Science for Saving Species

Research findings factsheet

Project 2.2.2



Sex ratio bias in swift parrots due to sugar glider predation and implications for population viability

In brief

The swift parrot is listed as Critically Endangered under the EPBC Act and is in rapid decline.

While swift parrot females are sitting on eggs or chicks within nesting tree hollows they are highly vulnerable to predation by sugar-gliders where the ranges of these two species overlap. Intense predation of nesting females in these areas has led to biased sex ratios. It is estimated that fewer than 1000 individual swift parrots remain, and overall 73% are estimated to be male. The swift parrot is naturally socially monogamous, but as there are now estimated to be roughly three males for every female, harassment of already paired females by single males has become substantial. We found that half (50.5%) of nests now have multiple fathers and this shared paternity is associated with reduced reproductive fitness in the species. Interference of nesting females by unpaired male swift parrots appears to be reducing the number of chicks that successfully fledge per nest. Other key threats to the species include deforestation, habitat degradation from altered fire regimes, timber harvesting, and climate change. Urgent and targeted management is needed to prevent the extinction of the species and will require coordinated protection of the species breeding and foraging habitat and management, where possible, of introduced nest predators.





BELOW: Figure 1: Forest loss/disturbance in Tasmania between 1996 and 2016 (red) and potential swift parrot breeding range (yellow line). Forest loss was estimated from the Global Forest Cover change layer.

Background

The swift parrot (Lathamus discolor) is listed as Critically Endangered under the Environment Protection and Biodiversity Conservation (EPBC) Act 1999. The swift parrot has been a species of conservation concern since the 1980s. A national recovery plan for the species was prepared in 2002, which was adopted under the EPBC Act. The extinction risk for this species is currently very high. An assessment in 2018 found that there was a one in three (31%) probability that swift parrots would be extinct within 20 years.

The species is in rapid decline due to a range of factors, including ongoing clearing of high-quality breeding and foraging habitat, nest predation by sugar gliders (*Petaurus breviceps*), and habitat degradation from altered fire regimes, timber harvesting and climate change.

Swift parrots breed in Tasmania in summer, and migrate to woodlands across south-eastern mainland states for the rest of the year. They feed mostly on the nectar of eucalypt flowers. Across their range, swift parrots follow flowering pulses in their favourite food trees. Climatic variations can result in wide variations in blue gum flowering from year to year. This means that an area that is suitable one year may not be suitable for several future years, and that swift parrots require large amounts of habitat over the long term. As variations in blue gum flowering are hard to predict, the movements of swift parrots are also hard to predict.

Swift parrots have highly specialised requirements for breeding: the co-occurrence of preferred flowering eucalypts for food, and tree hollows suitable for nesting.



Substantial areas of the swift parrot breeding range overlap with areas used by the timber industry, and have been lost or disturbed due to timber harvesting, clearance and conversion, and fire. Population declines due to habitat loss, and degradation of habitat can substantially exacerbate the impact of other threats, such as sugar gliders.

Predation by sugar gliders, which were introduced to Tasmania from the Australian mainland as early as the 19th century, is a key threat to the swift parrot. We monitored 70 nests in seven regions across three breeding seasons (2011–12) and found that sugar gliders eat eggs and young nestlings, and commonly kill the female parrot.

However, the actual predation rate varies greatly depending on which region the swift parrots nest in. On Bruny and Maria Islands, where sugar gliders are absent, there was no predation, while 44% of mainland nests were predated by sugar gliders, and in 83% of these cases the mother parrot was also killed and eaten.

The actual predation rate at mainland breeding sites varied substantially and was influenced by the level of mature forest cover. At sites with low forest cover, 100% of monitored nests were predated, while at sites with higher forest cover survival was much higher.

Due to intense predation of nesting females by introduced sugar gliders, swift parrots have a strongly malebiased population. Skewed sex ratios can lead to harassment of the rarer sex which can in turn lead to their reduced fitness. It can also lead to changes in mating patterns. This can have potentially severe impacts for population viability and stability of a species but had not been previously examined for swift parrots.

Research aims

We aimed to investigate factors affecting reproductive success in swift parrots and the implications of these for the long-term conservation of the species, including population viability.

In particular, we examined whether the male-biased population of swift parrots has led to greater competition for females and, consequently, changes in the mating system of the species.

This is part of a broader program of research aimed at reducing the very high extinction risk for swift parrots.

What we did

Over six years (2010–16) we collected genetic samples of 371 nestlings from 85 nests across a range of forest types over most of the breeding range. We undertook DNA extraction and genetic analysis to classify genetic relatedness and used two techniques for detection of multiple paternity.

We compiled the mortality rates of nesting females due to predation by sugar gliders across the Tasmanian breeding range of swift parrots. We measured fledging success for all monitored nests as the number of nestlings expected to fledge.

We undertook population viability analyses to examine the relationship between predation, sex ratio bias and extinction risk in the swift parrot.



Key findings

The predation of nesting females by introduced sugar gliders has led to changes in the mating patterns of the swift parrot. These changes in turn have implications for individual fitness, and long-term population viability of swift parrots.

The main findings are:

- Less than 1000 individual swift parrots remain, and overall 73% of these are male.
- 50.5% of swift parrot nests had shared paternity overall, although the birds remained socially monogamous. Shared paternity increased significantly

according to the rate of predation of breeding females, suggesting that rates of shared paternity increased when the adult sex ratio became more male-biased – i.e., on mainland Tasmania.

- This rate of shared paternity is unusually high compared to most parrot species. Although we do not know the extent of shared paternity before the introduction of the sugar glider, it is likely that the consistently male-biased adult sex ratio further promotes this form of mating in swift parrots.
- Shared paternity is associated with reduced reproductive success in the species.
- Nests that had shared paternity produced fewer fledglings. This could be a result of interference during the nesting period by unpaired male swift parrots.
- Modelling predicted that the population would decline by 89.4% over three generations if the birds maintained the lowest observed rate of shared paternity and by 92.1–94.9% under higher rates of shared paternity.



Implications and recommendations

The swift parrot is one of Australia's most imperilled birds and is experiencing ongoing rapid decline. It is listed as one of the 20 Australian birds most at risk of extinction in the next 20 years.

In contrast to other threatened species, the swift parrot is wellstudied, and the relative contribution of key threats is also well understood. The most important management actions required to halt swift parrot declines and reduce extinction risk are to:

- protect breeding and foraging habitat in Tasmania
- protect woodland foraging sites on the mainland, particularly spotted gum forests in the New South Wales south coast
- investigate measures to reduce impacts from sugar gliders at

key mainland breeding sites (but this may be impossible)

• ensure that islands remain sugar glider–free.

Measures to limit the impact of sugar gliders will reduce female mortality and increase reproductive rates via higher rates of monogamy, and are considered an important conservation action for swift parrots.

Cited material

Heinsohn, R., Olah, G., Webb, M., Peakall, R. & Stojanovic, D. 2018 Sex ratio bias and shared paternity reduce individual fitness and population viability in a critically endangered parrot. *Journal of Animal Ecology* 88, 502–510.

Further Information

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Cite this publication as NESP Threatened Species Recovery Hub. 2021. Sex ratio bias in swift parrots due to sugar glider predation and implications for population viability, Project 2.2.2 Research findings factsheet.