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The breeding biology of Spotted Flycatchers *Muscicapa striata* in South Worcestershire

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INTRODUCTION

Breeding Spotted Flycatchers *Muscicapa striata* have decreased in the United Kingdom by 82% over the past 25 years and are now a species of major conservation concern (Baillie *et al.* 2009); they are a Red Listed species in the UK and the subject of a UK Biodiversity Action Plan (UK BAP 2010).

At one time Spotted Flycatchers were considered a common bird of gardens. Reasons for their decline are only partially understood. Productivity measures (number of eggs laid, number of young fledged) based upon data held in the British Trust for Ornithology's (BTO) Nest Record Scheme have indicated that lower clutch and brood sizes and greater nest losses at the egg and chick stages may play a part in the decline (Leech & Barimore 2008), and a decrease overall in the ratio of juveniles to adults at constant effort ringing sites suggest lower productivity. Population modelling also suggests that decreases in the annual survival rates of Spotted Flycatchers in their first year of life are also likely to have driven the decline (Freeman & Crick 2003). However, since Spotted Flycatchers are Western Palaearctic-African migrants the geographical focuses of these declines are difficult to determine.

Decreasing survival rates and decreases in the number of chicks produced per breeding attempt may have been caused by deteriorations in woodland quality in the UK which have in particular led to declines in the large flying insects on which Spotted Flycatchers depend. However conditions either on the wintering grounds in Africa or along migration routes (Fuller *et al.* 2005) may have been particularly important factors in the decline of survival rates. This is suggested by the finding that population declines of Spotted Flycatchers have been similar across the main UK regions and habitat types. Thus it seems more likely that the decline has been driven by factors operating outside the UK.

Spotted Flycatchers that breed in the UK begin to migrate south in late July and the first peak of migratory departure is between mid-August and early September. The majority of birds fly south-west through Iberia to North Africa and it is thought that the bulk of UK breeding birds winter in coastal West Africa (Gambia to Nigeria), but some may go as far south as the Congo Basin (Wernham *et al,* 2002). Spotted Flycatchers are estimated to have declined by 59% across Europe during 1980–2005 (PECBMS 2007) again suggesting that factors on migratory stop-over and wintering sites may be particularly important in this general decline. However, a predator 'control' experiment has indicated that the abundance of nest predators may be determining the breeding success of Spotted Flycatchers, especially in woodland in the UK, where nest success was lower overall than in gardens (Stoate & Szczur 2006).

Another study using nest cameras has identified avian predators, especially Jays, as responsible for most nest losses (Stevens *et al.* 2008).

My study of the breeding biology of Spotted Flycatcher has focused upon a population using breeding sites in village gardens rather than the more typical woodland sites. It is a population which does not appear to have declined as much but accurate population data are not available. In view of general declines of this species, which contrasts with apparent greater population stability at my study site, I ask the question does this study population show breeding parameters (nest site location, clutch size, hatching success, fledging success) found for the population as a whole? Are there any signs that the breeding biology of this population differs from those of the wider population in the UK?

METHODS

This study relied on the cooperation and participation of more than one hundred households.

Study Period

Data collection started in 2001 and continued until 2008.

Study Site

Centred on the north half of Ordnance Survey Grid Square SO93 incorporating a group of villages on the southern lower slopes of Bredon Hill, South Worcestershire. The bulk of the observations were made in the villages of Bredon, Kemerton, Overbury, and Beckford with additional observations from Westmancote, Kinsham, Conderton, Ashton-Under-Hill & Bredons Norton.

Nest Record Data

Initial data collection was based upon nest site and nest outcome data as required by the BTO Nest Record Scheme (NRS 2010). All data have been lodged with the BTO. Nest Record data was gathered from 322 nests. These records represent approximately 25% of the breeding data collected nationally for this species between 2000 and 2008. For each nest the following were recorded: nest height, location, site, general habitat close to the nest site, clutch size, and fate of clutch.

Location of "pairs"

Pairs were located by two methods: 1). 'cold searching' of suitable locations: gardens, orchards and graveyards, and 2). following up reports from local people, many of whom were actively looking out for the birds.

Location of nest sites

Nests were located by searching likely sites against house walls, outbuildings, sheds or in cavities, climbing shrubs and epicormic growth on trees, and watching adults back to the nest.

