Amended on 29/03/2023.
Change to Clause 4.2. The Committee found the species ineligible for listing under Criterion A but this was not reflected in the notice and reasons for the Determination, which stated eligibility for Endangered under Clause 4.2 (b) 2 (b,c).

Conservation Assessment of mukarrthippi grasswren *Amytornis striatus striatus* Gould, 1840 (Maluridae)

Ben Hope, Cherylin Bray, Michael Pennay 29/03/2023

NSW Threatened Species Scientific Committee

Mukarrthippi grasswren *Amytornis striatus striatus* Gould, 1840 (Maluridae)
Distribution: Endemic to NSW
Current *EPBC* Act Status: Not listed
Current NSW *BC* Act Status: Striated grasswren *Amytornis striatus*, Vulnerable.
Action Plan for Australian Birds 2020: Critically Endangered (Todd *et al.* 2021)

Proposed listing on NSW *BC* Act and *EPBC* Act: Critically Endangered B2ab (i.ii.iii.iv.v), C2a(i) and D.

Summary of Conservation Assessment

The mukarrthippi grasswren *Amytornis striatus striatus* Gould, 1840 was assessed by Todd *et al.* (2021, in Garnett and Baker 2021) as Critically Endangered. This assessment is based on the information provided in Todd *et al.* (2021).

The main reasons for this sub-species being eligible are: the total population is very likely to be <50 mature individuals, undergoing a continuing decline (based on ongoing threats of wildfire, habitat deterioration and fragmentation), and consists of a single threat-based location containing up to 4 subpopulations.

Description and Taxonomy

The striated grasswren, of which the mukarrthippi grasswren is a subspecies, is a medium sized grasswren, similar in appearance to the related fairy-wrens (*Malurus* spp.), though significantly larger in size (14.5–19 cm; 15–23 g) (Rowley *et al.* 2020; DPIE 2021a). It has a relatively slender bill, long tail, which is held cocked and is blackish-brown in colour (Rowley *et al.* 2020). The upperparts are a soft reddish-brown, with white streaks while the underparts are buff with heavy white streaking on the breast. The eyebrow is rufous-brown and a heavy black whisker-streak is present. The throat is white, the bill blackish or grey and legs grey. The sexes differ slightly in plumage with the female having pale chestnut flanks. The appearance of the mukarrthippi grasswren is similar to the Murray Mallee striated grasswren *A. striatus howei*, but the white dorsal feather striations are narrower in the mukarrthippi grasswren (Black *et al.* 2020a) and the sub-species are allopatric (geographically distinct). The species is known to occur only on the lands of the Ngiyampaa People, for which the name mukarrthippi (moo-kwah-tippy) meaning ‘small bird of the spinifex’ is derived (Birdlife Australia Facebook post 11 November 2020).

The taxonomy of the striated grasswren complex is complicated and remains unresolved (Black *et al.* 2020a). However, there is strong evidence that *Amytornis striatus* is monophyletic, and strong support for the subclade formed by the mukarrthippi grasswren (Black *et al.* 2020a). Additionally, the mukarrthippi grasswren is widely geographically disjunct (Black *et al.* 2020a) from other striated grasswren sub-species. A recent comprehensive review of Australian birds reviewed this sub-species (Garnett and Baker 2021; Todd *et al.* 2021), adopting the taxonomy of Black *et al.* (2020a). For these reasons it is considered appropriate to assess the mukarrthippi grasswren as a sub-species.

Seven sub-species of striated grasswrens are currently recognised (Black *et al.* 2020a; Garnett and Baker 2021). Black *et al.* (2020a) separated the allopatric central New South Wales populations of *A. striatus striatus sensu lato* sub-specifically, resulting in the mukarrthippi grasswren *A. striatus striatus sensu stricto* (Gould 1840) in central NSW (type-locality Liverpool Plains at the eastern extremity of records in NSW) and the Murray Mallee striated grasswren *A. striatus howei* (Mathews 1911) (type-locality Kow Plains in the Victorian Murray Mallee). These two sub-species were reviewed in the 2020 Action Plan for Australian Birds (Garnett and Baker 2021) with the mukarrthippi grasswren, the focus of this review, being found to be Critically Endangered (Todd *et al.* 2021) and the Murray Mallee striated grasswren, Endangered (Verdon *et al.* 2021). Additionally, some sub-species previously contained within the striated grasswren have now been included by Black *et al.* (2020b) in the rufous grasswren *Amytornis whitei* complex. These sub-species are *A. whitei oweni* and an undescribed (or uncertain) sub-species.

