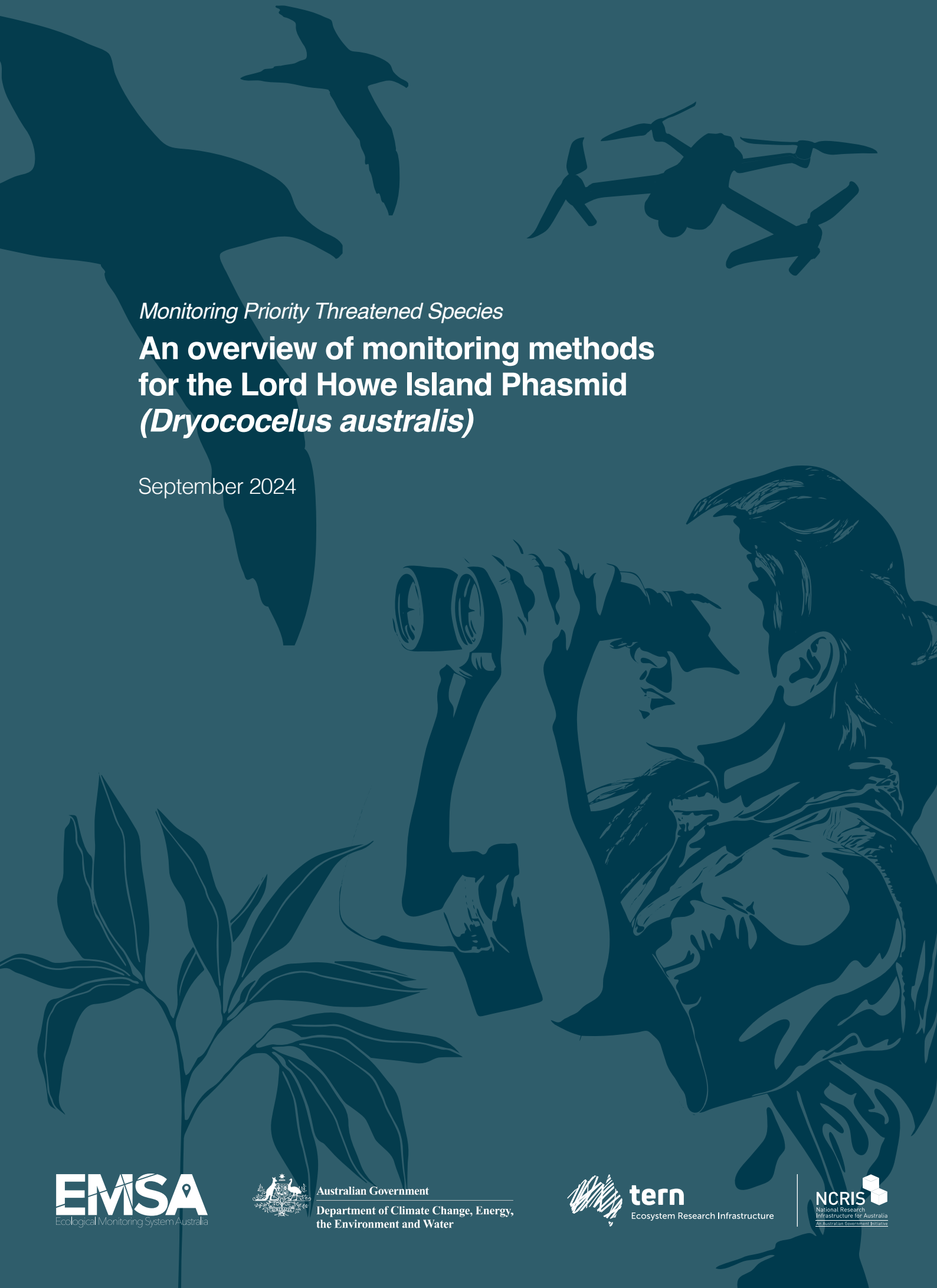


Monitoring Priority Threatened Species

An overview of monitoring methods for the Lord Howe Island Phasmid *(Dryococelus australis)*

September 2024

EMSA
Ecological Monitoring System Australia

Australian Government
Department of Climate Change, Energy, the Environment and Water

tern
Ecosystem Research Infrastructure

NCRIS
National Research Infrastructure for Australia
An Australian Government Initiative

Citation

TERN Australia (2024) Monitoring Priority Threatened Species: Overview of monitoring methods for the Lord Howe Island Phasmid (*Dryococelus australis*). Version 1 Report to the Department of Climate Change, Energy the Environment and Water. TERN, Adelaide.

