolution of Australian elapid snake venoms TNW Jackson, I Koludarov, SA Ali, J Dobson, CN Zdenek, D Dashevsky, P P Masci, A Nouwens, P Josh, J Goldenberg, V Cipriani, C Hay, I Hendrixx, N Dunstan, L Allen, B G Fry *Toxins* 8 (11), 309 2016

Proteomic comparisons of venoms of long-term captive and recently wild-caught Eastern brown snakes (*Pseudonaja textilis*) indicate venom does not change due to captivity RJR McCleary, S Sridharan, NL Dunstan, PJ Mirtschin, RM Kini *Journal of proteomics* 144, 51-62 2016

Deep venomomics of the *Pseudonaja* genus reveals inter-and intra-specific variation T Reeks, V Lavergne, K Sunagar, A Jones, E Undheim, N Dunstan, B Fry, PF Alewood

Journal of proteomics 133, 20-32 2016

Proteomic comparisons of long-and short-term captive eastern brown snakes (*Pseudonaja textilis*) RJR Mcclary, S Sridharan, NL Dunstan, PJ Mirtschin, PF Alewood, RM Kini

Integrative and Comparative Biology 56, E142-E142 2016

Venomomics of the Australian eastern brown snake (*Pseudonaja textilis*): detection of new venom proteins and splicing variants VL Viala, D Hildebrand, M Trusch, TM Fucase, JM Sciani, DC Pimenta, R K Arni, H Schlüter, C Betzel, P Mirtschin, N Dunstan, P J Spencer

Toxicon 107, 252-265 2015

Label-free (XIC) quantification of venom procoagulant and neurotoxin expression in related Australian elapid snakes gives insight into venom toxicity evolution J Skejic, DL Steer, N Dunstan, WC Hodgson

Journal of proteome research 14 (11), 4896-4906 2015

Comparative studies of the venom of a new taipan species, *Oxyuranus temporalis*, with other members of its genus CM Barber, F Madaras, RK Turnbull, T Morley, N Dunstan, L Allen, T Kuchel, P Mirtschin, W C Hodgson

Toxins 6 (7), 1979-1995 2014

Vintage venoms: proteomic and pharmacological stability of snake venoms stored for up to eight decades C Jesupret, K Baumann, TNW Jackson, SA Ali, DC Yang, L Greisman, L Kern, J Steuten, M Jouiaei, N R Casewell, E AB Undheim, I Koludarov, J Debono, D HW Low, S Rossi, N Panagides, K Winter, V Ignjatovic, R Summerhayes, A Jones, A Nouwens, N Dunstan, W C Hodgson, K D Winkel, P Monagle, B G Fry

Journal of proteomics 105, 285-294 2014

Venom down under: dynamic evolution of Australian elapid snake toxins TNW Jackson, K Sunagar, EAB Undheim, I Koludarov, AHC Chan, K Sanders, S A Ali, I Hendrikx, N Dunstan, B G Fry

Toxins 5 (12), 2621-2655 2013

Cross-neutralisation of the neurotoxic effects of Egyptian cobra venom with commercial tiger snake antivenom R Kornhauser, GK Isbister, MA O'leary, P Mirtschin, N Dunstan, W C Hodgson

Basic & clinical pharmacology & toxicology 112 (2), 138-143 2013

The In vitro Neurotoxic Effects of the Newly Discovered Central Ranges Taipan (*Oxyuranus temporalis*) CM Barber, P Mirtschin, N Dunstan, T Morley, WC Hodgson

Toxicon 60 (2), 192 2012

Identification of novel proteins from the venom of a cryptic snake *Drysdalia coronoides* by a combined transcriptomics and proteomics approach ST Chatrath, A Chapeaurouge, Q Lin, TK Lim, N Dunstan, P Mirtschin, P Kumar, R M Kini

Journal of Proteome Research 10 (2), 739-750 2011

Venom yields from Australian and some other species of snakes PJ Mirtschin, N Dunstan, B Hough, E Hamilton, S Klein, J Lucas, D Millar, F Madaras, T Nias

