Conservation Assessment of *Egernia roomi* Wells & Wellington 1985 (Scincidae)

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NSW Threatened Species Scientific Committee

Kaputar Rock Skink *Egernia roomi* Wells & Wellington 1985 (Scincidae)
Distribution: Endemic to NSW
Current EPBC Act Status: Not listed
Current NSW BC Act Status: Not listed

Proposed listing on NSW BC Act and EPBC Act: Critically Endangered

Conservation Advice: *Egernia roomi*

Summary of Conservation Assessment

Egernia roomi was found to be eligible for listing as Critically Endangered under Criterion B1ab (i,ii,iii,iv) and B2ab (i,ii,iii,iv).
The main reasons for this species being eligible are; a very restricted geographical range, fragmentation of habitat, and ongoing threats, including fire, habitat destruction due to humans and potential habitat destruction by feral goats (*Capra hircus*) and climate change.

Description and Taxonomy

Although unofficially recognised as a distinct taxon for over 25 years (Sadlier *et al.* 2019) and listed as an unnamed species of *Egernia* in popular literature for over 15 years (Swan *et al*. 2004; 2017), the formal description of *Egernia roomi* has only recently been published in peer-reviewed literature (Sadlier *et al.* 2019).
Swan *et al.* (2017) describes the species as "dark chocolate brown to grey-brown above, often paler on head and nape; dark brown variegations on head and nape form a broad, mottled dark brown ventral stripe, or two paravertebral stripes, that break up behind shoulders into dark brown bars along back. A broad, very dark upper lateral zone over face and neck breaks up behind shoulders. Throat bluish grey, belly dull orange. Snout to vent length 103-121mm".
This species differs from *E. saxatilis* and *E. mcpheei* by having smooth (or slightly grooved) dorsal scales, rather than sharply or bluntly keeled scales (Swan *et al.* 2017).

Common Name: Kaputar Rock Skink

Distribution and Abundance

Egernia roomi is endemic to NSW where it is restricted to the Nandewar Ranges, located in the Northern Tablelands region of NSW, and it has been recorded from three sites near the summit of Mount Kaputar and adjacent peaks (Sadlier *et al*. 2019). The sites are distanced apart by 3 km in a straight line. All known sites are within Mount Kaputar National Park (NP) and are situated in rocky escarpment habitat. The species has so far only been recorded from between 1360 and 1480 metres in elevation. The extent of this high elevation rock escarpment habitat across the Nandewar Range extends down to 1200 m in elevation and covers an area of 122 km^2.

Potentially suitable rocky escarpment habitat extends down to around 1000 m in elevation on the eastern sector of the Nandewar Range, but it is not known if the species inhabits these lower elevations (Sadlier *et al.* 2019). The rocky habitat 1000 m elevation and above in the Range covers an area of 241 km^2. The western section of the Nandewar Range has not been investigated for this species (R. Sadlier *in litt.* August 2019) but herpetological surveys undertaken around Mount Yulludunida (~8 km from known locations of species), with a summit of around 1160 m, did not detect the species despite having potentially suitable rocky habitat (R. Sadlier *in litt.* August 2019).

The population size of *Egernia roomi* is unknown and requires investigation. No systematic targeted surveys have been undertaken for the species. However, the more readily accessible areas of the summit region have been investigated opportunistically by professional herpetologists on at least four occasions, and there are records of images taken by amateur herpetologists and naturalists posted on the internet. Despite this attention, the species has only been found at three sites (ALA 2020; Sadlier *et al.* 2019).

In September 2020, a brief search for *Egernia roomi* at two high elevation rock escarpment sites on the Governor's Track and Mount Kaputar Summit was undertaken. Approximately 20 individual skinks of *Egernia roomi* were observed on the Governor's Track and three individuals at the Mount Kaputar summit lookout. All skinks were found in close association with rock, and were either active, basking or sheltering beneath rock slabs or within rock crevices (J. Rowley pers. comm. Oct 2020).

Ecology

Key habitat requirements: *Egernia roomi* is known only from high elevation outcrops of volcanic rock habitat at the escarpment edge of the Nandewar Range (Sadlier *et al.* 2019). Habitat may also include areas of outcropping rock such as plugs and dykes, though these areas are yet to be surveyed sufficiently for the species (R. Sadlier *in litt*. August 2019).

The species appears to prefer sheltering sites of rock overlying rock, (not rock in soil) and adjacent to rock habitat with appropriate exposure for basking (thermoregulatory) activity (Sadlier *et al*. 2019).

