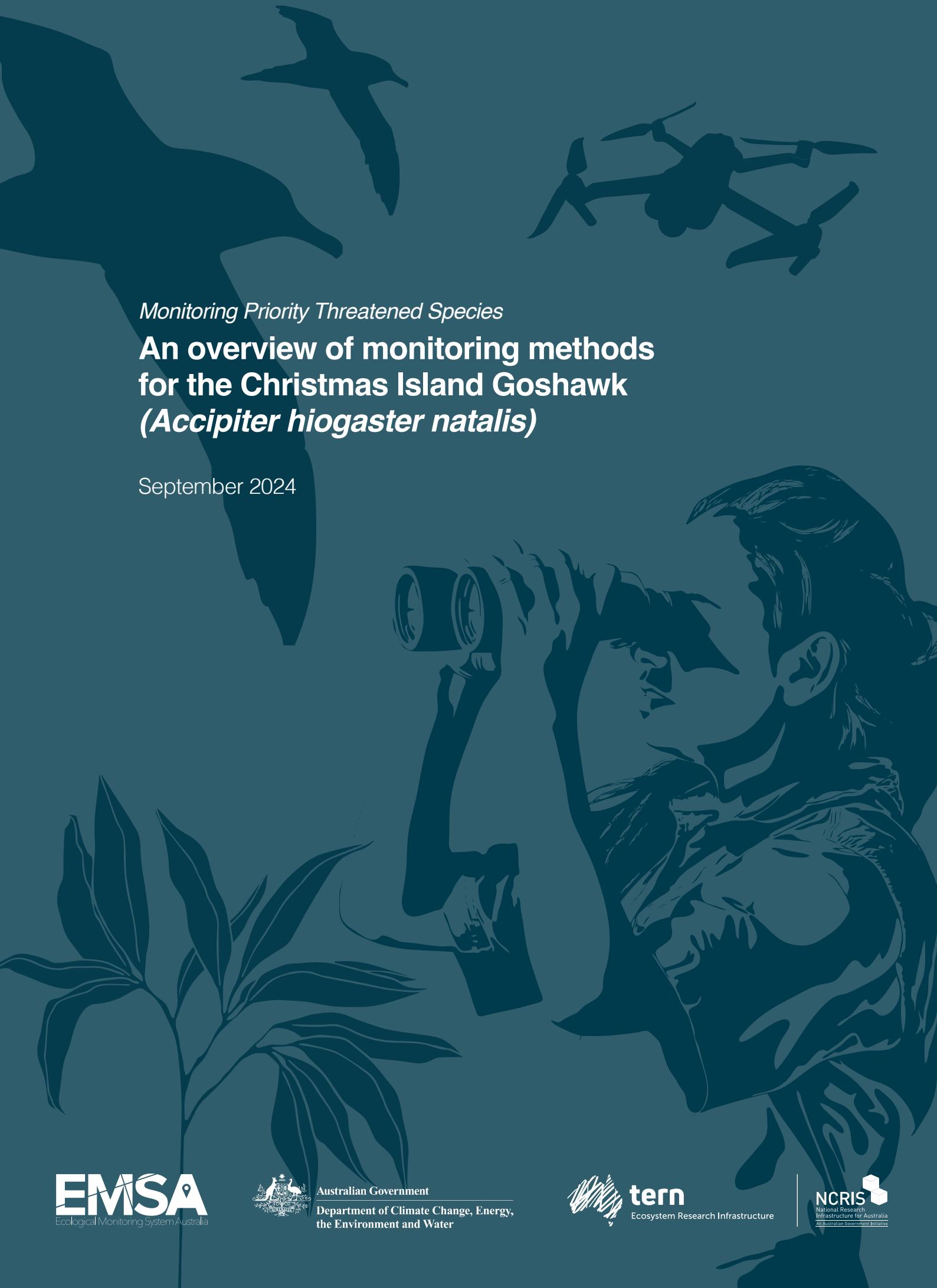


Monitoring Priority Threatened Species

An overview of monitoring methods for the Christmas Island Goshawk *(Accipiter hiogaster natalis)*

September 2024

EMSA
Ecological Monitoring System Australia

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

tern
Ecosystem Research Infrastructure

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National Research Infrastructure for Australia
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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.

