Threatened Species Assessment

Arachnocampa buffaloensis
Mt Buffalo Glow-worm

Taxonomy

Arachnocampa buffaloensis Baker, 2010

Traditionally considered members of the Mycetophilidae, a review of the higher taxonomy placed the Australian taxon into the Keroplatidae along with other bioluminescent genera (Matile 1981 cited by Baker 2010). Baker (2010) described a new subgenus, *Arachnocampa* (*Lucifera*) subgen. nov., which included two species, one of which is found in Tasmania and the other the Mt Buffalo glow-worm, *A. buffaloensis*.

Current conservation status

Listed as threatened under the *Flora and Fauna Guarantee Act 1988* (SAC 2002).

Categorised as Vulnerable in the 2009 Advisory list of threatened invertebrate fauna in Victoria (DSE 2009).

Proposed conservation status

Critically Endangered in Victoria

Criteria B1ab(iii)+2ab(iii)

Species Information

Description and Life History

Glow-worms are the larval stage of a primitive fly (fungus gnats) (Diptera: Keroplatidae: *Arachnocampa* spp.) which, in their larval stage, are commonly called glow-worms (Meyer-Rochow 2007, Hall 2012). The genus *Arachnocampa* are susceptible to desiccation and require conditions with high humidity or direct contact with water in their habitat (Baker 2010). The larvae are the longest stage of the life cycle, with adults only living for a few days, a week at the most.

The life history of a related taxon, *A. flava*, is as follows: egg development 10 days, larvae living for up to one year depending on food availability and environmental conditions; pupation for 7-9 days, adult females live for two days and males no more than six (Baker 2003, Hall 2012). It is expected that the life history of *A. buffaloensis* would be similar.

Generation Length

The generation length of *A. buffaloensis* is inferred to be 6 to 12 months, based on advice from David Merrit (University of QLD).

Distribution

The distribution of *Arachnocampa* species is strongly influenced by the fact that the adults are very poor flyers and are restricted in the ability to colonise new areas, and in the case of *A. buffaloensis,* the isolation of wet cave systems (Hall 2012). The actual distribution of *A. buffaloensis* is one granite boulder cave at Mount Buffalo.

Habitat

The single known site for this taxon is the Underground River Cave, a granite boulder infill cave approximately 300m in length with permanent flowing water. The cave lies within the boundary of the Mount Buffalo National Park (Baker 2010) on the Eurobin Creek, downstream of Lake Catani. The larvae are attached to the cave surface

above the waterline, but rely on the water that supplies of prey in the form of adult insects. The cave is open to the air as there is no soil covering the boulders. The glow-worms are found along the length of the cave with greater numbers towards the downstream end of the cave (D. Chitty pers. comm).

The larvae capture flying prey using snares composed of highly extensible silk fibres and sticky mucus droplets, with prey being attracted to the bioluminescence. The glow-worms recognise when prey are caught using a mixture of mechano- and chemoreception. Adults are poor fliers, live only for a few days, and do not feed as they have degenerative mouth parts (Meyer-Rochow 2007).

In general the genus can tolerate a wide range of temperatures. In winter it may survive near-freezing conditions, and during the summer experience considerable heat. The most important physical factor affecting them is relative humidity as the larvae and their mucus nests and threads are subject to desiccation; it has been estimated that glow worms will not tolerate relative humidities below 90-95% (Meyer-Rochow 2007).

Threats

Threats to this taxon include disturbance of the cave environment and microclimate through human disturbance (including tourism), exposure to predatory cave dwelling invertebrates such as spiders and beetles, water quality, and changes to water quality and flow as a result of threats affecting water catchment management.

This taxon is known from a single population, and is subject to stochastic events that may lead to complete loss of population. It is believed that water quality in the cave is likely to decline as result of the 2019-2020 bushfires.

IUCN Criteria

Criterion A. Population size reduction.
Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4

	Critically Endangered	Endangered	Vulnerable
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3, A4	≥ 80%	≥ 50%	≥ 30%

A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.

A2 Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.

A3 Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [*(a) cannot be used for A3*]

A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

based on any of the following:

(a) direct observation [*except A3*]

(b) an index of abundance appropriate to the taxon

(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat

(d) actual or potential levels of exploitation

(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites

Evidence:

Ineligible under Criterion A

There is insufficient evidence to determine whether there has been or will be a reduction in population sufficient to meet any threshold for Criterion A.

Criterion B. Geographic range in the form of either B1 (extent of occurrence) and/or B2 (area of occupancy			
	Critically Endangered Very restricted	Endangered Restricted	Vulnerable Limited
B1. Extent of occurrence (EOO)	< 100 km²	< 5,000 km²	< 20,000 km²
B2. Area of occupancy (AOO)	< 10 km²	< 500 km²	< 2,000 km²
AND at least 2 of the following 3 conditions:			
(a) Severely fragmented OR Number of locations	= 1	≤ 5	≤ 10
(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			
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals			

Evidence:

Eligible under Criterion B1 as Critically Endangered

The Extent of Occurrence (EoO) across the taxon's range is estimated to be 4 km², based on accepted, post-1970 records from the Victorian Biodiversity Atlas (VBA).

The taxon is estimated to have 1 location. The taxon is only known from a single cave, and any damage to the cave would potentially impact all individuals.

It has a continuing decline in (iii) above, as it is known from a single population subject to potential disturbance from recreational activities and alteration to the cave environment. Stochastic events may lead to complete loss of population.

Eligible under Criterion B2 as Critically Endangered

The Area of Occupancy (AoO) across the taxon's range is estimated to be 4 km², based on 2 x 2 km grids derived from accepted, post-1970 records in the VBA. As above, it has 1 location and has a continuing decline in (iii) above.

Criterion C. Small Population size and decline				
		Critically Endangered	Endangered	Vulnerable
Number of mature individuals		< 250	< 2,500	< 10,000
AND at least one of C1 or C2				
C1	An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future):	25% in 3 years or 1 generation (whichever is longer)	20% in 5 years or 2 generations (whichever is longer)	10% in 10 years or 3 generations (whichever is longer)
C2	An observed, estimated, projected or inferred continuing decline AND least 1 of the following 3 conditions:			
(a)	(i) Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000
	(ii) % of mature individuals in one subpopulation =	90 – 100%	95 – 100%	100%
(b) Extreme fluctuations in the number of mature individuals				

Evidence:

Ineligible under Criterion C as Data Deficient

It is not feasible to obtain an adult population size, because the population is confined to a single small cave, they do not glow so are hard to see, and they are rare because they only live for a few days (D. Merritt pers. comm. 2018).

Criterion D. Very small or restricted population			
	Critically Endangered	Endangered	Vulnerable
Number of mature individuals (observed or estimated)	<·50	<·250	<·1,000
D2 Only applies to the VU category Restricted area of occupancy or number of locations with a plausible future threat that could drive the species to critically endangered or Extinct in a very short time.	-	-	D2. Typically: AoO <·20 km2 or number of locations ≤·5

Evidence:

Eligible under criterion D2 as Vulnerable

The taxon is estimated to be very restricted.

Criterion E (Quantitative Analysis) was not addressed as the taxon does not have a detailed Population Viability Analysis.

References

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