On the Nandewar Range, distinct sub-alpine vegetation communities, including open forests of mountain gum and snow gum with snow grass groundcover, occur only in areas above the snowline at 1200 m elevation (DEC 2006). It is possible that the lower elevational limit of the species is driven by the same environmental parameters that restrict the elevational limits of the sub-alpine vegetation communities (Sadlier *et al.* 2019).

Habitat fragmentation: The species is likely to occur in suitable habitat across the Nandewar Range within its altitudinal limitations, however, the extent of interconnectivity of this type of habitat has yet to be determined and it is likely that the species is fragmented by areas of unsuitable habitat (*i.e.* areas lacking essential

sheltering sites). Areas of outcropping rock habitat away from the escarpment have yet to be thoroughly investigated and if these are not utilised by the species, then this may increase the degree of known fragmentation of habitat (R. Sadlier *in litt*. August 2019).

The extent to which the *Egernia roomi* can move between populations or habitat patches is unknown but will likely depend on its ability to utilize alternative sheltering and foraging sites in the intervening areas between its preferred habitat (R. Sadlier *in litt*. August 2019). Related rock-dwelling members of the genus appear to have episodic migration of individuals between isolated outcrops under natural conditions (Stow *et al.* 2001). However, this migration is reduced when natural cover between populations on outcrops is reduced, with female dispersal inhibited to a greater extent than males (Stow *et al.* 2001).

Diet: The diet of *Egernia roomi* is unknown, but likely to be similar to other members of the genus which are omnivorous, consisting predominantly of invertebrates, including beetles, ants, grasshoppers and cockroaches. There may be some reliance on vegetation adjacent to rock habitats to provide part of the species diet during some seasons (Brown 1991; Chapple 2003; O'Connor and Shine 2003; R. Sadlier *in litt*. August 2019).

Life History: There have been no detailed behavioural or ecological studies on this species. The population structure is not known, but other related rock-dwelling (or rock-dependant) members of the genus (e.g. *Egernia saxatilis*) form social groups or occur as related 'families' in areas of rock habitat (O'Conner and Shine 2003). *Egernia roomi* is likely to show a similar degree of defined home range (vs random movement through the landscape).

Generation Length: No information is available on generation length for this species but based on information on related species in the genus *Liopholis* and *Egernia*, this species could potentially mature at around two to three years and may live for up to 10 years (O'Connor and Shine 2003). For *Egernia roomi*, the time to maturity may be longer given the species is restricted to high elevation and the daily and seasonal activity periods for young individuals to undertake necessary activities to reach maturity (forage/bask) are likely to be shorter (R. Sadlier *in litt*. August 2019).

Threats

The availability of suitable habitat for *Egernia roomi* in the Nandewar Ranges is highly limited, making the species vulnerable to several threatening or potentially threatening processes, including fire, anthropogenic climate change and habitat disturbance and degradation by feral goats and humans (Sadlier *et al*. 2019; R. Sadlier *in litt.* August 2019). Foxes (*Vulpes vulpes*), feral cats (*Felis catus*), feral pigs (*Sus scrofa)* and black rats (*Rattus rattus*) are known to occur in Mount Kaputar NP (DEC 2006), and may be a threat to this species, however their impact is unknown.

Fire:
Natural fires occur at low frequency in the subalpine and alpine landscape, and post fire regeneration of vegetation is slow in these areas (Williams *et al.* 2009). In late 2019 and early 2020, wildfires burnt around 30% of Mount Kaputar NP (DPIE 2020), including large areas of the sub-alpine zone (*i.e*. above 1200 m; ~ 63%). Conservatively, the extent of *Egernia roomi* habitat (which includes all known records, and likely habitat above 1200 m, and potential occupied areas, down to 1000 m a.s.l.), impacted by the wildfire is estimated to be around 50% of the skink's range. The species has been listed as high priority for urgent management intervention as a result of the 2019-20 wildfires (DAWE 2020).

