

## Chapter 7

### Breeding seasonality and primary moult in weavers in eastern South Africa





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### Abstract

The breeding seasonality of Village *Ploceus cucullatus*, Yellow *P. subaureus*, Spectacled *P. ocularis* and Thick-billed Weavers *Amblyospiza albifrons* in KwaZulu-Natal is fairly similar. The three *Ploceus* species have the medians of their breeding periods in November and that of the Thick-billed Weaver is in December. The length of the egg-laying season is 3.7–4.1 months in the three *Ploceus* species and 4.4 months in the Thick-billed Weaver. The breeding seasonality is similar in the Eastern Cape and former Transvaal regions, both also being summer rainfall areas, but with some more variability than in KwaZulu-Natal. In the three *Ploceus* species, duration of moult was shortest in Yellow Weavers (66 days), intermediate in Village Weavers (96 days), and longest in Spectacled Weavers (114 days). Primary moult started in February and ended in May for all three species in KwaZulu-Natal. There were enough data for Village Weaver to analyse moult for three separate years, imposing a constant duration on all years. Start date varied significantly by up to two weeks in different years. The Thick-billed Weaver had a similar duration of moult in Gauteng and KwaZulu-Natal of 71 and 73 days respectively, but the start date was significantly earlier in Gauteng (five weeks earlier).

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### Introduction

The Village *Ploceus cucullatus*, Yellow *P. subaureus*, Spectacled *P. ocularis* and Thick-billed Weavers *Amblyospiza albifrons* are four common ploceids found in eastern South Africa. They have broadly similar distributions in the littoral regions of the Eastern Cape and KwaZulu-Natal, with the Yellow Weaver being the most coastal (Harrison *et al.* 1997). Farther north, the distributions diverge (Harrison *et al.* 1997, Parker 1999, Fry and Keith 2004). In southern Africa these species are confined to the summer rainfall region.

The four species are poorly studied in southern Africa, although there is an extensive literature on the Village Weaver farther north in Africa (e.g. Collias and

Collias 1970, Camara-Smeets 1982, Adegoke 1983, Lahti and Lahti 2002). Even though the Thick-billed Weaver has a vast distribution extending northwards to East and West Africa, the only comprehensive studies are at the southern extremity of its range, in KwaZulu-Natal (Laycock 1979, 1982, 1984). The Spectacled Weaver is also a widespread African species but with even fewer studies (Skead 1953, Craig 1984). Limited field notes have been published for Yellow Weaver (Skead 1995).

The Spectacled Weaver is mainly insectivorous; it is a solitary, monogamous breeder (Craig 1984). The other three ploceids are largely seed-eaters; they are colonial, polygynous breeders (Fry and Keith 2004). The peak breeding season in KwaZulu-Natal for these four weavers is September to January (Harrison *et al.* 1997).

Of the four species, only the Thick-billed Weaver has undergone a range expansion (Harrison *et al.* 1997); it expanded its range to Gauteng in the 1960s, in what appears to have been a natural expansion along the Olifants River from Mpumalanga (Tarboton 1968, Leinberger 1982, Winterton 1982, Tarboton *et al.* 1987, Harrison *et al.* 1997). This range expansion is continuing (Leinberger 1997). This region has summer rainfall as does KwaZulu-Natal. There have been no studies of this species in Gauteng.

The aim of this paper was to extend the range of species for which estimates of primary moult parameters are available. This paper examines the parameters of primary moult of adults of these four species in eastern South Africa, and considers the timing of moult in relation to timing of breeding. In KwaZulu-Natal, adult wing-moult has been considered in Thick-billed Weavers; but this study used an unorthodox approach, so the results are not readily compatible with any other studies (Laycock 1982, Brown *et al.* 2001). Wing-moult has been studied in Village Weavers in the Eastern Cape, using the same analysis technique as used in this paper, so the results are comparable (Craig *et al.* 2001). In addition to presenting results on primary moult for the four species in KwaZulu-Natal, this paper presents results for the Thick-billed Weaver in the new extension of its range in Gauteng.

