Conservation Assessment of *Fontainea* sp. Coffs Harbour (A.S.Benwell 341, NSW1102027) (Euphorbiaceae)

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NSW Threatened Species Scientific Committee

Fontainea sp. Coffs Harbour (A.S.Benwell 341, NSW1102027) (Euphorbiaceae)

Distribution: Endemic to NSW
Current EPBC Act Status: Not listed
Current NSW BC Act Status: Critically Endangered. The species was provisionally listed on an emergency basis in October 2021.
Proposed listing on NSW BC Act: Critically Endangered

Summary of Conservation Assessment

Fontainea sp. Coffs Harbour (A.S.Benwell 341, NSW1102027) was found to be eligible for listing as Critically Endangered under IUCN Criteria A3bc; B1ab(iii,v)+2ab(iii,v); C1+2a(i,ii); and D.

The main reasons for this species being eligible are i) <10 mature individuals are known and they occur in a single population; ii) it has a very highly restricted geographical range (EOO and AOO are 4 km^2); iii) there is only one location; iv) it is severely fragmented; (v) it is likely to undergo a very large reduction in population size; and (vi) there is continuing decline in area, extent and quality of habitat and number of mature individuals due to clearing and habitat disturbance from imminent road construction works.

Description and Taxonomy

Fontainea is a genus of rainforest trees in the Euphorbiaceae family. Nine species are known globally, of which six occur in Australia, in Queensland and New South Wales (ALA accessed September 2022). Two described species of *Fontainea* that currently occur in NSW (Jessup and Guymer 1985) are: *F. oraria,* listed as a Critically Endangered species on the BC Act and the EPBC Act, which occurs near Lennox Head on the NSW far north coast; and *F. australis,* listed as a Vulnerable species on the BC Act and EPBC Act, which occurs on the NSW far north coast/hinterland and in Queensland.

Fontainea sp. Coffs Harbour (A.S.Benwell 341, NSW1102027) (to be referred to throughout this document as '*Fontainea* sp. Coffs Harbour'), is a species recently described following a survey in the Coffs Harbour area in January 2021 (TfNSW 2022). *Fontainea* sp. Coffs Harbour was recognised as a distinct species by Guymer (*in litt.* August 2021) and this is reflected in PlantNET (accessed August 2022) and the Australian Plant Name Index (accessed August 2022). Genetic work has confirmed *Fontainea* sp. Coffs Harbour to be a distinct species (Ogbourne *et al.* 2021).

Fontainea sp. Coffs Harbour is described in PlantNET (2022) as a "small tree to 5 m high; bark grey, smooth to slightly rugose. Leaves with lamina elliptic to ovate, leaves (4-)6–9(-13) cm long, (2-)3–4(-6) cm wide, glabrous, upper surface dark green, lower surface paler; glands submarginal, 2–3 mm above base of lamina; petiole 5–15(-25) mm long, with slightly swollen joint at apex, and slightly swollen at the base. Inflorescense [sic] terminal or subterminal, a raceme of 3 flowers or reduced to solitary

flower. Flowers unisexual, unclear whether plants are monoecious or dioecius [sic]. Female floral axes 3–8 mm long. Female flower actinomorphic, 10–15 mm diameter, petals white, styles yellow, radiating from apex of ovary. Male floral axes 3–7 mm long, male flower actinomorphic, 10–15 mm diameter; stamens 20–25, erect in central cluster, basally connate. Fruit ellipsoidal, pink-orange, 25–30mm long, 16–24 mm diameter, the intersutural surface of the endocarp markedly rugose." (PlantNET accessed August 2022).

Fontainea sp. Coffs Harbour is thought to be most similar to *F. oraria*. The main feature that distinguishes *F.* sp. Coffs Harbour from *F. oraria* and other known *Fontainea* species is the unique endocarp of the fruit (Guymer *in litt.* August 2021). The endocarps of *F.* sp. Coffs Harbour are "ellipsoidal, about twice as long as wide, 24-28 mm long, 13-15 mm wide, apex acute; intersutural faces markedly rugose; fruits ellipsoidal, pink-orange, 25-30 mm long, 16-24 mm diameter." (Guymer *in litt.* August 2021). The endocarps of *F. oraria* are "globose about as long as wide, 15-18 mm long, 14-16 mm wide, apex obtuse; intersutural faces slightly rugose and grooved; fruits globular or depressed-globular, shallowly 3 or 6-lobed, pink to red, 18-22 mm long, 22-24 mm diameter." (Guymer *in litt.* August 2021). Further taxonomic work will provide a detailed description of the species.

