Department of Biodiversity, Conservation and Attractions

GOVERNMENT OF WESTERN AUSTRALIA

Nomination *(to be completed by nominator)*

Current conservation status	
Name of ecological community:	Aquatic Root Mat Community Number 3 of Caves of the Leeuwin Naturaliste Ridge (Kudjal Yolgah and Budjur Mar Caves) (hereafter termed 'Community No.3')
Other names:	Leeuwin Cave community
Description:	The community occurs in the cave system of the Leeuwin-Naturaliste Ridge, incorporating Kudjal Yolgah and Budjur Mar Caves. It comprises a complete food web. Rootlets and their associated microflora provide the primary food source, and root mat grazers, predators, parasites, detritivores and scavengers complete the interactions. The root mats are produced by *Eucalyptus diversicolor* (karri) and *Agonis flexuosa* (peppermint). Aquatic cavernicoles (cave animals) in the community include *Cherax preissii* (koonacs), other crustaceans, mites, rotifers, microscopic worms, tardigrades and insects. The Acarina, Oribatida sp. 6 (cf. Jasinska E.J. (1997)), the oligochaetes *Aeolosoma* sp., Enchytraeidae sp. 5, Enchytraeidae sp. 6, *Antarctodrilus micros* Pinder and Brinkhurst, *Pristina longiseta* Ehrenberg, sensu lato, *Pristina aequiseta* Bourne, *Pristina* WA4 sp. n. Tubificidae WA12 sp. n. ?, the copepod '*Kudjalmoraria nana*' n.g., n.sp. Karanovic in prep., the syncarid Bathynellacea Family indet., the coleopteran Helodidae sp. indet., the turbellarian *Alloeocoela* sp. 1 (cf. Jasinska E.J. (1997)) and Tricladida spp. indet. are specific to Kudjal Yolgah Cave. The community was originally described in Jasinska (1997).
Nomination for:	Listing ☒ Under Biodiversity Conservation Act Change of status ☐ Delisting ☐

1. *Is the ecological community currently on any conservation list, either in a State or Territory, Australia or Internationally?* 2. *Is it present in an Australian jurisdiction, but not listed?*	*Provide details of the occurrence and listing status for each jurisdiction in the following table*

Jurisdiction	List or Act name	Date listed or assessed (or N/A)	Listing category eg. critically endangered (or none)	Listing criteria eg. B1ab(iii)+2ab(iii) (or none)
National	EPBC Act	16/07/2000	EN	
Western Australia	Current ranking under WA Minister ESA list in policy	6/11/2001	CR	B) (under previous WA criteria)
	Priority list		1 ☐ 2 ☐	3 ☐ 4 ☐
Other State/Territory				

Nominated conservation status: category and criteria (include recommended status for deleted ecological communities)

Critically endangered (CR) ☒	Endangered (EN) ☐	Vulnerable (VU) ☐	Collapsed (CO) ☐
Priority 1 ☐	Priority 2 ☐	Priority 3 ☐	Priority 4 ☐ None ☐

What criteria support the conservation status category for listing as a threatened ecological community or collapsed ecological community? *Refer to Section 32 of the Biodiversity Act 2016 for definition of 'Collapsed', and Appendix 3 table 'IUCN Red List Criteria for ecosystems version 2.2'.*	CR A1, A2b, A3; B1a(i),(ii),b,c; B2a(i),(ii),b,c; C1, C2b, C3.

Eligibility against the criteria		
*Provide justification for the nominated conservation status; is the ecological community eligible or ineligible for listing against the five criteria. For **delisting**, provide details for why the ecological community no longer meets the requirements of the current conservation status.*		
A.	Reduction in geographic distribution *(evidence of decline)*	☒ **A1** ☐ **A2a** ☒ **A2b** ☒ **A3**
	Justification of assessment under Criterion A.	For criterion A, the community was assumed to collapse when the mapped distribution declines to zero. • Based on available data, 100% of areas of known habitat for this community identified in 1996 has been lost. All known habitat, characterised by water table pools with submerged tree roots, has dried out in Kujal Yolgah (see Appendix 1). Recently some water has been sighted within Budjur Mar, however, a site visit is required to confirm (pers comm. [redacted][1]). • All known habitat, characterised by water table pools with submerged tree roots, has dried out. It is assumed that the assemblage that was previously supported in the pools will not return even if water levels in the pools increase in future as there will not be intact habitat remaining that supports the invertebrates, from which the pools can be restocked. • Based on available evidence, the community meets Collapsed under criterion A1 as there has been a 100% decline in distribution over the past 50 years. • Meets Collapsed under A2b there has been 100% decline in distribution over a previous 50 year period (since 1996). • Meets Collapsed under A3 as 100% of all known areas of potential habitat for this community have been lost since 1750.