## **Methods**

Breeding seasonality data were obtained from the BirdLife South Africa Nest Record Card Scheme (NRC) (RP Prÿs-Jones and I Newton unpublished data; Underhill *et al.*

1991) and by adding my own unpublished records of breeding of Thick-billed Weaver in Gauteng. Prÿs-Jones and Newton (unpublished data) estimated the month of laying of the first egg for each record. They then summarised breeding seasonality for all birds in South Africa by presenting monthly totals of clutches laid per species per region. One of the regions they used was the former Transvaal province: this region incorporates the current Gauteng Province, from where most of the records originate. To compare breeding seasonality of weavers, the tabulated data of Prÿs-Jones and Newton (unpublished data) were used to estimate the median and the 5th and 95th percentiles for each species and region. The median was calculated by finding the cumulative monthly sums of the percentage of nest records. The median month was the month in which the cumulative sum first exceeded 50%. The values of the sums of the previous and successive months were used to assign a relative distance into the month. For example, if there were 47% of cumulative records by the end of October, and 64% by the end of November, the median clearly is during November. Then using proportions gives  $(50-47)/(64-47) = 17.7\%$ , the relative distance into November. Thus the median lies 17.7% into November (month 11), calculated as 11.177 (and rounded to 11.2 for presentation). The 5th and 95th percentiles were interpolated in a similar fashion. Dates in January were recorded as being in month 1 (not month 0).

Ringling data were collected by ringers in the standard SAFRING (South African Bird Ringing Unit) electronic format. This includes standard ringling information (such as location and date) and data on bird body mass, wing length and primary moult (de Beer *et al.* 2001). Ringling and recapture records submitted to SAFRING until mid-January 2005 for adults of the four species were extracted from the database. Primary moult records were extracted from SAFRING's database for Village, Yellow, Spectacled and Thick-billed Weavers in KwaZulu-Natal and for Thick-billed Weavers in Gauteng (Figure 1). The Village Weaver records were restricted to a one-by-one degree grid cell with 29°S and 30°E in the north-western corner. In all species moult of the primaries is ascendant, with the feathers renewed from innermost to outermost.

To determine the relative mass of each primary, as described in Underhill and Summers (1993), the primaries of the wings of a Thick-billed Weaver specimen were dried in an oven at 60°C for 24 hours to eliminate moisture and weighed (Ohaus GA200D balance, precision 0.0001g). These values were averaged and used for to calculate the relative mass of each primary. For Village Weaver the published relative

mass of each primary was used (Craig *et al.* 2001). Wings of Yellow and Spectacled Weavers were not available. Underhill and Joubert (1995) showed that small samples are adequate to determine the relative masses of primary feathers because there is little intra-specific variation in this characteristic; they also showed that within the Charadriiformes, the relative masses of the primary feathers were so similar that the average value for the species for which data were available could safely be used for species for which data were unavailable, and we used the same approach here. The wing shape of the Yellow Weaver is most similar to that of the Cape Weaver (HDO pers. obs) and the published relative masses for this species were used (Underhill and Joubert 1995). For Spectacled Weaver the wing shape is partially described by Moreau (1960: 449) and the most similar wing is that of the Thick-billed Weaver (pers. obs).

The Underhill-Zucchini moult model (Underhill and Zucchini 1988), developed to estimate start and duration of primary moult, was applied to the data sets. The data were considered to be of 'type 2' of Underhill and Zucchini (1988), because full moult scores were recorded for each bird and all birds were considered available for sampling throughout the moult period. The parameters of primary moult were estimated using the transformations recommended by Summers *et al.* (1980, 1983), designed to reduce the bias introduced by the fact that the individual feathers are of different masses. The moult index used was percentage feather mass grown (PFMG), calculated from the moult score for the individual feathers according to the method of Underhill and Summers (1993).

Brandao (1998) (see also Underhill *et al.* in press) extended the Underhill-Zucchini (1988) moult model to estimate starting dates for groups of birds (e.g. males and females, or annual groups), holding the other two parameters (duration and standard deviation) constant. She also developed rigorous statistical testing, using the likelihood ratio test, of the null hypothesis that the starting date for each group was the same. This method was applied to estimate starting dates for Village Weavers for each of three years.

