

NSW Threatened Species Scientific Committee

Conservation Assessment of *Cormodes darwini*

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***Cormodes darwini* Pascoe, 1860 (Cleridae)**

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: *Cormodes darwini* (Cleridae)

Summary of Conservation Assessment

Cormodes darwini, a Clerid 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 very highly restricted geographic distribution and is only known from one location; and ii) there is a projected decline in the area, extent and/or quality of habitat due to weeds, increasing aridity and the introduction of predators.

Description and Taxonomy

Cormodes darwini is a small beetle (1-1.5 cm, Reid and Hutton 2019) and is described by Pascoe (1860: 47) 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."

Cormodes darwini is the "only one of its family without wings" (Pascoe 1860), and Pascoe (1860) named the beetle, after Charles Darwin because he was impressed that Darwin's recently published theory of Natural Selection predicted that such flightless forms may arise on isolated islands. Pascoe (1860) did not describe the larva, which is typical of Family Cleridae, subfamily Clerinae and is: large (up to 2cm long) cream coloured with conspicuously dark brown head, pronotal shield and urogomphi, urogomphi multifid, area ventral to urogomphi closely setose (Reid, unpubl. data).

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) ignored Solervicens and Bartlett and put *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. Here the genus is treated as valid following Bartlett, who is the expert on Australian Cleridae.

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The adult of *Cormodes darwini* is shown in Figure 1 and the larva in Figure 2.

Figure 1. Adult of *Cormodes darwini* (from Reid and Hutton 2019).



Figure 2. Larva of *Cormodes darwini* (from Reid and Hutton 2019).



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Distribution and Abundance

Cormodes darwini is endemic to the Lord Howe Island Group, NSW and was described from Lord Howe Island in 1860, as a typical island form of beetle, i.e. uniquely flightless in a group of species with well-developed flight. It has never been recorded anywhere else. It is a clerid and therefore predatory on other insects as both adult and larva. *Cormodes* specialises in feeding on insects in dead or rotting wood, or subcortically (Reid and Hutton 2019).

Until its rediscovery in 2018 (Reid and Hutton 2019), this species was only known from 24 specimens collected from Lord Howe Island and held in collections worldwide (Bartlett 2009), only one of which had any detailed information: 'near Mount Gower under bark' (Olliff 1889). Prior to the most recent collection, specimens had been collected by Arthur Lea in a survey of the island's beetles in 1916. The collections made by Lea were all made before the accidental introduction of black rat (*Rattus rattus*) to Lord Howe Island in 1918, and this rat was considered to have led to the extinction of *Cormodes darwini* (Bartlett 2009; Reid and Hutton 2019).

Cormodes darwini is currently confined to an area of less than 1 ha – the area of tree canopies on Blackburn Island. In 2018, one adult and two larvae of *Cormodes darwini* were discovered on Blackburn Island, a small islet of 2.4 ha on which rats have never been recorded (Carlile *et al.* 2018; Reid and Hutton 2019). Blackburn Island is situated within the lagoon on the western side of Lord Howe Island, approximately 600 m from the shore of the main island. There is no evidence that it was 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* branches (Reid and Hutton 2019). In 2018 and 2019, searches were therefore made on the main island in this particular habitat, but no further specimens were discovered (Reid and Hutton 2019; Reid *et al.* 2020). The amount of suitable habitat on Blackburn Island is very small, as there are only 12 mature trees, confined to the middle and eastern portion (see Figure 3). *Cormodes darwini* adult and larvae were found in or around the dead wood debris of *Ficus macrophylla* (banyan), *Lagunaria patersonia* (Norfolk Island hibiscus) and may be associated with the introduced *Araucaria heterophylla* (Norfolk Island pine). There are about 45 well-established but small *Melaleuca* bushes and a single stunted *Lagunaria* on the steep southern slopes of Blackburn Island, so in 2019 attention was focussed on these as potential outlying sources of habitat for *Cormodes darwini* (Reid *et al.* 2020). Searching was by crawling under the bushes and turning over rocks and dead wood, plus sifting the soil for beetle remains. No *Cormodes* were found and it was evident that these bushes only support very low densities of dead wood insects. No specimens of *Cormodes darwini* have been collected on the Main Island of Lord Howe since 1916 despite numerous surveys.

Cormodes darwini 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 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 *Cormodes darwini* has not been found. It is very unlikely that the beetle occurs on these islets, due to lack of suitable treed habitat with dead wood.

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The population of *Cormodes darwini* is entirely protected within the Lord Howe World Heritage area.

