

Megascolides australis Giant Gippsland Earthworm

Taxonomy

Megascolides australis McCoy, 1878

Current conservation status

Listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999*.

Listed as threatened under the *Flora and Fauna Guarantee Act 1988* (SAC 1991).

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

Proposed conservation status

Endangered in Australia

Criterion B1ab(i,ii,iii,iv,v)

Species Information

Description and Life History

The Giant Gippsland Earthworm (GGE) is one of the largest species of earthworms in the world. Mature adults have an average length of 80cm, a diameter of up to 2cm and weight of 200g. However, lengths of well over 1.5m and weights up to 400gm have been recorded (Van Praagh 1992). They have a purple-coloured head region and pinkish-grey body.

Aspects of the biology and ecology of the GGE render the fragmented populations particularly vulnerable to threatening processes (Van Praagh 1992, McCarthy et al. 1994). These include a long lifespan, low reproductive and recruitment rates, and poor dispersal ability. The taxon is a hermaphrodite with breeding occurring predominantly in spring and summer (September to February). Large amber-coloured egg cocoons are laid in chambers branching from the adult burrow at an average depth of 22 cm. Only one embryo is found in each egg cocoon, which is thought to take over 12 months to incubate. Data suggests that worms may not reach sexual maturity till they are above a minimum weight of at least 200 g. Information extrapolated from laboratory studies suggests egg cocoons may take at least 12 months to incubate.

The GGE live in complex, permanent burrows that extend to around 1.5 m in depth. Worms remain underground, feeding on the root material and organic matter ingested in the soil. Given the poor dispersal abilities of the species and limited geographic range and connectivity of suitable habitat, it is likely that present-day populations would have been isolated for significantly long periods of evolutionary time, evolving as distinct genetic entities. This has been supported by recent genetic investigations (Woods 2006).

Generation Length

The generation length of the Giant Gippsland Earthworm is inferred to be 8 to 16 years. Maximum life span is unknown, however, based on the size of the worm and the slow growth rate, slow population turnover, and population age structure (predominantly adults they are likely to be very long lived. The density of adults was found to be more than 4 times that of immature worms (Van Praagh 1992).



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Distribution

The GGE is endemic to South and West Gippsland, Victoria in the Bass River Valley. It is confined to an area roughly bound in the north by Warragul, and in the south by Loch and Korumburra. Mt Worth represents the most easterly point of distribution. The most southerly confirmed records of GGE occur around Kernot. There are records of GGE as far south as Archies Creek. However, this record and several others around Blackwood Forest and Glen Forbes are unsubstantiated.

A 2013 IUCN assessment suggested that the taxon is only known from five localities. The number is much higher than this though the precise number of separate localities is unknown. There are now at least 1000 GGE records in the Victorian Biodiversity Atlas (VBA), though some of these are from the same general locality.

Giant Gippsland Earthworm Habitat

Suitable habitat for the taxon is restricted to very small areas, generally, in the deep blue-grey clayey soils formed mainly from cretaceous sediments in the rolling to steep hills of the Western Strzelecki Ranges and to the alluvial areas derived from this soil to the north and south west (Smith and Peterson 1982). It is generally found on the banks and terraces of streams and drainage channels, above the flood-level and on steep, south-facing hillsides, often with terracettes. The sites away from waterways are often associated with underground springs or areas of higher soil moisture.

Sites with GGE colonies generally have well-draining blue-grey clay soils or red-brown clay loam soils that, critically, remain moist year-round. GGE cannot survive in waterlogged soils or areas subject to seasonal flooding. They occur predominantly under open pasture on privately owned land used for agriculture, primarily dairy. They are rarely found in dense vegetation, or when they do it is usually in open patches with soaks and springs.

Threats

Whilst not all threatening processes operating on the GGE are known or understood, some key threats can be identified. The two major threats to the species are physical disturbances to the soil and altered hydrology such as changes in water table level, flooding and drainage patterns. Chemical soil disturbances represent potential threats but the impacts are unknown. Many of the actions responsible for threatening processes are interrelated and are associated with infrastructure development and agriculture and includes alteration to water table or drainage patterns; (e.g. flooding, drainage of creeks, dam building and dense revegetation of habitat), destruction of soil habitat (e.g. intensive farming such as cultivation, pugging by cattle or compaction by heavy machinery, road and dam making, urbanisation), chemical soils disturbances (e.g. fungicides, weedicides, insecticides and fertilizers).

