



Monitoring Priority Threatened Species

A review of monitoring methods for the Black-eared Miner (*Manorina melanotis*)

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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 review 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. Developing best practice field survey guidelines and recommendations will better equip practitioners 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 reviews 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 Species name

Black-eared Miner, *Manorina melanotis* (Wilson, 1911) was formerly in the genus *Myzantha* (Gardner et al. 2010). There has been some inconsistency around the species' taxonomic status, sometimes referred to as a sub-species of the Yellow-throated Miner (*Manorina flavigula*) (Schodde & Mason 1999; Silveira 1995) or morphological variant of the subspecies *Manorina flavigula obscura* (Ashby 1922) and referred to as the Dusky Miner.

1.2 Conservation status

The Black-eared Miner was listed as Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* in 2000 (Baker-Gabb 2003). The International Union of Conservation for Nature (IUCN) lists the species as Endangered citing a very small breeding population as a result of fire and ongoing hybridisation with Yellow-throated Miners (BirdLife International 2022). In 2018 the species was listed as number ten on a list of Australian Birds most likely to become extinct in the next 20 years (Geyle et al. 2018) and it is one of 22 priority species birds listed in the Australian Government Threatened Species Action Plan 2022-2032 (DCCEEW 2022). The conservation status of the Black-eared Miner is outlined in Table 1.

Table 1. International, national and state conservation status for the Black-eared Miner

Jurisdiction	Status	Legislation or listing
IUCN	Endangered	Global Status: IUCN Red List of Threatened Species: 2022.2 list
Commonwealth	Endangered	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
New South Wales	Critically Endangered	<i>Biodiversity Conservation Act 2016</i>
South Australia	Endangered	<i>National Parks and Wildlife Act 1972</i>
Victoria	Critically Endangered	<i>Flora and Fauna Guarantee Act 1988</i>

1.3 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.

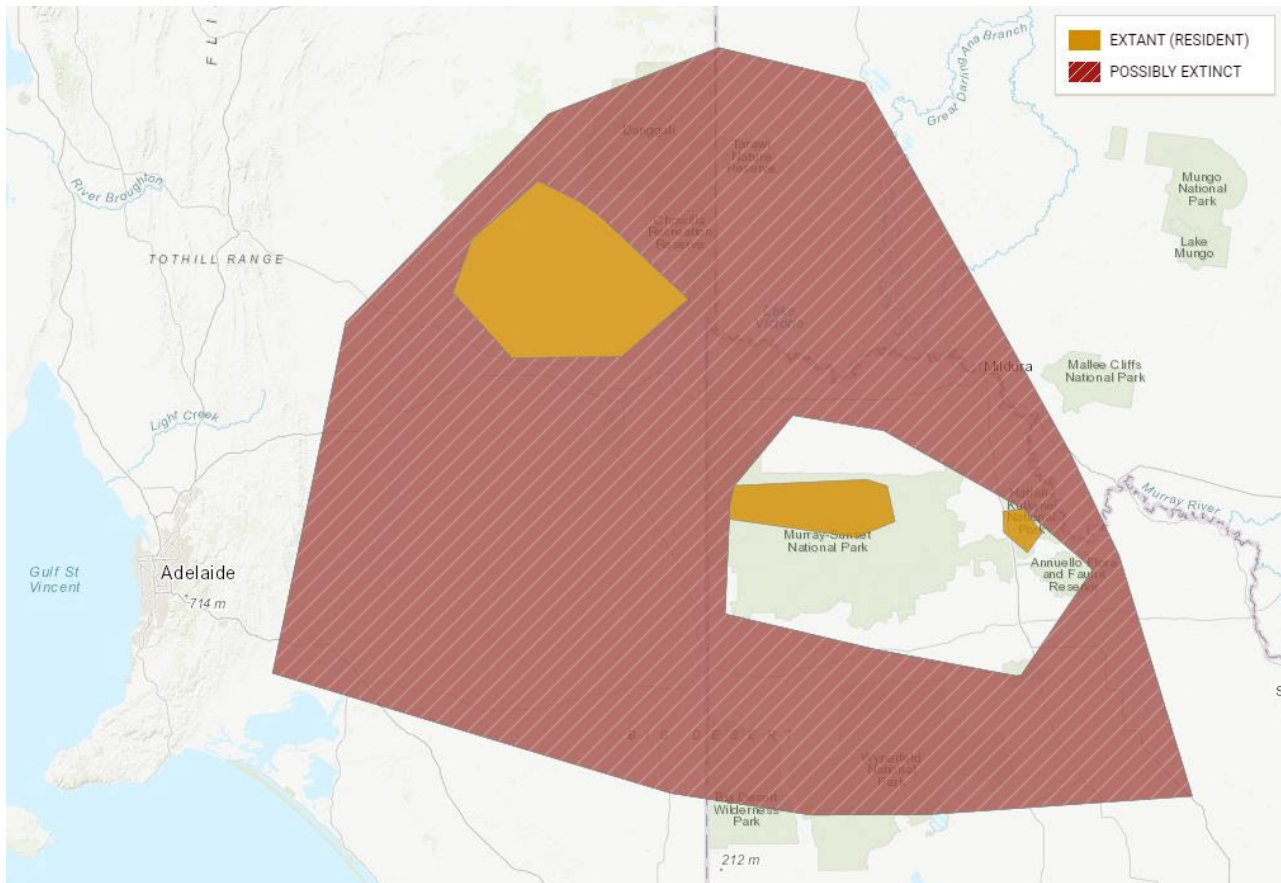
The TSX does not hold data on the Black-eared Miner. More information on the TSX, including how to contribute threatened species monitoring data to the index, can be found on the [TSX website](#).

