

Out of the box

Designing nest boxes for conservation success



Threatened
Species
Recovery
Hub

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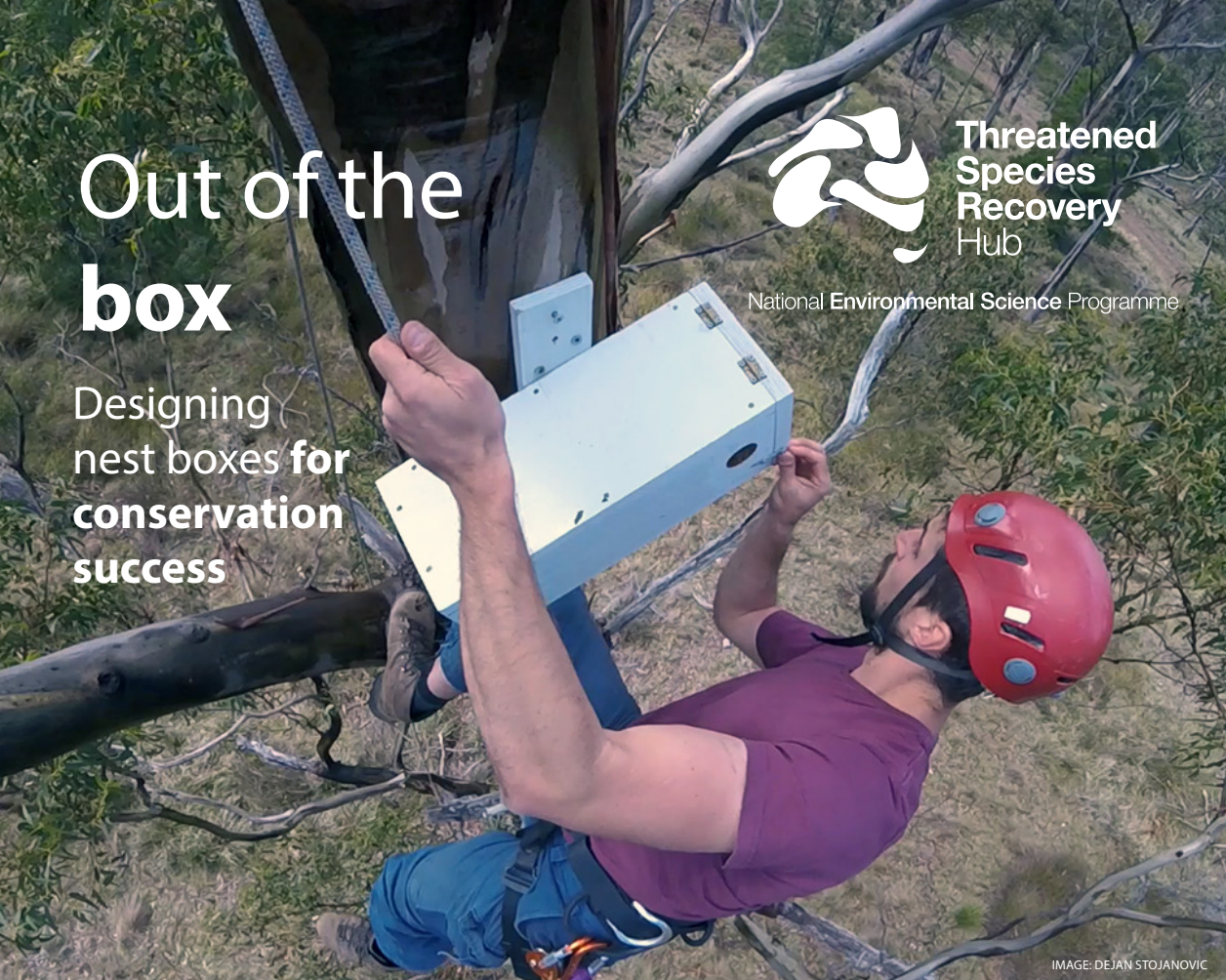


IMAGE: DEJAN STOJANOVIC

ABOVE: Dejan Stojanovic checks a swift parrot nest box mounted 20m up a tree.

Many of our threatened birds and arboreal mammals rely on tree hollows for nesting, but because we've cleared most of our big, old trees, these hollows are in short supply. Nest boxes are commonly proposed as an alternative, but do they actually provide an appropriate housing solution for our threatened species? **Rachel Robbins** from the Australian National University examines four case studies on our successes and failures with nest boxes.