[1] [redacted]: Karst specialists, Cavers Leeuwin Inc- CLIN

		• Plausibly meets collapsed or CR but expert advice indicates additional occurrences may exist in inaccessible crevices of the caves (pers comm. [redacted]). • **Meets criteria for Critically Endangered under A1, A2b, A3**
B.	Restricted geographic distribution *(EOO and AOO, number of locations and evidence of decline)*	☒ **B1** (specify at least one of the following): ☒ **a)(i)** ☒**a)(ii)** ☐**a)(iii)** ☒**b)** ☒**c);** ☒ **B2** (specify at least one of the following): ☒ **a)(i)** ☒**a)(ii)** ☐**a)(iii)** ☒**b)** ☒**c);** ☐ **B3 (only for Vulnerable Listing)**
	Justification of assessment under Criterion B.	• B1: EOO is 0.19km2 (≤2,000km2-threshold for CR). The community's EEO is less that the 2,000km^2 threshold for rank CR. Community meets threshold for rank CR under criterion part B1. • B1 a) (i), (ii) Monitoring of the known habitat of the community indicates a decline in groundwater levels from 1996. Site visit in March 2020, indicated cave pools and stream beds were completely dried out at Kudjal Yolgah Cave. Recently some water was sighted within Budjur Mar. A site visit is required to confirm (pers comm. [redacted]). (see Appendix 1 for further details). • B1 c): Community was previously considered to occur at 1 threat defined location. It is Inferred that there are hydrological connections between Kudjal Yolgah and Budjur Mar caves, based upon their close geographic proximity and convergent drainage patterns (Eberhard 2004). • B2: AOO. Community covers 1 grid cell. The community meets CR under criterion B2 for which the AOO threshold is ≤2 grid cells (threshold for CR ≤2 grid cells) (b and c of B1 are the same for B2) • B3: community was previously considered to occur at 1 threat defined location, based on two occurrences likely supported by a particular aquifer, within in single bushland location subject to a single management regime, including burning. Meets VU under criterion B3, as it occurs at 1 threat defined location. • Plausibly meets CR or collapsed but expert advice indicates additional occurrences may exist in inaccessible crevices of the caves (pers comm. [redacted]). • **Meets criteria for Critically Endangered under B1a(i),(ii),b,c; B2a(i),(ii),b,c.**
C.	Environmental degradation of abiotic variable *(Evidence of decline over 50-year period)*	☒ **C1** ☒ **C2** ☒ **C3**

	Justification of assessment under Criterion C.	• Hydrological change in the form of groundwater decline is the abiotic variable that presents the most significant threat to the community. • For criterion C, the assessment of decline in abiotic processes is focussed on hydrological change using data on the depth of cave pools supporting aquatic root mat assemblages. It was assumed that the community would collapse if the cave pools supporting this community completely dried up. • Groundwater levels in Kudjal Yolgah Cave are measured at two sites ([redacted] pers comm.). Kudjal Yolgah Cave water level has decreased significantly from 2004 (figure 1), and visits to the cave in 2018 indicated the site was completely dry ([redacted][2] and [redacted] pers comm.). A recent site visit in March 2020 also confirmed this ([redacted][3] pers obvs.) • It is inferred that there are hydrological connections between caves Kudjal Yolgah and Budjur Mar. Based on current water levels of the two measurement sites at Kudjal Yolgah Cave, it is was inferred pools within Budjur Mar are also dry. Recently some water has been sighted within Budjur Mar, however, a site visit is required to confirm (pers comm. [redacted]). • Based on these assumptions, the community plausibly meets criteria for collapsed, as the community's extent has declined by 100% with 100% severity, over the past 50 years. • The community also meets C2b C3, as the declines have occurred over any 50 year period, and since 1750. • Plausibly meets CR or collapsed but expert advice indicates additional occurrences may exist in inaccessible crevices of the caves (pers comm. [redacted]). • **Meets criteria for Critically Endangered under C1, C2b, C3**
D.	Disruption of biotic processes or interactions *(Evidence of decline over 50-year period)*	☐ **D1** ☐ **D2** ☐ **D3**
	Justification of assessment under Criterion D.	• Decline in the root mats that support the community including cave faunae that are important in the food web is a significant biotic variable affecting the community. • The collapse point is assumed to be total loss of the root mats that support the community, resulting in loss of significant parts of the food web. • There are insufficient monitoring data to track decline in extent and health of the root mats in relation to cave faunae that are important in the food web.