While the impact of fire on the species is unknown, the rock habitat of *Egernia roomi* may provide refugia during fire events and individuals may survive the direct impacts of fire. However resident populations would likely be impacted by the loss of surrounding vegetation, potentially resulting in reduced food availability, increased predation pressure, fragmentation of suitable habitat, and altered microclimate (Friend 1993; Fenner and Bull 2007). The impact of fire, even of low intensity, could further be exacerbated if proceeded or followed by an extended period of drought, by reducing the cover surrounding sheltering and foraging sites with the possible flow-on effect of reduced availability of food sources (R. Sadlier *in litt.* August 2019). Extensive drought-related defoliation of *Eucalyptus* species and shrub-death were observed within the Mount Kaputar National Park in the period preceding the 2019 fire (A. Fawcett pers. comm. May 2020)

Fire may adversely affect invertebrate prey abundance which may affect the body condition and reproductive output of some skinks (Pianka and Goodyear 2012; Atkins *et al.* 2015). Subsequently this may alter the age structure of the population. Further, predation is likely to be more pronounced after fire when there are fewer shelter sites, and when the vegetation is more open and the skinks more conspicuous, even though rocky habitats may provide a degree of refuge from predation (Amo *et al*. 2007; Fenner and Bull 2007).

Due to the fragmented nature of the populations and the likely limited dispersal ability of the species (as result of potentially unsuitable connecting habitat), intense and high frequency fires may result in further fragmentation of habitat, extirpate populations or reduce the viability of populations (Atkins *et al.* 2015). Species with low dispersal ability are likely to find it more difficult to recover from extreme events such as fires (Hagger *et al.* 2013).

In 2003 up to 45% of the range of the closely related alpine skink *Liopholis guthega* was impacted by wildfire and as a result the species experienced localised extinctions at several sites. It was found that this species was affected by fire both directly, through individual mortality, and indirectly through loss and degradation of habitat (Atkins *et al.* 2015).

Fire frequency and severity are predicted to increase within the range of *Egernia roomi* due to climate change (William *et al.* 2009). 'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation

structure and composition' is listed as a Key Threatening Process under the NSW *Biodiversity Conservation Act 2016*.

Climate Change:
Climate change is likely to have a negative impact on species such as *Egernia roomi* as it is adapted to a narrow, high elevation range of climatic conditions and occurs in isolated and fragmented populations. As such, it has limited scope for uphill migration in response to increasing temperatures and changes to habitat which are likely to make sites unsuitable, resulting in a reduction in habitat patch size and increased distance between habitat patches and fragmentation (Haines *et al*. 2017; R. Sadlier *in litt*. August 2019). Higher elevation sites may ultimately become highly significant refugia for the species, but *E. roomi* may also be subject to competitive interactions with *E. striolata* at these sites as climate changes (R. Sadlier *in litt*. October 2020).

The direct and indirect impacts of climate change on the life cycle and health of the species are unknown but are likely to be deleterious. Identified impacts of climate change on cool-adapted reptile species include a reduction in daily activity periods, physiological stress, and increased competition from other species in the face of a shrinking ecosystem (Sinervo *et al*. 2010; Haines *et al*. 2017).

Associated impacts correlated with, or exacerbated by, anthropogenic climate change include an increase in the severity and frequency of fire (Flannigan *et al.* 2009), an increase in the intensity and frequency of hot days and heatwaves, and intensifying drought conditions (William *et al.* 2009), all of which are likely to directly impact the species itself or may reduce the quality and/or extent of the habitat for the species. "Anthropogenic Climate Change" is listed as a Key Threatening Process under the NSW *Biodiversity Conservation Act 2016*.

Habitat Disturbance:
The disturbance and altering of the placement of bushrock by humans is considered to negatively impact rock-dependent reptiles by disrupting the microenvironment and structural attributes beneath the rock, rendering it unsuitable as a sheltering site (Pike *et al.* 2010; R. Sadlier *in litt.* August 2019).

Human-mediated disturbance of *E. roomi* habitat has been recorded within Mount Kaputar NP particularly at sites close to the edge of cliff lines that are readily accessible by walking tracks. Trampling of vegetation and rock disturbance were observed at 'Mt Dowe', 'The Governor' and elsewhere in Mount Kaputar NP during field studies in 2015 (Sadlier *et al*. 2019).

Around Kanangra Walls, on the Central Tablelands of NSW, rock disturbance was observed over an extensive area of granite outcrops and this resulted in a reduction of sheltering sites for populations of *E. saxatilis intermedia* (Sadlier *et al*. 2019).
'Bushrock removal' is listed as a Key Threatening Process under the NSW *Biodiversity Conservation Act 2016*.

Competition and habitat degradation by Feral Goats:
Feral goat disturbance has been recorded within the Kaputar Range (Hunter 2015) and goat control has been identified as a management priority for Mount Kaputar NP

(DEC 2006). However, the extent to which the current feral goat populations impact on preferred habitat at the escarpment edge is unknown.