## **Results**

In KwaZulu-Natal, breeding seasonality by the four species of weavers is fairly similar; the three *Ploceus* species have the medians of their breeding periods in

November and that of the Thick-billed Weaver is in December (Table 1). The length of the egg-laying season (5th and 95th percentiles) is 3.7–4.1 months in the three *Ploceus* species and 4.4 months in the Thick-billed Weaver. The breeding seasonality is similar in the Eastern Cape and former Transvaal regions, both also being summer rainfall areas, but with some more variability than in KwaZulu-Natal (Table 1).

Moulting birds were captured throughout the moulting season (Figure 2); this enables the moult parameters to be estimated reliably. For Thick-billed Weavers, however, the number of records of active moult is relatively small (60 of 179 records in Gauteng, and 105 of 462 records in KwaZulu-Natal); this is reflected in the larger standard errors compared to the other species (Table 3).

In the three *Ploceus* species duration of moult was shortest in Yellow Weaver (66 days), intermediate in Village (96 days), and longest in Spectacled Weavers (114 days). Moult started in February and ended in May for these three species in KwaZulu-Natal.

There were sufficient data for Village Weaver to analyse moult for three separate years, imposing a constant duration and standard deviation on all years. This is valid because there was no significant difference when using individual durations per year (likelihood ratio test,  $\chi^2_3=3.58$ ,  $p>0.05$ ). Start date varied by up to two weeks in different years (Table 3). These differences were highly significant (likelihood ratio test,  $\chi^2_3=173.8$ ,  $p<0.001$ ).

The Thick-billed Weaver had a similar duration of moult in Gauteng and KwaZulu-Natal of 2.4 months, but the start date was five weeks earlier in Gauteng. The difference in start date was highly significant (likelihood ratio test,  $\chi^2_2=77.9$ ,  $p<0.001$ ).

## Discussion

Breeding in the summer rainfall region for these four weavers starts in September or October, and ends in January or February. This corresponds well with the published peak breeding season in KwaZulu-Natal of September to January (Harrison *et al.* 1997).

Moult has not been analysed for Yellow and Spectacled Weavers previously (Craig 1983), although Britton and Britton (1986) published a figure with eight moult records for Spectacled Weavers in Mombasa, Kenya. The duration of primary moult

for Village Weavers was estimated to be 109 days, from 17 February to 5 June, in the Eastern Cape (Craig *et al.* 2001); in KwaZulu-Natal primary moult started an average of five days earlier and lasted two weeks less (Table 3).

Moult in Thick-billed Weavers has been studied in KwaZulu-Natal by estimating duration of moult visually from plots of moult score versus date. Laycock (1982) found moult in the population from December to June; this includes secondary moult which finishes a little later than primary moult. Brown *et al.* (2001) found primary moult from April to June. The present analysis gives a shorter duration of moult (2.4 months). Laycock (1982) found no difference in moult timing and duration in males and females.

No studies of Thick-billed Weavers in Gauteng exist; there are only published sightings showing that the species has expanded its range to this province (Harrison *et al.* 1997). This study shows breeding and moulting starting five weeks earlier in Gauteng compared to KwaZulu-Natal. We cannot offer an explanation for this unexpected result, and this clearly represents an opportunity for detailed study. The result obtained does not parallel that for the Southern Masked Weaver which has also expanded its range, into the Western Cape (chapter 5).

The monogamous species, Spectacled Weaver, has a similar peak breeding season (November) to the two polygynous *Ploceus* species, Yellow and Village Weavers. Primary moult in the Spectacled Weaver starts 1–3 weeks earlier, and ends 1–3 weeks later, than the other two species. Moult follows soon after breeding in all three species as is normal in passerines (Payne 1972). These weavers have a well-defined breeding and moulting season, which seems to be related to the mesic environment rather than mating system.