Recent taxonomic changes, particularly the understanding of the distribution of sub-species, has had significant implications on the conservation status of this taxa as the mukarrthippi grasswren is more threatened than the striated grasswren (*sensu lato*) or the other striated grasswren sub-species (Black *et al.* 2020a; Garnett and Baker 2021). Some grasswren (*Amytornis*) sub-species have narrow fragmented distributions, while others exhibit ecophenotypic clinal variation in plumage patterns (Christidis *et al.* 2010; 2013), and genetic techniques have been required to separate morphologically similar sub-species and better understand these geographic patterns.

The NSW population of striated grasswrens was identified as being of conservation concern (Vulnerable) at the inception of the *NSW Threatened Species Act* 1999 (Lunney *et al.* 1997). This listing included both of the two recently described subspecies: mukarrthippi grasswren and Murray Mallee striated grasswren. Reference to striated grasswren *Amytornis striatus* in Part 3 of Schedule 1 (Vulnerable species) of the Act will now be omitted. Striated grasswren is listed as Rare on the South Australian *National Parks and Wildlife Act* 1972 as *A. striatus*, however, the revised taxonomy of Black *et al.* (2020a) and the findings of Todd *et al*. (2021) and Verdon *et al.* (2021) have implications on this listing and it requires revision.

Distribution and Abundance

Distribution

The mukarrthippi grasswren is endemic to NSW. Todd *et al*. (2021) state that "mukarrthippi grasswrens occur only in central New South Wales. They are known to persist with certainty only on a single 30 ha sandhill on the western side of Yathong

Nature Reserve and have not been found elsewhere in the reserve despite searching. They may persist 60 km to the north at two sites, separated by 11 km, on the border of the Paddington and Hampton stations, but were last seen there in 2012 (M Todd, G Chapman unpublished). Historically, there are specimens from the Liverpool Plains (type locality), Namoi Valley, Coronga Peak and 'the Mossgiel district', and sight records from Coonamble in 1905 and Cobar in 1974 (McAllan 1987, Black *et al.* 2014). The 'Mossgiel' population was rediscovered at Taringo Downs north of Yathong in 1973 (Izzard *et al.* 1973; Miller 1973) and in Yathong Nature Reserve in 1975 (J Brickhill unpublished). However, the last record within the 60 km gap between recent records was in 2002 (M Todd unpublished)."

There is limited information available on the mukarrthippi grasswren, however available evidence indicates a restricted distribution, which suggests a need for specific habitats which are uncommon and limited further by habitat degradation, fire and grazing regimes. Furthermore, closely related taxa (Murray Mallee striated grasswren) are in rapid decline (Dooley 2019; Verdon *et al.* 2021) and face similar threats. It is likely that the mukarrthippi grasswren was geographically restricted historically and that recent threats have led to decline.

Abundance

Todd *et al.* (2021) stated that "the total known population is possibly <20 mature individuals", which is an order of magnitude lower than the IUCN Red List (2019) requirement for Critically Endangered under criterion C2. Todd *et al.* (2021) also stated that "One mukarrthippi grasswren pair has been recorded regularly on the sandhill site at Yathong Nature Reserve since 2010, and two pairs were found on one occasion (D Egan unpublished). There were known to be two pairs at one of the Paddington/Hampton sites in 2012 and a small number at the other site, but their persistence needs confirmation."

Ecology

Like many grasswrens, mukarrthippi grasswrens are inferred to be habitat specialists. Todd *et al*. (2021) state that "mukarrthippi grasswrens are thought to be confined to mature spinifex *Triodia* spp. with an overstorey of mallee eucalypts, particularly the *Eucalyptus socialis–E.dumosa–E.gracilis* community that covers most of the sandplain and dune areas in the central and western parts of the parks (NSW NPWS 1996). Striated grasswrens forage mostly on the ground, eating seeds, fruits, insects and other invertebrates (Higgins *et al.* 2001). Striated grasswrens may recolonise habitat within three years after fires (Carpenter and Matthew 1986) but appear to prefer habitat that has not been burnt for 5–15 years (S Vernon, ML Clarke unpublished). In Yathong Nature Reserve, the habitat last burnt in 1985 and is known to have been occupied since 1998. The Paddington/Hampton sites also last burnt in 1985, and birds were known to be present after 2002 (Cullenward 1989)."