Version

Version 1.

Last updated: 2 September 2024

Acknowledgements and contributions

This work was funded by the Australian Government Department of Climate Change, Energy, the Environment and Water.

Acknowledgement of Country

We acknowledge the Traditional Custodians of Australia and their continuing connection to land and sea, waters, environment and community. We pay our respects to the Traditional Custodians of the lands we live and work on, their culture, and their Elders past and present.

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This document is designed to be an information resource. It is not a statutory document or policy statement. If information diverges, the information in the statutory document(s) and policy statement(s) take precedence over this document. This document should be used in parallel with relevant survey guidance, conservation advice, and recovery plans.

About

This literature overview collates information on one of the 110 priority threatened species identified in the *Threatened Species Action Plan 2022-2032* and has been reviewed by invited practitioners experienced in monitoring the species.

The *Survey Guidelines for Monitoring Threatened Species* project, a collaboration of the Department of Climate Change, Energy, the Environment, and Water (DCCEEW) and the Terrestrial Ecosystem Research Network (TERN), aims to improve our knowledge of threatened species by enhancing accessibility and sharing of quality scientific threatened species data. By developing best practice field survey guidelines and recommendations, practitioners will be better equipped to conduct standardised, repeatable surveys.

By identifying the monitoring methods typically implemented by practitioners, documenting and assessing the techniques known to work, and identifying opportunities to standardise the methods, we can move towards ensuring all monitoring is species-appropriate, comparable between practitioners and populations, and repeatable over time. Further, together with consistent terminology, guidelines, instructions, and data collection, we can refine efforts and resources to measure and share information. Data collected using robust, standardised methods will improve our knowledge of threatened species and underpin threatened species recovery at scale. This project is essential to establishing monitoring protocols and data repositories to enhance the accessibility and sharing of threatened species data.

TERN has prepared the literature overviews for the Department of Climate Change, Energy, the Environment, and Water. For further information, please visit the EMSA Threatened Species Survey Guidelines website. Additional information, particularly monitoring methods and techniques not included that should be considered, can be brought to the author's attention by emailing tern@adelaide.edu.au for consideration for future updates.

Contents

1 Background 1
1.1 Conservation status and species trajectory 1
1.1.1 Current EPBC Act status 1
1.1.2 Summary of data held in the Threatened Species Index 1
1.2 Distribution 1
1.3 Habitat 1
1.4 Ecology 1
1.5 Threats 2
2 Existing monitoring methods 3
2.1 Summary of existing methods used 3
2.2 Existing survey requirements 3
2.3 Existing protocols 3
2.4 Methods to consider further 4
2.4.1 Available methods 4
2.4.2 Additional methods 4
2.4.3 Methods to rule out 4
2.4.4 Relevant Ecological Monitoring Standards Australia (EMSA) modules 4
2.4.5 Other 110 priority species with potential links 4
3 Considerations for survey guidelines development 5
3.1 Key documents for further review 5
3.2 Key agencies and organisations involved in the species research and recovery 5
4 References 6

1 Background

1.1 Conservation status and species trajectory

1.1.1 Current EPBC Act status

- Critically endangered

1.1.2 Summary of data held in the Threatened Species Index

The Threatened Species Index (TSX) provides reliable and robust measures of change in the relative abundance of Australia's threatened and near-threatened species at national, state and regional levels. Understanding these changes in species populations is crucial for monitoring Australia's conservation progress and allows users to measure and report on the benefits of conservation investments, and to justify and design targeted management responses. Currently, the index is restricted to birds, plants and mammals, with new groups to be added in the near future.