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**Table 1:** Months of egg-laying (percentages) for Village Weaver, Spectacled Masked Weaver, Yellow Weaver and Thick-billed Weaver in South Africa (from Prÿs-Jones and Newton unpublished data). For Thick-billed Weaver in the former Transvaal, HDO's records from Gauteng have been included. The percentages are summarized as 5th percentile (represents start of moult), 95th percentiles (end of moult), range (90% range of months of egg-laying) and median egg-laying month; numbers represent parts of months, e.g. 12.5 = mid December, 1.4 = 40% through January (see text)  
Localities are abbreviations for South African provinces: EC=Eastern Cape, KZN=KwaZulu-Natal, Tvl=former Transvaal (this region incorporates the current Gauteng Province)

Species	Area	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	n	5 <sup>th</sup>	95 <sup>th</sup>	Range	Median	
<b>Spectacled Weaver</b>																			
	EC			6	32	35	21	6						34	9.9	1.2	3.3	11.3	
	KZN			9	18	32	34	7						56	9.6	1.3	3.7	11.7	
	Tvl				20	40	40							5	10.3	12.9	2.6	11.8	
<b>Yellow Weaver</b>																			
	EC			17	29	25	4	25						24	9.3	1.8	4.5	11.2	
	KZN			18	23	38	13	7	<1					267	9.3	1.4	4.1	11.2	
<b>Village Weaver</b>																			
	EC				20	10	50	20						10	10.3	1.8	3.5	12.4	
	KZN				15	3	39	34	9					98	9.3	1.5	4.1	11.8	
	Tvl		7	40	16	24	9	2	2					55	8.7	12.9	4.2	10.2	
<b>Thick-billed Weaver</b>																			
	EC			5	5	14	64	9	5					22	10.1	2.0	3.9	12.4	
	KZN		1	2	10	13	39	23	13					101	10.2	2.6	4.4	12.6	
	Tvl		10	20	10	20	20	20						10	9.5	1.8	4.3	11.5	

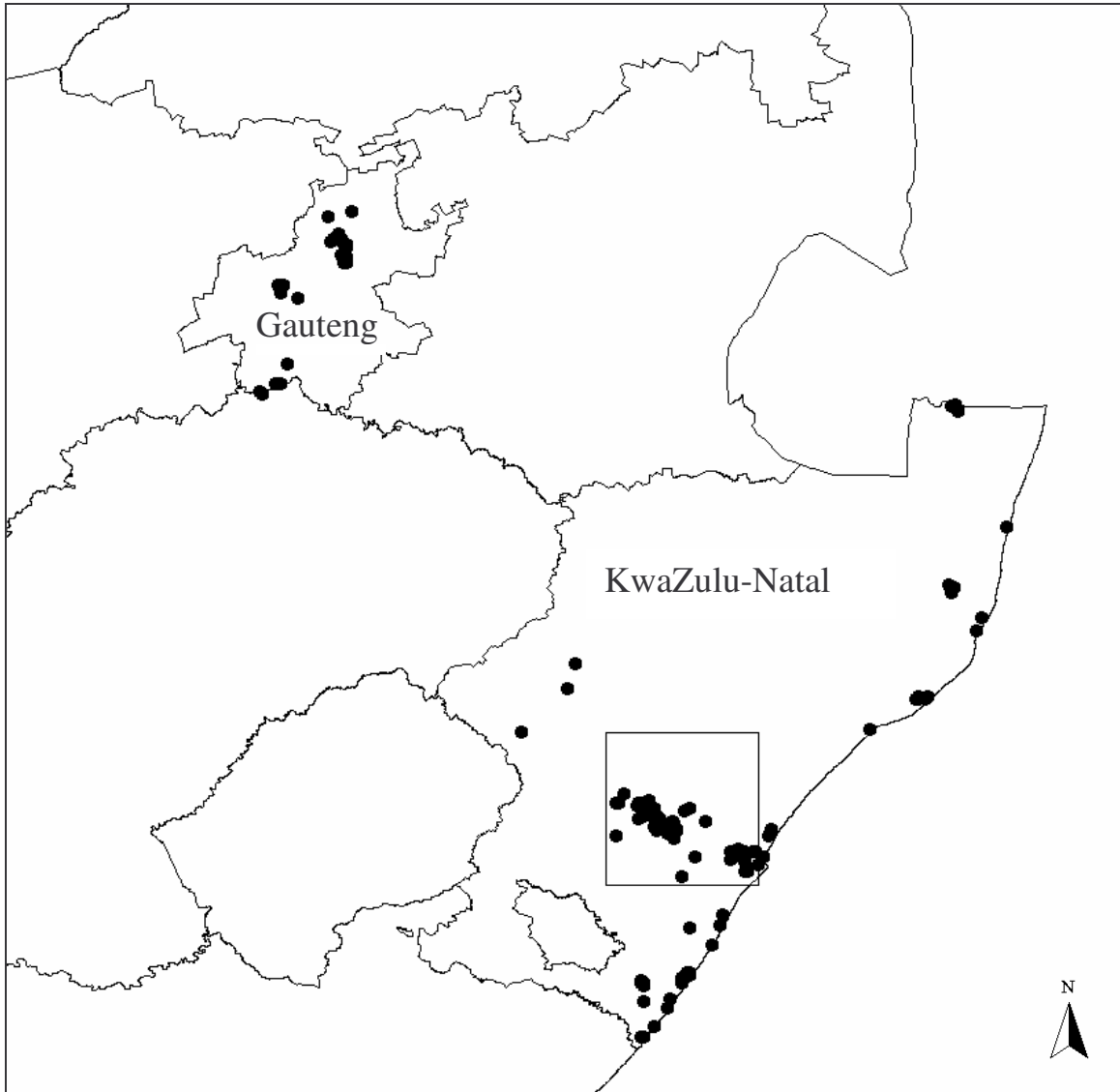
**Table 2:** Individual primary feather masses (g) of a Thick-billed Weaver specimen from Durban, KwaZulu-Natal, and the mean relative mass of each primary, used in the calculation of Percentage Feather Mass Grown