Generation length is estimated at 3 (2.3-3.8) years (Bird *et al.* 2020; Todd *et al*. 2021). Grasswrens are typically found in pairs, are strongly territorial and nest in cryptic nests on the ground (Karubian 2001). The breeding of the mukarrthippi grasswrens has not been studied and the following information is from general accounts of the striated grasswrens. Nests are built by the female and are a substantial dome (with a side entrance) of interwoven grasses, bark and spinifex, well-hidden towards the top or edge

of a spinifex clump (Rowley *et al.* 2020; DPIE 2021). Breeding has been recorded between Aug–Jan, and also following rainfall (Rowley *et al.* 2020). The breeding territory is approximately 3 hectares in size and there is some evidence of cooperative breeding (Rowley *et al.* 2020). Clutch size is 2–3 eggs with an incubation of 14 days; chicks are fed by both parents, independent at 4 weeks, but probably stay with the family for a longer period (Rowley *et al.* 2020).

Threats

The threats to the mukarrthippi grasswrens vary by locality as populations are known from Yathong Nature Reserve (managed for conservation) and private land (Todd *et al*. 2021). All known populations are very small and at elevated extinction risk from stochastic events (e.g. fire, high predator numbers, drought or heatwaves) and inbreeding depression (Keller and Waller 2002; O'Grady *et al.* 2006; Todd *et al*. 2021). On private land, additional threats include intensive grazing, browsing and trampling of habitat by dorper sheep (*Ovis aries*) and feral and semi-domesticated goats (*Capra hircus*) (Todd *et al*. 2021).

Populations on all tenures are threatened by fire. Fire could adversely impact an entire sub-population in a single event, in the worst case leading to local extinction (Todd *et al*. 2021). Ideal fire regimes are not known, however fire management that aims to reduce the chance of entire fragments burning in a single event and maintaining stages of regrowth within fragments is likely to benefit this species.

The sub-species habitat is fragmented and entire fragments may burn in single events (Sadlier *et al.* 2019). It is plausible that the entire habitat for the sub-species could burn in a single event. Drought and heat waves increase fire risk but also impact this sub-species in the absence of fire. These phenomena are predicted to increase in severity in the future across all tenures (Evans *et al.* 2017; Herold *et al.* 2018; Eldridge and Beecham 2018; Di Virgilio *et al.* 2019; Dooley 2019; Dowdy *et al.* 2019; Todd *et al.* 2021). Predicted decreased rainfall and reduced ground-storey plant cover (Eldridge and Beecham 2018) are expected to negatively impact this sub-species.

Habitat degradation is likely to occur from grazing by rabbits (*Oryctolagus cuniculus)* and high densities of kangaroos (*Macropus* and *Osphranter* spp.), given the grazing-sensitivity of the vegetation this sub-species prefers (Giljohann *et al*. 2017; Todd *et al*. 2021; Mills *et al.* 2020). Introduced predators, feral cats (*Felis catus)* (Woinarski *et al*. 2018) and foxes (*Vulpes vulpes*) may also limit population size (Todd *et al*. 2021). In the arid and semi-arid parts of Australia, densities of feral predators peak (boom) after large rainfall and breeding events of prey species (e.g. rabbits) (Catling 1988; Pavey *et al.* 2008), indicating possible temporal variability in this threat. Grasswrens nest on or very close to the ground, which makes the nest accessible to a range of predators including cats, foxes, birds and monitors, and exposing them to a similar suite of threats (predation, trampling, loss of cover) as small terrestrial mammals, many of which have declined dramatically in the arid zone (Reid and Fleming 1992; Smith *et al.* 1994; Short and Smith 1994; Short 2004).

The threats to this sub-species occur over a wide area and some of these threats (e.g. climate driven threats) may impact all habitat fragments simultaneously and reduce the ability to recover from adverse events such as fire (Gergis and Ashcroft 2013; Saddlier

et al. 2019; Mills *et al.* 2020). The failure to detect this sub-species at more than one location in Yathong Nature Reserve (Todd *et al.* 2021) indicates that even in a threat-managed landscape, abundance remains low and that some threats cannot currently be adequately managed. Given the low dispersal ability of this species, a floating population (non-breeding animals that usually persist in sub-optimal habitat) is therefore likely absent or very small which reduces the resilience of known populations to disturbance events (Robles and Ciudad 2017).

'Competition and land degradation by rabbits', 'Competition and land degradation by unmanaged goats', 'Land clearance', 'Predation by European red fox', 'Predation by feral cats', are listed as Key Threatening Processes under the Commonwealth *EPBC Act* 1999.

'Clearing of native vegetation', 'Competition and grazing by the feral European rabbit', 'Competition and habitat degradation by feral goats, *Capra hircus* Linnaeus 1758', 'Ecological consequences of high frequency fires', 'Human-caused Climate Change', 'Predation by feral cats' and 'Predation by the European red fox' are listed as Key Threatening Processes under the NSW BC Act 2016.