1.4 Distribution and abundance

Historically, the Black-eared Miner occurred in the Murray Mallee region of Victoria, South Australia and New South Wales (Baker-Gabb 2003). However, the current distribution of the Black-eared Miner has reduced significantly with the majority of birds now found within the Riverland Mallee, north-west of Renmark in South Australia (see Figure 1). This stronghold includes an estimated 481 colonies in 2015-2016, which is equivalent to around 95% of all known colonies (Baker-Gabb 2003; BirdLife International 2023).

Black-eared Miner populations are susceptible to hybridisation with the closely related Yellow-throated Miner (*M. flavigula*), and all known colonies contain hybrids of the two species. In Victoria, there were at least 18 known colonies within Murray-Sunset National Park in 2019 and in 2014 there were two colonies from Annuello Flora and Fauna Reserve (Boulton et al. 2021).

Figure 1. Distribution of the Black-eared Miner



Source: (BirdLife International 2022)

1.5 Habitat requirements

Black-eared miners are reliant on extensive tracts of Mallee, with all but one known colony within New South Wales and South Australia inhabiting areas greater than 100,000 ha of continuous Mallee (Baker-Gabb 2003). In Victoria, Black-eared Miners were found in stretches of Mallee larger than 12,000 ha (Baker-Gabb 2003).

Black-eared Miners occur in chenopod Mallee shrublands and shallow-sand Mallee in both the Riverland Biosphere Reserve in South Australia and the Murray-Sunset area in Victoria (Clarke et al. 2005). These vegetation communities are dominated by an upper stratum of mature (or old growth), multi-stemmed Mallee eucalypts including *Eucalyptus gracilis*, *E. dumosa*, *E. socialis* and *E. oleosa*, generally in association with shrubs from the families Chenopodiaceae and Zygophyllaceae, or a ground-layer dominated by Porcupine Grass (*Triodia scariosa*) (Baker-Gabb 2003).

Black-eared Miners will occupy areas where the vegetation has not been burnt for over 25 years, but are more abundant in Mallee which is greater than 50 years post-fire (Clarke et al. 2005; Connell et al. 2017). Regenerating Mallee five to ten years post-fire or older may also provide occasional foraging habitat (Baker-Gabb 2003; Raap et al. 2015), but at densities 40 % lower (Boulton 2019). Black-eared Miners prefer Mallee communities which have minimal impact from grazing (Baker-Gabb 2003). Black-eared Miner colonies situated more than 5 km from watering points such as dams,

and man-made clearings, are less likely to be impacted by Yellow-throated Miners (Baker-Gabb 2003).

Black-eared Miners nest in vertical forks or denser foliage of Mallee eucalypts, with these trees often located in dune swales as opposed to dune crests. Nests have also been recorded in parasitic vines of the genus *Cassytha*, as well as shrubs like *Myoporum platycarpum*, *Santalum murrayanum*, *Melaleuca lanceolata* and *Acacia colletioides* (Higgins et al. 2001).