Primary	Feather mass (g)		Mean relative feather masses
	Left wing	Right wing	
1	0.0239	0.0205	9.5
2	0.0266	0.0212	10.2
3	0.0258	0.0223	10.3
4	0.0267	0.0240	10.9
5	0.0298	0.0258	11.9
6	0.0305	0.0267	12.3
7	0.0285	0.0265	11.8
8	0.0271	0.0239	11.0
9	0.0248	0.0223	10.1
10	0.0047	0.0042	1.9
Total	0.2484	0.2174	100.0

**Table 3:** Estimates of the primary moult parameters of adult Village, Yellow, Spectacled and Thick-billed Weavers in KwaZulu-Natal and Gauteng, South Africa  
Localities are abbreviations for South African provinces: KZN=KwaZulu-Natal, GP=Gauteng Province, EC = Eastern Cape

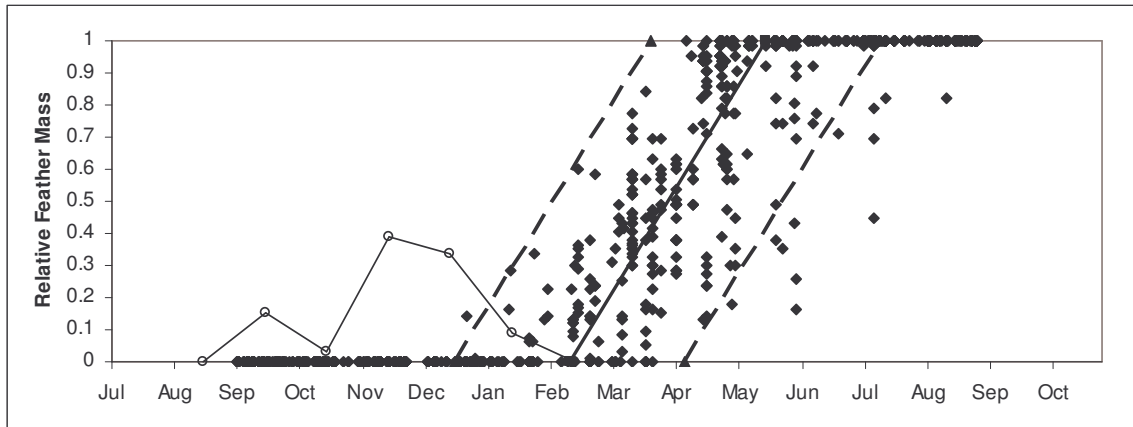
Locality /year	Mean starting date	Standard error (days)	Standard deviation (days)	Standard error (days)	Duration (days)	Duration (months)	Standard error (days)	Mean completion date	Standard error (days)	n
<b>Spectacled Weaver</b>										
KZN	3 Feb	3.4	21.0	1.3	114.1	3.8	4.3	28 May	2.3	388
<b>Yellow Weaver</b>										
KZN	27 Feb	2.6	19.7	1.4	65.8	2.2	3.9	4 May	2.8	653
<b>Village Weaver, in the one degree grid cell with 29°S 30°E in the north western corner</b>										
KZN	12 Feb	2.4	28.5	1.1	96.1	3.2	3.4	19 May	2.1	1215
2001	2 Feb	4.7	31.5	1.6	106.1	3.5	4.9	18 May	4.2	673
2002	7 Feb	4.0	31.5	1.6	106.1	3.5	4.9	24 May	3.8	673