Assessment against IUCN Red List criteria

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

Criterion A *Population Size reduction*

Assessment Outcome: Not eligible

Justification: A closely related species (Murray Mallee striated grasswren) has declined by 50–80% in the last ten years (generation time 3.0 years) based on the deterioration of habitat (Dooley 2019; Verdon *et al.* 2021). However given the small initial population size of the mukarrthippi grasswren, there is limited capacity for this species to decline and past declines of this magnitude are likely to have already led to extinction.Todd *et al.* (2021) found that two large fires could kill all remaining birds and one fire could halve the number of subpopulations, leading to irreversible decline. It is plausible that in a single period of high fire risk, all populations could be impacted by fire, resulting in extinction in short period of time.

Criterion B *Geographic range*

Assessment Outcome: Critically Endangered under Criterion B2ab(i,ii,iii,iv,v)

Justification: The AOO is 4–16 km^2, with a best estimate of 8 km^2 (Todd *et al.* 2021), based on 2 x 2 km grid cells, the scale recommended for assessing area of occupancy by IUCN (2019).

The EOO range considered in this assessment is 4–600 km^2. Todd *et al.* (2021) estimated EOO in the range of 0.02-600 km^2 with a best estimate of 386 km^2 based on a minimum convex polygon enclosing all mapped occurrences of the sub-species using the assessment method recommended by IUCN (2019). The minimum EOO was changed to make it equal to AOO to ensure consistency with the definition of AOO following IUCN (2019).

For both AOO and EOO the lower range is the single pair known from Yathong, while the upper range includes all known records, and the best estimate is all records since 2012. The best estimate of AOO (8 km^2) from Todd *et al.* (2021) has been used for this clause, and the AOO is <10 km^2 – the basis of the Critically Endangered finding under this clause.

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: Severely fragmented habitat, only one location based on threat of fire and heatwaves.

   Justification: The habitat of the sub-species is severely fragmented as a result of habitat loss from land clearing and habitat fragmentation due to the impact of introduced herbivores (Todd *et al.* 2021). All known populations are at immediate risk of extinction in the near future (severe fragmentation).

   Todd *et al.* (2021) estimate there are at minimum one population and maximum four, with a best estimate of two. The number of threat-based locations is one as it is plausible all known locations will burn or be impacted by heatwaves or drought within a single event.

   Todd *et al.* (2021) state that two fire events could lead to the extinction of this sub-species, which indicate 2 locations are likely, however one of these areas lacks recent (after 2012) records and an extended drought could lead to population loss in both sites within the same drought event. The best minimum (as determined by Todd *et al.* 2021) of 1 locations has been used.

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,iv,v.

   Justification: There is a continuing decline based on the ongoing threats of habitat loss and degradation as a result of grazing, browsing and trampling by feral semi-domesticated and native animals, changed fire regimes and climate change. Populations are small even in threat managed conservation reserves. Todd *et al.* (2021) found past decline and continuing declines are likely to have occurred and continue to occur. Two large fires could kill all remaining birds; one could halve the number of subpopulations. These threats lead to declines in geographic range (AOO and EOO), habitat quality within occupied areas and lead to reductions in the number of subpopulations (there is only one threat-based location) and the number of individuals.

c) Extreme fluctuations.

   Assessment Outcome: Sub-criterion not met.

   Justification: Not subject to extreme fluctuations in EOO, AOO, number of subpopulations, locations or mature individuals (Todd *et al.* 2021)

Criterion C Small population size and decline

Assessment Outcome: Critically Endangered under Criterion C2a(i)

Justification: Todd *et al.* (2021) found the total population is likely to be between 4 and 20 mature individuals, although reliability is listed as low.

Based on targeted surveys for this sub-species in NSW (where it is endemic), the population size is extremely small and very likely (despite uncertainty) to be under the IUCN (2019) thresholds for Critically Endangered under clause C2 (<250 mature individuals, with a continuing decline and <50 individuals in each subpopulation).

It is considered unlikely that further survey will increase this estimate by an order of magnitude given the species has been threatened in NSW since 1995 (which increases targeted survey effort; Lunney *et al.* 2018), has been of considerable interest to birdwatchers and any undiscovered population is also likely to have a small number of mature individuals, be in decline and at high risk of local extinction.

