# PEST RISK ASSESSMENT

## Lace Monitor

Varanus varius



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#### **About this Pest Risk Assessment:**

This pest risk assessment is developed in accordance with the *Policy and Procedures for the Import, Movement and Keeping of Vertebrate Wildlife in Tasmania* (DPIPWE 2011). The policy and procedures set out conditions and restrictions for the importation of controlled animals pursuant to s32 of the *Nature Conservation Act 2002*. This pest risk assessment is prepared by DPIPWE for use within the Department.

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### I. Summary

The Lace Monitor (*Varanus varius*) is a large arboreal lizard which is found in eastern and south-eastern Australia from Cape York Peninsula (Queensland) to south-eastern South Australia. Lace Monitors occur in well-timbered areas from dry woodlands to cool temperate forests in southern Australia. They forage widely, and frequently become habituated to picnic areas and camping grounds. The lizards also frequently raid farms for poultry and eggs.

Lace Monitors are noted for laying eggs within termite mounds that are either arboreal or terrestrial. The literature is conflicting in respect to whether termite mounds are critical to the lifecycle of this species. Some authors suggest that termite mounds are used frequently where they are available, while others consider that Lace Monitors are dependent on the mounds to complete their life cycle. If termite mounds are required, the species will not establish in Tasmania because the mound-building termite species (*Nasutitermes exitiosus*) is not present in the State. A precautionary approach is taken in this risk assessment and it is assumed that Lace Monitors could lay viable eggs in Tasmania despite the absence of termite mounds.

Lace Monitors are protected under legislation in all Australian jurisdictions where they are present. The species is listed as vulnerable in Victoria under the Wildlife Act 1975, and is listed as rare in South Australia under the National Parks and Wildlife Act 1972. It is not listed on the IUCN Red List of Threatened Species. The species is a 'controlled animal' under the Tasmanian Nature Conservation Act 2002.

The Lace Monitor is not considered a pest species. They have not established feral populations outside their native range and no introduction attempts have been noted. There is no evidence of the species causing any major impacts on agriculture.

This risk assessment determines that there is a high likelihood that this species could establish in Tasmania, with potential for moderate impacts. The most significant impacts are likely to be predation because Lace Monitors have a broad diet of small mammals, birds, reptiles, amphibians and carrion. They are known to climb trees and raid nests to feed on birds including those species that occur in the upper canopy. Given this, there is potential for impacts on a large number of Tasmanian threatened species, such as the Swift Parrot (*Lathamus discolor*), Wedge-tailed Eagle (*Aquila audax fleayi*), White-bellied Sea-Eagle (*Haliaeetus leucogaster*), Orange-bellied Parrot (*Neophema chrysogaster*), Masked Owl (*Tyto novaehollandiae castanops*), New Holland Mouse (*Pseudomys novaehollandiae*), Spotted-tailed quoll (*Dasyurus maculatus maculatus*), Green and Gold Frog (*Litoria raniformis*), Striped Marsh Frog (*Limnodynastes peroni*), and the Ptunarra brown butterfly (*Oreixenica ptunarra*).

Competition could also occur with Tasmanian lizard species such as the Mountain dragon (*Rankinia diemensis*), and the Tussock skink (*Pseudemoia pagenstecheri*). Lace Monitors could also have an impact on poultry farms in the State because they raid farms to feed on eggs and birds. Overall the potential consequences are estimated to be moderate.

This risk assessment concludes that Lace Monitors are a serious threat to Tasmania and proposes that imports be restricted to those license holders approved for keeping serious threat species.

### 2. Introduction

#### 2.1 NAME AND TAXONOMY

Kingdom: Animalia

Phylum: Chordata

Class: Reptilia

Order: Squamata

Suborder: Lacertilia

Family: Varanidae

**Genus:** Varanus

**Subgenus:** V. (Varanus)

**Species:** Varanus varius

Sub-species or variety (if applicable): None known.