2003	14 Feb	5.5	31.5	1.6	106.1	3.5	4.9	31 May	8.7	673
<b>Village Weaver, Craig <i>et al.</i> (2001)</b>										
EC	17 Feb	5	40.1	2.4	109	3.6	6	5 Jun	3.7	436
<b>Thick-billed Weaver</b>										
GP	20 Feb	4.3	23.8	2.6	71.2	2.4	6.8	2 May	5.4	179
KZ	26 Mar	3.9	22.9	2.2	73.3	2.4	6.4	8 Jun	5.2	462

**Figure 1:** Capture sites for adult Village, Yellow, Spectacled and Thick-billed Weavers in eastern South Africa, from which primary moult data were obtained. Gauteng shows Thick-billed Weaver records; the square in KwaZulu-Natal shows the records for Village Weavers; the whole KwaZulu-Natal has records for Yellow, Spectacled and Thick-billed Weavers, largely in the square

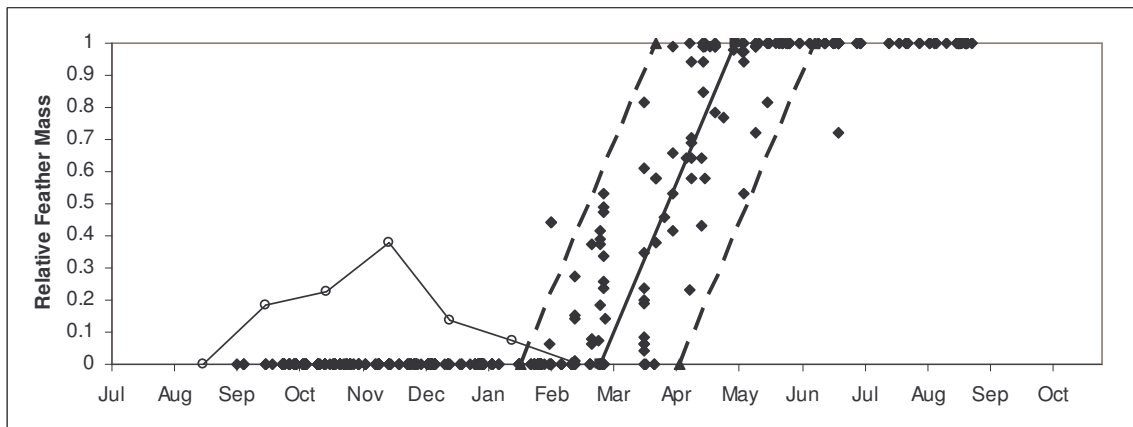


**Figure 2:** Timing of egg-laying and primary moult for adult weavers in different parts of South Africa; the open circles with thin solid line shows the proportion of eggs laid per month (from the Nest Record Cards summary by Prŷs-Jones and Newton unpublished data); the solid diamonds represent relative feather mass values by date; the solid diagonal line joins the estimated mean start and end dates of moult, while the diagonal dotted lines show the approximate 95% confidence intervals of moult scores on any given date