[2] [redacted]: Caves Manager, DBCA Blackwood district
[3] [redacted]: Technical officer, DBCA Kensington

		• **Insufficient data to assess the community against the criterion**
E.	Quantitative analysis *(statistical probability of ecosystem collapse)*	• No quantitative estimates of the risk of ecosystem collapse. • Unable to assess

Reasons for change of status
Genuine change ☐ New knowledge ☐ Previous mistake ☐ Review/Other ☒
Provide details: The community was initially ranked as Critically Endangered using ranking criteria developed in WA that differ from those in the IUCN Red List Criteria for Ecosystems (version 2.2).
Summary of assessment information *(provide detailed information in the relevant sections of the nomination form)*

EOO	0.19 km^2	AOO	100 km^2 (10x10km grid method)
No. locations	1	Severely fragmented	Yes ☒ No ☐ Unknown ☐ Community was confined to specific habitats in cave pools that were naturally highly fragmented
Current known area			Mapped situated land surface of 18.93ha (0.1893km^2). Area of lakes and streams with and without tree roots, estimated ~ 700m^2 (Eberhard 2004).
Pre-industrialisation extent or its former known extent (if known)			18.93ha based on very approximate estimates of extent.
Estimated percentage decline			Area occupied may have declined 100% due to observed 100% decline in known habitat (cave pools) in Kudjal Yolgah.

Summary assessment against IUCN RLE Criteria

Criterion	Rank indicated	Overall conclusion
A1	Critically Endangered	• 100% decline in known distribution over the past 50 years. • Plausibly meets collapsed but expert advice indicates additional occurrences may exist. • Meets criterion for CR
A2a	-	• Future predictions not possible as plausibly meets criteria for collapsed.
A2b	CR	• 100% decline in known distribution over a previous 50-year period (since 1996). • Plausibly meets collapsed but expert advice indicates additional occurrences may exist. • Meets criterion for CR
A3	CR	• 100% of all known areas of known habitat for the community have been lost since 1750. • Plausibly meets collapsed but expert advice indicates additional occurrences may exist • Meets criterion for CR
B1a	CR	• EOO is ≤2,000km^2 • Observed decline in environmental quality, with cave water levels depleted • Plausibly meets collapsed but expert advice indicates additional occurrences may exist • Meets criterion for CR B1a(i),(ii)
B1b	CR	• EOO is ≤2,000km^2 • Main threat identified as hydrological change. Known habitat, characterised by water table pools with submerged tree roots, has dried out. • Plausibly meets collapsed but expert advice indicates additional occurrences may exist • Meets criterion for CR
B1c	CR	• EOO is ≤2,000km^2 • Ecosystem exists at 1 threat defined location • Meets criterion for CR
B2a	CR	• AOO is 1 grid cell • Observed decline in environmental quality, with cave water levels depleted • Plausibly meets collapsed but expert advice indicates additional occurrences may exist. • Meets criterion for CR B2a(i),(ii)
B2b	CR	• AOO is 1 grid cell • Main threat identified as hydrological change. Known habitat, characterised by water table pools with submerged tree roots, has dried out. • Plausibly meets collapsed but expert advice indicates additional occurrences may exist. • Meets criterion for CR
B2c	CR	• AOO is 1 grid cell • Ecosystem exists at 1 threat defined location • Meets criterion for CR
B3	Vulnerable	• Known from one threat-defined location • Meets criterion for VU
C1	CR	• Available data indicate community indicates decline of 100% of the known extent with 100% severity of degradation over the past 50 years • Plausibly meets collapsed but expert advice indicates additional occurrences may exist • Meets criterion for CR

C2	CR	• Available data indicate community indicates decline of 100% of the known extent with 100% severity of degradation over the previous 50 years • Plausibly meets collapsed but expert advice indicates additional occurrences may exist. • Meets criterion for CR
C3	CR	• Available data indicate community indicates decline of 100% of the known extent with 100% severity of degradation over since 1750 • Plausibly meets collapsed but expert advice indicates additional occurrences may exist. • Meets criterion for CR
D1	-	• Insufficient data to indicate that community meets minimum proportion of the extent (≥30%) or proportional severity of disruption of biotic processes (≥30%) over the past 50 years to meet VU.
D2	-	• Insufficient data to indicate that community meets minimum proportion of the extent (≥30%) or proportional severity of disruption of biotic processes (≥30%) over any 50-year period to meet VU.
D3	-	• Insufficient data to indicate that community meets minimum proportion of the extent (≥30%) or proportional severity of disruption of biotic processes (≥30%) since 1750 period to meet VU.
E	NA	• No quantitative estimates of the risk of ecosystem collapse.
		Meets Critically Endangered under A1, A2b, A3; B1a(i),(ii),b,c; B2a(i),(ii),b,c; C1, C2b, C3. Meets VU under B3. *'The highest risk category obtained by any of the assessed criteria will be the overall risk status of the ecosystem'* (IUCN RLE Guidelines V1.1 page 42). **Meets CR under criteria A1, A2b, A3; B1a(i),(ii),b,c; B2a(i),(ii),b,c; C1, C2b, C3.**

