Science for Saving Species

Research findings factsheet

Project 2.2.3

Threatened Species Recovery Hub

National Environmental Science Programme

Conservation and management of the Endangered forty-spotted pardalote through "self-fumigation" of nests

In brief

The forty-spotted pardalote has undergone major declines and is now Endangered. Larvae of the parasitic fly (*Passeromyia longicornis*) is the primary cause of nesting failure, killing most chicks in some areas and severely hampering recovery efforts. If not addressed, this parasite could lead to the extinction of the species.

Our previous research has shown that spraying pardalote nests with a bird-safe insecticide can improve chick survival, but finding and accessing forty-spotted pardalote nests is logistically difficult.

To overcome this, we developed a technique that utilises the bird's own instinct of collecting feathers to line its nest in order to introduce the insecticide. We placed sterilised chicken feathers treated with insecticide in dispensers near nesting sites over two breeding seasons and pardalotes took these back to their nests, effectively self-fumigating.

In self-fumigated nests, 95% of hatchlings survived to fledging compared to just 8% of hatchlings in untreated control nests.

This novel technique is a highly effective and inexpensive method of reducing parasitism of chicks.

Background

The forty-spotted pardalote was once widespread across Tasmania but has suffered severe population declines and contraction of its range. It is now largely confined to two islands off the south-eastern coast of Tasmania, Bruny Island and Maria Island, and is listed nationally as Endangered.

The cause of its decline is likely a number of threats in combination. The forty-spotted pardalote's range is naturally restricted to Tasmanian forests where its preferred food tree, white gum (*Eucalyptus viminalis*), is the dominant or sub-dominant tree species, as the birds feed both on invertebrates that live in the tree foliage and by "farming" white gum manna, a sugary gum, by clipping the stalks of leaves with their beaks, causing them to exude this nutritious substance. Key threats to this dietary specialist species include loss or degradation of its white gum forest habitat, alongside competition from other birds, including aggressive invasive species such as noisy miners.

Forty-spotted pardalotes nest between August and January in tree hollows, where they build enclosed dome-shaped nests out of bark and grass, lined with soft material such as feathers or fur.

The pardalotes also make use of nest boxes where they are available, and nest boxes are an important management tool given that most remaining populations of the bird are in second-growth forest where tree hollows are in short supply.

In 2012, ANU research discovered that larvae of the native parasitic fly (*Passeromyia longicornis*) are impacting pardalote chicks. The flies are attracted to the nests where they lay eggs. When the chicks hatch, the fly maggots burrow under the skin of nestlings, feeding on their blood and causing severe mortality. In areas where the fly is most prevalent, the maggots have been found in 87% of forty-spotted pardalote nests. Nestling forty-spotted pardalotes suffer 81% mortality in parasitised nests.

Healthy forty-spotted pardalote chicks in a self-fumigated nest. Image: Fernanda Alves

Australian National University

Background (continued)

The fly is also native to Tasmania and has been recorded also parasitising four other species of bird.

Although parasites may be very costly to their hosts, from an evolutionary perspective they are not predicted to cause decline of the host population, when that population is healthy. However, when the population is small and/or declining and facing multiple other threats, as in the case of the forty-spotted pardalote, parasites can emerge as a critical threat. It is therefore crucial to find cost-effective ways to reduce the impact of the parasitic fly on the forty-spotted pardalote and boost its nestling survival rate.

A previous trial demonstrated that spraying nest boxes with a bird-safe insecticide could dramatically reduce parasitism; however, the natural tree hollows that forty-spotted pardalotes use for nesting tend to be high in the canopy, making them inaccessible to conservation managers and making the option of manual fumigation of large numbers of nests infeasible.

Research aim

We developed and tested the effectiveness of an innovative, low-cost and low-tech approach to reduce forty-spotted pardalote nestling mortality caused by the larvae of the native screw worm fly (*P. longicornis*).

Adult forty-spotted pardalote in a nest lined with fumigated chicken feathers. Image: Fernanda Alves

What we did

We used North Bruny Island as our study site because of its high prevalence of the parasitic fly *P. longicornis*. Previous research had shown it to be found in 87% of forty-spotted pardalote nests in that location. The area also contained a network of nest boxes known to be used by forty-spotted pardalotes.

Over two breeding seasons, August 2016 to January 2017 and August 2017 to January 2018, we conducted a field experiment designed to encourage the birds to "self-fumigate" their nests. We exploited the way forty-spotted pardalotes line their nests with feathers to introduce a commercial bird-safe insecticide (composed of Permethrin, Piperonyl Butoxide and Methoprene) to nests via feathers.

In the trial, we placed sterilised store-bought chicken feathers treated with the insecticide in "feather dispensers" hung in trees (the treatment). The dispensers were made of double hardware mesh to hold the feathers in place and attached a cover on the dispensers to slow the degradation of the insecticide from exposure to sunlight and rain. All feather dispensers were hung in trees about 4 m from nest boxes. We compared the effectiveness to feather dispensers in which the chicken feathers were not treated with insecticide (the control).