Ecotoxicology 15 (6), 531-538 2006

Influences on venom yield in Australian tigersnakes (*Notechis scutatus*) and brownsnakes (*Pseudonaja textilis*: Elapidae, Serpentes)
PJ Mirtschin, R Shine, TJ Nias, NL Dunstan, BJ Hough, M Mirtschin
Toxicon 40 (11), 1581-1592 2002

3.1 Wild Harvest Details

Description of what is being harvested

Live snakes are collected opportunistically in small numbers, generally by licenced wildlife professionals attending to nuisance snake requests from the public. Venom Supplies currently holds permits in South Australia and Queensland to collect snakes to be used for venom extraction. These permits provide for potential venom requirements and maintenance of genetic vigour of the captive colony.

The snakes will be/have been opportunistically collected in accordance with state legislation controls which regulate the collecting of native species from the wild. Whilst the details of collecting requirements in each state vary slightly, they all generally require a permit to collect and an additional permit to transport the snakes across state lines. Details of these permits are usually available on the respective state website. All the requirements and methods used have to be approved by the respective state authority. In each case it is simply a matter of catching the snakes when opportunities arise. Collection is by hand and in most cases the snakes are collected when they are interacting with the public and are removed to reduce the risk of snake bite to the public.

Location of harvest

These species are harvested in small numbers from private lands in South Australia and Queensland (other states may be included in the future) within their normal ranges in accordance with restrictions listed in the approvals from the respective state authorities. The ranges of each species can be obtained from the books Cogger, H.G. (2014), *Reptiles and Amphibians of Australia VII edition* CSIRO PUBLISHING, Melbourne and Wilson, S. and Swan, G. (2013) *A complete guide to Reptiles of Australia IV Edition*. Reed New Holland, Sydney.

Areas collected: Snakes are collected within their normal range in accordance with state controls. In all cases these areas are outside national and conservation parks. The respective ranges can be found in Cogger, H.G. (2014), *Reptiles and Amphibians of Australia VII edition* CSIRO PUBLISHING, Melbourne and Wilson, S. and Swan, G. (2013) *A complete guide to Reptiles of Australia IV Edition*. Reed New Holland, Sydney.

Land Ownership: Snakes are collected from privately owned land across South Australia and Queensland (and other states if required). Approval from the land owner is gained prior to collection as per State approval requirements.

Quantities harvested: In each case the number of snakes harvested is low and in accordance with state permit approval limits. Snakes are collected on an opportunistic basis and in most cases when interacting with the public to remove snake hazard. Over the last approval period (Dec 2014- Aug 2017) a total of 52 individual snakes were collected under Venom Supplies approved collection permits.

Harvest Methods: Snakes are caught by hand using a snake jigger, a soft padded device attached to a handle used to safely pin the snake without harming it (see picture).



Jigger is used to gently restrain snakes

Harvest Time: Snakes are generally harvested during their active period which is mostly from September to April each year.

3.2 General Operations (including breeding)

General husbandry:

Venom Supplies currently has 4 buildings and a number of secure outside enclosures (appendix 2) to maintain its collection of snakes and rodents (used as a food source). The facilities have 24 hour monitored security and fire systems. Venom Supplies is a recognised DAFF Quarantine Approved Facility and is subject to regular inspections from DAFF to maintain this status.

The majority of snakes at Venom Supplies are housed individually with the exception of snakes together for breeding purposes or those housed in the outdoor enclosures. Snakes (other than those in the outdoor enclosures) are housed in either a plastic 'tub' style enclosure or a fixed, wooden enclosure. All snakes are given a unique ID code and husbandry records are collected and recorded for all individuals during their lifetime. Breeding of snakes is performed on an as needed basis, generally in response to a direct service related requirement but also to maintain overall collection vigor and reduce the necessity of wild harvesting.