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Summary of location (occurrence) information *(provide detailed information in the relevant sections of the nomination form)*						
Occurrence site ID (Occurrence No.)	Land tenure	Survey information: date of survey	Condition	Area of occurrence (ha)	Threats *(note if past, present or future)*	Specific management actions
BUDJURMAR01 (1)	DBCA (Reserve 8428 Leeuwin-Naturaliste National Park)	1995, 1998-2020	100% beyond recovery as recent site visits in 2018 indicate Kudjal Yolgah Cave is now dry. It is assumed Budjur Mar cave is also dry and that the root mat assemblages will not recover even if water returns to the caves.	Mapped situated land surface of 18.93ha (0.1893km^2). Lakes and streams areas with and without tree roots ~ 700m^2 (Eberhard 2004). No formal measurements have been taken.	Groundwater decline, altered surface drainage, too high intensity fire in trees that provide tree root habitat, disease, water contamination, exotic species, trampling of roots from human activity	Monitoring of water levels and chemistry, access control, controls on activities that potentially result in water contamination, management of fire regimes in forest areas that contain trees that supply tree root mats, introduced fauna control

*For the purposes of relating condition to the criteria, condition categories from (Keighery (1994) Vegetation Condition Scale (Government of WA 2000)) are defined below:

Good (‘Pristine’, ‘Excellent’, ‘Very Good’ using Bush Forever (2000) scale): This includes vegetation ranging from ‘Pristine’ - with no obvious signs of disturbance, to ‘Excellent’ - Vegetation structure intact, with disturbance only affecting individual species, weeds are non-aggressive species and ‘Very Good’ - Vegetation structure altered, obvious signs of disturbance eg: from repeated fires, dieback, logging, grazing.

Medium (‘Good’ using Bush Forever (2000) scale): This includes vegetation categorised as ‘Good’ - Vegetation structure altered but retains basic vegetation structure or ability to regenerate it, obvious signs of disturbance are present, from activities including partial clearing, dieback and grazing.

Poor (‘Degraded’ using Bush Forever (2000) scale): Basic vegetation structure severely impacted by disturbance such as partial clearing, dieback, logging and grazing. Scope for regeneration but not to a state approaching good condition without intensive management.

Beyond recovery (‘Completely degraded’ using Bush Forever (2000) scale): Vegetation structure is no longer intact and the area is completely or almost completely without native species. These areas are often described as ‘parkland cleared’ with the flora comprising weed or crop species with isolated native shrubs and trees.

APPENDIX 1 THREATS

Major Threats

Groundwater Decline

Groundwater decline is overwhelmingly the most important and imminent threat to the survival of root mat assemblages in caves on the Leeuwin Naturaliste Ridge. The caves have experienced reduced groundwater levels and stream flow in recent years. Decline in water level in the four original root mat caves over recent decades was recorded by both Jasinska (1997) and Eberhard (2004, 2006).

In 2012, the water table in the Jewel Cave Karst System was the lowest level ever recorded, at 22.460 m AHD. This is more than 2.5 m below the maximum level recorded over the last 52 years since measurements commenced (Subterranean Ecology Pty Ltd 2012). The main cause of the water decline is reduced rainfall experienced in southwest Western Australia since the mid 1970s but may be exacerbated due to other land use practises such as tree plantations or altered drainage. Abstraction of water from areas up-gradient of cave streams has the potential to impact on the caves. As suggested by Eberhard (2004) reduced fire frequency in the national park in which the caves are situated may have contributed to the decline in water levels in these caves as well

In 1996, most of Kudjal Yolgah shallow streams were completely dry and streams were not flowing for the first time since recordings began (Jasinska 1997). On the other hand, water levels of the deep section of Kudjal Yolgah did not change over the period of the Jasinska (1997) study, from 1991 to 1995. Kudjal Yolgah has shown a slower decrease in water when compared to the other caves, however, a significant decline in water levels in this cave did begin in 2004 (figure 1). Some puddles were observed at site 1 between 2006 and 2008. Site visits to Kudjul Yolgah cave in 2018, indicated the site was completely dry ([redacted] and [redacted] pers comm.). The community was visited on 14 March 2020 by DBCA staff and volunteer cave experts. It was confirmed that water at Kudjal Yolgah cave was depleted, and that stygofauna were no longer evident within root mats that were observed (figure 2).

The root mat assemblage of Budjur Mar cave is identified as an additional site that holds aquatic root mat community no. 3. It is Inferred that there are hydrological connections between caves Kudjal Yolgah and Budjur Mar, based upon their close geographic proximity and convergent drainage patterns (Eberhard 2004). Budjur Mar is a vertical cave with CO_2 levels that are often high throughout the year (pers. comm. [redacted]). This site was not visited on this trip, however, some water was sighted within Budjur Mar ([redacted] pers comm.).