Recording Technique

Nest contents were checked using a mirror on a telescopic pole or a small dentist's mirror. Progress was monitored if possible from the start of nest-building through to fledging, with up to six visits per nest. Whenever possible pairs were tracked throughout the breeding season (constant monitoring) and records of successive nesting attempts linked. Nest searching and behavioural observations were aided by use of 10x30 binoculars with image stabilisation (Canon).

RESULTS

Nest Site Selection

Spotted Flycatchers arrived in the survey area from early May. They appeared to select breeding territories that contained certain features including holes in trees and walls, open-fronted nest boxes, and climbing shrubs growing against a wall. Almost invariably the territory included a range of tree and shrub heights forming a habitat structure which provided foraging in most weather conditions (unpublished observations).

Spotted Flycatcher were observed 'prospecting' nest sites by hovering – humming bird-like – in front of likely sites. Later they used the same technique to collect cobwebs for nest material.

Nest Sites

Some Spotted Flycatchers were attracted to half coconut shells sited in climbing shrubs. This has been noted elsewhere (Douglas-Home, 1977). Spotted Flycatchers often used the old nests of Blackbirds *Turdus merula* but many nests were in holes and ledges in trees and walls and climbing shrubs growing against a wall.

Nest Height

The majority of nests were located in nest boxes or coconut shells placed for the purpose of attracting Spotted Flycatchers to nest. This increased if more coconut shells were put up. In 2001–2002, when few were available, 14.81% of nests were in coconut shells but from 2003-2008 the average proportion was 59.21%. This is likely to have influenced average nest height above ground. The average height of natural sites was 2.6 m (Clarke 2005). The average height of all nests (n=322) was 2.51 m (range 0.8 m-5 m). The average height of successful nests was 2.41m (range 0.8 m-5 m) and the average height of failed nests was 2.60 m (range 0.8 m–5m). No nests were found higher than 5 m.

Average clutch size and total eggs laid

Where constant monitoring took place it was possible to determine average clutch size and total eggs laid; these are shown in Table 1. First clutch/attempt included only full clutches whereas subsequent attempts and second clutches included all clutches. 48 pairs and first clutches/attempts were followed throughout the breeding season.

Year	**1st attempt**	**2nd attempt**	**3rd attempt**	**2nd clutch**	**Total eggs laid per "pair"**
	48 pairs	28 nests	6 nests	29 nests	
2001	4.5	-	-	3.5	8.0

2002	4.6	-	-	3.3	7.9 (7-9)
2003	4.1	3.8	3.0	3.5	8.4 (7-11)
2004	4.5	3.6	3.0	2.0	8.3 (7-12)
2005	4.3	3.4	-	3.5	7.7 (6-9)
2006	4.6	4.3	4.0	3.3	8.2 (7-12)
2008	4.6	4.0	4.0	3.6	8.7(7-11)
overall	4.5 (3-5)	3.7 (3–5)	3.5 (3-4)	3.4 (2-6)	8.2 (7-12)

Table 1. *Average clutch size and the total eggs laid per female.*

Nest Failure Rates

Table 2 shows that nest failure rate differed with nest location

Nest location	**Number of nests**	**Nest failure rate (%)**
Against house wall	215	39
Against tree	21	38
Against building detached from house	45	42
Against fence or wall (not of a building)	41	4
Overall		31

Table 2*. Nest failure rate (n = 322) as a function of nest location*

A small number of nest failures against houses can be attributed to human disturbance. Occasionally Spotted Flycatchers nested in roof gutters and the nests were subsequently swamped. No comparisons between failure rates of nests on trees closer to or further from houses have been made but there would appear to be clear benefits for pairs nesting against houses (Table 3). There was no marked difference in nest failure rates between natural and artificial sites.

Nest location	**Mean nest failure rate (%)**
Against house	30
Remote from house*	46

Table 3*. Nest failure rates for 19 sites occupied each year as a function of nest location.* * 'Remote' includes sheds, out-buildings, walls and trees. Sites were also classed as 'remote' if a house was wholly or largely unoccupied.

Earliest and latest first egg laying dates

I differentiated between first and second clutches. Table 4 shows estimated earliest and latest laying dates for first and second clutches.

