Science for Saving Species

Research findings factsheet

Project 2.2.1

Threatened Species Recovery Hub

National Environmental Science Programme

Saving the orange-bellied parrot

Part 2: Traits of captive-bred birds and implications for conservation

In brief

The migratory orange-bellied parrot is one of Australia's most imperilled species. The release of captive-bred orange-bellied parrots has been a key management actions implemented to date, but has proven inadequate at reversing population declines for the species. This research investigated if traits of captive bred orange-bellied parrots have deviated from wild birds and the implications for conservation.

Key findings include:

- Of 17 nesting attempts monitored, wild bred pairs had double the breeding success (fledglings and eggs) compared to pairs with captive-bred females (64% vs 26%).
- Captive-bred females produce comparable clutch sizes, but with higher rates of infertile eggs, and with significantly fewer hatchlings.
- We found no evidence that body mass of orange-bellied parrots changes with increasing generations in captivity.
- We found differences in the wing shape and feather condition of captive-bred birds which would be expected to make captive-bred birds less suited to fast, long-distance flight and may affect the ability of captive-bred birds to undertake the migration to the Australian mainland.

Background

The orange-bellied parrot is one of Australia's most threatened species.

The parrot is migratory, breeding at a small single site at Melaleuca, Tasmania in summer, and migrating to coastal regions of mainland south-eastern Australia in winter.

The orange-bellied parrot has been a cause of conservation concern since the 1970s. It was the first threatened species in Australia to have a recovery team (formed in 1983), recovery plan (prepared in 1984) and emergency plan (prepared in 2010).

The orange-bellied parrot is subject to intensive conservation management, because the wild population is perilously small, with the most recent population estimate being 50 mature individuals. There is low survival of adult females and juveniles of both sexes, and a high reliance on supplementation from the captive population to prevent imminent extinction in the wild.

An insurance captive population for the orange-bellied parrot was established in 1986. This captive population was intermittently augmented with individuals from the wild between 1987 and 2009.

Captive-bred orange-bellied parrots have been repeatedly released to supplement the wild population at Melaleuca Inlet, but this effort has not had a lasting positive impact on the wild population, or improved migration rates for the species.

Captive-bred populations of animals are subject to novel selective processes and divergence from the wild source population. This can create problems for animals released into the wild. Captive animals that have different traits to wild animals may have impaired fitness after release.

Until recently, there has been no targeted research to assess adaptations to captivity, or whether captivity is compromising individual traits critical to survival in the wild.

Female orange-bellied parrot. Image: JJ Harrison CC BY-SA 3.0 wikimedia commons

Australian National University · Charles Sturt University · The University of Sydney · Tasmanian Government · Zoos Victoria (Werribee, Melbourne, Healesville)

Main aim of research

The main aim of the research was to investigate traits of captive-bred orange-bellied parrots and the implications for conservation. In particular we set out to:

1. Compare the reproductive success of captive bred vs wild bred individuals
2. Assess whether body mass can be used as a proxy for detecting morphological adaptation to captivity
3. Evaluate whether the wing shape of captive orange-bellied parrots is different to that of individuals in the wild.

We assessed these traits in terms of possible divergence of traits from the wild population, and whether any changes could pose a liability for animals released into the wild.

Orange-bellied parrots breed in forests on the west coast of Tasmania dominated by Smithton peppermints, (Eucalyptus nitida)*. Image: Natalie Tapson Flickr CC BY-NC-SA 2.0*

Landscape burned for orange-bellied parrots. Image: Dejan Stojanovic

What we did

Reproductive success of captive-bred vs wild-bred orange-bellied parrots

We compared the fecundity of captive-bred and wild-bred individuals by recording the number and fertility of eggs, number of hatchlings and fledglings at nest sites. We observed nesting attempts by:

- wild-bred females with wild-bred males (2 pairs)
- captive-bred females with wild-bred males (13 pairs)
- a captive-bred female with a captive-bred male (1 pair)

Evaluation of body mass as a useful measure of adaptation to captivity

We collated data on 374 captive-bred orange-bellied parrots from Taroona Wildlife Centre. Body mass was used as an index because this data is available for most individuals born in captivity, and is likely to be repeatable between observers. We collected information on individual body mass and other variables (mean mass of the individual's mother over her lifetime, maternal lineage, year of birth, number of offspring produced, number of generations in captivity and sex of the individual) and compared the relationship of these factors to adult mass.

