

All the eggs in one basket: Are island refuges securing an Endangered bird?

In brief

The forty-spotted pardalote is endemic to Tasmania, where it has been lost from most of its former range, and is now largely confined to a small number of offshore islands. These islands are serving as refuges for the Endangered bird; however, what caused the contraction to these places and why they still support viable populations has not been well understood.

This study assessed the range and severity of the threats to the persistence of the forty-spotted pardalote, established its population status, and produced recommendations to guide the planning of trial reintroductions of the species across its former range.

We identified large areas of suitable habitat that are too distant for natural recolonisation. To protect the species from the threat of extinction, we recommend that new populations of forty-spotted pardalotes be established immediately in these new sites via reintroductions while robust source populations still exist.

Background



Forty-spotted pardalote nest.
Image: Fernanda Alvez

The forty-spotted pardalote (*Pardalotus quadragintus*) is an Endangered bird endemic to Tasmania that is non-migratory and hard to detect due to its soft call, very small size and resemblance to two other more common pardalote species (*P. striatus* and *P. punctatus*).

It is considered a “specialist” as it nests in tree hollows, primarily of eucalyptus species, and is dependent for food on white gums (*Eucalyptus viminalis*).

The range of the species has contracted severely over the past century. Once widely distributed across Tasmania, it is now mostly confined to a few small offshore island refuges (see Figure 1).

Key threatening processes to the persistence of the species include

habitat loss due to land clearing, wildfire, competition from noisy miners, climate change, predation (particularly by introduced sugar gliders), and a newly discovered parasitic fly that kills nestlings.

Which of the threats are most significant to the species, if and how they interact, and how they have driven local extinctions in former parts of the bird’s range have not been previously assessed. Furthermore, the security of the remaining populations is uncertain.

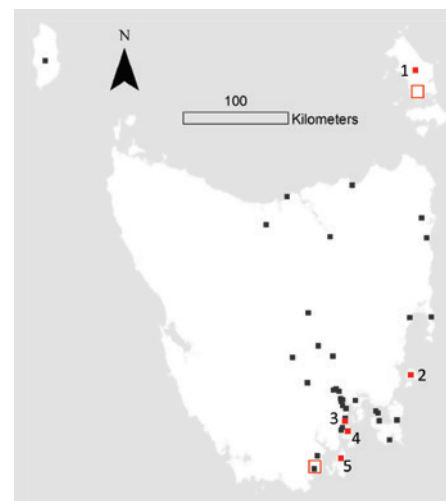


Figure 1. Current refuges and historical locations of the forty-spotted pardalote across Tasmania. Refuges are indicated by solid red squares, historical sites by black squares, and new sites identified during this study by open red squares. 1: Flinders Island; 2: Maria Island; 3: Tinderbox; 4: North Bruny Island; 5: South Bruny Island.



Research aims

This research aims to support two management priorities for the species: 1) to prevent yet further contraction of the forty-spotted pardalote's range; and 2) to examine the potential to expand its range through reintroductions to suitable habitat across its former range.

To secure the pardalote's future in these ways, we set out to increase our understanding of what it is exactly about the islands where the species is persisting that has made them refuges for the bird. Although islands are disproportionately represented in species extinctions globally, they can conversely become critical refuges when key threatening processes are absent, which is apparently what we are witnessing in the case of the forty-spotted pardalote. Understanding what characteristics allow the species to persist in an area will be valuable to identifying potential reintroduction sites across its former range.

To give reintroduced populations the best chance of survival it will also be important to determine which threats are the most critical to address at reintroduction sites and what conservation actions would be most effective (e.g., fire management, predator control, reservation, biosecurity).

What we did

To achieve our research aims of securing the forty-spotted pardalote, we first assessed the key threats to the species, and then established the status of the pardalote populations in known refuges by surveying those populations using an occupancy modelling framework.

We looked at the impact of forest loss as a result of land clearing, timber harvesting and wildfire, and estimated the total area of potential habitat of the forty-spotted pardalote and the total area of habitat affected by deforestation over the past 30 years. Also, as the pardalote's current and historical distribution is highly fire-prone, we estimated the area of habitat affected by wildfire over this period, and the likely future fire risk of each refuge.

Noisy miners are not currently found in forty-spotted pardalote refuges; however, they are widespread on the Tasmanian mainland and have expanded

their range with land clearance. We modelled the suitability of habitat across Tasmania for noisy miners, and based on the findings from those models, we assessed the environmental suitability of forty-spotted pardalote refuges for noisy miners, and created a map that predicts suitable and unsuitable environments.

We assessed each threat for its likely consequences to the species, and considered the potential impacts of climate change, in the context of the likelihood of other known threats worsening.

To determine the population status of the forty-spotted pardalote, we conducted baseline surveys on the known refuges of Maria Island, North Bruny Island and Flinders Island, which together support almost 80% of the bird's current habitat area. We used occupancy modelling to estimate numbers in critical habitat for each refuge as well as in other locations with sparser data.

Forty-spotted pardalote in tree hollow. Image: Dejan Stojanovic





Key findings

We were able to establish baseline population data and to quantify the historical impacts and future potential risks of threats to the refuge populations of forty-spotted pardalotes.

