

Notice and reasons for the Final Determination

The NSW Threatened Species Scientific Committee, established under the *Biodiversity Conservation Act 2016* (the Act), has made a Final Determination to list the beetle *Cormodes darwini* Pascoe, 1860 (Cleridae) as a CRITICALLY ENDANGERED SPECIES in Part 1 of Schedule 1 of the Act. Listing of Critically Endangered species is provided for by Part 4 of the Act.

Summary of Conservation Assessment

Cormodes darwini, a small beetle, was found to be Critically Endangered in accordance with the following provisions in the *Biodiversity Conservation Regulation 2017*: Clause 4.3 (a) (d) (e iii). The main reasons for this species being eligible are: i) it has a very highly restricted geographic distribution and is only known from one location; and ii) there is inferred continuing decline as the habitat of the species is threatened by weeds, increasing aridity/storms and the introduction of predators.

The NSW Threatened Species Scientific Committee has found that:

1. *Cormodes darwini* was described by Pascoe (1860) as "pale testaceous brown inclining to pitchy, particularly on the prothorax and base of the elytra, and everywhere but very sparingly covered with loose greyish hairs; head punctured in front; prothorax with a short deep longitudinal impression in the centre; elytra rather wider than the base of the prothorax, with a strong basal carina, which gradually disappears at rather beyond half their length, the shoulder with another strong carina which is continued nearly to the apex, the side beneath the outer carina bent inwards at the shoulder, coarsely and regularly punctured, the punctures becoming smaller posteriorly; mandibles pitchy; eyes brown. Length 7 lines." Pascoe (1860) provided an accurate detailed illustration of this insect. There is confusion about the correct generic placement. Pascoe erected the genus *Cormodes* in 1860 for this single species. *Cormodes* was monotypic until Kolibac (1997) placed *Cormodes* and other similar Australian genera in synonymy with an American genus, *Natalis*. Solervicens (2007) rejected that but was unable to study *Cormodes*. Bartlett (2009) treated *Cormodes* as valid, however Lawrence and Slipinski (2013) placed *Cormodes* back into *Natalis*. Most recently, Bartlett (2021), has restored the validity of *Cormodes* and placed it in a subtribe Cormodina, with 4 other genera, based on morphological analysis.
2. *Cormodes darwini* is endemic to Lord Howe Island, New South Wales and was described in 1860. It is a typical island form of beetle, *i.e.* uniquely flightless in a group of species with well-developed flight. It is a clerid and therefore predatory on other insects as both adult and larva. *Cormodes* belongs to a tribe of genera (Nataliini; Bartlett 2021) which specialises in feeding on insects in dead or rotting wood, or subcortically.

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3. Until its recent rediscovery, *Cormodes darwini* was only known from 24 specimens collected from the main island of Lord Howe and held in collections worldwide (Bartlett 2009), only one of which had any detailed information: 'near Mount Gower under bark' (Olliff 1889). Another specimen was collected from *Howea* sp. (Bartlett 2009) and must be from lowland palm forests. The most recent specimens from the main island were collected by Arthur Lea in a survey of the island's beetles in 1916. All these collections were 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 *C. darwini* from the main Lord Howe Island (Bartlett 2009; Reid and Hutton 2018). In 2018, one adult and two larvae of *C. darwini* were discovered on Blackburn Island, a small islet of 2.4 ha situated within the lagoon on the west side of the main Lord Howe Island (Reid and Hutton 2019). Rats have never been recorded from Blackburn Island (Carlile *et al.* 2018). There is no evidence that Blackburn Island had been sampled for beetles before the 1970s. The *C. darwini* specimens were associated with small colonies of darkling beetle adults and larvae (of four species) and in rotten *Lagunaria patersonia* branches (Reid & Hutton 2019). Searches on the main island in this particular habitat in 2018 and 2019 failed to locate any further individuals (Reid and Hutton 2019; Reid *et al.* 2020). The amount of suitable habitat on Blackburn Island is very small (< 1 ha), as there are only 12 mature trees, confined to the middle and eastern portion. As well, there are about 45 well-established but small *Melaleuca howeana* bushes and a single stunted *L. patersonia* on the steep southern slopes of Blackburn Island. Further searches in 2019 focussed on these steep southern slopes of Blackburn Island, but no *C. darwini* were found (Reid *et al.* 2020) in these habitats, and it was evident that these bushes only support very low densities of dead wood insects. The other vegetated and rodent-free islets off the main island of Lord Howe (Balls Pyramid, the Admiralty Islands and Mutton Bird Island) have scattered *M. howeana* bushes but lack trees. Balls Pyramid and Roach Island have been surveyed for beetles by the Australian Museum and *C. darwini* has not been found. It is very unlikely that the beetle occurs on these islets, due to the lack of suitable habitat.
4. *Cormodes darwini* has a very highly restricted geographic distribution. The area of occupancy (AOO) was estimated to be 4 km², based on the species occupying a single 2 km x 2 km grid cell, the spatial scale of assessment recommended by IUCN (2022). The extent of occurrence (EOO) was also 4 km². The EOO is reported as equal to AOO, despite the range of the species, measured by a minimum convex polygon containing all the known sites of occurrence, being less than the AOO. This is to ensure consistency with the definition of AOO as an area within EOO, following IUCN Guidelines (2022).
5. The life cycle of *Cormodes darwini* is unknown, but will be typical of Cleridae subfamily Clerinae, *i.e.* egg to larva to pupa to adult, although the duration of each stage is unknown. An adult and mature larva were found together, suggesting overlap of generations. Clerid life history is little studied in Australia or even worldwide (Lawrence and Slipinski 2013). Adults of *C. darwini* are flightless and predatory. The adult has been recorded under bark (Olliff 1889) and amongst dead wood and leaf litter on the ground (Reid and Hutton 2019). It is almost certainly nocturnally active and diurnally quiescent. Larvae of *C. darwini* are predatory and

