

NSW Threatened Species Scientific Committee

Conservation Assessment of *Promethis sterrha*

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***Promethis sterrha* Olliff, 1889 (Tenebrionidae)**

Distribution: Endemic to NSW

Current EPBC Act Status: Not listed.

Current NSW BC Act Status: Not listed.

Proposed change for alignment: List on EPBC Act and BC Act as Critically Endangered.

Conservation Advice: *Promethis sterrha* (Tenebrionidae)

Summary of Conservation Assessment

Promethis sterrha, a darkling beetle, was found to be eligible for listing as Critically Endangered under Criteria B1ab(iii)+2ab(iii). The main reasons for this species being eligible for this listing are: i) it has a highly restricted geographic distribution and is only known from one location; and ii) the habitat of the species is threatened by weeds, increasing aridity/storms and the introduction of predators.

Description and Taxonomy

Promethis sterrha, is a beetle (Coleoptera) from the Tenebrionidae family. Olliff (1889: 88) described the species as "elongate, robust, black, shining, strongly convex; prothorax broadly transverse, slightly narrowed behind, with a distinct median line; elytra very broad behind, narrowed in front, strongly punctate-striate, the interstices broad and convex.... Length 23-25 mm; greatest width 10-11 mm."

Olliff (1889) originally placed this species in *Nyctobates* but it was placed in *Promethis* by Kaszab (1988) and this is the currently accepted taxonomy (Matthews & Bouchard 2008). *Promethis* is a large genus, found from Asia to Tasmania and the west Pacific. *Promethis sterrha* is one of very few flightless species in this genus (Reid and Hutton 2019). It is a typical stenochiine tenebrionid and therefore inhabits dead and rotting wood, which it feeds on as both adult and larva (Matthews & Bouchard 2008).

Olliff (1889) did not describe the larva, which is unknown for *P. sterrha* but likely to be a typical of tenebrionids (Matthews & Bouchard 2008). The pupa of several *Promethis* species are described by Bouchard & Steiner (2004).

Figure 1. Adult of *Promethis sterrha* (photo: Ian Hutton, from Reid and Hutton 2019)



Distribution and Abundance

Promethis sterrha is endemic to the Lord Howe Island group of islands, NSW. The species was described from Lord Howe Island Group by Oliff in 1889 and has never been recorded anywhere else. It is a typical stenochiine tenebrionid and therefore inhabits dead and rotting wood, which it feeds on as both adult and larva (Matthews & Bouchard 2008).

Until 2000, this species was previously only known from 29 specimens collected from Lord Howe Island and held in collections worldwide (Kaszab 1988), only one of which had any detailed information: 'on banyan' (a fig tree) (Lea, in Kaszab 1988). The most recent specimens had been collected by Arthur Lea in a survey of the island's beetles in 1916. These collections were all made before the accidental introduction of black rat (*Rattus rattus*) to Lord Howe in 1918, and this rat was considered to have led to the extinction of *Promethis sterrha* (Bartlett 2009; Reid & Hutton 2019).

In 2000, one adult was discovered during a general insect survey of the Lord Howe Island Group on Blackburn Island (Cassis *et al.* 2003), a small islet of 2.4 ha on which rats have never been recorded (Carlile *et al.* 2018). Modern occurrences, all on Blackburn Island, are reviewed by Reid *et al.* (2020). Fragments of four adults and one living female were found in later surveys of Blackburn Island (Reid *et al.* 2018; Reid & Hutton 2019; Reid *et al.* 2020). Blackburn Island is situated within the lagoon on the west side of the main Lord Howe Island. There is no evidence that it was sampled for beetles before the 1970s. The *P. sterrha* specimens were all found in rotten wood or in debris under trees and bushes (Reid *et al.* 2020). The surveys of Blackburn Island in 2018 and 2019 (Reid and Hutton 2019, Reid *et al.* 2020) attempted to examine the debris under all the trees and many bushes on Blackburn Island. *Promethis sterrha* was mostly found under the mature trees of the northeast, but fragments of individuals were also found under two large bushes on the southern slope. The amount of habitat on Blackburn Island is very small, as there are only 12 mature trees, confined to the middle and eastern

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portion (see Figure 2) and about 45 well-established but small *Melaleuca* bushes and a single stunted *Lagunaria* on the steep southern slopes of Blackburn Island.

