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 2 of Caves of the Leeuwin Naturaliste Ridge (Strongs Cave) (hereafter termed 'Community No.2')
Other names:	
Description:	The community occurs in the cave system of the Leeuwin-Naturaliste Ridge incorporating Strongs Cave. 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). Aquatic cavernicoles (cave animals) in the community include *Cherax preissii* (koonacs), other crustaceans, mites, rotifers, microscopic worms, tardigrades and insects. The ologochaete Phreodrilidae spp. indet., the copepod Harpacticoida Family indet., the syncarid Parabathynellidae indet., and the turbellarian *Stenostomum* sp. 3 (cf. Jasinska E.J. (1997)) are specific to Strongs Cave. The community was originally described in Jasinska (1997).
Nomination for:	Listing ☒ **Under BC 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. • Based on available evidence, the community meets CR under criterion A1 as there has been 100% decline in known distribution over the past 50 years. • Meets CR under A2b there has been 100% decline in known distribution over a previous 50 year period (since 2001). • Meets CR under A3 as 100% of all known areas of known habitat for this community have been lost since 1750. • Plausibly meets collapsed or critically endangered. Expert advice indicates additional occurrences may occur in inaccessible crevices of the caves (pers comm. [redacted][1]). • Plausibly meets criteria for Critically Endangered or Collapsed under A1, A2b, A3. • **Expert advice indicates CR 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: B1: EOO is 0.03km2 (≤2,000km2-threshold for CR). The community's EEO is less that the 2,000km2 threshold for

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

		rank CR. Community meets threshold for rank CR under criterion part B1. • B1 a) (i), (ii) Monitoring of the known habitat of this community indicates a decline in groundwater levels from 2001. On a recent site visit in March, 2020, cave pools and stream beds were completely dried out. • B1 c): Community considered to occur at 1 threat defined location, based on a single occurrence. • 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 is considered to consist of 1 threat-defined location, based on a single occurrence of the community supported by a particular aquifer. The community meets VU under criterion B3, as community occurs at 1 threat defined location. • Plausibly meets collapsed but expert advice indicates additional occurrences may occur in inaccessible crevices of the caves (pers comm. [redacted]). • **Expert advice indicates CR 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 is the most significant threat to the community. • For criterion C, the assessment of decline in abiotic processes focussed on hydrological change using data on the depth of cave pools supporting the aquatic root mat assemblage. It was assumed that the community would collapse if the cave pools supporting this community completely dried up. • Groundwater levels in Strongs Cave are measured at two sites; the root mat dam and below the sand floor ([redacted] [2] pers comm.). Strongs Cave water level has decreased significantly since 2005 (figure 1) and, currently, the entire stream is without water. Observations of water levels at Strongs Cave from 2007 to 2019 indicated that both measurement sites are dry ([redacted] pers comm.). A recent site visit in March 2020 confirmed this ([redacted] [3] pers. obs.) • Based on current data from the two measurement sites at Strongs Cave, 100% of the extent of the community has a quantified severity of 100% due to the community's dependence on water and observations that the cave pool system was still dry when observed in March 2020. Therefore, the community plausibly meets criteria for collapsed, as both extent and severity are indicated to be 100% over the past 50 years. • Collapsed is also plausible under C2b (assuming 100% decline in cave pools that support the community over the last 50 years). • Collapsed plausible under C3 (assumed 100% decline in cave pools that support the community since 1750). • Plausibly meets collapsed but expert advice indicates additional occurrences may occur in inaccessible crevices of the caves (pers comm. [redacted]). • **Expert advice indicates CR 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 food web including cave faunae that are important in supporting the food web is a significant biotic variable affecting the community. • The collapse point is assumed to be total loss of the root mats resulting in loss of the food web that the root mats support.

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

		• There are insufficient monitoring data to track decline in specific groups of cave faunae that are important in supporting the food web in relation to the size and health of the root mats. Root mats still present as at March 2020. • **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	0.03 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			Cave has a mapped situated land surface of 3.25ha (0.03km^2). Area of lakes and streams with and without tree roots, estimated ~1450m^2 (Eberhard 2004). Tree roots cover > 10m^2, (Eberhard 2004). Site visit March 2020 indicates root mat area significantly > 10m^2 with large areas along stream beds. No formal measurements available.
Pre-industrialisation extent or its former known extent (if known)			3.24ha based on very approximate data and not accurate mapping of pools.
Estimated percentage decline			Area occupied has likely declined by 100% due to declining suitable habitat (cave pools).