We tested the prediction that body mass would change over successive generations in captivity.

Differences in wing shape – captive and wild birds

Changes in wing shape arising from captivity may affect survival in the wild if flight efficiency is impaired. We investigated wing shape of 201 orange-bellied parrots, comprising 147 captive-born, 54 wild-born animals, sourced from the two captive populations and various museum collections. We measured all specimens with folded wings using electronic calipers to the nearest 0.01 mm and a thin, soft plastic ruler (1 mm). We undertook an analysis of wing shape, using a method which considers the size, roundness or pointedness and concavity or convexity of the trailing edge of the wing. We then undertook a multi-variate analysis to determine whether the wings of captive-bred birds were different to those of wild-born birds.

Key findings

Reproductive success of captive-bred vs wild-bred orange-bellied parrots

Of the 17 nesting attempts monitored, the success of wild bred pairs had double the breeding success (fledglings and eggs) compared to pairs with captive-bred females (64% vs 26%).

Captive-bred females produce comparable clutch sizes, but with higher rates of infertile eggs, and with significantly fewer hatchlings.

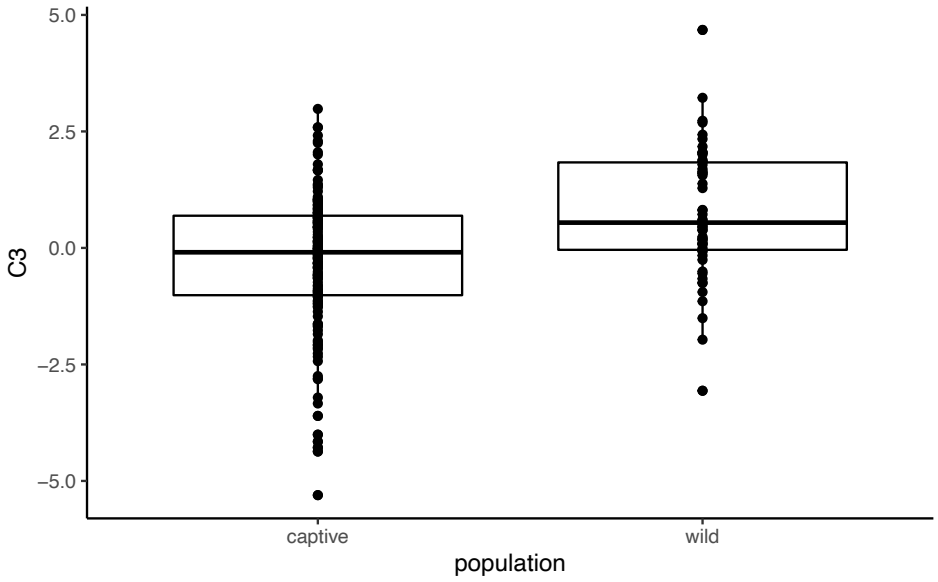
Evaluation of body mass as a useful measure of adaptation to captivity

We found no evidence that body mass of orange-bellied parrots changes with increasing generations in captivity.

Differences in wing shape – captive and wild birds

Our analysis revealed there are differences between the wings of captive- and wild-bred orange-bellied parrots. We found that captive-born adult orange-bellied parrots have shorter distal flight feathers, and longer proximal flight feathers, compared to wild-born birds (Figure 1). These changes result in a more convex trailing edge to the wing, and a more proximal wing tip in captive birds, feathers which are less suited to fast, long distance flight. The combination of poor feather condition in some captive-bred birds, coupled with the changes to wing tip shape, may affect the ability of captive-bred birds to undertake the migration to the Australian mainland.