The other vegetated and rodent-free Islets off the main island of Lord Howe, viz Balls Pyramid, the Admiralty Islands and Muttonbird island, have scattered *Melaleuca* bushes but lack trees. Balls Pyramid and Roach Island have been surveyed for beetles by the Australian Museum and *Promethis sterrha* has not been found. It is unlikely that the beetle occurs on these islets, due to paucity of habitat.

No specimens of *Promethis sterrha* have been collected on the Main Island of Lord Howe since 1916 despite numerous surveys.

Promethis sterrha has a very highly restricted geographic distribution, with both an extent of occurrence (EOO) and area of occupancy (AOO) of 4 km² based on a single 2 x 2 km grid (as recommended for assessing AOO, IUCN 2022). EOO is reported here as equal to AOO to ensure consistency with the definition of AOO as an area within EOO (IUCN 2022).

The population of *Promethis sterrha* is entirely protected within the Lord Howe World Heritage area.

Figure 2. Aerial shot of Blackburn Island (photo: Ian Hutton)



Ecology

Life cycle: unknown for this species, but certain to be typical of tenebrionids, i.e. egg to larva to pupa to adult. Duration of life cycle unknown.

Adults of *Promethis sterrha* are flightless and xylophagous (feed on wood), with the wood probably requiring a fungal infestation. The adult of *Promethis sterrha* has been recorded on a large fig tree surface (Lea, in Kaszab 1988) and amongst dead wood and leaf litter on the ground (Reid & Hutton 2019; Reid *et al.* 2020). It is almost certainly nocturnally active and diurnally quiescent (therefore surveying is best done at night). Larvae of *Promethis sterrha* almost certainly feed on dead fungoid (decaying) wood. Associated with the adult in rotting wood were larvae of the cerambycid *Agrianome howei*, and adults and larvae of the darkling beetles *Celibe exulans*, *Hydissus vulgaris* and *Metisopus*

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curtulus, and the predatory clerid *Cormodes darwini*, itself unique to Blackburn Island (Reid & Hutton 2019; Reid *et al.* 2020).

Threats

Exotic Rodents

Mice (*Mus musculus*) were introduced to Lord Howe in the 1860s and black rats (*Rattus rattus*) in 1918 (Bartlett 2009; Reid & Hutton 2018). Both are thought to have preyed on *Promethis sterrha*. A rodent eradication program was undertaken on Lord Howe Island in 2019, and depending on the ongoing success of this program, Lord Howe Island can be officially declared rodent free after two years with no rodents. There were incursions of rats to LHI in 2021, highlighting that re-introduction of rodents remains an ongoing threat. This also applies to Blackburn Island as there are no restrictions on visiting the island. Although rats and mice have not established populations on Blackburn Island in the past, ongoing visitation still carries a risk. Even 1-2 individual rats or mice could severely impact the remaining *P. sterrha*.

Weeds

Weeds may affect the remaining small area of habitat on Blackburn Island. Blackburn Island was originally entirely covered in woody plants but is now almost entirely covered in introduced grasses (predominately *Chloris gayana* (Rhodes grass) (Sheringham *et al.* 2020). These weeds may affect recruitment of remaining tree species (through competition) leading to ongoing habitat degradation.

Accidental Introduction of predators or competitors

There is a programme underway to restore the wooded vegetation of Blackburn Island, for use as a nursery of the Threatened Lord Howe Island phasmid. However, the planting is being done from the main Island of Lord Howe and if careful quarantine measures are not used the planters may inadvertently introduce exotic predators or woodborers (potential competitors) already established on the main Island to Blackburn Island where they are not currently established.

Climate change

Global warming is predicted to increase the risk of increased changed moisture availability on Lord Howe Island (ANU 2009, Auld and Leishman 2015) and an increased severity of extreme events such as droughts and storms (ANU 2009). Two recent summers (2018-2019) have seen severe aridity events on Lord Howe Island. This led to loss of the canopy leaves of the large fig on Blackburn Island, increasing the risk of tree mortality. Loss of trees in the small remaining area of habitat for *P. sterrha* may lead to invasion by exotic weeds and degradation of habitat.

Assessment against IUCN Red List criteria

For this assessment, it is considered that the survey of *Promethis sterrha* has been adequate and there is sufficient scientific evidence to support the listing outcome.

Criterion A Population size reduction

Assessment Outcome: Data Deficient.