4. Impact of Wild Harvest on Ecosystems

The impact of collecting on the ecosystem is immeasurably low and the likely impact of the collecting on species abundance is negligible. In general terms the relative impact of collecting animals for any purpose compared with other environmental impacts such as habitat loss and feral animals can be realised by reading an assessment by Professor Hal Cogger regarding land clearing in Queensland (Cogger *et al*, 2003). The report stated that an estimated 89 million reptiles are being killed annually in Queensland by land clearing. Earlier, hugely conservative, estimates in Ehmann and Cogger (1985), *Australia's endangered herpetofauna: a review of*

criteria and policies, reflect the true perspective of collecting compared with other classes of mortality:

<u>Natural mortality</u>	3,840 million	99.77%
<u>Human induced mortality</u>		
Road kills	5.48 million	0.14%
Land clearing	3.26 million	0.08%
Research collecting	0.02 million	0.0005%
Skins and amateur collecting	<0.02 million	0.0005%

5. Monitoring & Assessment (in relation to the wild harvest)

The environmental impact of the proposed activity of collecting snakes is believed to be miniscule. Monitoring is applied at both state and federal levels by state wildlife agencies through returns submitted by us, and Wildlife Trade are informed through Specimen Export Record form lodgement. No population studies have been carried out on these species in the areas from which they are likely to come, nor is any analysis possible.

5.1 Resource assessment (in relation to the wild harvest)

No population studies have been conducted for these species in areas from which they are likely to be taken. See above. Ecological studies of reptiles tend to be conducted in reserves. These specimens will all come/have come from private property.

6. Effective Management Strategies (in relation to wild harvest)

Population changes are hardly detectable when working with such small numbers over brief periods and would be indistinguishable from the effects of season and meteorological conditions on observable abundance.

The effectiveness of our management in the laboratory of the snakes we collect and hold is reflected in returns submitted to state wildlife authorities and AEC. Our standards are maintained at a superior level. Monitoring and feedback may result following review by these bodies of submitted returns.

7. Compliance

As noted under Section 1 *Species status under state legislation*, the species are protected under state legislation. The keeping and movement of native snakes in South Australia is regulated by DEWNR. Venom Supplies provides reports to DEWNR.

Compliance with permit conditions for the collection of snakes from the wild is monitored by state government agencies, particularly DEWNR in South Australia. This is to ensure that only legally obtained specimens are used in commercial trade.

8. Reports

Wildlife Trade is informed about exports through the lodgement of Specimen Export Record forms, which are provided for every consignment exported. Venom Supplies

will further provide the information already being supplied to the South Australian and other state authorities if required by Wildlife Trade.

9. Background information

Biological and ecological information on most Australian snake species is poorly known.

Professor Rick Shine from the University of Sydney is the best known in this area and an overview of biology and ecology of the Australian species involved can be found in Shine (1991), *Australian Snakes: A Natural History*.

Allen Greer authored a work which summarises a vast body of knowledge of the biology of Australian snakes in Greer, A.E. 1997. *The Biology and evolution of Australian Snakes* Surrey Beatty and Sons, Chipping Norton.

For taxonomic summaries see Cogger, H.G. (2014), *Reptiles and Amphibians of Australia VII edition* CSIRO PUBLISHING, Melbourne and Wilson, S. and Swan, G. (2013) *A complete guide to Reptiles of Australia IV Edition*. Reed New Holland, Sydney.

References

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Cogger, H.G., Ford, H., Johnson, C., Holman, J. and Butler, D. (2003). *Impact of Land Clearing on Australian Wildlife in Queensland*. WWF Australia Report.

Ehmann, H. and Cogger, H. (1985) Australia's endangered herpetofauna: a review of criteria and policies. *Biology of Australasian Frogs and Reptiles* (eds G. Grigg, R. Shine & H. Ehmann), pp. 435-447. Royal Zoological Society of New South Wales, Sydney, Australia.

Greer, A.E. 1997. *The Biology and evolution of Australian Snakes*, Surrey Beatty and Sons, Chipping Norton.

Shine, R. (1991). *Australian Snakes: A Natural History*, Reed Books, Sydney.

Wilson, S. and Swan, G. (2013) *A complete guide to Reptiles of Australia IV Edition*. Reed New Holland, Sydney.