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 generation (whichever is longer) (CR); 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: Not eligible

Justification: A closely related sub-species (Murray Mallee striated grasswren) is estimated to have declined by 50–80% in the last ten years based on loss and degradation of habitat (Dooley 2019; Verdon *et al.* 2021). Given the small initial population of the mukarrthippi grasswren, declines of this magnitude would have likely led to extinction of this species and are therefore unlikely. A single future fire event in any of the known populations is likely to lead to potentially irreversible decline in a very short period of time.

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

Assessment Outcome: Continuing decline inferred

Justification: There is a continuing decline based on the ongoing threats of habitat loss and degradation as a result of grazing, browsing and trampling by feral semi-domesticated and native animals, changed fire regimes and climate change (Todd *et al.* 2021). A closely related sub-species (Murray Malle striated grasswren) is estimated to have declined by 50–80% in the last ten years based on loss and degradation of habitat (Dooley 2019; Verdon *et al.* 2021). This species is also likely declining however the rate of decline has not been measured.

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: Critically Endangered

Justification: Todd *et al.* (2021) found the maximum population is 20 individuals.

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

Assessment Outcome: Data deficient.

Justification: Todd *et al.* (2021) found the minimum estimate of number of populations is 1, so 100% of the population may be confined to a single sub-population. However, the population size and status of known sub-populations is uncertain.

b. Extreme fluctuations in the number of mature individuals

Assessment Outcome: Sub-clause not met.

Justification: Todd *et al.* (2021) found no evidence of extreme fluctuations

Criterion D Very small or restricted population

Assessment Outcome: Critically Endangered

Justification: Population size is estimated to likely be < 20 and highly likely <50 mature individuals (Todd *et al.* 2021). Population estimated between 4–20 mature individuals (Todd *et al.* 2021)

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: Vulnerable

Justification: Population estimated between 4–20 mature individuals (Todd *et al.* 2021)

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: Number of locations (based on threat of fire) is between one and two; AOO is estimated to be between 4 and 16 km^2 (Todd *et al*. 2021). The sub-species is considered to be CR under other clauses as a result of ongoing threats including habitat loss and degradation as a result of grazing, browsing and trampling by feral semi-domesticated and native animals, changed fire regimes and climate change. Todd *et al.* (2021) found that two large fires could kill all remaining birds; one fire could halve the number of subpopulations. It is plausible that all populations could be impacted by fire, resulting in extinction.

Criterion E Quantitative Analysis

Assessment Outcome: Data Deficient

Justification: Not applicable: no population viability analysis has been undertaken.

Conservation and Management Actions

Conservation objectives

- All available habitat supports sustainable populations (Todd *et al.* 2021)
- Appropriate fire regime is established, enabling regeneration and sustained *Triodia* habitat as well as reducing the risk of wildfire (Todd *et al.* 2021)
- Grazing pressure from stock is maintained at or below a level at which habitat remains suitable for grasswrens (Todd *et al.* 2021)

Conservation actions under way

- Part of the population is within a protected area (Todd *et al.* 2021)
- There is active management of feral animals in Yathong Nature Reserve (Todd *et al.* 2021; Mills *et al.* 2020)
- Fire management on Yathong Nature Reserve which aims to reduce the extent of unplanned wildfire events (Todd *et al.* 2021)

Research required

- Ascertain the current distribution (Todd *et al.* 2021) and whether these areas are likely to remain suitable for the taxon under future climate change scenarios.
- Investigate feasibility and risks of genetic rescue, captive breeding, translocation or other interventions, into areas that are likely to contain suitable habitat and thermal patterns in the future.
- Document the taxon's habitat requirements and the relationship between structural attributes of *Triodia* and fire history (Todd *et al.* 2021)
- Investigate groundcover and stocking rates (considering drought) for the sustainable maintenance of *Triodia* and grasswrens (Todd *et al.* 2021)
- Create a fire management strategy that will maintain the grasswrens and their habitat (Todd *et al.* 2021)

Management actions required

- Actively protect all known populations from unplanned wildfire whilst using fire to introduce very small-scale seral heterogeneity and manage vegetation age at other sites with suitable habitat to maintain and enhance potential habitat (Todd *et al.* 2021)
- Exclude stock and feral herbivores.

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Experts consulted

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Stephen Garnett

APPENDIX 1

Assessment against *Biodiversity Conservation Regulations 2017* 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 4.4 (a) (d) (e i,iiA) and Clause 4.5 (a).

Clause 4.2 – Reduction in population size of species
(Equivalent to IUCN criterion A)
Assessment Outcome: Not eligible

(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)

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: Critically Endangered under Clause 4.4 (a) (d i) (e i,iiAI)

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: Critically Endangered under Clause 4.5 (a)

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.