Summary assessment against IUCN RLE Criteria

Criterion	Rank indicated	Overall conclusion
A1	Critically Endangered	• 100% decline of known distribution over the past 50 years • Plausibly meets collapsed but expert advice indicates CR. • Meets criterion for CR
A2a	-	• Future predictions not possible as community currently plausibly meets collapsed based on current data.
A2b	CR	• 100% decline in known distribution over a previous 50-year period (since 1996) • Plausibly meets collapsed but expert advice indicates CR. • Meets criterion for CR
A3	CR	• 100% of known areas of habitat for the community have been lost since 1750 • Plausibly meets collapsed but expert advice indicates CR • 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 CR • Meets criterion for CR for 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 CR. • 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 CR. • 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 CR. • 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 decline of 100% of the known extent with 100% severity of degradation over the past 50 years • Plausibly meets collapsed but expert advice indicates CR. • 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 CR. • 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 CR. • 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	-	• 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.**

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
STRONGS01 (1)	Shire of Augusta-Margaret River (Reserve 8437)	1995, 2001-2020	100% poor - degraded	Cave has a mapped situated land surface of 3.25ha (0.03km^2). Area of lakes and streams with and without tree roots estimated ~1450m^2 (Eberhard 2004). Tree roots > 10m^2 (Eberhard 2004). Site visit March 2020 indicates root area significantly >10m^2 with large areas of roots along stream beds. No formal measurements available.	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 roots, introduced fauna control

- Condition categories from (Keighery 1994 Vegetation Condition Scale, from 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).

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 those caves, although 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 the Strongs Cave's shallow streams were completely dry and streams were not flowing for the first time since recordings began (Jasinska 1997). Strongs Cave water level has decreased significantly since 2005 (figures 1 and 2) and, currently, the entire stream is without water. Observations of water levels at Strongs Cave, from 2007 to 2019, have recorded that both measurement sites are dry ([redacted] and [redacted] pers comm.). The cave was visited on 14 March 2020 by DBCA staff and cave experts who confirmed that water at Strongs cave was depleted, but root mats were present. Stygofauna was not evident within the root mats that were observed (figure 3). Following a brief search of the root mats, multiple species of troglobitic fauna, both alive and dead, were found including isopods, spiders, invertebrate egg sacs and moths (figure 4). The general condition of the roots making up the aquatic root mat community is uncertain. Root mats, whilst showing new growth in the form of white rootlets, also displayed signs of degradation ([redacted] pers. obs.)

Despite no evidence of functioning complete aquatic root mat assemblages due to water depletion and absence of stygofauna in accessible known locations, additional occurrences in inaccessible crevices of the caves may occur (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.