Justification: To be listed as threatened under Criterion A the species must have experienced a population reduction of >30% over three generations or 10 years (whichever is longer). *Promethis sterrha* was probably widespread in forest on the main Island of Lord Howe until 1918 but is now confined to the small islet (Blackburn Island). However, there is no data on generation length nor on any recent decline rates.

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Criterion B Geographic range

Assessment Outcome: Critically Endangered under B1ab(iii) + B2ab(iii).

Justification: *Promethis sterrha* has a very highly restricted geographic distribution, with both an extent of occurrence (EOO) and area of occupancy (AOO) of 4 km² based on a single 2 x 2 km grid (as recommended for assessing AOO, IUCN 2022). EOO is reported here as equal to AOO to ensure consistency with the definition of AOO as an area within EOO (IUCN 2022).

In addition to these thresholds, at least two of three other conditions must be met. These conditions are:

- a) The population or habitat is observed or inferred to be severely fragmented or there is 1 (CR), ≤5 (EN) or ≤10 (VU) locations.

Assessment Outcome: Subcriterion met (one location).

Justification: *Promethis sterrha* is considered to be found at one location. The most serious and plausible threats to the species are a combination of weed impacts, increasing aridity/extreme storm events and the introduction of predators. Due to the small area of habitat remaining, any or all of these threats could lead to a rapid decline in habitat quality and local extinction.

- 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

Assessment Outcome: Subcriterion met for continuing decline: (iii) observed in quality of habitat.

Justification: The assessment of continuing decline in quality of habitat is based on weed, and aridity impacts in the small remaining known site for the species. There is also the risk of future introductions of predators to this site.

- c) Extreme fluctuations.

Assessment Outcome: Data deficient.

Justification: It is not known if *Promethis sterrha* undergoes extreme fluctuations.

Criterion C Small population size and decline

Assessment Outcome: Data deficient.

Justification: The population size of mature *Promethis sterrha* is unknown and there has not been sufficient sampling to make a reliable estimate. Due to the small area of habitat currently occupied there is likely only a small population remaining.

At least one of two additional conditions must be met. These are:

- C1. An observed, estimated or projected continuing decline of at least: 25% in 3 years or 1 generation (whichever is longer) (CE); 20% in 5 years or 2 generations (whichever is longer) (EN); or 10% in 10 years or 3 generations (whichever is longer) (VU).

Assessment Outcome: Data deficient.

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Justification: There is insufficient population size data to assess *Promethis sterrha* against this criterion.

- C2. An observed, estimated, projected or inferred continuing decline in number of mature individuals.

Assessment Outcome: Data deficient.

Justification: It is unknown if continuing decline of mature individuals is occurring.

In addition, at least 1 of the following 3 conditions:

- a (i). Number of mature individuals in each subpopulation ≤ 50 (CR); ≤ 250 (EN) or ≤ 1000 (VU).

Assessment Outcome: Data deficient.

Justification: Total population size is unknown.

- a (ii). % of mature individuals in one subpopulation is 90-100% (CR); 95-100% (EN) or 100% (VU)

Assessment Outcome: Subcriterion met at Critically Endangered threshold.

Justification: 100% of the population is in one subpopulation.

- b. Extreme fluctuations in the number of mature individuals

Assessment Outcome: Data deficient

Justification: It is not known if *Promethis sterrha* undergoes extreme fluctuations.

Criterion D Very small or restricted population

Assessment Outcome: Vulnerable via D2.

Justification: : The population size of mature *Promethis sterrha* is unknown and there has not been sufficient sampling to make a reliable estimate. Due to the small area of habitat currently occupied there is likely only a small population remaining.

The number of locations and AOO are restricted and any of the individual threats (or these threats in combination) could drive the species to extinction in a very short timeframe.

Criterion E Quantitative Analysis

Assessment Outcome: Data deficient.

Justification: Currently there is not enough data to undertake a quantitative analysis to determine the extinction probability of *Promethis sterrha*.

Conservation and Management Actions

There is no National Recovery Plan and no NSW Saving Our Species program for this species. The following is derived from the threat information. Conservation and management actions should aim to maintain a stable population of the species on Blackburn Island and if feasible consider re-introduction to the main island.

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Habitat loss, disturbance and modification

- Because it now only occurs in a very small area of remnant habitat, disturbance to the area need to be kept to a minimum.
- Larval habitat could be potentially increased by placing timber of host tree species under the canopies of the existing trees. As these decay, they may become invaded by wood feeding *Promethis sterrha*.
- The current programme of tree planting on Blackburn Island, to develop a release site for the threatened Lord Howe Island phasid, will eventually favour *Promethis sterrha* by providing dead wood habitat.