The TSX does not hold data on the King Island Brown Thornbill. More information on the TSX, including how to contribute threatened species monitoring data to the index, can be found at tsx.org.au

1.2 Distribution

- The Lord Howe Island Phasmid (*Dryococelus australis*) is endemic to Lord Howe Island Group.
- The Lord Howe Island Group consists of the main island (Lord Howe Island) and a number of smaller outlying groups of islands, including Balls Pyramid.
- The Lord Howe Island Phasmid was formerly abundant on Lord Howe Island (Etheridge 1889), with as many as 68 individuals found inside a single hollow (Lea 1916).
- The species is now considered extinct on the main island (DECC 2007; DOE 2022).
  - In 2008, 20 phasmids were returned to an enclosure on Lord Howe Island (https://lhimuseum.com/learn/phasmids/).
  - Two captive populations exist at the LHI Board and the LHI School (Flemons *et al.* 2018).
  - In 2018 and 2019, revegetation projects began to restore the island with native plants that are food sources for phasmids. When these plants have grown to useful size, a phasmid reintroduction trial will be undertaken (https://lhimuseum.com/learn/phasmids/).

1.3 Habitat

- The Lord Howe Island Phasmid formerly inhabited forested areas on Lord Howe Island, in the trunk hollows of living trees, showing preference for hollows made by larvae of the Large Longicorn Beetle (*Agrianome spinicollis*) (DOE 2022).
- Some hollows appear to be occupied for many years (Lea 1916; DOE 2022).
  - On Balls Pyramid Island, the species is strongly associated with its primary food plant *Melaleuca howeana* (Flemons et al. 2018).

1.4 Ecology

- The Lord Howe Island Phasmid is a large, heavy-bodied, flightless stick-insect (OEH 2020).
- Females are slightly larger and have a body length of up to 12 cm, and males up to 10.6 cm.
- The species has mainly nocturnal habits (Pain 2006).
- Juvenile animals are bright green (DECC 2007) and active by day (Pain 2006; DOE 2022).

- After being released as part of the reintroduction program, climbers observed the insects falling into rocks' cracks. Previously, the species huddled together in hollowed-out sections of living melaleucas or in cavities formed in accumulated plant debris (Priddel *et al.* 2003; Flemons *et al.* 2018).
- Humidity is critical to phasmid survival (Honan 2008).
- The phasmids are adept climbers and appear to inhabit deep cracks during the day but range further at night to feed on *Melaleuca howeana* (Flemons *et al.* 2018).
    - It is unclear whether eggs are laid within cracks or whether they are deposit eggs in the open, and survival is a matter of chance (Flemons *et al.* 2018)

1.5 Threats

- The OEH (2020) identified the following as primary threats to the Lord Howe Island Phasmid:
    - Predation by introduced rodents
    - Habitat clearing
    - Herbicide use
    - Exotic plant species
    - Small population size
    - Restricted distribution
    - Climate change
    - Predation by big-headed ants
    - Other introduced species (crazy ants, cane toads, skink, etc.)
    - The species disappeared rapidly from the island after the introduction of Black rats (*Rattus rattus*) in 1918 (TSSC 2002; Priddel *et al.* 2003).

2 Existing monitoring methods

2.1 Summary of existing methods used

- Direct observation (involves expert rock climbing at night)
- Signs: floss/insect poo
- Signs – DNA/eDNA/eRNA
- Camera trapping
- Trapping – pitfall
- Trapping – Elliott/cage/or similar (ground)
- Trapping – Elliott/cage/or similar (in canopy)
- Refuge checks (burrows, dens, nests, caves, etc)
- Aerial surveys
- Invertebrate techniques