Distribution and Abundance

Fontainea sp. Coffs Harbour is endemic to NSW and is presently known from only two sites near Coffs Harbour on the NSW mid-north coast. The sites occur in two separate fragments of Brush Box–rainforest (Ecos Environmental 2022). This vegetation type is uncommon in the Coffs Harbour area (Ecos Environmental 2022). The species is currently known to occur on land owned by Transport for NSW (TfNSW) and within the project boundary of the Coffs Harbour bypass road construction project (TfNSW 2022). There are no known sites in conservation reserves.

In this assessment, the word population is used to refer to the concept of 'subpopulation' in IUCN (2022), in keeping with the terminology used in the NSW BC Act, EPBC Act and other state/territory environmental legislation and general biological usage. For *Fontainea* sp. Coffs Harbour, the only known population has been fragmented by clearing, so the two areas of current occurrence of the species will be referred to as 'sites' in this assessment.

Additional targeted surveys were carried out to determine if *Fontainea* sp. Coffs Harbour occurs in areas of similar habitat (vegetation, geology, and landform) around and within the bypass corridor, but no other occurrences have been found (TfNSW 2022). Further searches of potential habitat are recommended (e.g. in gullies of the surrounding ranges and in Ulidarra National Park (Ecos Environmental 2022)).

The geographic distribution of *Fontainea* sp. Coffs Harbour is very highly restricted. The extent of occurrence (EOO) and the area of occupancy (AOO) are both 4 km^2. The AOO is based on the species' occupying a single 2 km x 2 km grid cell, the spatial scale of assessment recommended by IUCN (2022). The extent of occurrence (EOO) was measured by a minimum convex polygon containing all the known sites of occurrence. When EOO is less than AOO, IUCN (2022) recommend EOO estimates be adjusted to be equal to AOO to ensure consistency with the definition of AOO as an area within EOO.

An extremely low number (<10) of mature individuals of *Fontainea* sp. Coffs Harbour are known. The two sites where the species occurs are considered to be part of the one population due to their close proximity and the potential dispersal ability of the fruits and pollen likely to allow genetic exchange between the sites. The species may have been more widespread in the past, at least within the vicinity of the known sites, prior to recent and historical clearing.

Ecology

Information about the ecology of *Fontainea* sp. Coffs Harbour is limited. The two known sites occur in separate fragments of Brush Box–rainforest (Ecos Environmental 2022). This vegetation community is dominated by mature *Lophostemon confertus* (Brush Box), 30-40 m high with occasional *Eucalyptus microcorys* (Tallowwood), *Corymbia intermedia* (Pink Bloodwood), *E. pilularis* (Blackbutt) and *E. grandis* (Flooded Gum) over a rainforest understorey (5-20 m high) of small to medium sized trees, including *Dysoxylum mollissimum* (Red Bean), *Cryptocarya microneura* (Murrogun), *Cryptocarya rigida* (Forest Maple), *Elaeocarpus reticulatus* (Blue-berry Ash), *Endiandra discolor* (Domatia Tree), *Synoum glandulosum* (Scentless Rosewood), *Niemeyera whitei* (Rusty Plum), *Archontophoenix cunninghamiana* (Bangalow Palm) and *Ficus watkinsiana* (Strangling Fig), plus many vines, herbs and ferns (Ecos Environmental 2022).

The Brush-box–rainforest vegetation community occurs locally in narrow zones along drainage lines and gullies. This vegetation community can be broadly classed as a type of wet sclerophyll forest, transitional between wet sclerophyll dominated by *Eucalyptus* and subtropical rainforest (Ecos Environmental 2022). The soil at the sites is a medium fertility, red-yellow clay podzol formed on metasediment (Ecos Environmental 2022). *Fontainea* sp. Coffs Harbour may occur in other topographies and vegetation communities.

Fontainea species are dioecious, meaning there are separate male and female plants, or rarely monoecious, with separate male and female flowers on the one plant (Jessup and Guymer 1985). Observations of the related species *F*. *oraria* show both traits (DECCW 2011). The reproductive biology of *F.* sp. Coffs Harbour is yet to be confirmed. Flowering has been observed from December to April, with fruit apparently needing 2-3 months to mature, ripening through winter and spring (Ecos Environmental 2022).

Seed dispersal of the related *Fontainea oraria,* based on fruit morphology, is likely to be by wind, gravity or ballistic methods over short distances and may be assisted by birds or mammals (DECCW 2011). While there is no specific information on the seed dispersal of *F.* sp. Coffs Harbour, it is thought to be comparable to *F. oraria*. Seedlings of *F. oraria* occur close to the parent plant, indicating predominately short dispersal distances (DECCW 2011), and the same pattern has been observed in *F.* sp. Coffs Harbour.