Despite no evidence of functioning aquatic root mat communities due to water depletion and absence of stygofauna in accessible known locations, additional occurrences may exist in inaccessible crevices of the caves (pers comm. [redacted]). Tree roots are capable of growing in spaces to a depth of at least 40m (Eberhard 2004), and likely prefer habitats with high humidity and moist conditions (pers. comm. [redacted]). Given there is no known evidence of resistance to drying in these stygofauna species, complete water depletion at these sites suggest stygofauna that occurred within the accessible known root mat communities, are now presumed locally extinct.

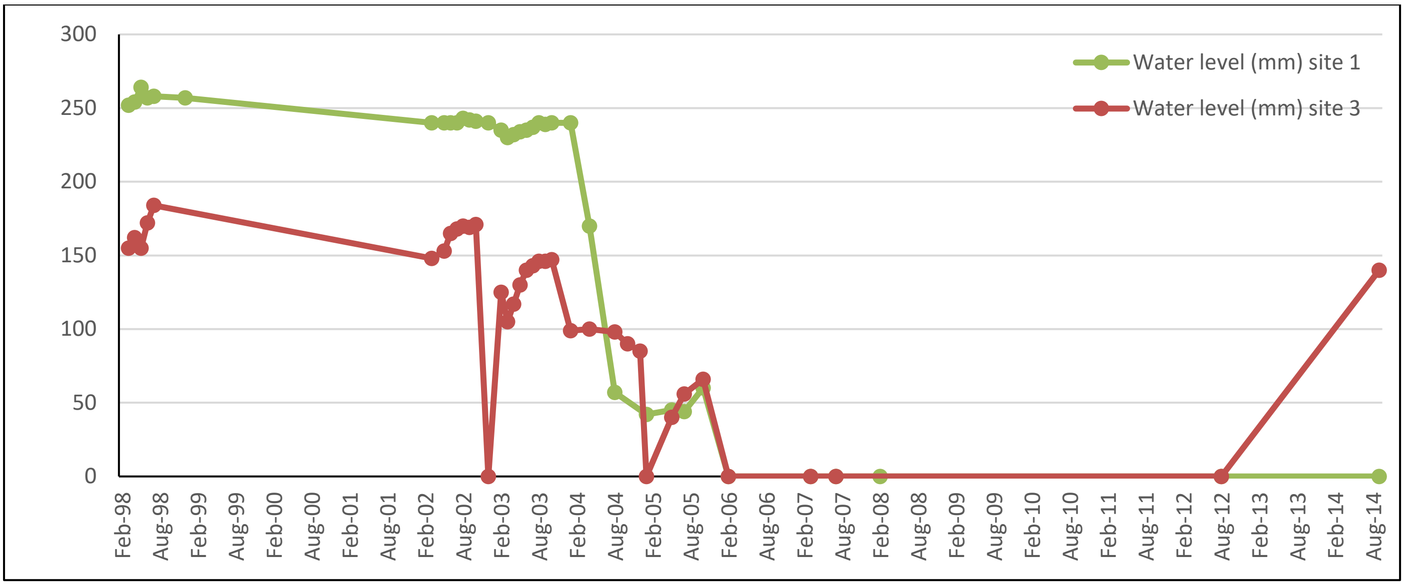


Figure 1. Kudjal Yolgah hydrograph 1998 to 2014 showing water levels (mm) at two different sites that host the community within the cave ([redacted] pers comm.).

