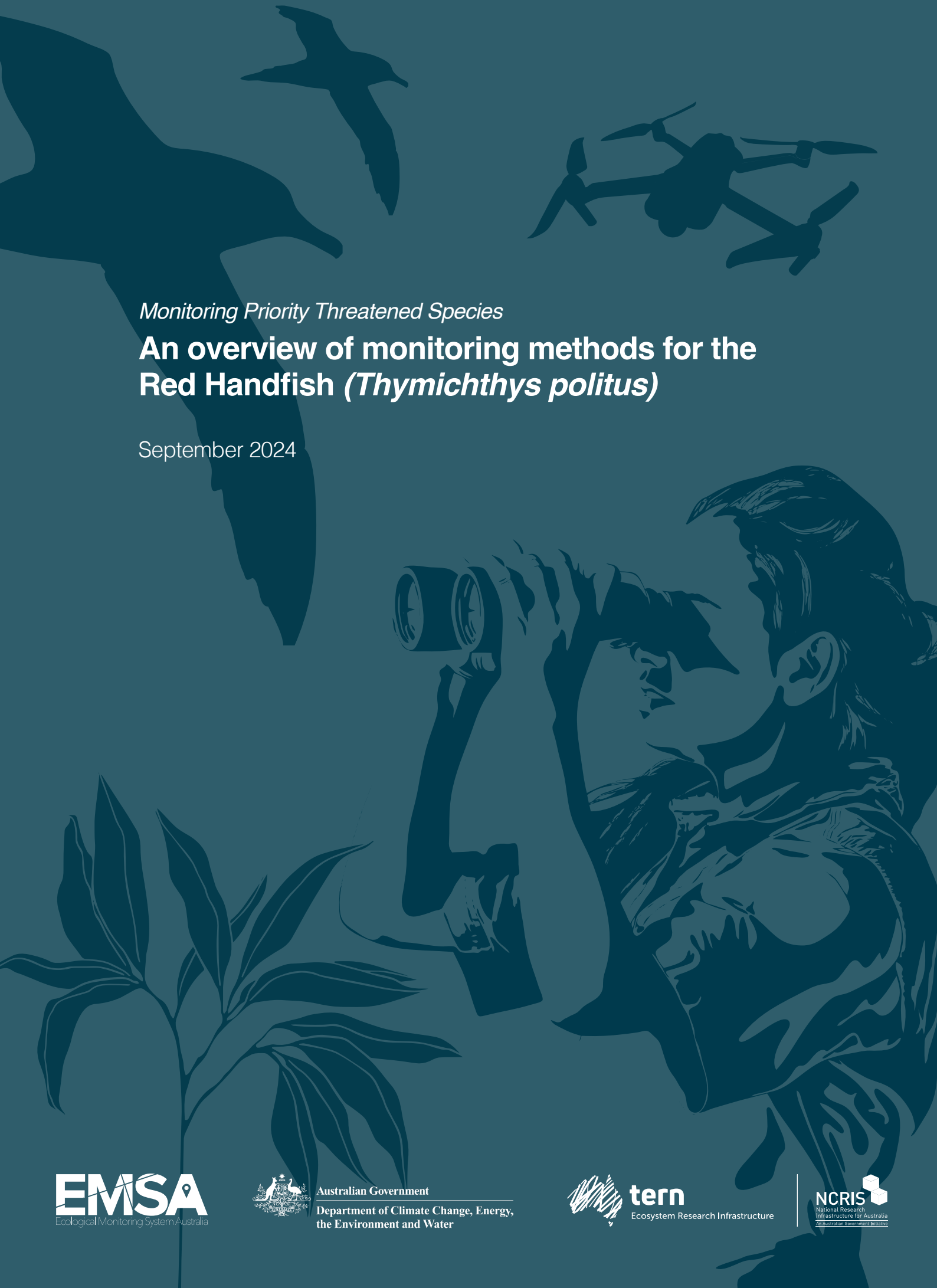


Monitoring Priority Threatened Species

An overview of monitoring methods for the Red Handfish *(Thymichthys politus)*

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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

- 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 Red Handfish. 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 Red Handfish *(Thymichthys politus)* persists as a small population in Tasmania (DSEWPC 2012).
- The species was first collected near Port Arthur in the nineteenth century but is now known only from two small, isolated populations in a single region near Frederik Henry Bay off the south-eastern coast of Tasmania (Stuart-Smith 2019).
- The individual populations are restricted to small reef areas approximately 50 x 20 meters in area (IMAS 2019).
- The Red Handfish has undergone a marked decline in distribution and abundance since it was first observed (DSEWPC 2012).
- The total population is now estimated at around 100 (Stuart-Smith 2019).