It is acknowledged that Traditional Ecological Knowledge exists for many rainforest species. Aboriginal people have a long history of biocultural knowledge, which comes from observing and being on Country, and evolves as it is tested, validated, and passed through generations (Woodward *et al.* (Eds.) 2020). Aboriginal people have

cared for Country for tens of thousands of years. There is Traditional Ecological Knowledge for all plants, animals and fungi connected within the kinship system (Woodward *et al*. (Eds.) 2020).

Threats

Fontainea sp. Coffs Harbour is in immediate threat from clearing and road construction works. The sites have been disturbed in the past due to their proximity to cleared land and have been subject to grazing and trampling from domestic stock and feral deer.

Past clearing

Much of the vegetation in the Coffs Harbour area, including possible habitat for *Fontainea* sp. Coffs Harbour, has been cleared in the past for grazing by domestic stock, timber collection, food production, such as bananas, and more recently for urban development and blueberries. It is estimated that more than 80% of the original lowland wet sclerophyll forest in the Coffs Harbour and Kororo Basins has been cleared (Anon. *in litt.* October 2021). Lowland wet sclerophyll forest dominated by brush box may have undergone similar or even greater reduction, given its association with gullies and drainage lines, depending on accessibility.

Current clearing

The two sites where *Fontainea* sp. Coffs Harbour occurs are within the project boundary of the approved highway bypass at Coffs Harbour. One site will be cleared as part of the road construction project. This will lead to the loss of all *Fontainea* sp. Coffs Harbour plants and their habitat at this site. There is a plan to translocate *F.* sp. Coffs Harbour plants from this site to a new site nearby (TfNSW 2022). For inclusion in an assessment under IUCN (2012), a translocated population is only considered viable when the translocated plants have established and are self-sustaining, (i.e. when the plants have produced viable offspring that have reached maturity or are likely to do so) and at least five years have passed since the introduction (IUCN 2022). Consequently, any planned or future translocation of *F*. sp. Coffs Harbour plants cannot be considered as a part of the mature population for this assessment. Plants of *Fontainea* sp. Coffs Harbour occurring in the second site will be retained *in-situ* however, some surrounding habitat will be cleared at this site and there may be adverse impacts from the road construction project on the site (see next section). A management plan has been developed (TfNSW 2022).

Habitat Loss and disturbance

The habitat of *Fontainea* sp. Coffs Harbour comprises small vegetation remnants surrounded by largely cleared areas. The site that is due to be cleared is a very small forest patch. Until recently (3 years ago) it was open to surrounding cleared paddocks. Domestic stock, horses and feral deer may have grazed and trampled any young seedlings reducing the regeneration success of the species. Due to the small size of the remnant, micro-climatic stress during dry periods may also have reduced the ability of seedlings and juveniles to survive and establish (TfNSW 2022).

The second site for *Fontainea* sp. Coffs Harbour is also within the project boundary of the bypass project and some of the existing vegetation will be cleared, reducing the size of the remnant vegetation and increasing edge effects. The area containing *Fontainea* sp. Coffs Harbour will be retained but remaining plants will be in close proximity to cleared areas and road construction activities, with associated risks to

remaining plants and their habitat (TfNSW 2022). Clearing of the adjacent vegetation may lead to changes in the micro-climatic conditions of the site (TfNSW 2022). The edges of remnant forest that are exposed are at an increased risk of weed invasion reducing the suitability of the habitat. These changes will likely lead to reduced plant health, reduced reproduction and/or individual tree survival and reduced establishment and survival of seedlings and juvenile plants of *F.* sp. Coffs Harbour (TfNSW 2022). Pest fauna movement may increase due to the introduction of cleared areas adjacent to the highway and may lead to increased grazing on individual threatened plants and/or predation of seeds as well as introducing/spreading pathogens and disease (TfNSW 2022). The increased accumulation of dust on the leaf surfaces of individual plants has the potential to cause individual plant stress and/or mortality (TfNSW 2022).

Pest Animals

Feral deer and horses are present at one site of *Fontainea* sp. Coffs Harbour (TfNSW 2022) and there is evidence of disturbance by deer to co-occurring species at the other site. Feral deer may kill or damage seedlings and saplings by their browsing activities, which in some cases includes stripping bark from trunks, reducing plant vigour, promoting disease entry, or even ring-barking stems.

Unauthorised visitation

Unauthorised visitation could lead to further disturbance at the site and introduce pathogens such as *Phytophthora* species to the *Fontainea* sp. Coffs Harbour habitat.