	First clutch		**Second clutch**	
Year	**Earliest egg**	**Latest egg**	**Earliest egg**	**Latest egg**

2001	24th May	16th June	4th July	14th July
2002	20th May	15th June	4th July	20th July
2003	20th May	11th June	1st July	17th July
2004	18th May	8th June	5th July	21st July
2005	20th May	8th June	27th June	16th July
2006	16th May	13th June	27th June	17th July
2008	16th May	6th June	3rd July	21st July

Table 4. *Estimated earliest first egg and latest last egg laying dates for 1st and 2nd clutches based upon 142 first clutches and 44 second clutches.*

These results indicate a trend of first egg dates for first clutches getting earlier during the study period but the sample is too small to test statistically. However there is no clear trend regarding second clutches. Over the eight years of this study all first egg dates for first clutches (142 nests) occurred during a nine day period, the latest first egg dates occurred during an eight day period. On average there appears to be a gap of about twelve days between the earliest egg date and the latest egg date during the period when the first clutches are being laid. For second clutches (44 nests) all first egg dates occurred over a nine day period and latest egg dates over an eleven day period with again a twelve day gap between the two periods.

Nest failure rates

I divided the breeding season into 4 quarters (Q1 to Q4). Q1: 1st May to 30th May; Q2: 31st May to 16th June; Q3: 17th June to 2nd July; Q4: 3rd July to 21st July; and have analysed the rate of nest failures in each of these quarters over the period of the study (Table 5). Quarters were determined such that the longest known breeding season was divided into four approximately equally long sections.

Year	**Q1**	**Q2**	**Q3**	**Q4**
2001	8	33	50	29
2002	25	33	0	20
2003	42	33	50	0
2004	27	52	60	25
2005	54	23	33	50
2006	54	44	33	18
2008	40	50	20	17
Mean	27	40	35	25

Table 5 *Nest failures rates (%) in each quarter of the breeding season 2001-2008. Data was used from 272 nests where first egg date could be calculated to within ± 2 days.*

The failure rate in each quarter varied from year to year – most particularly so during Q3 and Q4 but the mean failure rates suggest that nests started in the early part of the season are less likely to fail than those laid mid-season.

Nest failure rates for nests in which at least one egg was laid.

These are shown in Table 6.

Year	Overall nest failure rate (%)
2001	22
2002	24
2003	36
2004	48
2005	43
2006	42
2008	37
Mean	36

Table 6 *Overall nest failure rates*

Number of Breeding Attempts

Whenever possible pairs were followed in their attempts to breed. Unless birds are colour-ringed it is impossible to guarantee that the same pair is being followed as Spotted Flycatchers tend to nest in 'clusters' of pairs. However, with frequent nest monitoring and assisted by local observers it was possible to calculate the number of breeding attempts for a number of pairs. If the nest failure was noted soon after the event, extra site visits were made to track down the pair. Usually they re-nested within 20-100m of the failed nest site. Table 7 shows the number of breeding attempts recorded each year.

Year	Number of pairs studied	No of pairs attempting to nest twice	No of pairs attempting to nest three times	No of pairs that raised two broods	No of pairs that failed to breed
2001	30	4	0	6	?
2002	31	2	3	6	2
2003	28	3	3	5	8
2004	33	8	4	4	9
2005	22	6	0	10	4
2006	22	4	5	5	4
2008	22	5	2	7	1
Totals	188	32	17	46	28

Table 7 *Number of breeding attempts over years*

Over the period of the study a minimum of 17% (32/188) of pairs made two attempts, 9% (17/188) made three attempts and 15% of pairs (28/188) failed to breed. 25% (46/188) laid second clutches after successful earlier attempts.

DISCUSSION

The general conclusion to be drawn from all of this data is that the breeding biology of Spotted Flycatchers in the Bredon Villages study area does not differ from what is already known about these birds over an historical period across the UK. While this is not surprising it is comforting to find that these birds do not show any signs of an unusual response to the habitats that are offered in these south Bredon Villages. Although this study population is a small sample of the total UK population there seems little ground for supposing that the general decline of this species (nationally an 82% decline over the past 25 years (Baillie *et al.* 2009) are attributable to changes in the breeding biology of birds from this region of the UK. My main bases for comparisons that lead to this conclusion are the summary data for Spotted Flycatchers presented in Vol. 7 of *The Birds of the Western Palaearctic* (BWP, 1993).

Nest Site location

Nest sites have been recorded previously over a wide range of heights above the ground between 0-20m. The lowest height in this study was 0.8 m and the highest 5 m, with the average about 2.5 m which is approximately the height where the majority of nests have been previously recorded. Bredon Villages birds preferred (66%) to place their nests against a wall compared with general estimates of 60% of nests in a similar location (BWP, 1993).

