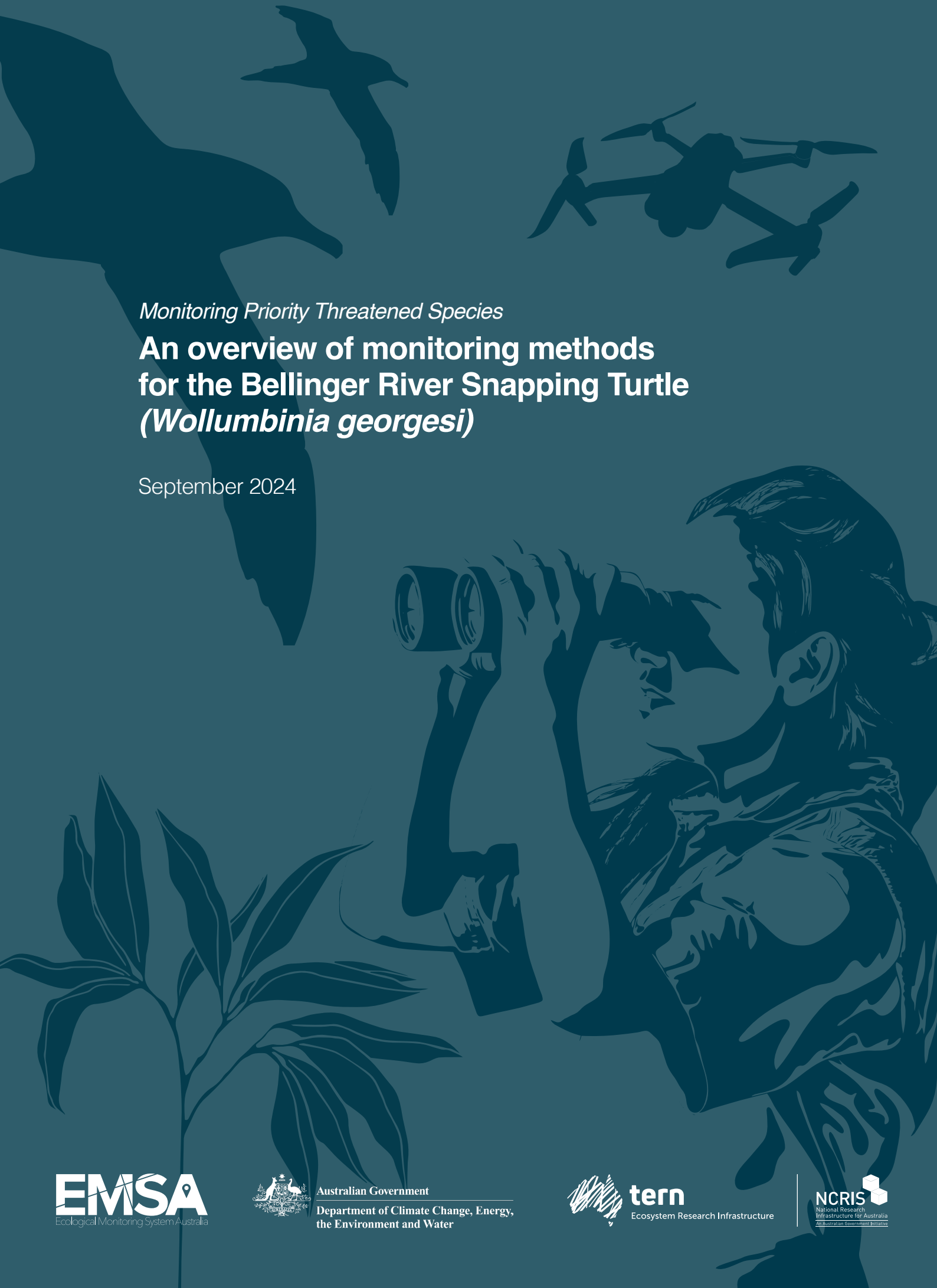

Monitoring Priority Threatened Species

An overview of monitoring methods for the Bellinger River Snapping Turtle *(Wollumbinia georgesi)*

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

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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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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 Bellinger River Snapping Turtle. More information on the TSX, including how to contribute threatened species monitoring data to the index, can be found at tsx.org.au

1.1.3 General background

- The Bellinger River Snapping Turtle's scientific name is *Myuchelys georgesi* (current Australian Faunal Directory name). The species is also referred to as *Wollumbinia georgesi*, and *Elseya georgesi.*