2.2 Existing survey requirements

- Optimal time of year/season/climate conditions (timing with resource availability etc)
  - Australian Museum 2017 survey was from 21st – 29th March to minimise disruption to nesting seabirds, especially sooty terns (Flemons *et al.* 2018).
- Optimal location of surveys
  - Balls Pyramid for monitoring the existing population.
- Minimum survey effort
  - 4-8 days ("It was estimated that the survey work on Balls Pyramid would take six to eight days to complete however the team believed they would still achieve significant outcomes with as little as four days"; Flemons *et al.* 2018).
- Survey personnel
  - Australian Museum 2017 survey had four people in base camp and six climbers.
- Other factors:
  - Field surveys require expert climbers. Australian Museum 2017 survey volunteer climbers were Zane Priebbenow, Paul Priebbenow, Vanessa Wills, David Gray, Keith Bell and Brian Mattick.
  - Balls Pyramid can only be accessed by swimming from a moored boat (Flemons 2017).
  - Thin endoscopic equipment could be used in addition to nocturnal surveys to enable visualisation deep into cracks and permit the collection of eggs and other materials (Flemons *et al.* 2018).
  - The highest biosecurity precautions are required to prevent the transmission of weeds, other pathogens such as *Phytophthora* or myrtle rust, and the introduction of animals such as rats or cockroaches (Flemons *et al.* 2018).

2.3 Existing protocols

- Flemons *et al*. (2018) have developed an observation and collection guidline for experienced climbers.
  - An extensive search has been undertaken but no national survey guidelines for threatened

invertebrates exists.

2.4 Methods to consider further

The methods listed below have been identified as potential methods and techniques to survey for the species, either to identify presence or absence, or to assist determining population size and status. Further review of the literature and consultation with experts is required, particularly to identify and assess specific techniques for examining population ecology factors.

2.4.1 Available methods

- Direct observations at night
- Signs

2.4.2 Additional methods

- Endoscopic equipment to survey rock cracks
- Potential for using drones with a thermal camera flying up and down cliffs at night
  - Only possible if the flightless, nocturnal (adults) phasmid have a thermal signature that can be detected against background heat (Uzair et al. 2021)

2.4.3 Methods to rule out

- All survey methods typical for invertebrates are considered suitable (no specific methods ruled out).

2.4.4 Relevant Ecological Monitoring Standards Australia (EMSA) modules

The following Ecological Monitoring System Australia (EMSA) modules developed by TERN for the Australian Government should be considered for surveying the Lord Howe Island Phasmid.

- Invertebrate fauna (active search)
- Targeted surveys.

In addition, the Plot description, Floristics, Cover, Condition and Vegetation mapping modules may be beneficial for assessing the suitability of a location against the species' habitat preferences.

2.4.5 Other 110 priority species with potential links

- Other priority threatened speices endemic to Lord Howe Island:
  - Mount Lidgbird Charopid Land Snail *Pseudocharopa ledgbirdi*
  - Little Mountain Palm Lepidorrhachis mooreana

3 Considerations for survey guidelines development

Key considerations should a full literature review and/or survey guidelines be developed for the Lord Howe Island phasmid are highlighted below.

- Special equipment required
  - Boat hire to transport personnel and gear to and from Balls Pyramid, 23 kms from Lord Howe Island.
  - Requires experienced climbers and associated climbing apparatus.
- Estimated time and surveyor effort
  - 4-8 days for the actual survey of Balls Pyramid.
- Vegetation communities or landscapes of the species' preferred habitat not suitable for the optimal survey methods
  - None have been identified to date.

3.1 Key documents for further review

The documents listed below have been identified as key documents to review should a full literature review and/or survey guidelines be developed for the Lord Howe Island Phasmid.

- Protocols
  - Observation/collection by climbers (Flemons *et al.* 2018)
- Scientific papers and reports
  - Flemons, Paul, Vanessa Wills, David Gray, Kate Pearce, Zane Priebbenow, Paul Priebbenow, Brian Mattick, Keith Bell, Frank Köhler, Hank Bower, Ian Hutton, Tom Bannigan and Rhiannon Stephens (2018) The Australian Museum Lord Howe Island Expedition 2017—Balls Pyramid survey for phasmids. Technical Reports of the Australian Museum, Online 26: 77–94 (Flemons *et al.* 2018).
  - *Dryococelus australis* in Species Profile and Threats Database (DOE 2022)

3.2 Key agencies and organisations involved in the species research and recovery

- Paul Flemons, Australian Museum Research Institute, Australian Museum, 1 William Street, Sydney NSW 2010, Australia
  - Hank Bower, LHI Board
  - LHI Board Research Permit
- Ian Hutton, LHI Museum
- NSW Department of Planning and Environment, Environment and Heritage Group
  - Scientific License.

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