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Common names (including any industry or trade names): Lace Monitor, Lace Goanna, Tree Goanna.

#### 2.2 DESCRIPTION

The Lace Monitor is the second largest monitor lizard, or goanna, in Australia. The average length is about 1.5m, but they may grow to more than 2m (Cogger 2000). Australian varanids have a long slender neck with a long, strong body, a muscular tail and well developed limbs with strong claws (King and Green 1993). The body is covered with loose-fitting skin. They have moveable eyelids and an extremely long, slender forked tongue.

The upper body is typically dark blue with numerous scattered white, cream or yellow scales, or groups of scales, that form spots and blotches. In the young, these markings tend to be confined to light areas between dark cross-bands. The markings can be lost in adults, although banded adults occur in northern New South Wales and south-eastern Queensland. In these individuals the banding across the body is black and yellow and extends from the snout or chin.

The tail is about 1.8 times as long as the head and body, and is laterally compressed with a distinct median dorsal double keel, which does not extend to the base.

#### 2.3 CONSERVATION AND LEGAL STATUS

#### **CONSERVATION STATUS**

The Lace Monitor is not listed on the IUCN Red List of Threatened Species (IUCN 2010). The species is not listed as threatened fauna under the *Environment Protection and Biodiversity Conservation Act 1999*.

#### **LEGAL STATUS**

In Australia Lace Monitors are protected under legislation in each State within their native range. They are protected under the Queensland *Nature Conservation Act 1992*; the New South Wales *National Parks and Wildlife Act 1974*; the Victorian *Wildlife Act 1975*; and the South Australian *National Parks and Wildlife Act 1972*.

In Tasmania the species is a 'controlled animal' under the Tasmanian Nature Conservation Act 2002.

## 3. Biology and Ecology

#### 3.1 LIFE HISTORY

Lace Monitors are generally active in spring, summer and autumn, and inactive during winter (between June and August) (Guarino 2001). Mating occurs in late spring. Males can be extremely aggressive during the mating season and are often seen with large wounds (Carter 1990). Females may mate with one or several males over a period of a few days. Observations from captive populations indicate that eggs are laid approximately 35 days after mating (Bredl and Schwaner 1983, Horn and Visser 1989 cited in Greer 2006). In southern Australia the female buries the clutch of 4-15 eggs in active termite mounds which can either be in trees or on the ground (Greer 2006). Circumstantial evidence suggests that the young are released from the termite mounds by the mother (Greer 2006). Hatchlings may stay in and around the termite mound for two weeks before dispersing. They start feeding 7 to 10



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days after hatching but do not eat the termites. Females reproduce once a year.

There are few data on the longevity of varanids in the wild (King and Green 1993). In captivity there are records of some species being held for up to 20 years, and it has been estimated that in the wild some species can live up to 50 years.

#### 3.2 HABITAT REQUIREMENTS AND PREFERENCES

Lace Monitors live in lowland forests, woodland and closed forest, although in dry areas they only occur in woodland adjacent to rivers. They do not venture far into grasslands, but they may utilise 'edge effects' by foraging along the edges of cleared land that have a higher abundance of potential food such as invertebrates, rabbits and carcasses (Weaver 1993).

Lace Monitors may use tree hollows (Gibbons and Lindenmayer 2000). They can climb trees, and are known to prey on nesting birds and eggs. Lace Monitors will also climb trees when disturbed by people (Weavers 1993).