1.6 Biology and ecology

The Black-eared Miner is a colonial honeyeater, one of four species in the genus *Manorina* (Baker-Gabb 2003). The species is about 20 cm long, has a pale underside, is dark grey above and has a dark facial mask with a yellow-orange bill and legs. Black-eared Miners are similar in appearance to Yellow-throated Miners but can be distinguished by their darker rump, absence of a pale terminal band on the tail, and the extent of the black mask which covers under and over the eye and uniformly over the ear-coverts (Baker-Gabb 2003). Black-eared Miners also have an obscure grey 'moustache-streak'.

Black-eared Miners have a complex social structure with colonies consisting of well-defined subgroups with a breeding pair assisted by a contingent of up to twelve juvenile and non-breeding adult helpers (mostly males; Baker-Gabb 2003; Ewen et al. 2001). Females are the dispersing sex and therefore breeding males within a colony are often more closely related (Baker-Gabb 2003). The adult population of breeding colonies is male-biased (64%), whereas, the sex ratio of nestlings is female biased (61%), thus suggesting there is a higher mortality rate for females between fledging and gaining reproductive status (Baker-Gabb 2003; Ewen et al. 2001).

Black-eared Miners are opportunistic breeders, reproducing only when conditions are suitable (Baker-Gabb 2003; Ewen et al. 2001). Nests have been found in all months, however, breeding typically extends from September through to December (Ewen et al. 2001). On three occasions, widespread breeding was also witnessed between March and May (Baker-Gabb 2003). Rainfall events during mild to warm seasons are believed to trigger breeding due to the increase in flowering events, proliferation of insect activity and lerp abundance (Baker-Gabb 2003; Higgins et al. 2001). Nests are cup-shaped and assembled from grasses and sticks, and within a colony may be as close as 25 m apart (Baker-Gabb 2003; Higgins et al. 2001). Clutches consist of two to three eggs and the length of incubation is not known. If nesting is unsuccessful during a breeding phase, birds will re-build and lay within two weeks (Higgins et al. 2001).

The social structure partially collapses during non-breeding periods with birds becoming more dispersed and less faithful to sites (Ewen et al. 2001). Adults generally forage close to the nest when breeding (up to 800 m), however can occupy a home range of several hundred hectares when not breeding (Baker-Gabb 2003; Clarke & Clarke 1999). Consequently, colonies can only be identified during the breeding season when social interactions increase as birds assemble within a relatively small area (approximately 12 ha; Ewen et al. 2001).

Black-eared Miners predominantly eat invertebrates and lerps (a crystallised honeydew made by psyllids; Baker-Gabb 2003). Black-eared Miners glean and probe decortivating bark, limbs, twigs and foliage of eucalypts to obtain prey (Baker-Gabb 2003; Raap et al. 2015). They will also hawk for flying insects and occasionally feed on the ground (Baker-Gabb 2003; Raap et al. 2015). Their diet also includes nectar from *Eucalyptus* spp., *Eremophila* spp. and *Grevillea huegelii*, as well as pollen, seeds and fruits (Baker-Gabb 2003; Raap et al. 2015).

1.7 Threats

Clearing of native vegetation for agriculture and habitat fragmentation due to other human activities is the key underlying reason for the species historic decline (Clarke et al. 2005; Joseph 1986). Fragmentation of Mallee habitat has led to increased genetic isolation and therefore reduced genetic variability and reproductive opportunities. This leaves the species at a higher risk of negative impacts arising from stochastic events such as drought or fire, and overall reduces the viability of a population.

The loss and alteration of habitat has also promoted the encroachment of the closely related Yellow-throated Miner (*Manorina flavigula*), which prefers more open habitats (Clarke et al. 2001; Clarke et al. 2005; McLaughlin 1993). As a consequence, overlap in resource use between the two species has facilitated introgressive hybridisation (Clarke et al. 2001; Joseph 1986) and 'genetic swamping' by Yellow-throated Miners (Baker-Gabb 2003; Clarke et al. 2001; McLaughlin 1993). In many areas within their distribution, Black-eared Miners are outnumbered by Yellow-throated Miners and hybrids, and consequently, Black-eared Miners are now an insular population (Baker-Gabb 2003). Hybridisation is most severe in small reserves (less than 20,000 ha) and has likely been accentuated by habitat fragmentation e.g. from wildfires (Baker-Gabb 2003). If left unchecked, the ecological and genetic role of the Black-eared Miner could disappear due to introgressive hybridisation.