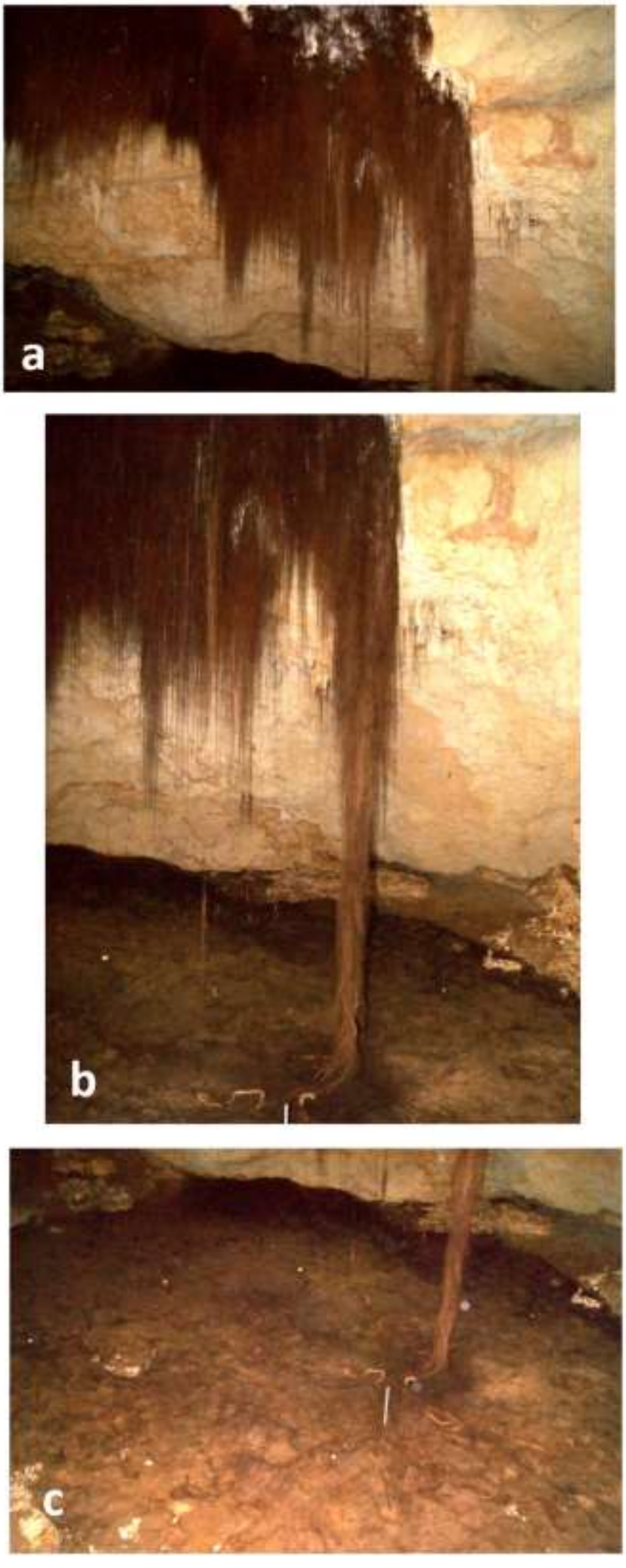


Figure 2. Large network of roots hanging from the cave ceiling in a curtain-like manner with the main column tree root descending and contributing to a circular root mat in a previously water-filled pool within the main chamber of Kudjal Yolgah (a-c).

Minor threats

Pollution of Groundwater

Karst aquifers are very vulnerable to contamination from pollutants carried in surface waters because of rapid ingress of such waters via sinking streams and free flowing conduits, including sink-holes and solution pipes, and an associated low filtration capacity. Therefore, longer-term threats to the root mat assemblages include pollution of the groundwater. Water quality can have significant influence on the taxa present and their growth and survival (Trayler and Davis 1996; Cairns *et al.* 1993).

Long term planning is required to ensure waters entering caves are not polluted with fertilisers, fungicides or pesticides used in agricultural production, by runoff from urban uses, or by waters carrying pollutants from land-uses such as rubbish tips or industrial areas.

At least one ex-tourist cave that may have contained a root mat community was vandalised through pollution of the cave stream with wiring, batteries, and drink containers and it possibly receives subterranean drainage from a waste disposal site nearby and upstream of the cave (Jasinska 1997).

Activities such as agriculture, large tourist developments including caravan parks and hotels that produce substantial amounts of effluent and require large quantities of water already occur near caves that contain stygofauna on the Leeuwin-Naturaliste Ridge, and these types of development can be expected to expand in future.

Invasion of Exotic Species

Introduced fauna such as yabbies (*Cherax destructor*) may compete with or prey upon other fauna in the community, alter habitat and represent a threat to the root mat communities, and/or particular species of stygofauna. Yabbies have been recorded from caves at Stockyard Gully, Eneabba, and are thought to have had a significant impact on the cave fauna in that area (Jasinska *et al.* 1993). Crayfish were identified from Lake Cave in August 1995 (Jasinska 1997). All the specimens were the endemic *Cherax preissii* (koonacs). If feasible methods exist, any accidentally or deliberately introduced species should be removed unless side effects of removal are likely to do more harm than the introduced species.

Loss of tree roots by death of trees

Trees whose roots reach the water table may be killed by hot fire, too frequent fire, clearing or disease. An increased distribution of tree roots throughout karst systems of the Leeuwin-Naturaliste Ridge is now known, and the hundreds, probably thousands of trees involved, suggest that normal good management of forests should prevent major effects from fires or disease. Clearing may be a localised threat in land adjacent to conservation lands and planning processes should include careful consideration of this factor.

Eberhard (2004) concluded that vigorous growth of native vegetation and heavy accumulations of litter, resulting from lower frequency of fires over the last few decades (with the last significant fire in the catchment in 1977), may have contributed to reduced amounts of rainfall penetrating the soil and reaching the cave system.