Browsing of vegetation and fouling of rock habitat by feral goats alters the ecology of rocky habitat and the areas immediately adjacent (Coblentz 1978; NSW Scientific Committee 2004; Murphy 1996). This may result in exposing areas adjacent to sheltering sites for *Egernia roomi* and therefore affecting their suitability for foraging activities. This reduction of cover may also increase the risk of predation on foraging individuals (R. Sadlier *in litt.* August 2019). The impact of feral goats on the landscape is likely to extend beyond areas near sheltering sites to habitat used by individuals during any migration between subpopulations.
'Competition and habitat degradation by Feral Goats, *Capra hircus* Linnaeus 1758' is listed as a Key Threatening Process under the NSW *Biodiversity Conservation Act 2016*.

Assessment against IUCN Red List criteria

For this assessment it is considered that the survey of *Egernia roomi* has been adequate and there is sufficient scientific evidence to support the listing outcome.

Criterion A Population Size reduction

Assessment Outcome: Data Deficient
Justification: To be listed as threatened under Criterion A, the species must have experienced a population reduction of ≥30% (VU threshold) over three generations or 10 years (whichever is longer). Although the species may have undergone a reduction in population size as a result of habitat loss due to severe fire, there are no quantitative data available on the population size or dynamics of this animal and there are no data on population declines over any relevant time frames (10 years or 3 generations). Therefore, there are insufficient data to assess *Egernia roomi* against this criterion.

Criterion B Geographic range

Assessment Outcome: Critically Endangered under Criterion B1ab (i,ii,iii,iv) and B2ab (i,ii,iii,iv)
Justification: *Egernia roomi* is known only from three sites in Mount Kaputar NP, in NSW.
Extent of occurrence (EOO) for all known records for the species, was estimated to be 1 km^2, based on a minimum convex polygon enclosing all known mapped occurrences of the species, the method of assessment recommended by IUCN (2019). Note: 'If the EOO is less than AOO, EOO should be changed to make it equal AOO to ensure consistency with the definition of AOO as an area within EOO' (IUCN 2019). Therefore, the EOO is 8 km^2 as reported below A species with an EOO of less than 100 km^2 qualifies under the Critically Endangered threshold.

The areas of minimum convex polygons fitted around the potential habitat of the species, corresponding to areas above either 1200 m or 1000 m in elevation in the Kaputar Range, are 122 km^2 and 241 km^2, respectively. Given the future impacts of

climate change, and since the skink is known to be absent from at least parts of these areas, it is unlikely that the discovery of future populations will result in an EOO exceeding 100 km^2.

AOO - The area of occupancy (AOO) for all records was estimated to be 8 km^2, based on 2 x 2 km grid cells, the scale recommended for assessing area of occupancy by IUCN (2019). A species with an AOO of less than 10 km² qualifies under the Critically Endangered threshold.

Using the method of projected sites of potential occurrences, by calculating the area above 1200 m and 1000 m in elevation in the Kaputar Range, the potential AOO is assessed as 30 km^2 and 134 km^2, respectively (Sadlier *et al*. 2019). As described above, future discoveries are unlikely to change the assessment outcome.

Egernia roomi meets the Critically Endangered category for Criterion B1 and B2
In addition to these thresholds, at least two of three other conditions must be met. These conditions are:

a) The population or habitat is observed or inferred to be severely fragmented or there is 1 (CR), ≤5 (EN) or ≤10 (VU) locations.

   Assessment Outcome: Critically Endangered

   Justification: The species occurs in one location based on the threat posed to all populations by a single fire event and climate change.

b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals.

   Assessment Outcome: Continuing decline in (i) (ii), (iii) and (iv)

   Justification: There is a continuing decline as a result of current ongoing threats including fire, habitat destruction by humans and feral goats and climate change.

c) Extreme fluctuations.

   Assessment Outcome: Data Deficient

   Justification: There are no available data to suggest that extreme fluctuations occur in population size or geographic distribution of *Egernia roomi,* although this is highly unlikely.

Criterion C Small population size and decline

Assessment Outcome: Data Deficient

Justification: Currently there are no available census data to assess the population size or trends in *Egernia roomi*. Therefore, there is insufficient information to assess this species under Criterion C.

At least one of two additional conditions must be met. These are:

C1. An observed, estimated or projected continuing decline of at least: 25% in 3 years or 1 generations (whichever is longer) (CE); 20% in 5 years or 2 generations (whichever is longer) (EN); or 10% in 10 years or 3 generations (whichever is longer) (VU).