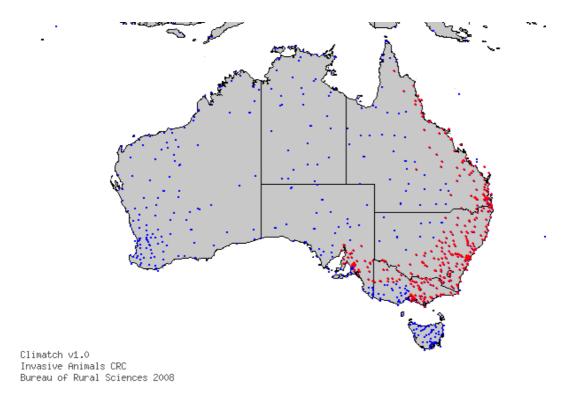
The literature is unclear in relation to whether termite mounds are required for Lace Monitors to complete their life cycle, or whether they are just frequently used. Greer (2006) suggests they are dependent on the species of termites that build the mounds (*Nasutitermes exitiosus*) because there

are no reliable records of the lizards nesting anywhere else in southern Australia. There are several benefits to nesting in the termite mounds including constant temperatures and humidity, and protection from predators and floods (Greer 2006).

Other references suggest that although nesting in the mounds occurs often, it is not restricted to the mounds (Cogger 2000). If termite mounds are required, the species will not establish in Tasmania because the mound building termite (*Nasutitermes exitiosus*) is not present in the State. Given this uncertainty, a precautionary approach is taken in this risk assessment and it is assumed that Lace Monitors could lay eggs that would hatch in Tasmania, despite the absence of termite mounds.

#### 3.3 NATURAL GEOGRAPHIC RANGE

The Lace Monitor is present in Queensland, New South Wales, Victoria and South Australia. It occurs throughout the Great Dividing Range on the east coast, through riverine woodland on the Murray-Darling river system and extends into South Australia. There is also a population in the Southern Flinders Ranges in South Australia that is isolated from the main population. It is considered rare in South Australia. The natural range is estimated at approximately 1,500,000 km².



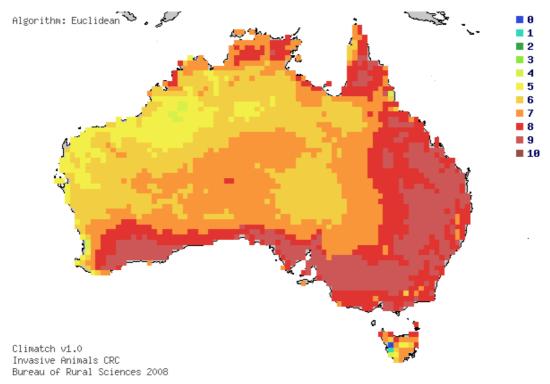
**Figure 1.** Natural range of the Lace Monitor (*V. varius*) (are highlighted in red). (Distribution source: Cogger 2000).

#### 3.4 INTRODUCED GEOGRAPHIC RANGE

There is no evidence of the Lace Monitor establishing feral (non-naturally occurring) populations outside their native range and no introduction attempts have been noted (Krauss 2009). The species is not recorded on the Global Invasive Species Database (GISP 2011).

#### 3.5 POTENTIAL DISTRIBUTION IN TASMANIA

Using modelling applications developed by the Australian Bureau of Agricultural and Resource Economics and Sciences (DAFF), climate is compared between the species' historical distribution and potential distribution throughout Australia (shown in Figure 2). Modelling indicates that Tasmania has a highly similar climate which may support the establishment of introduced populations (highest climate match score: 8).



**Figure 2.** Climate comparison between the historical range of *V. varius* and the whole of Australia, where 10 is a 'perfect' match and 0 is having a very dissimilar climate. Tasmania shows a match between 0 and 8 (Distribution source: Cogger 2000).

#### 3.6 DIET AND FEEDING BEHAVIOUR

The Lace Monitor is the second largest endemic carnivore in eastern Australia. It is an active arboreal and terrestrial forager (Guarino 2001). The species is a generalist predator and scavenger that feeds on a wide range of prey including mammals, birds, fish, amphibians, eggs and insects (King and Green 1979; Losos and Greene 1988; Weavers 1989).