Existing populations

We found that occupancy rates are very high at two refuges (Maria and Bruny Islands) but that the pardalote is almost extinct on Flinders Island, likely due to recent wildfire. Over the period of the study, we recorded the pardalote at 59 of 67 sites (88%) on Maria Island, 55 of 61 sites (90%) on Bruny Island and just 7 of 115 sites (6%) on Flinders Island. No birds were found at any previously known sites on Flinders Island; the detections were made at a new site on the island that is separated from the previously known refuge by more than 20 km of primarily agricultural land. We also found the species in a small patch of habitat near Southport on the Tasmanian mainland, where the last record of their presence in the vicinity was more than 120 years ago, although data was too sparse for modelling at these locations.

Threats

Deforestation in refuges has abated in recent decades, and these areas appear to currently support viable populations. However, according to our overall risk assessment, all refuges face high, very high or extreme risks from multiple threats (see Table 1). These are chiefly wildfire, colonisation by the hyper-aggressive noisy miner, and climate change.

Fire

Our results indicate that the islands that are serving as refuges are not

Table 1. Risk of potential threats over the next 30 years at current and former forty-spotted pardalote sites. Former sites were assessed to assist the identification of suitable reintroductions.

Location	Fire	Noisy miner colonisation	Deforestation	Climate change
Maria Island	Very high	Moderate	Moderate	Very high
North Bruny Island	Very high	Very high	High	Very high
Tinderbox	Very high	Very high	Very high	Very high
South Bruny Island	Very high	Very high	High	Very high
Flinders Island	Extreme	Low	High	Very high
Southport	Extreme	Moderate	High	Very high
Large patches of intact habitat in former range	Unknown	Low	Unknown	Very high

secure from these threats despite being extensively reserved. Fire frequency, intensity and extent are expected to increase with climate change, and as most refuge habitat excluding Flinders Island has not burnt for a long time, they are supporting a high fuel load, suggesting that severe fire is likely under suitable weather conditions.

The impact of fire on the remnant populations of the forty-spotted pardalotes has the potential to be devastating, as evidenced by the population findings from Flinders Island. Despite some forest recovery, that location is still unoccupied by the pardalote over a decade later. Given the small size of the refuges, they are all at risk of being totally destroyed, with little chance of recolonisation.

Noisy miners

We found that the environmental suitability for noisy miners is high across most of the former and present distribution of the forty-spotted pardalote; and that noisy miners are well-established less than 4 km from all refuges except Flinders Island, with the implication of risk of expansion of their range into those refuges.

Given the preference of noisy miners for fragmented environments,

their impact will depend on local forest structure; noisy miners particularly pose a potential threat to Bruny Island pardalote populations, as most occupied pardalote habitat on that island is nearby to fragmented agricultural land. The forest on Maria Island is more intact; however, extensive livestock grazing across large parts of Maria Island severely suppresses the understorey vegetation, reducing or eliminating cover, which may advantage noisy miners.

Parasitic fly

While the parasitic fly can cause high nestling mortality, the degree of this threat is as yet unknown. However, it is likely to vary in time and space according to environmental conditions, and may be exacerbated under post-fire conditions and climate change.

We conclude that the current distribution across island refuges is unlikely to secure the species from extinction. While we identified large areas of potential habitat across the species' former Tasmanian mainland range, these are likely too distant from source populations for natural recolonisation. They also are subject to the threatening processes discussed above that allow the expansion of noisy miners and other aggressive birds.



Recommendations

Our findings lead us to propose that establishing new populations of forty-spotted pardalotes via reintroduction is essential to secure the species, and that this is best achieved without delay while robust source populations still exist. Because of the current threats to refuges we believe any risks associated with translocations far outweigh the risks of not acting.

Reintroduced animals should be sourced from wild populations; wild animals are likely to have a greater chance of successfully establishing than captive-bred individuals, as even slight genetic adaptations from captivity can have a negative effect over the long term on the size of wild populations and their genetic diversity.

The most suitable reintroduction sites are in white gum forest across the species' former range. In total these areas cover more than 1100 km², about half of which occurs in patches of greater than 1 km² in area and which often form part of larger forest remnants.



Forty-spotted pardalote. Image: Henry Cook

Although this is also climatically suitable noisy miner habitat, these birds are rarely found in the intact interior of larger forest patches.

Diagnosing the processes that have led to a species' current distribution is extremely valuable because sites that have previously seen local extinctions do not necessarily remain permanently unsuitable.

Likewise, the existing refuge sites may not provide long-term security.

In particular we have identified that refuge sites are at risk from severe fires and deforestation or other habitat simplification such as caused by grazing. Management at these sites should aim to mitigate these threats.

Targeted revegetation programs may eventually increase the area that the forty-spotted pardalote inhabits, but this will not address the immediate threats to its refuges.

Cited material

Webb, M., Alves, F., Tulloch, A., Shaw, J., Bryant, S., Stojanovic, D., Crates, R. & Heinsohn, R. 2018 All the eggs in one basket: Are island refuges securing an endangered passerine? *Austral Ecology* 4(3), 523–33 (doi:10.1111/aec.12693).

Further Information

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