Assessment Outcome: Data Deficient

Justification: There are no data on population declines over any relevant time frames to determine whether or not there is a continuing decline in population size.

C2. An observed, estimated, projected or inferred continuing decline in number of mature individuals.

Assessment Outcome: Data Deficient

Justification: There is no information for this species for which to determine whether or not there is a continuing decline in population size.

In addition, at least 1 of the following 3 conditions:

a (i). Number of mature individuals in each subpopulation ≤50 (CR); ≤250 (EN) or ≤1000 (VU).

Assessment Outcome: Data Deficient

Justification: There are no available census data to assess number of mature adults per subpopulation of the species.

a (ii). % of mature individuals in one subpopulation is 90-100% (CR); 95-100% (EN) or 100% (VU)

Assessment Outcome: Data Deficient

Justification: The percentage of mature adults per subpopulation is unknown. There are insufficient data to assess the species against this subcriterion.

b. Extreme fluctuations in the number of mature individuals

Assessment Outcome: Data Deficient

Justification: There are no available data to suggest that extreme fluctuations occur in population size or geographic distribution of *Egernia roomi,* although this is highly unlikely.

Criterion D Very small or restricted population

Assessment Outcome: Vulnerable under Criterion D2
Justification: Although currently there are no available census data to assess the population size of *Egernia roomi*, the species has a restricted area of occupancy of 8km^2.
To be listed as Vulnerable under D, a species must meet at least one of the two following conditions:

D1. Population size estimated to number fewer than 1,000 mature individuals

Assessment Outcome: Data Deficient

Justification: Currently there are no available census data to assess the population size or trends in *Egernia roomi*. Therefore, there is insufficient information to assess this species under this subcriterion.

D2. Restricted area of occupancy (typically <20 km^2) or number of locations (typically <5) with a plausible future threat that could drive the taxon to CR or EX in a very short time.

Assessment Outcome: Vulnerable

Justification: The area of occupancy (AOO) for all known records was estimated to be 8 km^2, based on 2 x 2 km grid cells, the scale recommended for assessing area of occupancy by IUCN (2019). A species with an AOO of less than 20 km^2 qualifies under the Vulnerable threshold for this subcriterion. In addition, there is estimated to be only one location, with fire being the main threat. A species with 5 or less locations qualifies for the Vulnerable threshold for this subcriterion.

Criterion E Quantitative Analysis

Assessment Outcome: Data Deficient
Justification: There are insufficient data available to undertake a quantitative analysis to determine the extinction probability of *Egernia roomi.*

Conservation and Management Actions

Habitat loss, disturbance and modification

- Prevent the disturbance and dislodgment of bushrock through improved education to promote community awareness of the impact of these actions on biodiversity in Mount Kaputar NP.
- Control populations of introduced predators (e.g. foxes and feral cats), and feral grazers (e.g. feral goats and pigs) in Mount Kaputar NP
- Implement fire management actions in accordance with the Mount Kaputar National Park Fire Management Plan.

Survey and Monitoring priorities

- Undertake surveys to determine if the species continues to persist in known sites, post-fire.

- Undertake targeted surveys in lower altitudinal areas with suitable habitat to identify the environmental (climatic) parameters determining the species distribution on the Nandewar Range.
- Undertake surveys to determine if the species utilises rocky habitat away from the known escarpment habitat.

  Note: Surveys should be undertaken in a way that least disturbs the species habitat (i.e. no rock turning, as this may alter the attributes of the microhabitat). The most appropriate way to determine its presence would be 'sit and wait' observation at likely sites, possibly with investigation of suitable crevices using torchlight and/or fibreoptic cable with a camera head. Surveys would best be conducted during late spring and summer (when animals are out and active after winter hibernation and temperatures are sufficiently high for basking activity).
- Once habitat requirements of the species are better understood, undertake surveys to identify occurrence of its preferred habitat across the Nandewar Range, especially in the western section of the ranges, and identify any additional key subpopulations and other potential sites within the region

Information and Research priorities:

- Where the species is detected, aim to undertake research to identify key aspects of the species biology with respect to habitat, including the attributes of preferred sheltering sites, diet and population structure.
- At known sites for the species, undertake threat assessment of any introduced predators (e.g. foxes and feral cats), feral grazers (e.g. feral goats and pigs) and other forms of habitat disturbance (e.g. movement of bushrock sheltering sites).
- Conduct genetic studies to identify genetic diversity within species and movement between subpopulations to assess the potential impacts of threatening processes that might further isolate subpopulations. Information on genetic identity would assist with any future translocation planning.