Monitors will opportunistically prey on food that is locally abundant, and as a result, different populations can show intra-specific variation in prey. Guarino (2001) conducted a stomach and faecal analysis of *V. varius* in New South Wales and concluded that carrion was the most important staple food source. Carrion is available throughout the year, and is generally more abundant during periods of drought when herbivores die due to food shortages. Birds, rabbits, reptiles and amphibians were eaten mainly during spring and early summer when they were most abundant.

Lace Monitors will forage over large distances. The home range of male *Varanus varius* is of the order of 65±34ha (Weavers 1993). They are known to travel over several kilometres and have been recorded to move more than I km within a few hours (Heatwole and Taylor 1987).

#### 3.7 SOCIAL BEHAVIOUR AND GROUPINGS

During the breeding season males engage in combat behaviour involving wrestling. They clutch each other with the forelegs and the victor may bite the other male. Males are often seen with severe wounds, suggesting that there is strong competition for mates.

Females may mate frequently with one or more males, and groups of males have been observed trying to mate with an individual female. Eggs are often laid in termite mounds, and a female (most probably the mother) may dig the hatchlings out. Hatchlings may stay in and around the termite mound for two weeks before dispersing.

#### 3.8 NATURAL PREDATORS AND DISEASE

It is considered likely that Lace Monitors are eaten by a wide variety of predators. Young monitors may escape predation by spending their early life in trees. The only records of predators of larger monitors are snakes and dingoes (Greer 2006).

Monitors tolerate a large number of internal and external parasites. Nematodes, protozoans and cestodes are often present in the gastrointestinal tract. Varanids also host blood parasites including protozoans and malarial plasmodia (King and Green 1993).

Ticks and mites are also common on monitors. Thirty or more ticks can be present on an adult. They attach themselves to the chest, the base of the tail behind the cloaca, between the eyes and in the nasal cavity (King and Green 1993).

#### 3.9 THREAT TO HUMAN SAFETY

When Lace Monitors are approached by humans they usually climb a tree. They may hold their ground when startled, and rise up on their rear legs and hiss. When grasped by humans monitors are reported to regurgitate their stomachs and defecate. Bites on digits from a Lace Monitor have been observed and resulted in rapid swelling within minutes. These wounds are prone to infection and the bites may be somewhat venomous.

#### 3.10 HISTORY AS A PEST

There are no records of *Varanus varius* being introduced into new areas. However, four species within the Genus have been introduced into new areas (Kraus 2009) including the following species: *Varanus gouldii*; *V. indicus*; *V. niloticus*; and *V. rosenbergi*.

#### 3.11 POTENTIAL IMPACT IN TASMANIA

If Lace Monitors were introduced into Tasmania there is potential for significant impacts on a number of native and threatened fauna because the species is an opportunistic carnivore that takes a wide range of prey, across a broad range of size classes. They feed on insects, reptiles and small mammals and are a major predator of nesting birds because they climbs trees and predate on nesting birds and eggs (Cogger 2000).

There is potential for significant impacts on a large number of Tasmanian threatened species, such as the Swift Parrot (*Lathamus discolor*), Wedge-tailed Eagle (*Aquila audax fleayi*), White-bellied Sea-Eagle (*Haliaeetus leucogaster*), Orange-bellied Parrot (*Neophema chrysogaster*), Masked Owl (*Tyto novaehollandiae castanops*), New Holland Mouse (*Pseudomys novaehollandiae*), Spotted-tailed quoll (*Dasyurus maculatus maculatus*), Green and Gold Frog (*Litoria raniformis*), Striped Marsh Frog (*Limnodynastes peroni*) and the Ptunarra brown butterfly (*Oreixenica ptunarra*).

Lace Monitors could potentially compete for resources with Tasmanian lizard species such as the Mountain dragon (*Rankinia diemensis*), and the Tussock skink (*Pseudemoia pagenstecheri*). The Tussock skink is a threatened species and is listed as 'vulnerable' under the *Threatened Species Protection Act 1995*. More than 80% of the Tussock skink population occurs within areas identified as suitable for the Lace Monitor.