Invasive species

- Weeds should be controlled in and around the habitat of the species in a way that minimises any adverse impacts on *Promethis sterrha*.
- Habitat for the species needs to be kept rodent free. Develop an biosecurity plan for Blackburn Island, including emergency actions for any incursions.
- Emerging threats (e.g., introduction of additional predators) require ongoing monitoring and control.

Survey

- Typical survey techniques for wood inhabiting species would involve breaking open all available dead wood on the island, which would probably quickly lead to extinction of the species. If feasible, non-invasive survey methods (e.g. eDNA) should be deployed.
- Non-obtrusive night surveys are needed on Blackburn Island to see if adults are active on surfaces at night
- If there is evident nocturnal activity this species might lend itself to mark and re-capture methods of population estimate.

Ex situ conservation

- An ex-situ living collection could be established on the main Island. The utility of doing this need to be established. Any living collection or translocation needs to be staged, with prey populations needing to have been identified or established prior to any potential translocation

Stakeholder Management

- Inform landowners and managers (i.e. NSW Lord Howe Island Board) of the known site and consult with them regarding options for conservation management and protection of the species.

Survey and Monitoring priorities

- Monitoring to detect any declines in known site.
- Once the main island of Lord Howe is declared rodent free, consider re-introduction to that island.

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- Monitor life history cycling in the species and investigate habitat preferences for larvae and adults.
- Investigate potential of using DNA analysis of gut contents to identify prey species.
- Investigate distinguishing features of larvae (morphological work on larval diagnostics) of the other (much smaller) species of stenochiine tenebrionid on Blackburn Island, (*Metisopus curtulus* and *Hydissus vulgaris*) as this will also help with monitoring.

References

Australian National University (2009) Implications of climate change for Australia's World Heritage properties: a preliminary assessment. A report to the Department of Climate Change and the Department of the Environment, Water, Heritage and the Arts by the Fenner School of Environment and Society, the Australian National University.

Auld TD, Leishman MR (2015) Ecosystem risk assessment for Gnarled Mossy Cloud Forest, Lord Howe Island, Australia. *Austral Ecology* **40**, 364–372.

Bouchard P, Steiner W (2004) First descriptions of Coelometopini pupae (Coleoptera: Tenebrionidae) from Australia, southeast Asia and the Pacific Region, with comments on phylogenetic relationships and antipredator adaptations. *Systematic Entomology* **29**, 101–114.

Carlile N, Priddell D, O'Dwyer T (2018) Preliminary surveys of the endangered cockroach *Panesthia lata* (Blattodea: Blaberidae) on two islands within the Lord Howe Group, Australia. *Austral Entomology* **57**, 207–213.

Cassis G, Meades L, Reid C, Harris R, Carter G, Jefferys E (2003) Lord Howe Island: terrestrial invertebrate biodiversity and conservation. A report prepared by the Australian Museum Centre for Biodiversity Conservation and Research, for NSW National Parks and Wildlife Service. Australian Museum, Sydney.

IUCN Standards and Petitions Subcommittee (2022) Guidelines for Using the IUCN Red List Categories and Criteria. Version 15. Prepared by the Standards and Petitions Subcommittee. <http://www.iucnredlist.org/documents/RedListGuidelines.pdf>.

Kaszab Z (1988) Faunistische Angaben der Gattung *Promethis* Pascoe, 1869 (Coleoptera: Tenebrionidae). *Folia entomologica Hungarica* **49**, 55–116.

Matthews EG, Bouchard P (2008) Tenebrionid beetles of Australia. ABRS, Canberra. 398pp.

Olliff AS (1889) The insect fauna of Lord Howe Island. *Memoirs of the Australian Museum* **2**, 77–98, plate vi.

Reid C, Jenkins Shaw J, Jensen A (2018) The Australian Museum Lord Howe Island expedition 2017 - Coleoptera. *Technical Reports of the Australian Museum Online* **26**, 53–67.

Reid C, Hutton I (2019) Citizen science and the art of discovery: new records of large Coleoptera from Lord Howe Island, July 2018. *Technical Reports of the Australian Museum Online* **28**, 1–16.

Reid C, Hutton I, Thompson S (2020) The citizen scientist survey of large Coleoptera on Lord Howe Island, August 2019. *Technical Reports of the Australian Museum Online* **31**, 1–15.