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were also found amongst dead wood and leaf litter on the ground. Associated with the recently found specimens of *C. darwini* in rotting *Lagunaria* wood on the ground or a dead *Lagunaria* branch were larvae of a range of potential prey for the species, including: the cerambycid *Agrianome howei*; adults and larvae of the darkling beetles *Celibe exulans*, *Hydissus vulgaris*, *Metisopus curtulus* and *Promethis sterrha*; and the weevil *Orthorhinus cylindrirostris* (recorded as *O. vagans*) (Reid and Hutton 2019; Reid *et al.* 2020).

6. The main threats to *Cormodes darwini* are exotic rodents, weeds, introduction of predators or competitors and increasing aridity and storm activity under a changing climate. Mice (*Mus musculus*) were introduced to Lord Howe in the 1860s and Black Rats (*Rattus rattus*) in 1918 (Bartlett 2009; Reid and Hutton 2019). Both are thought to have preyed on *Cormodes darwini* and led to its extinction on the main Lord Howe island. A rodent eradication program has recently been undertaken on Lord Howe Island, and depending on the ongoing success of this program (there were some rats detected in 2021), Lord Howe Island can be officially declared rodent free after two years with no rodents. Re-introduction of rodents remains an ongoing threat to *C. darwini*. Most of Blackburn Island (where a few individuals of *C. darwini* were recently found) is covered in introduced grasses (predominately *Chloris gayana* (Rhodes Grass) (Sheringham *et al.* 2020) and ongoing weed control is needed to protect the remaining habitat of *C. darwini*. There is a programme underway to restore the wooded vegetation of Blackburn Island for use as a nursery for the threatened Lord Howe Island phasmid. However, as the planting is being done from the main Island of Lord Howe careful quarantine measures are needed to ensure there is no inadvertent introduction of other invertebrates that are currently established on the main Island to Blackburn Island (where they currently do not occur). This includes, exotic predators (that may prey on or compete with *C. darwini*) and woodborers (that may compete with the prey of *C. darwini*). Recent summers on Lord Howe Island have been very dry leading to drought impacts on a range of plants including, loss of the canopy leaves of the large fig on Blackburn Island. Ongoing drought stress may lead to the loss of trees on Blackburn Island and reduced habitat suitability for *C. darwini*. Increased storm severity and more southern tracking of cyclones may also impact on the survival of the small number of trees where *C. darwini* occurs. 'Predation by the Ship Rat *Rattus rattus* on Lord Howe Island', 'Invasion of native plant communities by exotic perennial grasses', and 'Anthropogenic Climate Change' are Key Threatening Processes under the Act.
7. *Cormodes darwini* Pascoe, 1860 is eligible to be listed as a Critically Endangered species as, in the opinion of the NSW Threatened Species Scientific Committee, it is facing an extremely high risk of extinction in Australia in the immediate future as determined in accordance with the following criteria as prescribed by the *Biodiversity Conservation Regulation 2017*:

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Assessment against *Biodiversity Conservation Regulation 2017* criteria.

The Clauses used for assessment are listed below for reference.

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

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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–vulnerable species (Equivalent to IUCN criterion D2)

Assessment Outcome: Vulnerable under 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.
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Chairperson
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Supporting Documentation:

Reid C, Hutton I (2020) Conservation Assessment of *Cormodes darwini* Pascoe, 1860 (Cleridae). Australian Museum and Lord Howe Island Museum.

References:

Bartlett J (2009) The Cleridae of Lord Howe Island, with descriptions of two new species (Coleoptera: Cleroidea). *Records of the Australian Museum* **61**, 225–228.

Bartlett J (2021) A preliminary suprageneric classification for Clerinae (Coleoptera: Cleridae) based on molecular and morphological evidence, including a review of tegminal terminology. *Annales Zoologici* **71**, 737–766.

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.

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>.

Kolibac J (1997) Notes on the classification of *Natalis* Laporte de Castelnau and *Notocymatodera* Schenkling, with a description of *Notocymatodera disjuncta* sp. n. (Coleoptera: Cleridae). *Acta Musei Moraviae Scientiae Biologicae* **82**, 191–198.

Lawrence J, Slipinski A (2013) 'Australian Beetles. Volume 1'. (CSIRO Publishing, Clayton. 561pp.)

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

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- Pascoe FP (1860) Notices of new or little known genera and species of Coleoptera. Part 1. *Journal of Entomology* **1**, 34–64, plates ii-iii.
- 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.
- 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.
- Solervicens JA (2007) Cladistic analysis of species of *Natalis* Laporte (1836) and related genera *Eunatalis* Schenkling (1899) and *Eurymetomorphon* Pic (1950) (Coleoptera: Cleridae: Clerinae) with redescription of a restored Clerinae genus. *Zootaxa* **1398**, 1–14.