1.3 Habitat

- The Red Handfish relies critically on the availability of green alga as spawning substrate (DSEWPC 2012). *Ulerpa simpliciuscula* has been observed to be the preferred spawning substrate of Red Handfish at Primrose Sands Reef and appears to be critical to spawning success (Bruce *et al.* 1997).
- Red Handfish utilise a variety of habitat types, including on the top of rocks, amongst macro-algae and in sandy areas between rocks and the reef-sand interface (Bruce *et al.* 1997).
- Inhabits shallow reefs from 0-20 m (Last and Gledhill 2009).

1.4 Ecology

- Red Handfish have a depth distribution of 1-20 metres (Last and Gledhill 2009).
- Egg masses have been observed in late October to early November, varying in size from an estimated 30 to 60 eggs (Bruce *et al.* 1997). The egg masses are guarded by an adult Red Handfish and attached to the green alga *Caulerpa simpliciuscula* (DOE 2022).

- The egg structure was similar to those of the Spotted Handfish, with eggs in transparent 'flasks' connected by tubules and bound together by associated threads (Bruce *et al.* 1997).

1.5 Threats

- The Tasmanian Department of Primary Industry, Parks, Water and Environment released a discussion paper in 2009 listing 'increasing urchin barrens' as a management issue for the Tasmanian Rock Lobster Fishery (DPIPWE 2009).
- An increase in the abundance of the native sea urchin *Heliocidaris erythrogramma* has resulted in significant over-grazing of algae and depletion of handfish. When *H. erythrogramma* invaded and destroyed the algal habitat at Primrose Sands Reef in the 1990s, Red Handfish disappeared from the site (Last and Gledhill 2009).

2 Existing monitoring methods

2.1 Summary of existing methods used

- Direct observation
  - The species are cryptic fish and are difficult to find. Therefore, surveys require knowledge of fish behaviour and the ability to minimise disturbance to fish and habitat while conducting surveys. Underwater visual census (UVC) surveys are an effective observational technique, and the Institute for Marine and Antarctic Studies (IMAS) has built a team of experienced Red Handfish divers. Seasonal dive surveys at both sites consist of 50 m underwater transects (Project ERFIP000278 – see below: Example RLP case studies).
  - Surveys were carried out using globally standardised Reef Life Survey UVC methodology along 50 m transect lines, including a specific survey component for small benthic fishes with cryptic appearance and/or behaviour. This method is considered one of the most suitable non-destructive technique for quantitative surveys for fishes such as handfish. Surveys using these methods have been used to monitor the Red Handfish population at the Primrose Sands site since 2010, complemented by off-transect searches in isolated habitat patches (Edgar *et al.* 2015).

2.2 Existing survey requirements

- Optimal time of year/season/climate conditions (timing with resource availability etc)
  - Egg masses are usually observed from late October to early November (DOE 2022).
  - The chances of finding the species are believed to be greatest when they are guarding egg masses, and thus further survey effort would ideally be concentrated during this time, although continued surveys at any time would still be valuable (Edgar *et al.* 2015).

- Optimal location of surveys
  - Previous known sites, with the only recently (2013) known active site being the Primrose Sands reef/area (Edgar *et al.* 2015).
  - "Since 2018 IMAS, CSIRO and Seahorse World have successfully hatched and reared over 150 Red Handfish. And in 2020, 42 were released into their known habitats, Dr Stuart-Smith, who co-leads the conservation project with Dr Trotter" (https://www.imas.utas.edu.au/news/news-items/mission-accepted-imas-marine-science-students-join-red-handfish-rescue-challenge; Stuart-Smith and Trotter 2021).

- Minimum survey effort
  - Hours of visual searching (diving; Method 2) per site (see Table 3 in Edgar *et al.* (2015); weeks per site of camera trapping using stereo-BRUVS (assuming they attract the small Red Handfish – could use unbaited to minimise predation risk); few hours per site to collect water samples for eDNA analysis. Sites used a 50 m transect line and either a 1 m, 2 m, or 5 m band either side of the transect.