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1 Background

1.1 Conservation status and species trajectory

1.1.1 Current EPBC Act status

- 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 table below summarises Christmas Island Goshawk data held in the TSX. More information on the TSX, including how to contribute threatened species monitoring data to the index, can be found at tsx.org.au

Table 1. Summary of Christmas Island Goshawk data held in the Threatened Species Index

TSX information	Christmas Island Goshawk data held in the TSX
Data held in the TSX	Yes
Number of data sources	1
Number of unique sites	225
Average time series length	5.6
Average number of sampling years	3.3

1.2 Distribution

- Reflecting its namesake, data suggests that the Christmas Island Goshawk is confined to the Australian territory of Christmas Island (Peters 1931; Marchant and Higgins 1993).
- The Christmas Island Goshawk is widespread on Christmas Island (Corbett *et al.* 2003; Hill 2004; Hurley 2005; James and Retallick 2007) but uncommon (Hill 2004).
- The extent of occurrence of the Christmas Island Goshawk is estimated, with high reliability, to be 160 km² (Flakus *et al.* 2021).
- The number of mature individuals is estimated at 250. The population is considered probably stable, with four sets of surveys providing no indication of decline (Flakus *et al.* 2021).
- Data on site occupancy collected in 2011, 2013 and 2015 are not yet publicly available (Flakus *et al.* 2021).

1.3 Habitat

- The Christmas Island Goshawk occurs in all major habitat groups (Corbett *et al.* 2003; Hill 2004; Hurley 2005; James and Retallick 2007) including all forest types on Christmas Island (Hill 2004).

- The Christmas Island Goshawk prefers secondary forest, settlements or rehabilitated habitat (Hill 2004), often occurring in sparser vegetation growth at edges or in clearings in the forest (Gibson-Hill 1947).
- Cleared land provides improved visibility and resource access (Hill 2004).
- The goshawk is capable of foraging in most available habitats, but requires suitable tall trees in native rainforest for nesting (Hill 2004).

The species of trees, the density and height of trees, and the amount of understorey vegetation are not important in habitat choice (Marchant and Higgins 1993).

1.4 Ecology

- The Christmas Island Goshawk is territorial and does not migrate, unlike the closely-related subspecies on the Australian mainland (Stokes 1988; Marchant and Higgins 1993).
- The life expectancy of the Christmas Island Goshawk has not been documented (Aumann 1988).
- It is assumed that breeding season and behaviour of the Christmas Island Goshawk are like those of the mainland goshawk populations of northern Australia:
    - These populations breed from early September to early December (Hollands 1991). They make a rough nest of sticks with leaves throughout, lined with green leaves (Cupper and Cupper 1981).
    - Mainland goshawks are considered to be monogamous, but there have been no long-term studies of marked birds (Marchant and Higgins 1993).
    - Mainland goshawks apparently pair for at least one season, but replace their mate if lost (Aumann 1988).
    - Female goshawks may breed successfully in their first or second year, but males typically breed only in full adult plumage (Ashton 1987; Aumann 1988; Hollands 1991).
    - The clutch size of Australian mainland goshawks is usually three, but is sometimes two or four (Baker-Gabb 1984). Eggs are incubated and chicks brooded by both sexes, but mostly by the female. The incubation period is 30–33 days (Olsen *et al.* 1982), and the fledging period is 28–40 days, with males usually fledging before females (Hobbs 1971; Hollands 1991).
- The Christmas Island Goshawk feeds on large insects, such as grasshoppers, beetles and mantids, centipedes and small birds, mammals and reptiles (Gibson-Hill 1947; Hill 2004; Hurley 2005).
- The Christmas Island Goshawk searches for prey mainly from concealed perches within foliage, but also from low unconcealed perches or actively on the wing. It is not usually active on the ground, but may stalk and take prey there (Marchant and Higgins 1993).