Habitat degradation by grazing herbivores, including domestic stock and feral and native species, is an ongoing threat to the persistence of this species (Baker-Gabb 2003). Inappropriate grazing or fire regimes result in changes to vegetation structure and floristic diversity, reducing habitat quality and impacting community stability (Garnett et al. 2011).

Mallee vegetation is extremely flammable, however, Black-eared Miners are more abundant in old-growth Mallee habitat which is at least 40 years post-fire (Baker-Gabb 2003; Clarke et al. 2005). Large uncontrolled wildfires are of particular concern as they can destroy large tracts of remaining old-growth Mallee and cause fragmentation (Baker-Gabb 2003; Threatened Species Scientific Committee (TSSC) 2016). Most of the remaining habitat in NSW and Victoria is less than 25 years post-fire and a wildfire in 2006 burnt 118,000 ha within the Riverland Biosphere Reserve, effectively reducing the largest remaining old-growth Mallee by almost a third (Raap et al. 2015; Threatened Species Scientific Committee (TSSC) 2016). Fire can lead to direct mortality of birds, but inappropriate fire regimes can also impact on vegetation features as well as impede dispersal of young independent females from colonies (Baker-Gabb 2003).



2 Existing monitoring

2.1 Overview of monitoring methods

In areas of suitable habitat within their range, Black-eared Miners can be detected by direct observations or via call identification (Clarke et al. 2003; Clarke et al. 2005; Ewen et al. 2001). Identification by sight alone can be difficult due to their morphological similarities with the Yellow-throated Miner and range of hybrid forms (Clarke et al. 2001; Clarke et al. 2002; Higgins et al. 2001). A simple guide has been created to distinguish Black-eared Miners in the field (Baker-Gabb 2003; Clarke & Clarke 1999) however, it may be necessary to capture individuals for more confident identification based on morphometric measurements and genetic analysis (Ewen et al. 2001).

Key population monitoring indices include:

- Population abundance (estimated)
- Number of breeding pairs/females
- Effective population size (based on number of breeding pairs, sex ratio and excluding hybrids)
- Number of known breeding sites
- Area of breeding habitat
- Area of occupancy
- Habitat suitability (e.g. long-unburnt, old growth Mallee).

2.2 Monitoring resources

- Baker-Gabb (2003) Recovery Plan for the Black-eared Miner *Manorina melanotis* 2002 -2006: Conservation of old-growth dependent Mallee fauna:
 - Provides an overview of previous monitoring and research on components of Black-eared Miner ecology including population numbers and densities, breeding season and success, and colony quality and stability.
 - Proposes several monitoring actions including undertaking surveys to locate Black-eared Miners in areas not previously investigated and monitoring Black-eared Miner population trends in response to effective control of genetic introgression.
 - Endorses active population re-establishment using translocations at some sites. This includes monitoring the success of newly translocated populations.
 - Recognises the need to maintain and enhance Black-eared Miner habitat, ensuring suitable habitat is identified and mapped and that no habitat or colonies are lost.
 - Boulton et al. (2021) Black-eared Miner *Manorina melanotis*. In 'The Action Plan for Australian Birds 2020' (Garnett & Baker 2021):
 - Recognises that the level of monitoring, although 'medium' (i.e. conducted every 5 - 10 years), is sufficient enough to understand population trends.
 - Identifies that research is necessary into how to maintain Black-eared Miner populations without culling Yellow-throated Miners, especially within colonies.
 - Suggests monitoring of genetic health is necessary, particularly of isolated populations.

2.3 Survey methods

Key survey methods include call playback, active searches (either point-based, along transects or within a designated area), and opportunistic sightings. Mist-netting is also undertaken to obtain individuals for banding, and to collect morphometric measurements and genetic material for

accurate identification. Assessments are also important for determining areas of suitable habitat. More information is provided under the relevant headings below.

