

## Post juvenile moult and associated bare part changes in Star Finches (*Neochmia ruficauda*) in the Wyndham region of Western Australia

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**Abstract.** This article reports the transition from juvenile to adult plumage in a population of Star Finches in the Wyndham district of the Kimberley region, Western Australia. Here, Star Finches are reported to take several months to undergo post-juvenile moult and do not breed in their first year post fledging.

**Keywords.** Star Finch, banding study, post juvenile moult

### Introduction

Juvenile Star Finches (*Neochmia ruficauda*) differ greatly from adults in both plumage and bare part colour. Like several other estrildid finches, fledglings have a dark bill and are predominately brown in colour. A year later, they have bright red heads and bills, olive throats spotted with white, yellow bellies, and olive-green backs. Yet most descriptions and illustrations of this species describe an adult or a recently-fledged juvenile and pay scant attention to the changes that occur during the transition from juvenile to adult plumage – the post juvenile (first pre-basic) moult (Higgins *et al.* 2006).

Previously there has been little investigation into Star Finch biology in the Kimberley region. A study on morphology and foraging was conducted by Todd (2003) in Kununurra, 100 km away from the site of this study in the area around Wyndham. However, the Kununurra study site was in/near an extensive irrigated agricultural area which provided birds with access to fresh grass seed for most of the year. In contrast, the population of Star Finches in Wyndham are reliant on wild food sources. This study therefore records the transition of juveniles to adulthood in a ‘natural’ way. It reveals that, unlike some other members of the Estrildidae, such as Zebra (*Taeniopygia guttata*) and Long-tailed Finches (*Poephila acuticauda*), Star Finches take several months to undergo post-juvenile moult and do not breed in their first year post fledging (Higgins *et al.* 2006).

### Methods

Star Finches were caught in mist-nets erected at locations along water courses, at drinking sites and at night-time roosts on the margins of the King River (15°33'12"S, 128°08'44"E) and Parry Creek floodplains (15°35'37"S, 128°16'9"E) near Wyndham. Banding commenced in early May 2009 and late April 2010, and continued until mid-September in both years. It was discontinued when hot weather conditions made it difficult to catch Star Finch flocks safely and juveniles became difficult to distinguish from adults whose bright red heads had reduced in extent and bills darkened after breeding.

Each individual captured was banded on the right tarsus with a numbered metal band from the Australian Bird and Bat Banding Scheme (ABBBS). Juveniles were distinguished from adults on the basis of plumage and bill colour (Higgins *et al.* 2006). The bill colour, eye colour, moult, and plumage of all juvenile birds captured were examined. Primary moult was scored according to the ABBBS conventions in Lowe (1989). Birds were considered to be actively moulting if one or more of the primary feathers was less than fully grown. In September 2010, 161 juveniles were also examined for the presence of moult in secondary wing feathers and spots on their upper-tail coverts.

In 2009, after capture of the first 65 juveniles, it became apparent that the changes in each bird's bill, eye colour, and plumage were occurring in a similar progression. To facilitate a standardised method of

recording these changes, a system was designed to identify each individual as being at one of five stages. The specific descriptors used to identify each stage, illustrated in Figure 1, were:

Stage 1. Bill black/dark brown; gape white and fleshy; eye dark; plumage brown.

Stage 2. Bill slightly pinkish; gape trace of white only; eye chestnut; plumage brown.

Stage 3. Bill pinkish; eye orange; head pale brown, no red or white spots on head or neck.

Stage 4. Bill bright pink; eye orange, trace of red feathers on head and/or white spots on neck; yellowish belly.

Stage 5. Many red feathers on head and white spots on neck (i.e. colour in more than 5 places).

## Results and Discussion

One thousand five hundred and forty-four juvenile Star Finches were captured from May-September 2009 and April-September 2010. Of these, 289 were recaptured whilst still juvenile, 49 more than once (Table 1).