Most of the taxon's original habitat has been converted from forest to improved pasture. While the historic range of the taxon is unknown, it has likely decreased, and populations appear to have declined. This is based on the scale of habitat loss and fragmentation and life history traits that mean it is vulnerable to habitat deterioration due to its low recruitment rate and poor dispersal ability. This has also been supported by anecdotal information by farmers who believe numbers have declined on their properties. While ploughing is seldom used on the scale it once was, anecdotal evidence describes the fields after ploughing as being "Red with Blood" and that worms hung from the tines of the plough like spaghetti.

It is currently threatened by agricultural expansion, changes in drainage, urbanisation, chemical pollution from pesticides and herbicides. It is likely that the range has decreased, the populations have declined and become further fragmented over time. Their distribution is severely fragmented, and colonies can be restricted to very small areas of suitable habitat, sometimes as small as 5-10 m² making them particularly vulnerable to threatening processes. Poor dispersal abilities mean that without contiguous habitat, these colonies are isolated from each other.

Soil moisture is critical to GGE survival. One of the major threats to the GGE is loss of suitable habitat through alteration to the water table and natural drainage patterns. Inappropriate (dense) planting of vegetation has recently been identified as a potential threat to GGE colonies by reducing the available soil moisture. Planting of trees in or close to GGE colonies can result in a reduction in soil moisture and therefore a loss in suitable habitat.

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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%

<p>A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.</p> <p>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.</p> <p>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]</p> <p>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.</p>	<p>based on any of the following:</p>	<p>(a) direct observation [except A3]</p> <p>(b) an index of abundance appropriate to the taxon</p> <p>(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat</p> <p>(d) actual or potential levels of exploitation</p> <p>(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites</p>
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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.

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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 km ²	< 5,000 km ²	< 20,000 km ²
B2. Area of occupancy (AOO)	< 10 km ²	< 500 km ²	< 2,000 km ²
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 Endangered

The Extent of Occurrence (EoO) across the taxon's range is estimated to be 1,079 km², based on accepted, post-1970 records from the VBA.

The taxon is estimated to be severely fragmented, as GGE has extreme low dispersibility and is confined to generally very small patches of suitable habitat where their survival is precarious. They are unable to move between those patches, so that there is increased extinction risk and little or no probability of recolonisation should subpopulations become extinct. Genetic studies of two subpopulations 5km apart showed that the GGE were separated for over a million years (Woods 2006).

It has a continuing decline in (i), (ii), (iii), (iv) and (v) above due to changes to the local hydrology and both physical and chemical disturbances.

Eligible under Criterion B2 as Vulnerable

The Area of Occupancy (AoO) across the taxon's range is estimated to be 524 km², based on 2 x 2 km grids derived from accepted, post-1970 records in the VBA. As above, it is severely fragmented, and has a continuing decline in (i), (ii), (iii), (iv) and (v).

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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

There is insufficient evidence to determine the number of mature individuals. The Giant Gippsland Earthworm is difficult to study because of its subterranean habits and physical fragility, so there is no information on overall population size. Populations are very irregularly distributed, size of colonies can vary and density is around 2 worms per m², probably restricted by their large size and availability of suitable habitat (Van Praagh 1992, Van Praagh 1994, Van Praagh and Yen 2010). Populations usually exhibit large numbers, that needs to be seen in the context of populations of other earthworm species. Most species of earthworms are widespread in the soil and population figures might be up to 5 million per hectare. This is different for GGE, which exist in often very small patches of habitat and are not widespread through the paddocks or soil etc. Native earthworms generally have much higher densities per m² than GGE.

Criterion D. Very small or restricted populations				
		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 km ² or number of locations ≤ 5

Evidence:

Ineligible under Criterion D

There is insufficient evidence to determine the number of mature individuals.

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



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References

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