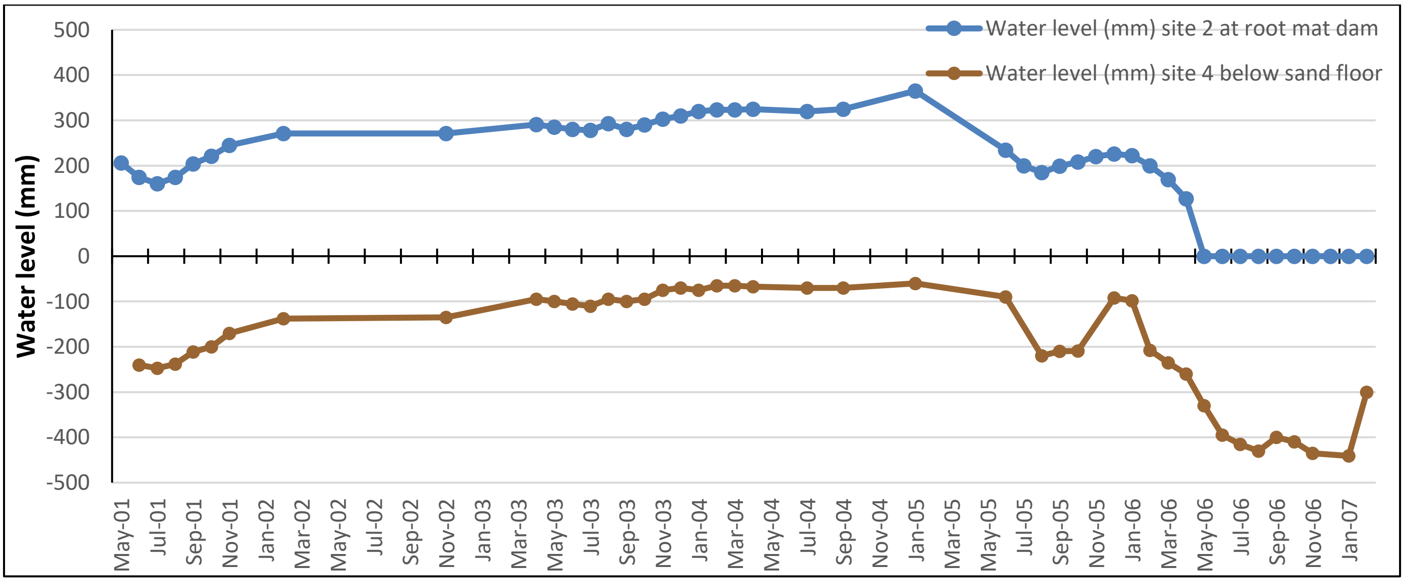
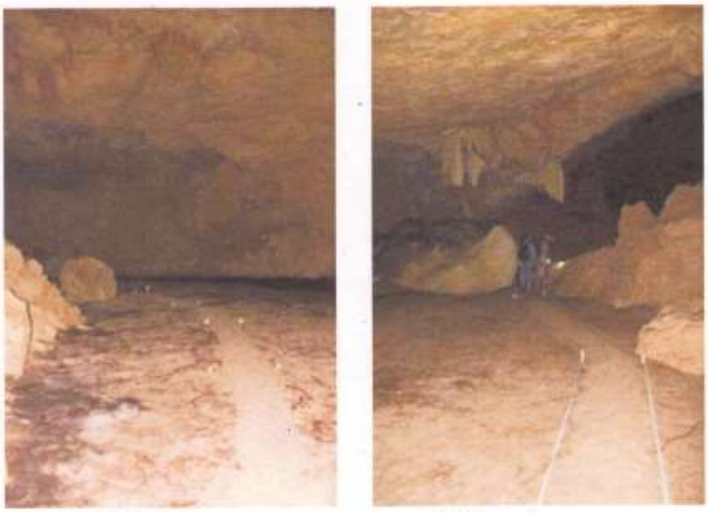


Figure 1. Strongs Cave hydrograph 2001 to 2007 showing water levels (mm) at two different sites; the root mat dam and below the sand floor ([redacted] pers comm.).

2012 1972



2012 2012

Figure 2. Historical photos showing water depletion within Strongs Cave from 1972 to 2012.