2.3.1 Direct counts

Black-eared Miners can be detected via sight or by call during active searches or opportunistically. Optimal timing for surveys for Black-eared Miners is during breeding periods as this is when vocalisations increase and birds congress within a relatively small area (Baker-Gabb 2003; DEWHA 2010; Ewen et al. 2001).

Distance sampling using direct counts likely overestimates abundance, partly because Black-eared Miners move towards an observer when they're close by, but avoid detection at greater distances which over estimates abundance (BirdLife International 2023). The species' skewed adult sex ratio and clumped distribution even within core habitat can also lead to over-estimation of population size (BirdLife International 2023).

2.3.2 Direct counts and opportune records

Search techniques for Black-eared Miners include on-ground active searches within a designated area, following transects, using point-based searches either on foot or by vehicle, or driving slowly along a track listening for calls (Clarke et al. 2003; Clarke et al. 2005; Joseph 1986). The use of call playback is often an integral part of each of these approaches and observations on ecology and behaviour often accompany each detection. These methods can be used for several monitoring measures. For instance, recording locations of detections can be used simply for distribution mapping (e.g., Joseph 1986), area searches can be used to estimate colony and population sizes (e.g., Clarke et al. 2003), and transects can be used to estimate bird density (using distance sampling; e.g., Clarke et al. 2005). Opportunistic sightings are important records providing information on bird location, habitat use, degree of hybridisation, foraging accounts and breeding events (Baker-Gabb 2003; Raap et al. 2015). Further information regarding direct counts is provided in Table 2.

2.3.3 Surveys of breeding birds

The majority of surveys on Black-eared Miners are carried out during breeding periods (Baker-Gabb 2003; Ewen et al. 2001). During this time, colony sizes can be estimated, breeding pairs can be identified and breeding behaviour can be observed. For example, Ewen et al. (2001) located nests through active searching within known colonies and by observing bird behaviour. Nestlings were weighed, aged, a blood sample collected and observed using binoculars or a spotting scope for four hours every few days (Ewen et al. 2001). Examination of nesting birds presents insight into nestling and adult sex ratios, mortality of nestlings, population age structure and degree of hybridisation by Yellow-throated Miners (Clarke et al. 2002; Ewen et al. 2001). More information on surveys of breeding birds can be found in Table 2.

Table 2. Methods overview of key studies using direct count surveys.

Survey type	Study design	Survey effort	Location	Reference
Foraging observations	<ul style="list-style-type: none"> Black-eared Miners were opportunistically followed, and foraging behaviour was observed Observations made using binoculars 	<ul style="list-style-type: none"> Surveys conducted from 8 am-11 am on three consecutive mornings per colony. 	Riverland Biosphere Reserve, SA	(Raap et al. 2015)
Transects and density estimates	<ul style="list-style-type: none"> Surveys undertaken during breeding season Transects positioned north-south to cover both dune crests and swales. When a Black-eared Miner or group of miners was detected, their location was recorded using GPS and the perpendicular distance from the fixed transect was measured. This enabled bird density to be calculated using distance sampling. 	<ul style="list-style-type: none"> A total of 532 km of transects were traversed on foot 30 min surveys undertaken after dawn, midday and in the afternoon when conditions suitable. Transects of 0.5 km or 1 km in length 	Riverland Biosphere Reserve, SA	(Clarke et al. 2005)
Point counts and call playback	<ul style="list-style-type: none"> Standardised point counts Black-eared Miner calls broadcast at 5 points spaced 250 m apart with a search radius of 30 m. The total area surveyed at each colony was 1.4 ha. 	<ul style="list-style-type: none"> Surveys took place within 6 hrs of sunset and took about 1 hr to complete Surveys were undertaken during the breeding periods in autumn and spring over 2.5 years at 22 colonies. 	Riverland Biosphere Reserve, SA	(Clarke et al. 2003)
Nest observations and mist-netting	<ul style="list-style-type: none"> Black-eared Miner nests were located via active searching within known colonies and by observing bird behaviour. Behavioural observations were carried out from hides approximately 10 m from a nest Surveyors used binoculars or a spotting scope. Sampling involved taking a blood sample, recording weight and estimating the age of the oldest nestling. Observations began when the first bird arrived at the nest. 	<ul style="list-style-type: none"> Surveys occurred the breeding season in spring Surveys conducted on 8 nests Periods of observation were 4 hrs on a day when nestlings were 1-4, 5-8, and 9-13 days old 	Riverland Biosphere Reserve, SA	(Ewen et al. 2001)
Call playback surveys	<ul style="list-style-type: none"> Recordings of either Noisy Miner (<i>Manorina melanocephala</i>) or Yellow-throated Miner (<i>M. flavigula</i>) were broadcast for around 30 seconds at 5 km intervals along general survey routes or at 1 km intervals in areas with known populations. Calls were repeated if necessary to bring birds closer to more accurate identification. Observations were also made on ecology and behaviour. 	<ul style="list-style-type: none"> Thirty-eight days total in the field. 	Murray Mallee areas in SA, north-western Vic and south-western NSW	(Joseph 1986)