### Body moult and bare part changes

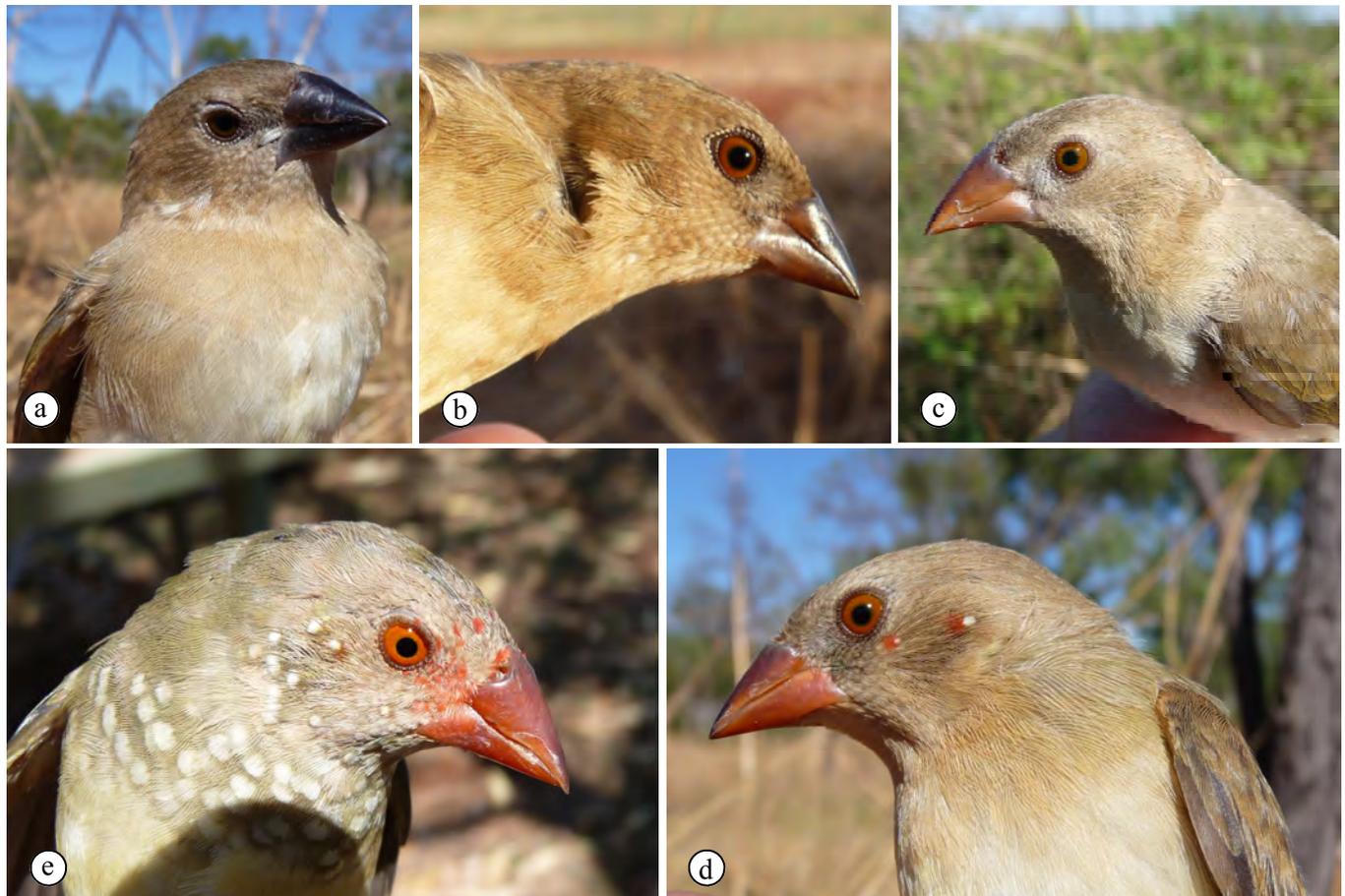
Free-flying juvenile Star Finches appeared in late April

2009 and 2010 (Lewis 2010). Analysis of plumage and bare part changes revealed a steady change in their appearance (Figure 2). In May and June the majority of birds had dark (stage 1 or 2) plumage, with only a small percentage (9.2%) beginning to get coloured spots on their heads and throats. By July only a few birds (3.8%) had the dark bill and white gape of recently fledged juveniles; the majority (96.2%) had bills that were turning pink and over a quarter (32.8%) also had red or white spots starting to appear on their heads and throats. By September nearly all birds (94.3%) had pink bills and the majority of birds had spotted heads or throats (76.9%).