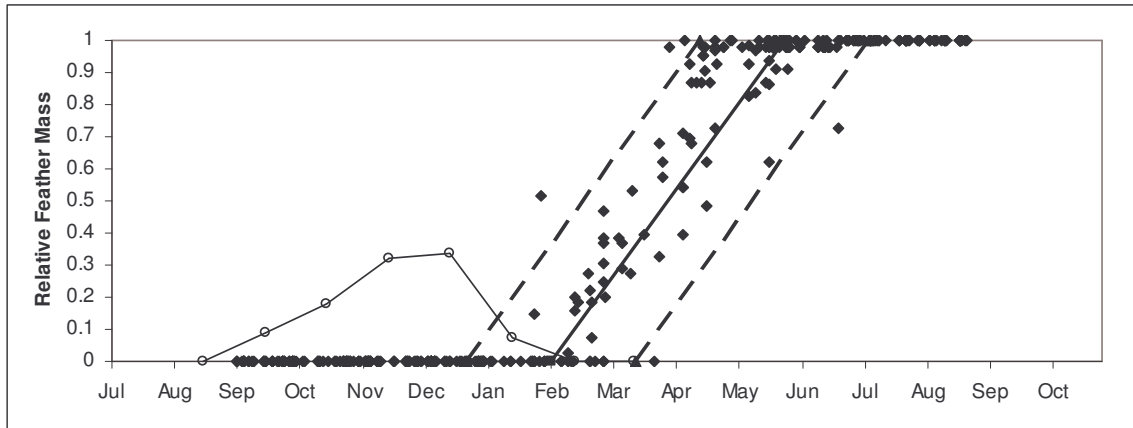
(a) Village Weaver, grid 2930 in KwaZulu-Natal



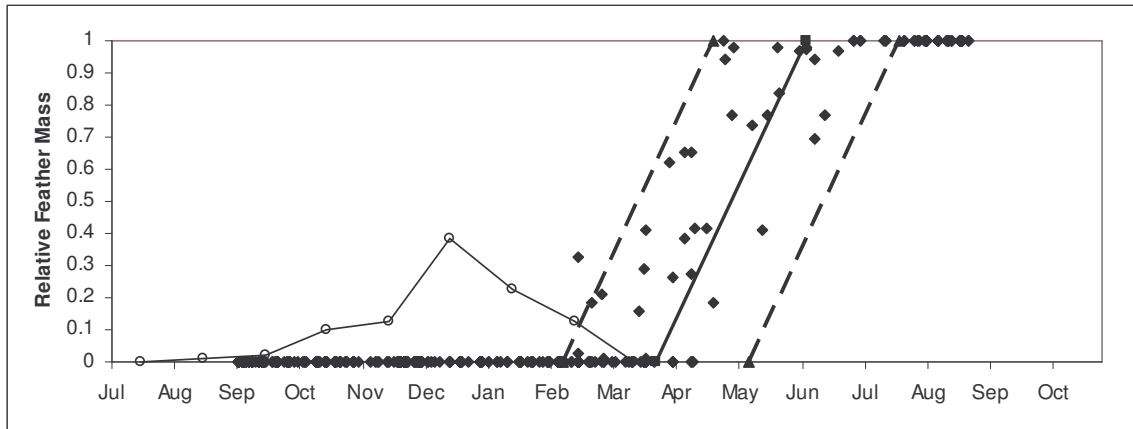
(b) Yellow Weaver, KwaZulu-Natal



(c) Spectacled Weaver, KwaZulu-Natal



(d) Thick-billed Weaver, KwaZulu-Natal



(e) Thick-billed Weaver, Gauteng