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Sheringham P, Richards P, Gilmour P, Smith J, Kemmerer E (2020) A systematic flora survey, floristic classification and high-resolution vegetation map of Lord Howe Island. *Cunninghamia* **20**, 35–98.

Expert Communications

Bower, H. (Lord Howe Island Board). Emails from 2018 onwards, concerning conservation.

Appendix 1

Assessment against *Biodiversity Conservation Regulation 2017* criteria

Overall Assessment Outcome:

Promethis sterrha was found to be Critically Endangered under Clause 4.3 (a) (d) (e iii).

Clause 4.2 – Reduction in population size of species

(Equivalent to IUCN criterion A)

Assessment Outcome: Data deficient

(1) - The species has undergone or is likely to undergo within a time frame appropriate to the life cycle and habitat characteristics of the taxon:			
	(a)	for critically endangered species	a very large reduction in population size, or
	(b)	for endangered species	a large reduction in population size, or
	(c)	for vulnerable species	a moderate reduction in population size
(2) - The determination of that criteria is to be based on any of the following:			
	(a)	direct observation,	
	(b)	an index of abundance appropriate to the taxon,	
	(c)	a decline in the geographic distribution or habitat quality,	
	(d)	the actual or potential levels of exploitation of the species,	
	(e)	the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.	

Clause 4.3 - Restricted geographic distribution of species and other conditions

(Equivalent to IUCN criterion B)

Assessment Outcome: Critically Endangered via Clause 4.3 (a) (d) (e iii).

The geographic distribution of the species is:			
	(a)	for critically endangered species	very highly restricted, or
	(b)	for endangered species	highly restricted, or
	(c)	for vulnerable species	moderately restricted,
and at least 2 of the following 3 conditions apply:			
	(d)	the population or habitat of the species is severely fragmented or nearly all the mature individuals of the species occur within a small number of locations,	
	(e)	there is a projected or continuing decline in any of the following:	
		(i)	an index of abundance appropriate to the taxon,
		(ii)	the geographic distribution of the species,
		(iii)	habitat area, extent or quality,
		(iv)	the number of locations in which the species occurs or of populations of the species,
	(f)	extreme fluctuations occur in any of the following:	
		(i)	an index of abundance appropriate to the taxon,

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	(ii)	the geographic distribution of the species,
	(iii)	the number of locations in which the species occur or of populations of the species.

Clause 4.4 - Low numbers of mature individuals of species and other conditions

(Equivalent to IUCN criterion Clause C)

Assessment Outcome: Data deficient.

The estimated total number of mature individuals of the species is:		
(a)	for critically endangered species	very low, or
(b)	for endangered species	low, or
(c)	for vulnerable species	moderately low
and either of the following 2 conditions apply:		
(d)	a continuing decline in the number of mature individuals that is (according to an index of abundance appropriate to the species):	
	(i)	for critically endangered species very large, or
	(ii)	for endangered species large, or
	(iii)	for vulnerable species moderate
(e)	both of the following apply:	
	(i)	a continuing decline in the number of mature individuals (according to an index of abundance appropriate to the species), and
	(ii)	at least one of the following applies:
	(A)	the number of individuals in each population of the species is:
		(I) for critically endangered species extremely low, or
		(II) for endangered species very low, or
		(III) for vulnerable species low
	(B)	all or nearly all mature individuals of the species occur within one population,
	(C)	extreme fluctuations occur in an index of abundance appropriate to the species.

Clause 4.5 - Low total numbers of mature individuals of species

(Equivalent to IUCN criterion D)

Assessment Outcome: Data deficient.

The total number of mature individuals of the species is:		
(a)	for critically endangered species	extremely low, or
(b)	for endangered species	very low, or
(c)	for vulnerable species	low.

Clause 4.6 - Quantitative analysis of extinction probability

(Equivalent to IUCN criterion E)

Assessment Outcome: Data deficient.

The probability of extinction of the species is estimated to be:		
(a)	for critically endangered species	extremely high, or
(b)	for endangered species	very high, or
(c)	for vulnerable species	high

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**Clause 4.7 - Very highly restricted geographic distribution of species
(Equivalent to IUCN criterion D2)**

Assessment Outcome: Vulnerable via Clause 4.7.

For *vulnerable species*, the geographic distribution of the species or the number of locations of the species is very highly restricted such that the species is prone to the effects of human activities or stochastic events within a very short time period.