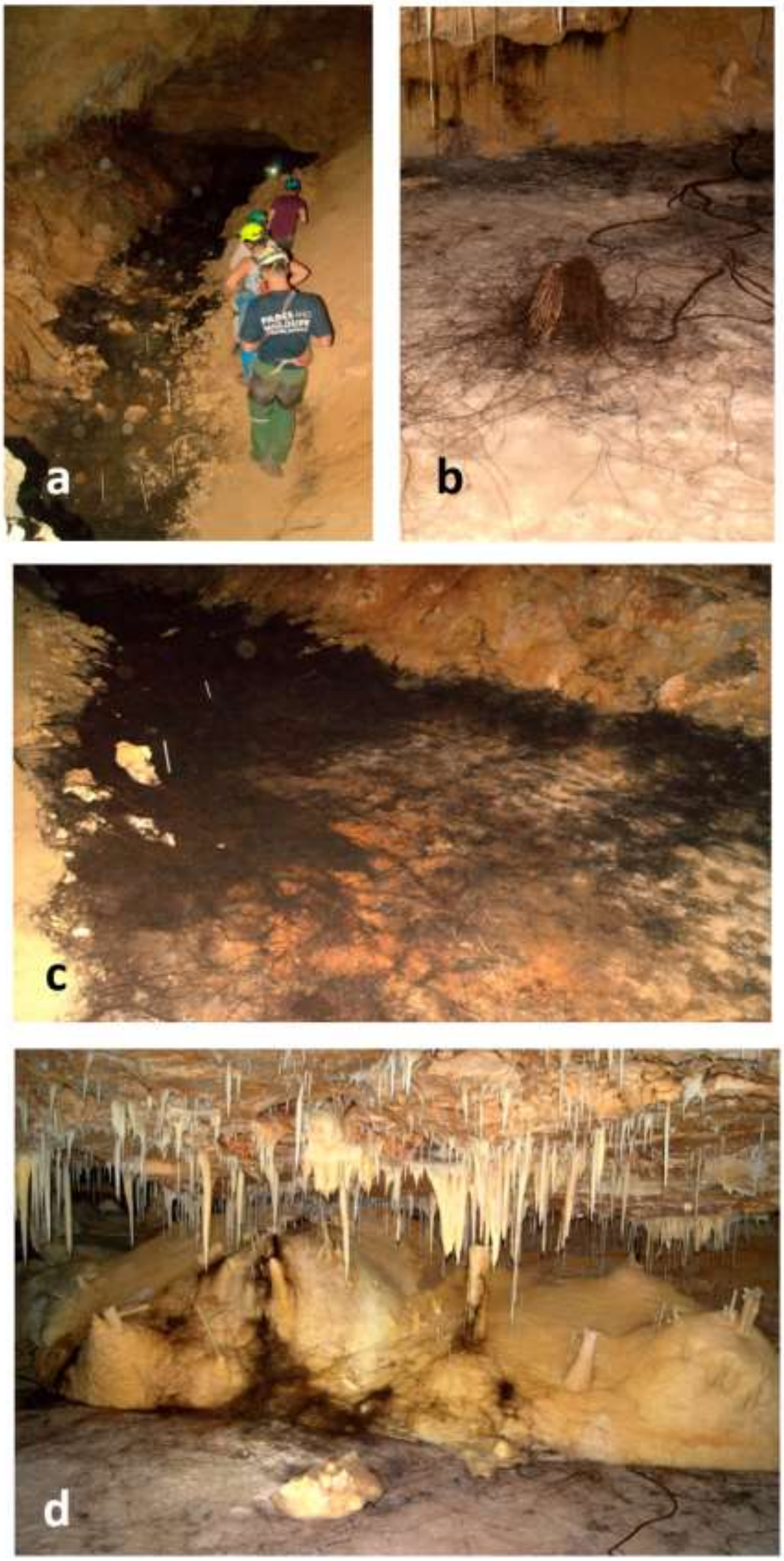


Figure 3. March 2020: Extensive root mats occurring along dry stream beds of Strongs (a & c). Roots growing through dry sandy streamways (b), and through cave walls (d).