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Expert Communications

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- Dr Jodi Rowley Curator, Amphibian & Reptile Conservation Biology, Australian Museum
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Appendix 1
Assessment against Biodiversity Conservation Act criteria
The Clauses used for assessment are listed below for reference.

Overall Assessment Outcome: Critically Endangered under Clause 4.3 (a) (d) (e ii, iii, iv).

Clause 4.2 – Reduction in population size of species
(Equivalent to IUCN criterion A)
Assessment Outcome: Data Deficient

(1) - The species has undergone or is likely to undergo within a time frame appropriate to the life cycle and habitat characteristics of the taxon:			
	(a)	for critically endangered species	a very large reduction in population size, or
	(b)	for endangered species	a large reduction in population size, or
	(c)	for vulnerable species	a moderate reduction in population size.
(2) - The determination of that criteria is to be based on any of the following:			
	(a)	direct observation,	
	(b)	an index of abundance appropriate to the taxon,	
	(c)	a decline in the geographic distribution or habitat quality,	
	(d)	the actual or potential levels of exploitation of the species,	
	(e)	the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.	

Clause 4.3 - Restricted geographic distribution of species and other conditions
(Equivalent to IUCN criterion B)
Assessment Outcome: Critically Endangered under Clause 4.3 (a) (d) (e ii, iii, iv).
[Equivalent to IUCN Criterion B via B1ab (i, ii, iii, iv) and B2ab (i, ii, iii, iv)]

The geographic distribution of the species is:			
	(a)	for critically endangered species	very highly restricted, or
	(b)	for endangered species	highly restricted, or
	(c)	for vulnerable species	moderately restricted,
and at least 2 of the following 3 conditions apply:			
	(d)	the population or habitat of the species is severely fragmented or nearly all the mature individuals of the species occur within a small number of locations,	
	(e)	there is a projected or continuing decline in any of the following:	
		(i)	an index of abundance appropriate to the taxon,
		(ii)	the geographic distribution of the species,
		(iii)	habitat area, extent or quality,

		(iv)	the number of locations in which the species occurs or of populations of the species,			
	(f)	extreme fluctuations occur in any of the following:				
		(i)	an index of abundance appropriate to the taxon,			
		(ii)	the geographic distribution of the species,			
		(iii)	the number of locations in which the species occur or of populations of the species.			

Clause 4.4 - Low numbers of mature individuals of species and other conditions
(Equivalent to IUCN criterion C)
Assessment Outcome: Data Deficient

The estimated total number of mature individuals of the species is:						
	(a)	for critically endangered species			very low, or	
	(b)	for endangered species			low, or	
	(c)	for vulnerable species			moderately low,	
and either of the following 2 conditions apply:						
	(d)	a continuing decline in the number of mature individuals that is (according to an index of abundance appropriate to the species):				
		(i)	for critically endangered species		very large, or	
		(ii)	for endangered species		large, or	
		(iii)	for vulnerable species		moderate,	
	(e)	both of the following apply:				
		(i)	a continuing decline in the number of mature individuals (according to an index of abundance appropriate to the species), and			
		(ii)	at least one of the following applies:			
			(A)	the number of individuals in each population of the species is:		
				(I)	for critically endangered species	extremely low, or
				(II)	for endangered species	very low, or
				(III)	for vulnerable species	low,
			(B)	all or nearly all mature individuals of the species occur within one population,		
			(C)	extreme fluctuations occur in an index of abundance appropriate to the species.		

Clause 4.5 - Low total numbers of mature individuals of species
(Equivalent to IUCN criterion D)
Assessment Outcome: Data Deficient

The total number of mature individuals of the species is:			
	(a)	for critically endangered species	extremely low, or
	(b)	for endangered species	very low, or
	(c)	for vulnerable species	low.

Clause 4.6 - Quantitative analysis of extinction probability
(Equivalent to IUCN criterion E)
Assessment Outcome: Data Deficient

The probability of extinction of the species is estimated to be:			
	(a)	for critically endangered species	extremely high, or
	(b)	for endangered species	very high, or
	(c)	for vulnerable species	high.

Clause 4.7 - Very highly restricted geographic distribution of species– vulnerable species
(Equivalent to IUCN criterion D2)
Assessment Outcome: Vulnerable

For vulnerable species,	the geographic distribution of the species or the number of locations of the species is very highly restricted such that the species is prone to the effects of human activities or stochastic events within a very short time period.