2.3.4 Live trapping

Mist-netting is the most common method employed to capture birds in the field. Capture of Black-eared Miners can be particularly important for identification as pure individuals can be difficult to distinguish from Yellow-throated Miners and the many hybrid forms (Baker-Gabb 2003; Clarke et al. 2001; Clarke et al. 2002). Captured birds can be measured, weighed, banded and DNA collected to enable accurate species identification, individual birds to be identified and sexed (Clarke et al. 2002; Ewen et al. 2001) and effective population size estimates to be made. Details on mist-netting are supplied in Table 3.

Table 3. Methods overview of key studies using live trapping surveys.

Survey type	Study design	Survey effort	Location	Reference
Capture with DNA sampling	<ul style="list-style-type: none"> Genetic samples from Black-eared Miners, Yellow-throated Miners, and hybrids (interbred birds) Samples collected to provide current hybridisation rates, deliver estimates of population size, distribution, levels of inbreeding and clarify links between the two species. 	n/a	Riverland Biosphere Reserve (Gluepot Reserve, Taylorville Station, Calperum Station), SA Murray-Sunset National Park, Annuello Flora and Fauna Reserve, Hattah-Kulkyne National Park, Vic	(Landscape South Australia 2023)
Capture with morphometric and DNA sampling	<ul style="list-style-type: none"> Morphometric measurements including wing length, tail length, culmen depth, total head length, tarsus length, body mass. The presence/absence of a brood patch was also recorded Black-eared and Yellow-throated Miners were captured to collect morphometric measurements and DNA samples to sex and age birds and determine differences between the two species. Birds were banded with metal band and a unique combination of three colour bands. 	<ul style="list-style-type: none"> Surveys undertaken between Sept 1997 and Nov 2000 Two observers responsible for measurements 	Murray Mallee of SA and Vic	(Clarke et al. 2002)
Mist-netting of adult birds	<ul style="list-style-type: none"> Mist-netting conducted to capture adult birds. Nets were placed near active nest sites after active searches within colonies. Captured birds were weighed, measured, banded and blood samples collected for DNA analysis. 	<ul style="list-style-type: none"> Surveys undertaken during three breeding seasons from Sept-Dec in 1996, 1998, 1999. 18 colonies surveyed 1-4 days of mist-netting at each colony where breeding occurred 	Riverland Biosphere Reserve, SA	(Ewen et al. 2001)

2.3.5 Habitat assessment

As Black-eared Miners have specific habitat requirements, namely old growth Mallee at least 45 years post-fire and with minimal grazing impact (Baker-Gabb 2003; Clarke et al. 2005; Raap et al. 2015), identification of areas of suitable habitat are thus important when monitoring and evaluating the ongoing population trends of this species. At a regional level, digital maps identifying vegetation classifications, fire history and information relating to past and on-going grazing can be used to identify broad areas of potential habitat (Clarke et al. 2005). Fine-scale ground surveys may be required to substantiate suitability for Black-eared Miners (Clarke et al. 2005). Further details on habitat assessments are provided in Table 4.

Table 4. Methods overview of key studies using habitat assessment surveys.