Despite having dark bills and the trace of a white gape, 14% of the 517 individuals captured with Stage 2 plumage also had a few red or white spots on their heads or throats. Seven of these 65 birds were recaptured as adults. All were male, indicating that the early acquisition of coloured plumage may be a means of identifying some juveniles as males.

### Upper-tail covert moult

Juveniles with Stage 1 plumage have plain dark red tails and upper-tail coverts. Adult tail feathers are also plain red, but the outer end of the upper-tail coverts have a large white spot with a dark red surround



**Figure 1.** Plumage and bare part transitions in juvenile Star Finches. Stage 1 (a); Stages 2-5 (b-e). (Photographs: J. Lewis).

**Table 1.** Number of juvenile Star Finches captured and recaptured.

Year	No. juveniles captured	Recaptured once	Recaptured twice	Recaptured three times	Recaptured four times
2009	706	151	32	8	1
2010	838	89	8	0	0

**Table 2.** Percentage of juveniles with white spots on their upper-tail coverts in September 2010.

Stage of body moult	Stage 2	Stage 3	Stage 4	Stage 5
% with spots on tail coverts	9	17	80	97
<i>N</i>	11	36	55	59

(Figure 3). Examination of 161 juveniles in September 2010 revealed that 97% of individuals with stage 5 body plumage also had at least one white spot on an upper-tail covert. Birds that had not yet developed spots on their head or neck were also less much likely to have white spots on their upper-tail coverts (Table 2).

### Primary moult

The primary wing moult of 1,294 juveniles was examined. Only one in 207 (0.48%) individuals with stage 1 plumage was actively moulting. New growth in body plumage was accompanied by moult of primary feathers (Figure 4). Seventy-five percent of individuals with stage 3 body plumage had also begun to moult wing feathers. By the time birds had achieved Stage 5 body plumage, 96.3% of individuals had commenced and five individuals had completed primary wing moult.

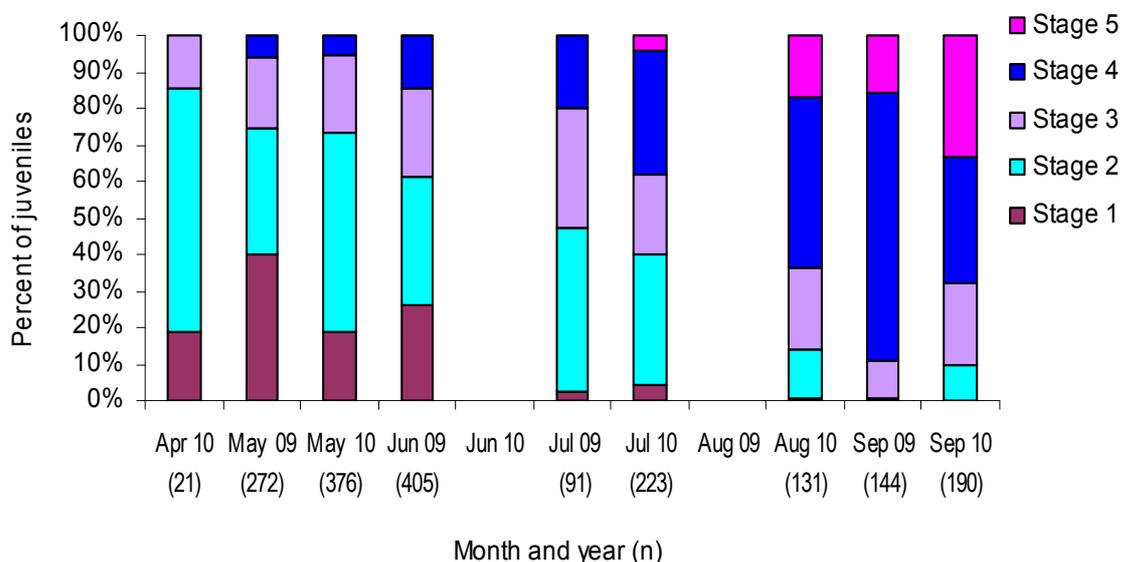
### Secondary moult

The moult of secondary wing feathers was examined in 161 juveniles in September 2010. This revealed that secondary moult never occurred before primary moult,