1.5 Threats

- At high densities, invasive Yellow Crazy Ants (*Anoplolepis gracilipes*) are capable of altering the forest structure required by the Christmas Island Goshawk (Threatened Species Scientific Committee 2005). The absence of sustained monitoring and (where necessary) control of the pest since 2004 means it could rapidly attain high densities and it is therefore seen as a key threat to the goshawk (Hill 2004).
- The critical habitat of the Christmas Island Goshawk, primary rainforest, has been fragmented by clearing, and is dissected by roads and 'grid lines' cleared for historic phosphate exploration (Hill 2004).

  - Historically, the removal of native rainforest on Christmas Island to establish human settlements, phosphate mining operations and associated infrastructure (Stokes 1988; Hutchings and Brown 2014) removed 25% of the goshawk's habitat. Since 1988, clearing of the primary vegetation has no longer been permitted. Future removal of vegetation could threaten the species (Flakus et al. 2021).

- Care must be taken in control of Black rats (Rattus rattus) to ensure the rodenticide does not cause secondary mortality of goshawks (Flakus et al. 2021).

2 Existing monitoring methods

2.1 Summary of existing methods used

- Direct observation
- Trapping
- Refuge checks (nests)
- Call surveys

2.1.1 Existing survey requirements

- Optimal time of year/season/climate conditions (timing with resource availability etc)
  - Breeding season
- Optimal location of surveys
  - Christmas Island – secondary forest, settlements or rehabilitated habitat
- Minimum survey effort
  - Area surveys 20 hours/4 days (in areas less than 50 ha)
  - Broadcast surveys 2 hours/2 days (DEWHA 2010)
- Other factors:
  - None have been identified to date.

2.1.2 Existing protocols

Existing protocols identified are identified in Table 1.

Table 2. Survey guidelines, protocols, and key resources that identify Christmas Island Goshawk monitoring methods

Protocol	Comments	Reference
Survey guidelines for Australia's threatened birds	Recommends area searches for sightings or calls, and watches for courting pairs soaring above the canopy from vantage points. Daytime broadcast (playback) surveys may be effective before and during the breeding season, although the timing of breeding is currently unknown.	(DEWHA 2010)

2.2 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.

2.2.1 Available methods

- Area search (for sightings and calls)
- Visual survey from vantage points
- Trapping for mark-recapture
- Nest surveys
- Opportunistic observation

Daytime broadcast (playback) surveys

2.2.2 Additional methods

- Pellet analysis for determining prey items

Trawling (lures on fishing line) to assist with capture

2.2.3 Methods to rule out

All survey methods typical for birds are considered suitable (no specific methods ruled out)

2.2.4 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 Christmas Island Goshawk:

- Opportune
- Vertebrate fauna

Targeted

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, particularly for roosting and feeding behaviours.

2.2.5 Other 110 priority species with potential links

- Similar monitoring methods:
  - Red Goshawk (Erythrotriorchis radiatus)

3 Considerations for survey guidelines development

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

- Special equipment required
  - Acoustic recorder
- Estimated time and surveyor effort
  - In 2005–2006, the species was detected from 6 of 527 survey sites specifically for birds, representing a reporting rate of 1.1% (10 min at 128 sites generally repeated four times; James and Retallick 2007). In more general island-wide surveys, the species was detected at 5% of 933 sites in 2011 and 9% and 11% of 1106 sites surveyed in 2013 and 2015, respectively. Differences in methods mean the results are not comparable (Flakus et al. 2021).
- Vegetation communities or landscapes of the species' preferred habitat not suitable for the optimal survey methods
  - Only applicable to Christmas Island where the species is present

3.1 Key documents for further review

- Protocols
  - No protocol with specific requirements are available
- Scientific papers and reports
  - National Recovery Plan for the Christmas Island Goskawk (Hill 2004).
  - Action Plan for Australian Birds (Flakus *et al*. 2021) – refers to unpublished data, could contact to obtain access.

- Generation lengths of the world's birds and their implications for extinction risk (Bird *et al.* 2020).
- Christmas Island Biodiversity Monitoring Programme: Summary Report (James and Retallick 2008).
- Forest Birds of Christmas Island: A Baseline Survey of Abundance (James and Retallick 2007) – mentioned in the Action plan but cannot find document online.

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

- BirdLife Australia

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