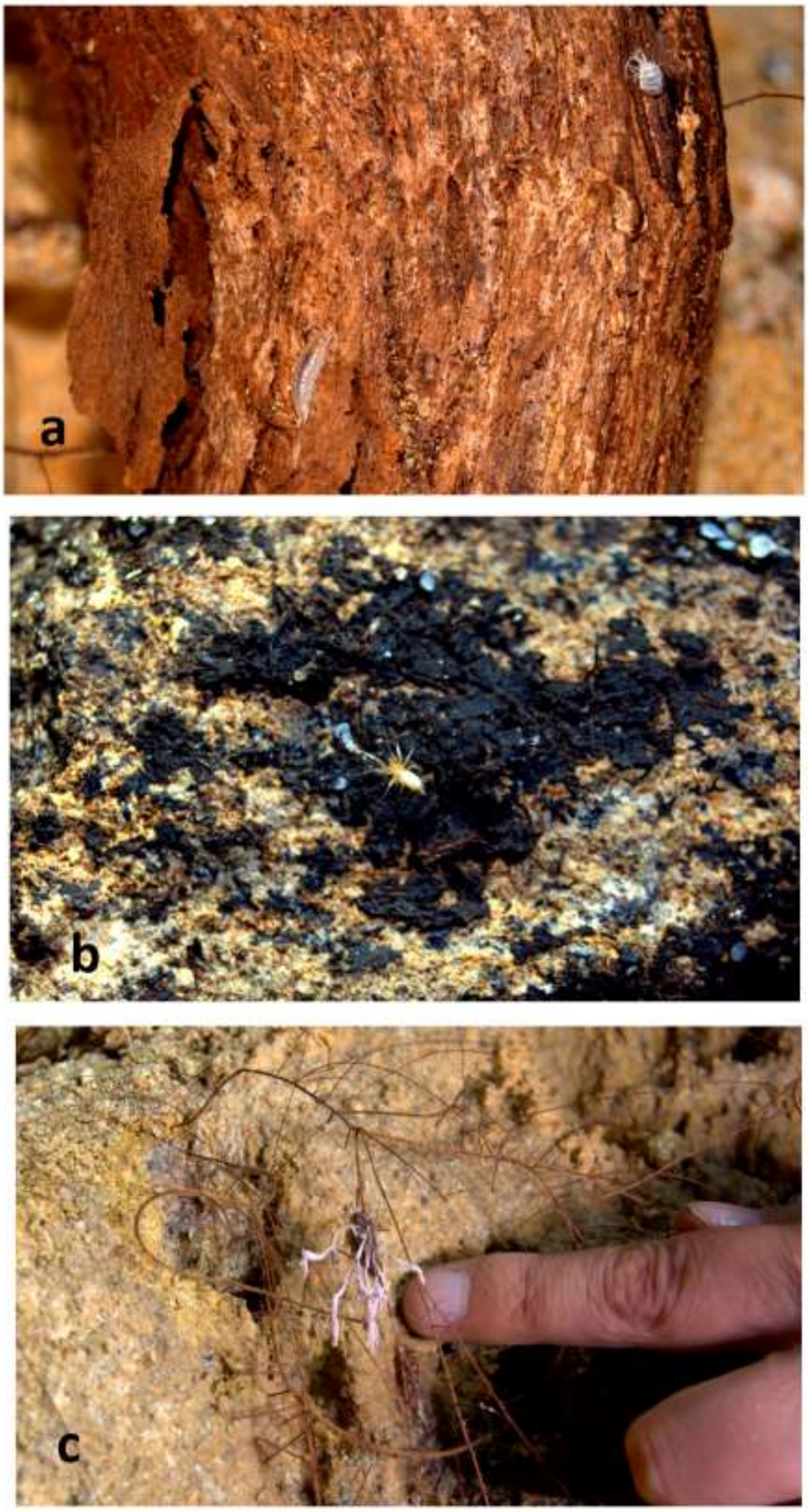


Figure 4. March 2020: Troglobitic fauna, both alive and dead, observed within Strongs cave including; isopods (a), spiders (b) and invertebrate egg sacs (c).

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. Thus, longer-term threats to these communities 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 has been 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) and are still present in the cave ([4] [redacted] pers. comm). 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. However, the much greater distribution of tree roots throughout karst systems of the Leeuwin-Naturaliste Ridge 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 (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 such things as heavy human or vehicular traffic over the caves and the use of explosives nearby should be avoided. Good management practices

[4] [redacted]: Ecologist, DBCA Kensington

should include ensuring any tracks or commonly used walk trails do not occur above the caves, and by ensuring heavy machinery and explosives are not used near them.

APPENDIX 2 Aquatic Root Mat Community Number 2 of Caves of the Leeuwin Naturaliste Ridge (Strongs Cave)

The map above was created using ArcGIS version 10.6.1 and shows the location of the cave that supports the 'Aquatic Root Mat Community Number 2 of Caves of the Leeuwin Naturaliste Ridge (Strongs Cave)'. This community is found along Caves Road in 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 <u>abiotic</u> 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 <u>abiotic</u> 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 <u>abiotic</u> 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 <u>biotic</u> 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