or before the inner two primary feathers had been moulted. In most cases secondary moult began simultaneously with the moult of P3, in fewer cases with P4 or P5. While only 14% of birds with stage 3 body moult had commenced moult of their secondary feathers, 97% of individuals with stage 5 body moult had also commenced secondary wing moult.

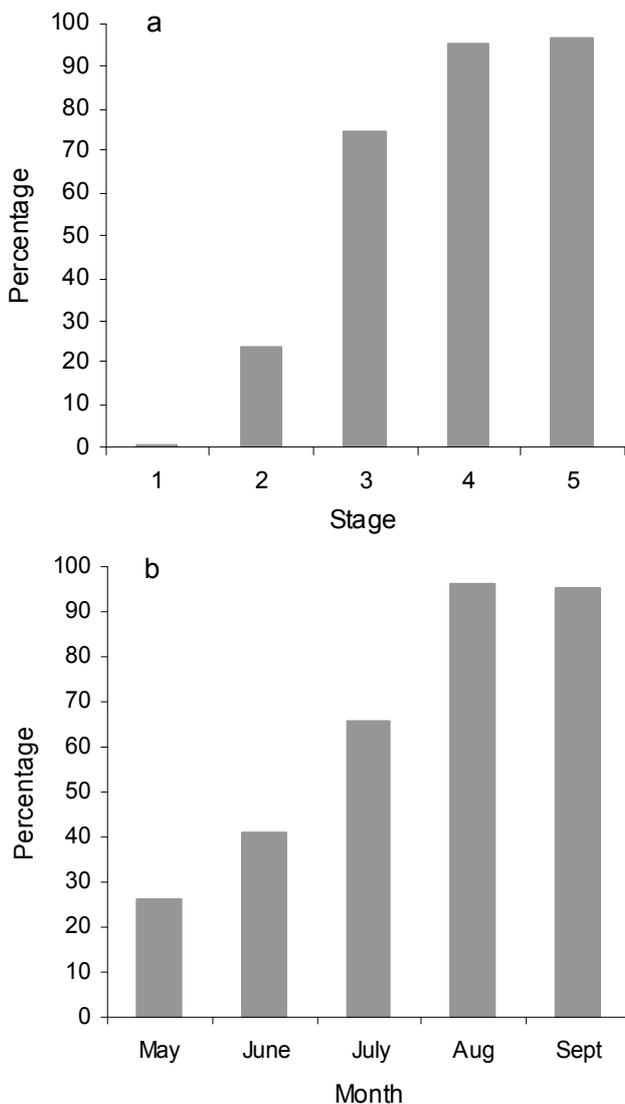
### The relationship between post juvenile moult and breeding

The breeding season of Star Finches in the Wyndham area is at the end of the wet season, in March and April, and is relatively short (Lewis 2010). No juvenile Star Finch examined had an active brood patch, and no recaptured individuals had achieved adult plumage in the first five months of their life. These results strongly indicate that, unlike some other members of the Estrildidae, such as Zebra and Long-tailed Finches, juvenile Star Finches do not have the opportunity to breed in their first year. However, of five 2009 juveniles recaptured in March 2010, four (80%) had an active brood patch, confirming that birds breed at the beginning of their second year.

**Figure 2.** Monthly changes in post-juvenile moult of juvenile Star Finches.



**Figure 3.** Tail of juvenile Star Finch that has not yet commenced post-juvenile moult (a) and adult tail (b). (Photographs: J. Lewis).



**Figure 4.** Percentage of juvenile Star Finches with active wing moult according to (a) the stage of plumage change and (b) month.

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