The reasons for the differences in wing shape of the captive population is currently unclear. It is possible that wing shape in captivity may depend on a combination of heritable and environmental factors.



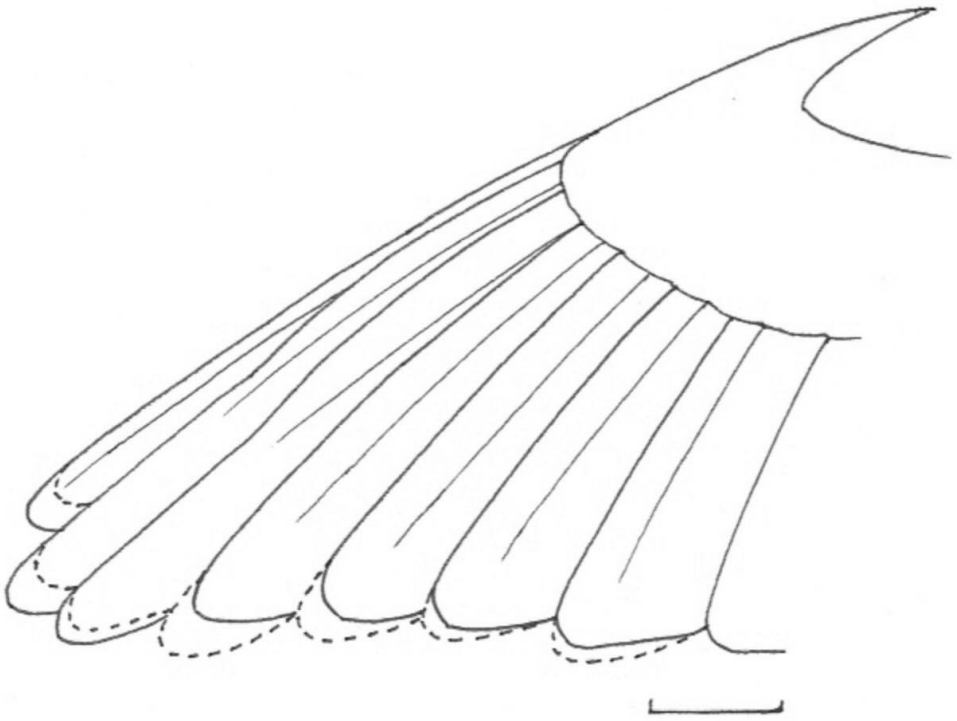


Figure 1: *Box plot showing the features of wing concavity for wild-and captive-born orange-bellied parrots. The illustration shows the extremes of very high (solid lines) and very low (dotted lines) of wing concavity on an outspread wing. Captive-born birds have a more convex trailing edge to their wings compared to wild-born birds.*

Implications

The release of captive-bred orange-bellied parrots has been a key focus of the management actions implemented to date, but has not reversed population declines for the species. The relatively high rates of infertility of released captive-born birds highlight that the quality of captive birds released to the wild is crucial to the success of reintroduction aims.

The findings of these studies highlight that:

- Increasing the number of captive-bred birds released to the wild (during spring) will remain a key recovery action for the species. Increasing the number of captive-bred individuals released to the wild, in order to correct the sex ratio in the population and increasing the number of nests initiated in the wild. Releases should be undertaken in spring.
- Body mass is not a useful measure of adaptation to captivity in the orange-bellied parrot.
- Ongoing monitoring of captive populations is essential for the early identification of morphological changes that may impair wild survival. Traits of interest may include changes in bill shape, gut morphology, song learning and foot/leg morphology, and warrant closer consideration.

This project also addressed major gaps in knowledge about 1) habitat suitability and management for the wild population; and 2) new targeted interventions required to prevent extinction, the findings of which are presented in separate factsheets.

RIGHT: Orange-bellied parrot in front of a nestbox with a young parrot emerging. Photo: ANU

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Further Information

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