Assessment against IUCN Red List criteria

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

Criterion A *Population Size reduction*

Assessment Outcome: Critically Endangered under Criterion A3(b,c).

Justification: There is imminent clearing of one of the two known sites for the construction of the Coffs Harbour bypass and the remaining site is likely to be adversely disturbed by road construction works nearby and the clearing of remnant vegetation. The loss of the first site would equate to at least a 50% reduction in the best estimate of mature plant population size of *Fontainea* sp. Coffs Harbour in the near future. For the remaining site, there is likely to be inferred decline in habitat quality and inferred decline in the number of *F.* sp. Coffs Harbour individuals, both mature and juvenile, due to the threats at the site, as outlined above. Being precautionary, the combined loss across both sites is inferred to be up to 100% for the species in the near future. While time to first flowering, the length of time that mature plants remain reproductive and plant longevity are unknown for *Fontainea* sp. Coffs Harbour, the species is expected to be a long-lived tree, with mature plants remaining reproductive for a number of decades. Consequently, 3 generations are likely to be >100 years. Hence, population reduction in the next 100 years is inferred to be at least 50% as a lower bound and up to 100% as an upper bound. Taking the upper bound, the species qualifies for Critically Endangered as there is likely to be $\geq$ 80% population reduction over three generations.

Criterion B Geographic range

Assessment Outcome: Critically Endangered under Criterion B1ab(iii,v) +2ab(iii,v)

Justification: The extent of occurrence (EOO) and the area of occupancy (AOO) of *Fontainea* sp. Coffs Harbour are both 4 km^2 meeting the thresholds for the category Critically Endangered (EOO <100 km^2 (CR) and AOO <10 km^2 (CR)).

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: Severe fragmentation and one location, meeting the threat category of Critically Endangered.

   Justification: The population and habitat of *Fontainea* sp. Coffs Harbour is severely fragmented. Most individuals of the species are found in a small population that may go extinct (*sensu* IUCN 2012, 2022). One of the two sites is about to be cleared and recolonisation of this habitat will not be possible. At the second site, there will be clearing of vegetation in the habitat remnant and increased edge effects.

   There is one location for *Fontainea* sp. Coffs Harbour. The single threatening event that can rapidly affect all individuals of the taxon is disturbance from road construction works including the clearing of one of two known sites and partial loss and disturbance to the habitat at the remaining site.

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 (iii) and (v).

   Justification: There is continuing decline projected due to the imminent clearing of one of the two known sites and inferred continuing decline due to the partial loss of habitat and disturbance to the remaining site from road construction works.

c) Extreme fluctuations.

   Assessment Outcome: Unknown, but unlikely.

   Justification: *Fontainea* sp. Coffs Harbour is thought to be a long-lived tree.

Criterion C Small population size and decline

Assessment Outcome: Critically Endangered under Criterion C1+2a(i,ii)

Justification: There are <10 mature individuals from direct counts at the two known sites meeting the thresholds for Critically Endangered of <250.

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: Critically Endangered.

Justification: Road construction works are projected to lead to a decline of at least 50% (and potentially up to 100%) in the best estimate of mature individuals within the immediate future and well within a single generation. There is a further risk that the habitat loss and disturbance to the second site may lead to a further loss of mature plants.

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

Assessment Outcome: Met.

Justification: There is projected continuing decline in the number of mature individuals. One of the two sites is soon to be cleared for road construction works, while there will be partial loss of habitat and increased disturbance at the other site.

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: Met for Critically Endangered.

Justification: There is only one population of *Fontainea* sp. Coffs Harbour which has < 10 mature individuals.

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

Assessment Outcome: Met for Critically Endangered.

Justification: As all the mature individuals are within the one population, the threshold of 90-100% for Critically Endangered is met.

b. Extreme fluctuations in the number of mature individuals

Assessment Outcome: Unknown, but unlikely.

Justification: *Fontainea* sp. Coffs Harbour is thought to be a long-lived tree.

Criterion D Very small or restricted population

Assessment Outcome: Critically Endangered under Criterion D

Justification: There are <10 mature individuals from direct counts at the two known sites meeting the threshold for Critically Endangered of <50.

Criterion E Quantitative Analysis

Assessment Outcome: Data Deficient under Criterion E

Justification: There is insufficient data to assess this newly discovered species against this criterion.

Conservation and Management Actions

This species is currently provisionally listed on the NSW *Biodiversity Conservation Act 2016* and a conservation project is being developed by the NSW Department of Planning and Environment under the Saving our Species program. Transport for NSW are also developing a management plan.

The following is derived from the threat information and could be used to develop management actions.