The Lace Monitor has the potential to compete with the threatened Glossy grass skink (*Pseudemoia rawlinsoni*), which has a small localised range in northern Tasmania. Direct competition is unlikely however, because the Glossy grass skink inhabits wetter habitats such as swamps, watercourses and areas subject to frequent flooding.

### 4. Risk Assessment

#### **4.1 PREVIOUS RISK ASSESSMENTS**

No formal risk assessments have been noted for this species.

#### **4.2 RISK ASSESSMENT**

The following risk assessment determines the risk of the Lace Monitor (*Varanus varius*) to Tasmania using the Bomford model (2008) and proposes assigned threat categories and import classifications for the species.

Species:	Lace Monitor (Varanus varius)			
Date of Assessment:	September 2011			
Literature search type and date:	See references			
Factor	Score			
A1. Risk posed from individual escapees (0-2)	I	The animal can make unprovoked attacks causing moderate injury (requiring medical attention) or severe discomfort but is highly unlikely (few if any records) to cause serious injury (requiring hospitalisation) if provoked.  Bites cause rapid swelling within minutes, localised disruption of blood clotting, shooting pain. Bites often become infected and may require medical attention.		
A2. Risk to public safety from individual captive animals (0-2)	O Nil or low risk (highly unlikely or possible).			
Stage A. Risk posed by individual animals (risk that a captive or escape animal would harm people)	Public Safety Risk Score = AI + A2 = I	Public Safety Risk Ranking  A ≥ 2, Highly Dangerous  A = 1, Moderately Dangerous  A = 0, Not Dangerous  = Moderately Dangerous		
B1. Family random effect value	-0.59	Varanidae		
B2. Proportion of introduction events that led to species establishment (Prop.species value)	0.467	7 out of 15 attempts were successful at the Genus level.		
B3. S(Climate 6 value)	1.52	Climate 6 Score (24).		

Stage B. Likelihood of establishment (risk	Establishment Risk	Establishment Risk Ranking	
that a particular species will establish a	Score	B = ≥0.86, Extreme	
wild population in Tasmania)	$= 1/(1 + \exp(0.80 - 2.90)$	B = 0.40-0.85, High	
	(Prop.species) –	B = 0.17-0.39, Moderate	
	S(Climate6) – Family	B = ≤ 0.16, Low	
	Random Effect))	= High	
	= 0.80	1 ng.1	
C1. Taxonomic group (0-4)	0	Not in a taxonomic group known to have significant impacts.	
C2. Overseas range size (0-2)	0	Range is estimated at 1,500,000 km <sup>2</sup> .	
C3. Diet and feeding (0-3)	0	Not a mammal	
C4. Competition for native fauna for tree		Can nest or shelter in tree hollows.	
hollows (0-2)	2	Lace Monitors may use tree hollows	
		(Gibbons and Lindenmayer 2000).	
C5. Overseas environmental pest status (0-3)	0	Never reported as an environmental pest	
	0	in any country or region.	
C6. Climate match to areas with susceptible		75% of the geographic range overlaps	
native species or communities (0-5)	5	with susceptible native species.	
	3	Potential for significant impacts on a	
		number of threatened species.	
C7. Overseas primary production (0-3)		Minor pest of primary production in	
	1	Australia	
		Lace Monitors are known to raid	
		poultry farms for eggs and birds.	
C8. Climate match to susceptible primary		Lace Monitors are known to raid	
production (0-5)	1	farms for poultry and eggs and there is an overlap of suitable climate and	
		poultry production in the State.	
C9. Spread disease (1-2)	<u> </u>	Reptile.	
	·		
C10. Harm to property (0-3)	0	<\$100,000 per year.	
	U	Unlikely to cause any damage to	
		property.	
C11. Harm to people (0-5)	2	Injuries or harm or annoyance likely to be minor and few people exposed.	
Stage C. Quantitative Consequence	Consequence Risk	Consequence Risk Ranking	
Assessment	Score	C > 19, Extreme	
	= sum of CI to CII	C = 15-19, High	
	= 12	C = 9-14, Moderate	
		C < 9, Low	
		= Moderate	