1.2 Distribution

- The Bellinger River Snapping Turtle is currently known only from the Bellinger catchment on the north coast of New South Wales (Blamires *et al.* 2005).
- It is restricted to the Bellinger River and, possibly, the Kalang River. The range within the Bellinger River extends from Bellingen township upstream to an area east of Brinerville (Spencer *et al.* 2007).
- The Bellinger River Snapping Turtle was present at a few scattered locations in the Kalang River, although since 2000 a limited number of surveys have failed to locate the species, or have only been able to locate hybrid animals *(M. georgesi* x *E. macquarii)* or *E. macquarii* (Murray River turtles; Cann 1993).
- There are no records for Bellinger River Snapping Turtle from the Kalang River in the Atlas of New South Wales Wildlife database (Spencer 2015). In addition, there are no records from the Kalang River in museum collections (NSW Scientific Committee 2016).
- The current population is estimated to be approximately 150 (Chessman *et al.* 2020).
- Historically, the population size of the species in the Bellinger River was estimated at 4,468 ± 1,409 individuals (mean ± SE; Blamires *et al.* 2005).
- Density estimates from surveys in 2007 and 2014 suggested a population half the size calculated by Blamires *et al*. (2005); that is, about 2,200 individuals (Spencer *et al.* 2018; Chessman *et al.* 2020).

1.3 Habitat

- The Belllinger River snapping turtle prefers moderate to deep pools with a rocky substrate (Spencer *et al.* 2007; Blamires and Spencer 2013; Spencer *et al.* 2014).

1.4 Ecology

- The Bellinger River Snapping Turtle exhibits type III survivorship where mortality rates decrease with age (Blamires *et al.* 2005). As a consequence, the stability of the population is sensitive to changes in adult survivorship (Blamires *et al.* 2005; Blamires and Spencer 2013).
- Female Bellinger River Snapping Turtles are gravid between September and November and nest between October and December (Cann 1997; Blamires *et al.* 2005).
- Clutch size averages 13.5 +/- 3.2 eggs (Blamires *et al.* 2005). Hatchlings appear after 72 days (Cann 1997).
- Modelling and life cycle analysis calculated that female Bellinger River Snapping Turtles should have a maximum life expectancy of 28.9 (± 4.5) years. Generation time was defined as the minimum female reproductive age, which was calculated to be 7.9 ± 1.2 years (mean ± standard error; Blamires *et al.* 2005). Therefore, the generation length (as defined by IUCN) is approximately 20 years.

1.5 Threats

- In 2015, a novel nidovirus of unknown origin, now named Bellinger River virus (BRV), was responsible for mass mortality of Bellinger River Snapping Turtles in the Bellinger River (Moloney *et al.* 2015; Jakob-Hoff *et al.* 2017; Zhang *et al.* 2018; Chessman *et al.* 2020).
- Predation of turtles by foxes, goannas and large catfish, and nest predation/destruction by foxes, goannas and cattle, are significant risks (Blamires *et al.* 2005).
- Limited distribution and specific habitat requirements. Alteration to water quality.
- Hybridisation and interspecific competition with the Murray River turtle (*Emydura macquarii*; TSSC 2016).

2 Existing monitoring methods

2.1 Summary of existing methods used

- Divers equipped with masks, snorkels, and fins (by hand or hand net – not specified)
- Electrofishing (specify type)
- Gillnets
- Fyke nets
- Other net traps: 'cathedral' traps.

2.2 Existing survey requirements

- Optimal time of year/season/climate conditions (timing with resource availability etc.)
  - Between September and February (Blamires *et al.* 2005).
- Optimal location of surveys
  - The length of the Bellinger River from which turtles have historically been recorded has been divided into four sections. The distribution of known and possible turtle habitat in each of these sections has been mapped from a combination of survey experience, aerial imagery, and on-ground reconnaissance of selected areas. This habitat excludes areas that are considered too fast-flowing and shallow for turtles to occupy except transiently when migrating. The known and possible habitat has been divided into 143 reaches of varying sizes, mostly delimited by the upstream and downstream ends of deep pools (Chessman *et al.* 2020).
- Minimum survey effort
  - Previously, monitoring sites were snorkelled by 1–7 persons for a varied amount of time. In shallower, upstream sections of river, the majority of turtles in a waterhole were able to be captured, however in other sections of the river, snorkelling was stopped after 2 h, or when no new turtles were caught (Spencer *et al.* 2014). This could be applied to surveys for new records.
- Survey personnel
  - Ideally 2–4 personnel are required (more in large waterholes) to undertake snorkelling capture, and/or fish-trap capture, surveys of as many of the 143 river reaches as possible.
- Other factors:
  - Quarantine protocols to minimise any spread of Bellinger River virus (BRV; Zhang *et al.* 2018; Chessman *et al.* 2020).
  - Access constraints, time limitation, poor underwater visibility, presence of sharks, or lack of suitable habitat (Chessman *et al.* 2020).

