

Synemon nais Orange Sun Moth

Taxonomy

Synemon nais Klug, 1850

Current conservation status

Listed as threatened under the *Flora and Fauna Guarantee Act 1988* (SAC 1994).

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

Proposed conservation status

Endangered in Victoria

Criteria B1ab(iii)+2ab(iii)

Species Information

Description and Life History

The sun-moths are often brightly-coloured, diurnal moths with broad wings, slender bodies and clubbed antennae. They bear a strong resemblance to butterflies. With an average wingspan of 2.7 cm for males and 3.0 cm for females, the Orange Sun-moth is one of the smallest of the nine sun-moth species that are now known to occur in Victoria. The larvae of the Orange Sun-moth live in underground tunnels where they are thought to feed on the roots of perennial native grasses, possibly *Rytidosperma* (*Austrodanthonia*) spp. (Wallaby Grasses) and/or *Austrostipa* spp. (Spear Grasses). Pupation finally occurs in a more or less vertical tunnel which leads to the soil surface. After adult emergence the empty pupal case is left protruding from the ground.

Generation Length

The generation length of *Synemon nais* is suspected to be 2 years, based on information on congeners, as little is known regarding the longevity or generation length of the taxon.

Distribution

The taxon is distributed in isolated populations from near Mundrabilla, in the far south-east of Western Australia, across the Nullarbor Plain in South Australia, to near Ouyen in Victoria. It was also recorded historically from near Sea Lake in Victoria. Within Victoria it has been recorded during the past ten years at the following seven localities:

- Quinn's Tank Bushland Reserve, 6.7 km south-east of Ouyen;
- Walpeup Bushland Reserve, on both sides of the Ouyen Highway at 2 km to 3 km east-north-east of Walpeup;
- the grounds of the Walpeup Recreation Reserve and the adjacent verges of Nestor Road along the eastern boundary of the recreation reserve;
- the grounds of the former Mallee Research Station, immediately to the west of its main entrance (1.9 km north-west of Walpeup);
- Yetman's Flora and Fauna Reserve, on the west south-west side of the Hopetoun-Patchewollock Road, 3.8 km south-south-east of Patchewollock;
- Danyo, formerly proposed town site on N. side of Ouyen Hwy. at 0.1 to 0.5 km E. of Danyo;
- Danyo Bushland Reserve on N. side of Ouyen Hwy. at 3 to 3.8 km W. of Danyo.

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Habitat

The habitat of the Orange Sun-moth is the grassy understory of open and often diverse grassy woodland and/or grassy mallee communities. It requires undisturbed open areas of native perennial grasses. Larvae are thought to feed in underground tunnels on the roots of Bristly Wallaby-grass (*Rytidosperma setacea*). However, it is also possible that the Orange Sun-moth uses other species of Wallaby-grass and/or one or more species of Spear-grass as larval hosts.

Threats

Clearing for agriculture appears to have reduced the Victorian distribution of this species to a few small sites near Walpeup. The historic records from the Sea Lake area suggest that it may have occurred more widely throughout the central Mallee in the past.

Parts of the largest breeding site, 2 km east-north-east of Walpeup (on the Ouyen Highway) are threatened by weed invasion, particularly *Avena barbata* (Wild Oat). During years of good rainfall it seems that Wild Oat has the ability to colonise any areas that have been disturbed, for example disturbance and compaction by vehicle movements away from the road, including trail bikes. Such disturbance has degraded some of the restricted patches of perennial grasses required by the Orange Sun-moth. This disturbance has also broken the cryptogamic crust (of lichens and mosses) in places, further exacerbating the potential for weed invasion of the area generally.

Although the other two sites where this taxon occurs near Walpeup are in good (i.e. natural) condition, they may be under threats from inappropriate firebreak construction, leading to further habitat loss and/or weed invasion; change of land tenure and management practices at the Recreation Reserve site, causing alienation of habitat; weed establishment (especially Wild Oats) along the northern boundary of the Recreation Reserve site; clearing or modification of the Mallee Research Station site to use more land for agricultural research.

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

The past population reduction does not meet the threshold for eligibility under criterion A2, and the future population reduction does not meet the threshold for eligibility under criterion A3.

The Orange Sun-moth appear to temporarily decline during periods of drought, however the known populations seems to be stable in the past 10 years. The taxon is habitat is situated on crown land, protected from land clearing. However, weed invasion and soil disturbance and compaction by vehicle may still operating.

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 1,783 km², based on accepted, post-1970 records from the Victorian Biodiversity Atlas (VBA).

Individuals of the taxon is estimated to be severely fragmented, considering the limited dispersal ability of the taxon, the barriers to dispersal, or lack of habitat separating them.

It is estimated to have a continuing decline in (iii) above, as construction of fire breaks and other activities that lead to soil disturbances could result in a continuing decline in the quality of habitat.

Eligible under Criterion B2 as Endangered

The Area of Occupancy (AoO) across the taxon's range is estimated to be 28 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 (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

It is inferred that there are 1600 mature individuals, but this qualifier is too weak and other thresholds under this criterion have not been met.

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:

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

DSE (2002). Action Statement Five threatened Victorian Sun-moths (Synemon species) No. 146. Department of Sustainability and Environment, Melbourne. Retrieved from: https://www.environment.vic.gov.au/__data/assets/pdf_file/0015/32523/Orange-sun-moth_Five_threatened_Victorian_sunmoths_Synemon_species.pdf

Douglas, F. (1993). The Conservation Status, Distribution and Habitat Requirements of Diurnal Lepidoptera in Central and Western Victoria (Part 1: Family Castniidae). Unpublished report, Department of Natural Resources and Environment, Melbourne, Victoria.

Douglas, F. (1996). The Current Conservation Status of *Synemon nais* (orange sun moth) and *Synemon* sp. aff. *selene* (pale sun moth), Family Castniidae and *Ogyris idmo halmaturia* (large brown azure butterfly), *Ogyris* sp. aff. *idmo* ("Mildura Ogyris" butterfly) and *Ogyris otanes* (small brown azure butterfly), Family Lycaenidae. Unpublished report, Department of Natural Resources and Environment, Melbourne, Victoria.

Douglas, F. (2007a). MSc. The Sun-moths (Lepidoptera: Castniidae) of Victoria, with a detailed study of the Pale Sun-moth (*Synemon selene* Klug, 1850). University of Ballarat, Ballarat, Victoria.

Douglas, F. (2007b). Survey of Threatened Lepidoptera in North-western Victoria, 2006/07: Plus Current Management Recommendations. Unpublished report to the Department of Sustainability and Environment and the Mallee Catchment Management Authority, Mildura, Victoria.

Douglas, F. (2007c). A Review of the Conservation Status of Victorian Sun-moths (Lepidoptera: Castniidae). Unpublished report to the Arthur Rylah Institute for Environmental Research, Heidelberg, Victoria.

Douglas, F. (2012a). The distribution and conservation of the Orange Sun-moth, *Synemon nais*, Lepidoptera: Castniidae in the Mallee area of north-western Victoria. Unpublished report to the Mallee Catchment Management Authority, Mildura, Victoria.

DSE (2009) *Advisory list of threatened invertebrate fauna in Victoria - 2009*. Department of Sustainability and Environment, Melbourne.

SAC (1994). Flora and Fauna Guarantee Scientific Advisory Committee: Final Recommendation on a Nomination for Listing. Nomination No. 323 *Synemon nais*.