A safe box for swift parrots

It's estimated there are only 2,000 mature swift parrots (*Lathamus discolor*) left in the wild. This Critically Endangered native bird is in desperate need of a little help, especially when it comes to safe nesting hollows.

Each year these slim, medium-sized green-and-red birds migrate from the Australian mainland to Tasmania to breed. Swift parrots need tree hollows to breed, however with the loss of suitable nest hollows due to land management, in particular forestry, the parrots are facing a life-threatening housing shortage. Population modelling by the TSR Hub suggests that without intervention the bird faces extinction by 2031.

To further complicate conservation efforts, Hub researchers Rob Heinsohn and Dejan Stojanovic have [discovered](#) that sugar gliders are preying on nesting swift parrots. A much loved native species on the mainland, sugar gliders are not native to Tasmania, and their introduction has had disastrous consequences for swift parrots. The small possums are just the right size to access the high, deep nesting hollows of the parrots. Once inside, the sugar gliders devour both the adult female, her nestlings and eggs.

During his PhD, Stojanovic uncovered the shocking impact that sugar gliders are having on the swift-parrot population. Swift parrots follow floral resources, breeding in different locations each year. Stojanovic's research has shown that when breeding occurred in areas with sugar gliders, 83% of the nesting females were killed during the breeding season, while

none were killed when breeding occurred on Bruny Island (which is free of sugar gliders).

"Swifties and gliders actually share a lot of the same habitat requirements," explains Stojanovic. "They both nest in tree hollows, they both feed on nectar, and they both like old-growth habitat."

However, there are glimmers of hope. Heinsohn and the swift-parrot research team have been trialling nest boxes and artificial tree hollows as potential nesting sites for the birds, and have demonstrated they can work.

But how might these nest boxes be configured to protect nesting swift parrots from the nocturnal raids of sugar gliders? With the help of an electrician, Stojanovic thinks he may have found the solution.

"We've designed "possum-keeper-outer" (PKO) nest boxes," he says. "In this version, a door closes behind the parrot once darkness falls.

"Effectively, it's just a little motor and a light sensor. As soon as it's daytime the sensor automatically detects that there's ambient light and it will open the door to release the parrot to go about their business.



IMAGE: DEJAN STOJANOVIC

A clutch of swift parrot nestlings in the bottom of a nest box. In some situations nest boxes can provide critical habitat for threatened species.



A good night's rest was had by all swift parrots sleeping within – the sugar glider is blocked from entering a nest box by the PKO (Possum Keeper Outer).

"Then, as the light fades at the end of the day and the swift parrots are back in the box, the sensor triggers the door to close for the night."

The new PKO boxes need to be sturdy says Stojanovic because the possums really want to get into them after dark. But he is confident the new design is a potential winner.

"We trialled PKOs on swift parrots last year to check if the birds are disturbed by the light-

triggered door," says Stojanovic. "We we were thrilled to find they didn't mind the machinery at all."

At \$400 a nest box, the price on protecting the swift parrot remains a significant barrier. At the end of October last year the swift-parrot team launched a crowd-funding campaign (titled 'Operation Possum Keeper Outer') to raise \$40,000 to cover the costs of installing 100 nest boxes to protect the parrots this season. Community support was critical to enabling fast action to protect this irreplaceable species during this year's breeding season.

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Offset fails to tick the box

Biodiversity offsetting aims to mitigate (or offset) the adverse impacts of human activities on biodiversity in one area by improving biodiversity value in another area. In theory gains should equal losses so there is no net loss. Despite being widely applied across Australia, the impacts of biodiversity offsetting are rarely evaluated.

TSR Hub researcher David Lindenmayer and colleagues embarked on [a four-year case study](#) examining the impacts of a biodiversity offset which established nest boxes to compensate for the losses of natural tree hollows caused by the widening of sections of the Hume Highway (the road linking Sydney and Melbourne).

The expansion of the Hume Highway resulted in the clearing of nationally endangered temperate box gum grassy woodland which provides habitat for three (NSW listed as vulnerable) threatened species: the squirrel glider (*Petaurus norfolcensis*), brown treecreeper (*Climacteris picumnus*) and superb parrot (*Polytelis swainsonii*). The biodiversity offset was targeted to provide habitat specifically for these three threatened species.

Over four years of monitoring, the researchers found the nest boxes weren't used much by the target species. For example, of the 324 nest boxes which were checked around ten times each over the monitoring period, there were no records of use by superb parrots, and only two by brown treecreepers and seven by squirrel gliders.