A very hot wildfire burned much of the catchment of Calgardup Cave, that also supports a root mat assemblage, and some of that for Lake Cave, in April 2006. This provides an opportunity to monitor the effect of severe fire on water levels in those caves to help to clarify major hydrological drivers for them.

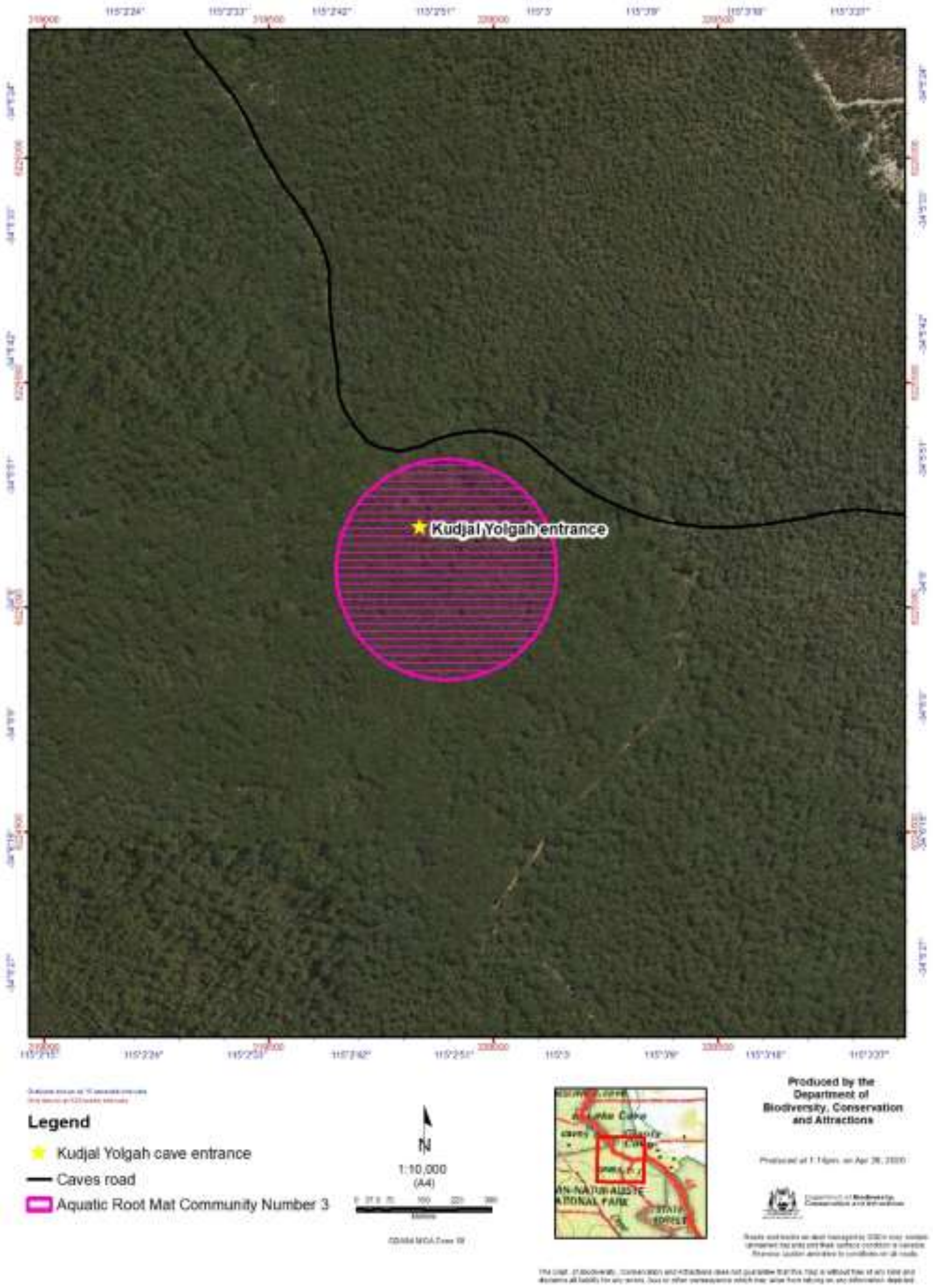
Damage to root mats from human trampling within the caves

Access to all of the caves that contain root mats on the Leeuwin-Naturaliste Ridge are already controlled to some extent and this helps to prevent physical damage to the communities.

Cave collapse

While cave collapse is a natural process in karst systems, the exacerbation of this by heavy human or vehicular traffic over the caves and the use of explosives nearby should be avoided. Good management practices should include ensuring any tracks or commonly used walk trails do not occur above the caves, and ensuring heavy machinery and explosives are not used near them. The consequences from a cave collapse would be major, however, currently the likelihood of this event is minor.