To ensure that the results were not affected by site and/or season, we divided the study area in half. The half that received treatment feather dispensers in the 2016–17 breeding season for the first clutch received control feather dispensers for the first clutch in the 2017–18 season, and vice versa.

We also switched nests between treatment groups for each successive nesting attempt within a season. (Pardalotes have multiple broods per season.) After a nest succeeded or failed, we cleaned the nest boxes to encourage the birds to rebuild and swapped their feather dispenser from control to treatment or vice versa. The timing was very much aligned between individual nests, both for when they were built by the birds and for their date of success/failure, so it was possible to switch groups of nests between experimental treatments with no risk of overlap.

Examining a nest box used by forty-spotted pardalotes on North Bruny Island for the presence of the parasitic fly. Image: Fernanda Alves

Key findings

- Our key finding was that making insecticide-treated feathers available to forty-spotted pardalotes was highly effective at facilitating "self-fumigation" by exploiting the natural behaviours of the species.
- The simple and low-cost method substantially boosted fledging success in self-fumigated nests; 95% of hatchlings survived to fledging in the treatment nests compared to just 8% of hatchlings in the control nests.
- The technique resulted in an immense improvement in the reproductive success of this Endangered pardalote, while avoiding many of the disadvantages of more intrusive, less feasible and more expensive techniques such as manually spraying nests. Manual spraying involves a significant time investment to locate and access nests in tree hollows, and often requires challenging tree-climbing. By contrast, in self-fumigation, the feathers are deployed just above ground level, so that no tree-climbing is necessary.
- Our results found that self-fumigation is not only substantially more cost-effective than manual spraying and also more effective. An earlier trial involving manual spraying forty-spotted pardalote nests with insecticide resulted in 89% survival of hatchlings to fledging. Our self-fumigation experiment yielded a 6% improvement on nestling survival. The survival rate of control nests in both studies was the same, at 8%.
- In the self-fumigation trial, the forty-spotted pardalotes made heavy use of the chicken feathers from the dispensers when constructing their nests, both as lining for the nest cup itself and also as a more general construction material. The higher survival rate found in our self-fumigation study than in the spray trial might reflect the use of treated feathers as a nesting material within the nest interior, which is likely to be a more effective defence against the parasitic fly larvae than spraying outside the dome. The nest cavities naturally protect the insecticide from degradation by sunlight and rain.

Setting up the self-fumigation experiment with chicken feather dispensers. The birds made heavy use of the feathers from these dispensers. Image: Fernanda Alves

Construction of the feather dispensers costs approximately $8 per unit plus one hour of assembly and deployment time. This is such a low-cost approach that it may be feasibly deployed at large enough scales to be suitable as an effective conservation tool for the Endangered forty-spotted pardalote.

Conservation actions can be criticised for not considering the importance of parasites to healthy ecosystems. However, parasite control is justifiable in the case of the forty-spotted pardalote, as it has been reduced to small and isolated populations that are experiencing the ill effects of cumulative threatening processes, especially habitat loss and limited availability of nesting sites. Moreover, the parasite *P. longicornis* is a generalist that exploits the nestlings of other Tasmanian bird species, so control of it is unlikely to have a negative conservation impact on its populations, as other host species are available.

Below: A nest box lined with fumigated chicken feathers. The method is not only simple and low-cost, it utilises the natural behaviour of the Endangered forty-spotted pardalote. Image: Fernanda Alves

Implementations and recommendations

The natural behaviour of forty-spotted pardalotes can be used to facilitate self-fumigation of nests. By hanging dispensers filled with feathers treated with a bird-safe insecticide near forty-spotted pardalote nests, the birds themselves will take the insecticide back to their nests and incorporate it though the nest structure.

This method was found to be highly effective at improving chick survival in areas impacted by parasitism. The method is also simple and low-cost, further recommending it as a suitable tool for conservation managers.

Our results may have implications for many threatened bird species, because parasitic flies are widespread and affect a large range of species. The dispensers and nesting material could be tailored to suit the ecology of many other bird species as well as nest-building mammals that are also afflicted by parasites – for example, by deploying the dispensers on the ground or using different nesting material.

This study also demonstrates the benefit that can be gained by working with and utilising the natural behaviours of a threatened species when approaching a seemingly insurmountable conservation problem.

Cited material

This factsheet summarises key findings from:

Alves, F., Langmore, N., Heinsohn, R., Stojanovic, D. (2020). "Self-fumigation" of nests by an endangered avian host using insecticide-treated feathers increases reproductive success more than tenfold. *Animal Conservation*. doi:10.1111/acv.12627

Further information

Fernanda Alves
fernanda.alves@anu.edu.au

We used double hardware mesh for the dispensers and attached a cover to slow degradation of the insecticide from the elements. Image: Fernanda Alves

Australian Government

Threatened Species Recovery Hub
National Environmental Science Programme

This project is supported through funding from the Australian Government's National Environmental Science Program.