Survey type	Study design	Survey effort	Location	Reference
Habitat assessment	<ul style="list-style-type: none"> Regional scale mapping was carried out digitally by overlaying coarse vegetation classifications (i.e., dominant vegetation type), with a fire history layer outlining fire scars large fire footprints from, along with information relating to grazing history. Followed up with on ground truthing 	<ul style="list-style-type: none"> Mapping included every fire scar since 1980 and large fire footprints since 1950 On-ground truthing was carried out by traversing over 1,000 m of transects of foot 	Riverland Biosphere Reserve, SA and Murray Sunset National Park, Vic	(Clarke et al. 2005)

2.3.6 Other survey methods

Other potential survey methods include:

- Radio-telemetry – can be used to understand local movement patterns of Black-eared Miners better, particularly when non-breeding, and to understand dispersal and survivorship better (Liu et al. 2020; Snell et al. 2020).
- Autonomous acoustic recorders – can be established for long-term monitoring within an area for some species. Acoustic recorders can be used to distinguish between sexes and potentially individual birds (e.g., Kennedy et al. 2009; Terry et al. 2005; Węgrzyn et al. 2021; Wilson & Mennill 2010), identify the range of Black-eared Miner vocalisations and their context (e.g., feeding, alarm or social vocalisations; Holt et al. 2017), and provide population estimates (e.g., Lambert & McDonald 2014). Black-eared Miners, however, cannot be distinguished by call from Hybrids and Yellow-throated Miners, therefore this method is limited in its use for collecting species specific data.
- Genetic sampling– genetic samples can be analysed to provide current hybridisation rates, population estimates, distribution and levels of inbreeding may clarify links between the Black-eared Miner and Yellow-throated Miner (Landscape South Australia 2023).

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

Key agencies, organisations or individuals identified as having been previously or currently actively involved in monitoring Black-eared Miner include:

- [Threatened Mallee Bird Steering Committee](#)
- Threatened Mallee Bird-Conservation Action Plan team
- Rebecca Boulton, University of Adelaide
- Rohan Clarke, Monash University
- Stephen Garnett, Charles Darwin University
- Katherine Harrison, La Trobe University
- Wendy Stubbs, Murrumbidgee and Riverlands Landscape Board.

4 Key survey guidelines recommendations gathered from the literature

The literature review of the monitoring methods relating to Black-eared Miners has identified some key points to be considered when developing species-specific survey guidelines. These points include:

- Morphological and phenotypic similarities between the Black-eared Miner, Yellow-throated Miner and hybrids of the two make visual identification difficult if not in the hand for close inspection and requires experienced expert identification. Standard observations should include identifying characteristics differentiating between Black-eared Miner and Yellow-throated Miner and hybrids.
- The species can be distinguished by their darker rump, absence of terminal band on their tail and the extent of the black mask that covers under and over the eye and then uniformly over the ear coverts (Baker-Gabb 2003)
- During breeding season Black-eared Miners are easier to locate and monitor than outside of breeding season, when their home range increases and they are more difficult to locate. Breeding most commonly occurs in spring, however, can be opportunistic at any time of year when conditions are favourable.
- Distance sampling using direct counts likely overestimates abundance (BirdLife International 2023), thus known colonies not model estimates provide more accurate estimates for population size.
- Call playback has been used as an integral part of detection for a range of monitoring outcomes including distribution mapping (e.g., Joseph 1986), area searches can be used to estimate colony and population sizes (e.g., Clarke et al. 2003), and transects can be used to estimate bird density (using distance sampling; e.g., Clarke et al. 2005).
- The frequency of playback broadcast both physically and temporally should be considered when using this technique, particularly as to not to draw birds away from their nests in defensive behaviour.
- Captured birds can be measured, weighed, and banded, and DNA can be collected to enable accurate species identification and individual birds to be identified and sexed (Clarke et al. 2002; Ewen et al. 2001).
- Genetic analysis of blood samples allows for current hybridisation rates and levels of inbreeding in the species, as well as effective population size estimates (Landscape South Australia 2023), to be assessed.
- Boulton et al. (2021) suggests that the current monitoring frequency – every 5 - 10 years has been adequate to understand the trends in population.
- Clarke et al. (2003) found that greater than 17 field person days are necessary to provide precise population estimates via direct observation detection studies. However, no standard for survey effort has been established in the 20 years since the publication of the 2003 paper.
- Ecological Field Monitoring System Australia (EMSA) standard protocols include modules for vertebrate fauna with bird survey protocols and vegetation mapping that may be relevant to surveying the Black-eared Miner.

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