APPENDIX 2 Aquatic Root Mat Community Number 3 of Caves of the Leeuwin Naturaliste Ridge (Kudjal Yolgah and Budjur Mar Caves)



The map above was created using ArcGIS version 10.6.1 and shows the extent of distribution of the cave that supports the 'Aquatic Root Mat Community Number 3 of Caves of the Leeuwin Naturaliste Ridge (Kudjal Yolgah and Budjur Mar Caves)'. This community is found along Caves Road within Boranup.

The map was created from known mapped occurrences of the community contained on the Western Australian Threatened Ecological Community database (TECDB), as administered by the Department of Biodiversity and Conservation (DBCA).

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APPENDIX 3 IUCN Red List Criteria for ecosystems (version 2.2) (IUCN 2017)

A. Reduction in geographic distribution over ANY of the following time periods:

		CR	EN	VU
A1	Present (over the past 50 years).	≥ 80%	≥ 50%	≥ 30%
A2a	Future (over the next 50 years).	≥ 80%	≥ 50%	≥ 30%
A2b	Future (over any 50 year period including the present and future).	≥ 80%	≥ 50%	≥ 30%
A3	Historic (since 1750).	≥ 90%	≥ 70%	≥ 50%

B. Restricted geographic distribution indicated by EITHER B1, B2 or B3:

		CR	EN	VU
B1	Extent of a minimum convex polygon enclosing all occurrences (Extent of Occurrence)	≤ 2,000 km²	≤ 20,000 km²	≤ 50,000 km²
	AND at least one of the following (a-c):			
	(a) An observed or inferred continuing decline in **EITHER**:			
	i. a measure of spatial extent appropriate to the ecosystem; **OR**			
	ii. a measure of environmental quality appropriate to characteristic biota of the ecosystem; **OR**			
	iii. a measure of disruption to biotic interactions appropriate to the characteristic biota of the ecosystem.			
	(b) Observed or inferred threatening processes that are likely to cause continuing declines in geographic distribution, environmental quality or biotic interactions within the next 20 years.			
	(c) Ecosystem exists at …	1 location	≤ 5 locations	≤ 10 locations
B2	The number of 10 × 10 km grid cells occupied (Area of Occupancy)	≤ 2	≤ 20	≤ 50
	AND at least one of a-c above (same sub-criteria as for B1).			
B3	A very small number of locations (generally fewer than 5) **AND** prone to the effects of human activities or stochastic events within a very short time period in an uncertain future, and thus capable of collapse or becoming Critically Endangered within a very short time period (B3 can only lead to a listing as VU).			VU

C. Environmental degradation over ANY of the following time periods:

			Relative severity (%)		
		Extent (%)	≥ 80	≥ 50	≥ 30
C1	The past 50 years based on change in an abiotic variable affecting a fraction of the extent of the ecosystem and with relative severity, as indicated by the following table:	≥ 80	CR	EN	VU
		≥ 50	EN	VU	
		≥ 30	VU		
			≥ 80	≥ 50	≥ 30
C2	The next 50 years, or any 50-year period including the present and future, based on change in an abiotic variable affecting a fraction of the extent of the ecosystem and with relative severity, as indicated by the following table:	≥ 80	CR	EN	VU
		≥ 50	EN	VU	
		≥ 30	VU		
			≥ 90	≥ 70	≥ 50
C3	Since 1750 based on change in an abiotic variable affecting a fraction of the extent of the ecosystem and with relative severity, as indicated by the following table:	≥ 90	CR	EN	VU
		≥ 70	EN	VU	
		≥ 50	VU		

D. Disruption of biotic processes or interactions over ANY of the following time periods:

			Relative severity (%)		
		Extent (%)	≥ 80	≥ 50	≥ 30
D1	The past 50 years based on change in a biotic variable affecting a fraction of the extent of the ecosystem and with relative severity, as indicated by the following table:	≥ 80	CR	EN	VU
		≥ 50	EN	VU	
		≥ 30	VU		
D2			≥ 80	≥ 50	≥ 30

	(D2a) The next 50 years, or (D2b) any 50-year period including the present and future, based on change in a biotic variable affecting a fraction of the extent of the ecosystem and with relative severity, as indicated by the following table: OR	≥ 80	CR	EN	VU
		≥ 50	EN	VU	
		≥ 30	VU		
			≥ 90	≥ 70	≥ 50
D3	Since 1750, based on a change in a biotic variable affecting a fraction of the extent of the ecosystem and with relative severity, as indicated by the following table:	≥ 90	CR	EN	VU
		≥ 70	EN	VU	
		≥ 50	VU		
E. Quantitative analysis					
			CR	EN	VU
… that estimates the probability of ecosystem collapse to be:			≥ 50% within 50 years	≥ 20% within 50 years	≥ 10% within 100 years