The inevitable conclusion from the monitoring was that the offset was clearly not effective in



compensating for the loss of hollow-bearing trees and the 1:1 offset ratio (ie, one nest box for each tree hollow lost) was inadequate because it did not account for the risk of the boxes not being used. Improving offset ratios could lead to greater success in future offsetting programs.

Eight percent of the nest boxes also fell out of trees or were stolen in the four year monitoring period. Given that trees are usually 80 to 120 years old before they form tree hollows, it is fair to assume that most nest boxes would therefore fail before new hollows formed. This highlights the need for any nest box program to include a long-term and adequately resourced program of monitoring and maintenance.

The main takeaway message from this case study is the distinction between offset

Researchers conducted 3,000 checks of the nest boxes along the Hume Highway in southern NSW.

compliance and offset effectiveness. In Australia, it is not mandatory that offset effectiveness is assessed. As a result, offset programs can be considered compliant at implementation, but there is no expectation that the effectiveness of these offsets will be monitored after implementation.

Nest boxes alone were inadequate in providing habitat equivalent to the tree-bearing hollows which were lost because of the development. Offset programs need to go further than simply ticking compliance check-boxes and provide measurably effective outcomes for biodiversity.

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Putting the heat on nest boxes

Nest boxes are often advocated by people wanting to create a little bit of habitat for wildlife. Some wildlife care groups, for example, recommend installing nest boxes out in the garden so possums use the boxes rather than invading the roof spaces of houses. It's a nice idea but do nest boxes provide the protection that wildlife need? Natalie Briscoe from the TSR Hub was part of a team that looked into whether nest boxes provided thermal protection. [Their study](#) measured the temperature suitability of nesting boxes for four different species of possums.

The researchers compared the temperatures in nest boxes against those in tree hollows during summer and winter to see which ones provided the best living conditions across the seasons.

Temperatures inside the nest boxes fluctuated greatly compared to tree hollows. This is because the nest boxes responded strongly to changes in solar radiation and outside temperature whereas the tree hollows were generally better insulated. On average, nest



Paired tree hollow and nest-box from the study of den thermal suitability in the Strathbogie Ranges. Tree hollows are generally better insulated.

boxes were 8°C warmer than tree hollows in summer (with a maximum temperature of 52°C recorded in nest boxes, compared to 38°C in tree hollows) and 3°C warmer in winter.

In summer, possums seek shelter so they can cool their bodies down, avoiding heat-stress and dehydration which can lead to death. Briscoe and colleagues found that large species like common brush tails and common ringtails needed to lose up to 2.4 times more heat to

remain cool in nest boxes than tree hollows. In winter, nest boxes were beneficial because their warmer temperatures reduced the amount of energy possums needed to expend to keep warm.

They concluded that nest boxes do not match the performance of tree hollows in summer, but they can be valuable over the winter months. While nest boxes can in some cases provide a habitat solution for our native species, it's clear that we need to start thinking outside the box when designing nest boxes.

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Judging a box by its cover

Natalie Briscoe and colleagues were part of a team that has been investigating whether we can improve the functional performance of nest boxes. They wondered what difference surface reflectance would have on the temperature inside nest boxes if the outsides of the boxes were painted in different colours.

The team tested three different coloured nest boxes (white, light-green, and dark-green) to see if the colour of the nest boxes had an effect on the internal temperature they maintain.

[Their study](#) found that light coloured boxes were the best at reflecting heat during summer and dark coloured boxes absorbed heat well in winter. Other factors including box design, placement, and the amount of shade boxes received also influenced the internal temperature of the nest boxes.

These conclusions have important implications for the use of nest boxes as a conservation tool. Conservation managers considering the implementation of nest boxes programs need to give careful consideration to design, colour, placement and shade profile of nest boxes.

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Whose house is cooler? Turns out it's the light green nest boxes on the tree on the right (in this case, boxes for bats). Which probably means light green is better in the summer but the warmer dark green boxes might be more suitable in winter. (IMAGES: STEVE GRIFFITHS)

Key messages

Achieving a conservation outcome is not as easy as simply putting up a nest box. Different species and situations require tailored solutions

In some cases, nest boxes can assist with threatened species, as with the swift parrot.

In other cases focusing on compliance and ignoring the effectiveness of nest boxes, as in the case of the Hume Highway offset, results in little being achieved.

Nest boxes do not replace tree-hollows, however, creative approaches to designing nest boxes and pairing nest boxes with other conservation strategies could greatly improve their value as a habitat resource.