Qualitative Consequence Assessment		
Adverse impacts	Lace Monitors can raid poultry farms taking birds and eggs.	
Closes relatives with similar behavioural and ecological strategies that have had adverse impacts elsewhere	Many monitor lizards have similar behavioural or ecological strategies, but none are noted for having any additional adverse impacts.	
Dietary generalists	The species has traits of a generalist carnivore and consumes a variety of animals including small mammals, birds, insects, reptiles and carrion.	
Stir up sediments to increase turbidity in aquatic habitats	This species does not inhabit aquatic environments.	
Occur in high densities in their native or introduced range	Lace Monitors are not noted for occurring in high densities throughout their range.	
Have the potential to cause poisoning and/or physical injury	This species has some potential to cause poisoning or physical injury. Lace Monitor bites often get infected and can result in rapid swelling within minutes, localised disruption of blood clotting, and shooting pain. There is some evidence that monitors are venomous.	
Harbour of transmit diseases or parasites that are present in Australia	This species is an Australian endemic and harbours diseases and parasites which are present in the country. They tolerate a large number of external parasites such as mites and ticks, and internal parasites such as nematodes in the gastrointestinal tract, cestodes, pentastomes, and protozoans.	
Have close relatives among Australia's endemic reptiles and amphibians	The Lace Monitor is native to Australia and the genus is widespread over most of the Australian mainland. There are 24 species on the Australian mainland, of which 20 are endemic. Northern and arid regions can support up to 10 different species in one area, whereas temperate areas generally only support 1 or 2 species. No monitor lizards are present in Tasmania.	
Are known to have spread rapidly following their release into new environments	There is no evidence of Lace Monitors establishing feral (non-naturally occurring) populations outside their native range and no introduction attempts have been noted.	
Stage C. Qualitative Consequence Assessment	Based on the outcomes of the qualitative consequence assessment, it is estimated that the potential consequence of Lace Monitors establishing in Tasmania is moderate.	
Stage C. Consequence of Establishment (risk that an established population would cause harm)	Quantitative Consequence : Moderate Qualitative Consequence : Moderate  Highest Consequence Assessment: Moderate	
ASSIGNED THREAT CATEGORY:	SERIOUS	
PROPOSED IMPORT CLASSIFICATION:	IMPORT RESTRICTED TO THOSE LICENSE HOLDERS APPROVED FOR KEEPING SERIOUS THREAT SPECIES	

### 5. Risk Management

This risk assessment concludes that Lace Monitors (*Varanus varius*) are a serious threat to Tasmania and that imports should be restricted to those license holders approved for keeping serious threat species.

As defined under the *Policy and Procedures for the Import, Movement and Keeping of Vertebrate Wildlife in Tasmania* (DPIPWE 2011), the following mandatory conditions will apply to the import and keeping of this species. Additional requirements will be implemented.

- I. Import of serious threat species will generally be prohibited unless there is a clear public benefit and sufficient measures exist for the secure housing and on-going management of the species. Species kept solely for:
  - Public display and education purposes approved by DPIPWE and/or
  - Genuine scientific research approved by DPIPWE.
- 2. The animal must not be released, or be allowed to escape from effective control.
- 3. Specimens seized or forfeited as a result of illegal or accidental introductions, where rehousing is not available, will be humanely euthanized.
- 4. Animal welfare requirements under the *Animal Welfare Act 1993* and any approved Code of Practice or Management Plan must be met.
- 5. Import only permitted by holders approved to keep the species under licence.
- 6. Individuals to be micro-chipped or otherwise identified, or treated to allow identification.
- 7. Facility must meet minimum standards for welfare and security.
- 8. Facility must be available for inspection at any reasonable time.
- 9. Audits of facilities and collections.
- 10. The maximum number of individuals of a species held at the facility to be stipulated on the licence, taking into account relevant factors. Gender may also be stipulated.
- 11. Written approval prior to movement of animals between facilities and trade of species under licence.
- 12. Record keeping and reporting to DPIPWE as required by DPIPWE.
- 13. Collections containing species subject to approval by DPIPWE as meeting best practice for keeping the species concerned.
- 14. Bonds, insurance or cost recovery systems.