Habitat loss, disturbance and modification

As the road construction project has been approved, collaboration with TfNSW will be necessary to ensure the best outcome for the continued survival of the remaining known site for *Fontainea* sp. Coffs Harbour. The main priority is to ensure the protection of *in situ Fontainea* sp. Coffs Harbour individuals whilst the road construction works are in progress and in the following years/decades.

- Ensure appropriate strategic planning and environmental impact assessment is undertaken by consent and determining authorities to enable protection of all known individuals and their habitat.
- Prevent further clearing and disturbance to the remaining site. Develop and implement a management plan for the species that addresses minimising threats and incorporates *ex situ* conservation measures and translocation (see below).
- Negotiate for the implementation of permanent protection measures for the species and its habitat on any private land the species is found on or translocated to.

Invasive species

- Identify and remove/control invasive species including weeds and feral and domestic animals while avoiding disturbance to individuals of *Fontainea* sp. Coffs Harbour and their habitat. Fencing should be installed where required to protect subpopulations from disturbance and invasive species.

Ex situ conservation and Translocation

- Develop and implement a targeted *ex situ* germplasm program following best-practice guidelines (Martyn Yenson *et al*. 2021). Living material should be made available to a range of host botanic gardens (as multiple backups) and cover the full genetic diversity within the species.
- Implement national translocation protocols (Commander *et al*. 2018) if establishing additional populations or enhancing populations is considered necessary and feasible.
- Establishment of translocation sites using *ex situ* material is a priority and to resource long term management of these sites.
- Draw on multiple institutions and their expertise (e.g. The Australian Botanic Garden Mt Annan and Coffs Harbour Botanic Gardens) for any propagation,

seed storage and translocation of *Fontainea* sp. Coffs Harbour material to spread the opportunity for the propagation success.

Stakeholders

- Consultation and collaboration between the NSW Department of Planning and Environment and TfNSW regarding options for conservation management and protection of the species.
- Report new records of *Fontainea* sp. Coffs Harbour to Department of Planning and Environment.

Survey and Monitoring priorities

- Undertake further detailed systematic searches and surveys to identify additional, currently undiscovered occurrences of the species in the Coffs Harbour district, with follow-up action for protection in perpetuity (see actions above).
- Monitoring for increased habitat degradation. Monitor for changes in the habitat due to the nearby road construction works, such as the abundance of weeds, changes in the hydrology of the habitat, dust etc.
- Regular monitoring to determine whether there is a decline in the remaining *Fontainea* sp. Coffs Harbour population. Permanent monitoring plots should be established to record growth, plant health, shade characteristics, life history changes (flowering, fruiting, recruitment etc) and mortality of *Fontainea* sp. Coffs Harbour and co-occurring species. This would also assist in tracking changes in *Fontainea* sp. Coffs Harbour habitat (e.g., weed arrivals).
- Examine the response of *Fontainea* sp. Coffs Harbour to any disturbance that occurs in the species habitat (e.g., stem death, resprouting, leaf browning, flowering or fruiting, recruitment).
- Monitoring for herbivory and/or illegal collections.
- Undertake systematic surveys to identify multiple candidate translocation sites,

Restoration

- In the event there are insufficient matched sites for translocation consider the restoration of degraded lands to supplement translocations to native sites.

Information and Research priorities

- Develop a research program to understand the life history and ecology of the species, including recruitment mechanism and seedling survival, pollination, breeding system, dispersal, germination biology. Research on the remaining *in situ* site needs to be carefully planned and managed to avoid inadvertent loss, or the introduction of weeds and pathogens (as there are so few remaining plants left in the wild). Include any proposed translocation site in this research.
- Develop propagation methods for the species to ensure a high likelihood of success with limited source material.

- There are research actions in the *Fontainea oraria* Conservation Assessment report that may also be applicable for *Fontainea* sp. Coffs Harbour, particularly once a translocation site has been initiated/established.

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APPENDIX 1

Assessment against *Biodiversity Conservation Regulation 2017* criteria
The Clauses used for assessment are listed below for reference.

Overall Assessment Outcome:
Fontainea sp. Coffs Harbour was found to be Critically Endangered under Clause 4.2(1a)(2bc), Clause 4.3(a)(d)(e, i,iii), Clause 4.4(a)(d i)(e i,iiA(I)B), and Clause 4.5(a).

Clause 4.2 – Reduction in population size of species
(Equivalent to IUCN criterion A)
Assessment Outcome: Critically Endangered under Clause 4.2(1a)(2bc).

(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, i,iii).

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,iiA(I)B).

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 under Clause 4.7.

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.