Average clutch size and total eggs laid

Average clutch size of first breeding attempts in this study was 4.5 eggs (Table 1). This compares with a clutch size of 4.44 found in northern England and Scotland and 4.21 in south-west England and Wales (BWP 1993). The Bredon Villages birds also showed a decrease in clutch size through the seasons with average clutch size falling from 4.5 to 3.4 between first and second clutches (Table 1). BWP (1993) reports that clutch size typically declines from 4.4 to 3.5 for first and second clutches.

Breeding Success

Around the Bredon Villages the average nest failure rate was 31% (Table 2). This compares with failure rates reported in BWP (1993) of 39% for early clutches (May) to 33% for late clutches (July) but the differences between these periods is not significant.

Nest failure rates

The overall nest failure rate of 36% (Table 6) is lower than the 41% for garden nests of Spotted Flycatchers recorded by Stevens *et al* (2007).

Number of Breeding Attempts

Summers-Smith (1952) estimated that 20% had second broods whilst Kirby *et al* (2005) put the figure at 14%. The percentage of pairs attempting second broods in this survey (Table 7) varied considerably from year to year (12% to 45%). 28 out of 158 pairs failed to breed (17%).

Are Spotted Flycatchers breeding earlier?

These results (Table 4) indicate a trend of first egg dates for first clutches getting earlier during the study period but the sample is too small to test statistically. However, this would

be in line with evidence of earlier breeding in a wide range of passerine birds over recent decades Crick *et al*. (1997) which has been correlated with an increase in early season ambient temperature attributed to climate warming, and may also be correlated with the pattern of earlier arrival dates of migrant birds into Europe from Africa in the spring (Sparks *et al* 2005). It is also interesting to note that the data of Table 4 could also indicate that birds may arrive in the area of this study in "two waves". Perhaps ringing data and data from Bird Observatories might show a double peak of arrival each spring? However, the passage of birds through a number of Bird Observatories appears to show a single peak of arrival in mid to late May (Riddiford 1981), but this data is now historical, being based upon observations collected before 1980. Perhaps the now generally earlier arrival of migrant passerines would show a double peak?

Overall conclusion

It is reassuring to find that the breeding biology of the population of Spotted Flycatchers that has been studied in villages around Bredon Hill in the first decade of this century is typical of that of Spotted Flycatchers across the UK over the previous 20+ years. The data presented here does not show any evidence of a change in the breeding biology of Spotted Flycatchers except perhaps with respect to the time of breeding.

The trend towards earlier breeding (Table 4) could have an effect on the survival of young birds (e.g. more time is available to achieve optimal body conditions before the need to migrate) and their subsequent recruitment into the breeding population the following year. Clearly this is an area of Spotted Flycatcher breeding biology worthy of further study in both this local area and more widely.

The basic stability in the breeding biology of Spotted Flycatchers in the Bredon Villages is reassuring at a time of widespread environmental change in terms of habitat alteration and climate change. This suggests that the garden habitats of the Bredon Hill villages are as favourable today for Spotted Flycatchers as they were historically and they probably provide an important population reservoir for Spotted Flycatchers at a regional, if not a national scale. Of course, it is not possible to say anything about the stability of the population of these birds in the study area since I have not collected data on population size and so we do not know whether it has changed. However there is plenty of anecdotal evidence from around the villages which indicates that the population has fallen, but it is not possible to quantify this. However, it seems very unlikely to have been as high as the 82% decline over the past 25 years recorded nationally.

Finally, the breeding biology data presented here does suggest that this study population is at the present time an important and valuable part of the UK population. Clearly, because of its favourable status, there should be continued efforts to maintain and possibly expand this population through the provision of suitable nest sites and the management of garden habitats. In this context it is worth emphasising that Spotted Flycatchers are a Red Listed species in the UK and the subject of a UK Biodiversity Action Plan (UK BAP 2010). The data presented here also supports the idea that the decline of this species has been driven by factors operating primarily outside the UK, and suggests that more research is required on the biology of these birds on their migration or on their winter grounds, while at the same time continuing to monitor their breeding biology in the UK.

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Spotted flycatcher. Picture ©John Robinson

Spotted flycatcher nest and eggs in a half-coconut shell. Picture ©John Clarke

Spotted flycatcher in nest

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