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# 7. Appendices

### APPENDIX A: CALCULATING TOTAL COMMODITY DAMAGE SCORE

Column I	Column 2	Column 3	Column 4	Column 5
Industry	Commodity Value Index (CVI)	Potential Commodity Impact Score (PCIS, 0-3)	Climate Match to Commodity Score (CMCS, 0-5)	Commodity Damage Score (CDS columns 2 x 3 x 4)
Cattle (includes dairy and beef)	11	N/A		
Timber (includes native and plantation forests)	10	N/A		
Aquaculture	6	N/A		
Sheep (includes wool and meat)	5	N/A		
Vegetables	5	N/A		
Fruit (includes wine grapes)	5	N/A		
Poultry (including eggs)	1.5	2	4	12
Cereal grain (includes wheat, barley, sorghum etc)	1	N/A		
Other crops and horticulture (includes nuts and flowers)	I	N/A		
Pigs	1	N/A		
Bees (includes honey, beeswax, and pollination)	0.5	N/A		
Oilseeds (includes canola, sunflower etc)	0.5	N/A		
Grain legumes (includes soybeans)	0.3	N/A		
Other livestock (includes goats and deer)	0.3	N/A		
Total Commodity Damage Score (TCDS)				12

#### **APPENDIX B: ASSIGNING SPECIES TO THREAT CATEGORIES**

A: Danger posed by individual animals (risk a	B: Likelihood of	C: Consequence of	Threat category	Implications for any
captive or escaped individual would harm people)	establishment (risk that a	establishment (risk that an		proposed import into
	particular species will establish a	established population would		Tasmania
	wild population in Tasmania)	cause harm)		
Highly, Moderately or Not Dangerous	Extreme	Extreme	Extreme	Prohibited
Highly, Moderately or Not Dangerous	Extreme	High		
Highly, Moderately or Not Dangerous	Extreme	Moderate		
Highly, Moderately or Not Dangerous	Extreme	Low		
Highly, Moderately or Not Dangerous	High	Extreme		
Highly, Moderately or Not Dangerous	High	High		
Highly, Moderately or Not Dangerous	Moderate	Extreme		
Highly, Moderately or Not Dangerous	High	Moderate	Serious	Import restricted to those license holders approved for keeping serious threat species
Highly, Moderately or Not Dangerous	High	Low		
Highly, Moderately or Not Dangerous	Moderate	High		
Highly Dangerous	Moderate	Moderate		
Highly Dangerous	Moderate	Low		
Highly, Moderately or Not Dangerous	Low	Extreme		
Highly, Moderately or Not Dangerous	Low	High		
Highly Dangerous	Low	Moderate		
Highly Dangerous	Low	Low		
Moderately or Not Dangerous	Moderate	Moderate	Moderate	Import restricted to those license holders approved for
Moderately or Not Dangerous	Moderate	Low		
Moderately or Not Dangerous	Low	Moderate		keeping moderate threat
Moderately Dangerous	Low	Low		species
Not Dangerous	Low	Low	Low	Import permitted
Unknown	Any value	Any value	Extreme until proven	Prohibited
Any Value	Unknown	Any value	otherwise	
Any Value	Any value	Unknown		
Unassessed	Unassessed	Unassessed	7	



## RESOURCE MANAGEMENT AND CONSERVATION DIVISION

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