Appendix 1

Common Name	Scientific Name
Common Death Adder	<i>Acanthophis antarcticus</i>
Northern Death Adder	<i>Acanthophis praelongus</i>
Desert Death Adder	<i>Acanthophis pyrrhus</i>
Lowlands Copperhead	<i>Austrelaps superbus</i>
Pygmy Copperhead	<i>Austrelaps labialis</i>
Brown Tree Snake	<i>Boiga irregularis</i>
Northern Dwarf Crowned Snake	<i>Cacophis churchilli</i>
White - Crowned Snake	<i>Cacophis harriettae</i>
Dwarf Crowned Snake	<i>Cacophis krefftii</i>
Golden Crowned Snake	<i>Cacophis squamulosus</i>
Papuan Whip Snake	<i>Demansia papuensis</i>
Yellow faced Whip Snake	<i>Demansia psammophis</i>
Desert Whip Snake	<i>Demansia reticulata</i>
Collared Whip Snake	<i>Demansia torquata</i>
Black Whip Snake	<i>Demansia vestigiata</i>
De Vi's Banded Snake	<i>Denisonia devisi</i>
White Lipped Snake	<i>Drysdalia coronoides</i>
Masters Snake	<i>Drysdalia masteri</i>
Bardick	<i>Echiopsis curta</i>
Red- Naped Snake	<i>Furina diadema</i>
Orange -Naped Snake	<i>Furina ornata</i>
Brown Headed Snake	<i>Furina tristis</i>
Grey Snake	<i>Hemiaspis damelii</i>
Black Bellied Swamp Snake	<i>Hemiaspis signata</i>
Pale Headed Snake	<i>Hoplocephalus bitorquatus</i>
Stephens banded snake	<i>Hoplocephalus stephensii</i>
Peninsular Island Snake	<i>Notechis ater niger</i>
Western Tiger Snake	<i>Notechis ater occidentalis</i>
Eastern Tiger snake	<i>Notechis scutatus</i>
Inland Taipan	<i>Oxyuranus microlepidotus</i>
Coastal Taipan	<i>Oxyuranus scutellatus</i>
Papuan Taipan	<i>Oxyuranus scutellatus canni</i>
Little Whip Snake	<i>Parasuta flagellum</i>
Monk (hooded) Snake	<i>Parasuta monachus</i>
Mitchells Short Tailed Snake	<i>Parasuta nigriceps</i>
Mallee Black - headed Snake	<i>Parasuta spectabilis</i>
King Brown snake/ Mulga	<i>Pseudechis australis</i>
Collett's Snake	<i>Pseudechis colletti</i>
Spotted Black Snake	<i>Pseudechis guttatus</i>
Papuan Black Snake	<i>Pseudechis papuanus</i>
Red Bellied Black Snake	<i>Pseudechis porphyriacus</i>
Dugite	<i>Pseudonaja affinis</i>
Western Brown Snake	<i>Pseudonaja aspidorhyncha</i>
Speckled Brown Snake	<i>Pseudonaja guttata</i>
Peninsula Brown Snake	<i>Pseudonaja inframacula</i>
Ingram's Brown Snake	<i>Pseudonaja ingrami</i>
Western Brown Snake	<i>Pseudonaja mengdeni</i>
Ringed Brown Snake	<i>Pseudonaja modesta</i>

Western Brown snake
Common/ Eastern Brown Snake
Capentaria Whip Snake
Small Eyed Snake
Black Striped Snake
Coral Snake
Narrow Banded Snake
Unbanded shovel
nosed Snake
Half Girdled Snake
Dwyers snake
Little Spotted Snake
Myall Snake
Rough scaled Snake
Bandy Bandy

Pseudonaja nuchalis
Pseudonaja textilis
Rhinoplocephalus boschmai
Rhinoplocephalus nigrescens
Rhinoplocephalus nigrostriatus
Simoselaps australis
Simoselaps fasciolatus

Simoselaps incinctus
Simoselaps semifasciatus
Suta dwyeri
Suta punctata
Suta suta
Tropidechis carinatus
Vermicella annulata

Appendix 2