Figure 3.

Aerial shot of Blackburn Island (photo: Ian Hutton)



Ecology

The life cycle of this species is unknown, but likely to be typical of beetles in subfamily: Clerinae i.e., from egg to larva to pupa and then adult. The timing and duration of the life cycle 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 *Cormodes darwini* are flightless and predatory. The adult of *Cormodes darwini* has been recorded under bark (Olliff 1889) and amongst dead wood and leaf litter on the ground (Reid and Hutton 2019). It is likely nocturnally active and diurnally quiescent (therefore surveying is best done at night). Larvae of *Cormodes darwini* are predatory and were also found amongst dead wood and leaf litter on the ground. The larvae are considered specialised predators of woodboring beetle larvae (Redi and Hutton 2019). Associated with these three specimens in rotting *Lagunaria* wood on the ground were larvae of the cerambycid *Agrianome howei* and adults and larvae of the darkling beetles *Celibe exulans*, *Hydissus vulgaris*, *Metisopus curtulus* and *Promethis sterrha* (Reid and Hutton 2019; Reid *et al.* 2020). The weevil *Orthorhinus cylindrirostris* (recorded as *O. vagans*) was present as larvae and pupae in a dead *Lagunaria* branch above the site where one larva was collected. All of these beetles, especially their larvae, are potential prey for *Cormodes darwini*.

Threats

Exotic Rodents

Mice (*Mus musculus*) were introduced to Lord Howe in the 1860s and black rats (*Rattus rattus*) in 1918 (Bartlett 2009; Reid and Hutton 2018). Both are thought to have preyed on *Cormodes darwini*. 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

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the past, ongoing visitation still carries a risk. Even 1-2 individual rats or mice could severely impact the remaining *C. darwini*.

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 tress 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 for 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 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 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). The 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 *C. darwini* 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 *Cormodes darwini* 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). *Cormodes darwini* was considered to be widespread in forest on the main Island of Lord Howe until 1918 based on records varying from Mount Gower (Olliff 1889) to in association with *Howea* sp. (lowland palms) (Bartlett 2009). The species is now confined to less than 1 ha on the small islet (Blackburn Island). However, there are no data on generation length nor on any recent decline rates.

Criterion B *Geographic range*

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

Justification: *Cormodes darwini* 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:

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- 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: *Cormodes darwini* 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 and 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/storm 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 *Cormodes darwini* undergoes extreme fluctuations.

Criterion C Small population size and decline

Assessment Outcome: Data deficient.

Justification: The population size of mature *Cormodes darwini* 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.

Justification: There is insufficient population size data to assess *Cormodes darwini* 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, although it is likely given the threats to the species.

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

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- 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 *Cormodes darwini* undergoes extreme fluctuations.

Criterion D Very small or restricted population

Assessment Outcome: Vulnerable under D2.

Justification: The population size of mature *Cormodes darwini* 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 *Cormodes darwini*.

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.

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 potentially be increased by placing timber of host tree species under the canopies of the existing trees. As these decay, they will become invaded by wood feeding larvae which are prey of *Cormodes darwini*.

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- The current programme of tree planting on Blackburn Island, to develop a release site for the threatened Lord Howe Island phasmid, will eventually favour *Cormodes darwini* by providing dead wood habitat for the prey of the larvae.

Invasive species

- Weeds should be controlled in and around the habitat of the species in a way that minimises any adverse impacts on *C. darwini*.
- Habitat for the species needs to be kept rodent free. Develop a 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. Therefore, if feasible, non-invasive survey methods (e.g. eDNA techniques) should be deployed.
- Non-obtrusive night surveys are needed on Blackburn Island to see if adults are active at night.
- If there is evident nocturnal activity this species might lend itself to mark and re-capture methods of population estimate.

Prey identification

- The prey of *Cormodes darwini* is unlikely to be specific but the prey species need to be identified for future work on rearing. This may be possible though DNA analysis of gut contents.

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.

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- Once the main island of Lord Howe is declared rodent free, consider re-introduction to that island.
- 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.

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Expert Communications

Bartlett, J. (DPI Queensland). Emails from 9/8/2018 onwards, concerning rarity, phylogeny, taxonomy, molecular sampling.

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

Gunter, N. (Cleveland Museum of Natural History). Emails from 8/2018 onwards, concerning molecular sampling.

Appendix 1

Assessment against *Biodiversity Conservation Regulation 2017* criteria

Overall Assessment Outcome:

Cormodes darwini 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,	

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	(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.

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.

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**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

**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.