2.3 Existing protocols

Existing protocols identified are identified in Table 1.

Table 1. Survey guidelines, protocols, and key resources that identify Bellinger River Snapping Turtle monitoring methods

Protocol	Comments	Reference
Trapping	Cathedral traps were set throughout the River. The upper parts of the traps were tied to overhanging trees for support and traps were placed next to bank in the vicinity of good microhabitat (e.g. logs, overhanging banks, aquatic vegetation). Traps were baited with sardines, with part of the bait held loosely in nylon mesh bags and available for the turtles to eat, and part of the bait held in perforated cans. Traps were checked at intervals of 4–10 h and re-baited after approximately 24 h. Traps were left in place for 24–48 h at each location.	Spencer et al. (2014) p. 770
Hand netting by spotlight	Turtles were captured using longhandled dip-nets off a small boat at night. To locate turtles, portable spotlights were used. This method was restricted to deeper waterholes around Bellingen, where the water was deep enough to operate a small flat-bottomed boat.	Spencer et al. (2014) p. 770
Capture-mark-release	Sites were snorkelled by 1–7 persons for a varied amount of time. In shallower, upstream sections of river, the majority of turtles in a waterhole were captured, however in other sections of the river, snorkelling was stopped after 2 h, or when no new turtles were caught.	Spencer et al. (2014) p. 770
Capture-mark-release	Divers equipped with masks, snorkels, and fins, and net traps to catch turtles. Turtles marked by scute marking and PIT tagging.	Chessman et al. (2020)

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

- Capture-mark-release surveys.
- Divers equipped with masks, snorkels, and fins.
- 'Cathedral' traps (telescoping vertical cylindrical nets ~1 m wide and 2 m high when fully extended, constructed of 25 and 50 mm stretched mesh, with three entrance funnels near the base).
- Fyke nets ~1 m high and 3 m long, with two wings 5 m long, constructed of 25 mm stretched mesh (Chessman *et al.* 2020).

2.4.2 Additional methods

- Passive integrated transponder (PIT) tags injected into the body cavities of turtles >100 mm SCL (straight-line medial carapace length).
- Captured turtles scanned for tags in subsequent surveys to supplement scute marking as a means of recognising recaptures (Chessman *et al.* 2020).
- Incorporating a submersible PIT tag reader (https://fishbio.com/beginners-guide-pit-tags/) with a baited tunnel (fyke net with bottom end also open) might provide PIT tagged turtle recapture data. Incorporating a GoPro camera might provide a measure of untagged turtles (total turtles on camera – PIT tagged turtles = untagged turtles).
- Because of their more limited read range, FDX tags and scanners are more suitable for narrow passageways like fish ladders. When a larger antenna is necessary to cover a full stream

channel, a HDX system is generally the better choice. Because they operate on 12 to 24 volts of direct current electricity, energy can be easily provided to these systems through the use of solar power, making them well-suited for remote locations where frequently replacing batteries would be challenging (https://fishbio.com/beginners-guide-pit-tags/).

2.4.3 Methods to rule out

- All survey methods typical for aquatic reptiles 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 Bellinger River Snapping Turtle:

- the Opportune module may have some relevance.

EMSA protocols to date have only focussed on terrestrial ecosystems and have not been tested in marine/freshwater environments.

2.4.5 Other 110 priority species with potential links

- None have been identified to date.

3 Considerations for survey guidelines development

Key considerations should a full literature review and/or survey guidelines be developed for the Bellinger River Snapping Turtle are highlighted below.

- Special equipment required
  - PIT tags
  - PIT tag reader set-ups
- Estimated time and surveyor effort
  - 2–3 weeks – see Spencer *et al.* (2014) p. 770.
- 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 Bellinger River Snapping Turtle.

- Protocols
  - None have been identified to date.
- Scientific papers and reports
  - *On a razor's edge: Status and prospects of the critically endangered Bellinger River Snapping Turtle*, Myuchelys georgesi (Chessman *et al.* 2020).
  - *The risk of inter-specific competition in Australian short-necked turtles* (Spencer *et al.* 2014).

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

- Institute for Applied Ecology, University of Canberra.
- Hawkesbury Institute for the Environment, School of Science and Health, Western Sydney University .
- Centre for Ecosystem Science, School of Biological, Earth and Environmental Sciences, University of NSW, Sydney.

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