- Survey personnel
  - 2-4 (two divers for Method 2)

- Other factors:
  - Positive relationship with green alga and hence negative relationship with the native sea urchin *Heliocidaris erythrogramma*, an alga grazer. Abundance of sea urchin impacted by large rock lobsters (*Jasus edwardsii*), themselves impacted by lobster fishing (Edgar *et*

al. 2015).

- "data collected from Tasmania's shallow marine reefs over the last 29 years … there have been 7653 underwater surveys (each survey is a 50 m long transect) undertaken by scientific divers (University staff and trained volunteers) using systematic standardised methods. No new Red or Ziebell's handfish populations have been recorded during these surveys" (https://handfish.org.au/the-search-for-red-and-ziebells-handfish/)

2.3 Existing protocols

Existing protocols identified are identified in Table 1.

Table 1. Survey guidelines, protocols, and key resources that identify Red Handfish monitoring methods

Protocol	Comments	Reference
Method 2/M2	"Globally standardised RLS [Reef Life Survey] methodology, which is based on Underwater Visual Census (UVC) along 50 m transects … Macroinvertebrate/cryptic fish surveys (known as Method 2, or M2) – surveyed in two 1 m wide by 2 m high bands on either side of the transect line".	Edgar et al. (2015);
Survey guidelines for Australia's threatened fish	National Guidelines for surveying the Red Handfish are included more generally within the Handfish section.	DSEWPC (2011)

2.4 Methods to consider

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

- Underwater dive surveys (Edgar *et al.* 2015).

2.4.2 Additional methods

- Baited remote underwater stereo-video systems (stereo-BRUVS) (Langlois *et al.* 2020).
- Reduced visibility in kelp/weed, and needing to detect a fish that walks on its fins.
- "autonomous photo-identification systems" developed/utilised for the spotted handfish (Bessell 2018).
- eDNA (methods being developed by IMAS/CSIRO PhD student Tyson Bessell; https://handfish.org.au/handfish-dna/).
- Supplier for Niskin bottle for water sampling = https://imbros.com.au/product-category/marine/water-samplers/

2.4.3 Methods to rule out

- All survey methods typical for fish are considered suitable (no specific methods ruled out).
- Methods that pose a risk to this critically endangered fish (e.g. nets, traps) should be carefully considered.

2.4.4 Relevant Ecological Monitoring Standards Australia (EMSA) modules

No Ecological Monitoring System Australia (EMSA) modules developed by TERN for the Australian Government have been identified for consideration in surveying the Red Handfish. EMSA protocols to date have only focussed on terrestrial ecosystems.

2.4.5 Other 110 priority species with potential links

- Species that could also potentially be surveyed using baited remote underwater stereo-video systems (stereo-BRUVS) (Langlois *et al.* 2020) and eDNA (Weltz *et al.* 2017; Budd *et al.* 2021):
  - Grey Nurse Shark (eastern) *(Carcharias taurus)*
  - Maugean Skate (Zearaja maugeana)
  - Tasmanian Giant Freshwater Crayfish *(Astacopsis gouldi)*
  - Bellinger River Snapping Turtle *(Wollumbinia georgesi)*
  - Short-nosed Sea Snake (Aipysurus apraefrontalis)

3 Considerations for survey guidelines development

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

- Special equipment required:
  - Stereo-BRUVS
  - For eDNA surveys: Niskin bottle water sampling gear, water filtration products, cold chain storage, eDNA analysis costs.
  - Boat hire and diving gear.
- Estimated time and surveyor effort:
  - Estimated minimum of two days per site to confirm presence.
- Any 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 Red Handfish.

- Protocols
  - Method 2/M2 (Edgar et al. 2015)
- Scientific papers and reports
  - Edgar, G. J., Stuart-Smith, R. D., Cooper, A. T. and Jacques, M. (2015). Systematic Surveying of Two Threatened Handfish Species. Report for the Department of the Environment. The Reef Life Survey Foundation and Institute of Marine and Antarctic Studies.

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

- Institute for Marine and Antarctic Studies (IMAS, University of Tasmania) – see project ERFIP000278.
  - Dr Jemina Stuart-Smith, coordinates the Handfish Conservation Project
  - Tyson Bessell, PhD student at the University of Tasmania
- Southern Regional Natural Resource Management Association – see project ERFIP000278.
- National Handfish Recovery Team
- Handfish Conservation Project (https://handfish.org.au/projects/)

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

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