

Breeding biology of the house sparrow (*Passer domesticus*) in the Faroe Islands

Nøringin hjá føroyska gráspurvum (*Passer domesticus*)

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Abstract

The breeding biology of the Faroese house sparrow (*Passer domesticus*) is described based on the results from nestlings that were ringed just before they were fledging. By means of dates and numbers, the beginning and duration of the breeding seasons are determined and the reproductive output is estimated. Our study has shown that Faroese house sparrows produce two, occasionally three, broods annually. Overall, eggs of the first, second and third clutch are normally laid in the beginning of May, in the middle of June and in the beginning of July, respectively. In a season, a female produced 6.3 nestlings, on average. For the whole period, the average brood size was 3.5 nestlings. During the first part of the time series (1985-1989), the breeding season became earlier each year, but then to be later again in the years 1990 to 1992. The first clutch was laid more than five weeks earlier in 1989 than in 1985 and the second clutch almost seven weeks earlier.

Úrtak

Árini frá 1985 til 1992 vóru tilsamans 347 gráspurvaungar (*Passer domesticus*) merktir í bygdini Nólsoy, beint áðrenn teir vóru floygdir. Við at nýta dagfestingina tá ungarnir vórðu merktir og talið av ungum er ásett, nær og hvussu ofta gráspurvur verpur og hvussu nógvar ungar hann fær hvørja ferð. Kanningarnar vísa, at føroyski gráspurvur verpur tvær ferðir um árið, viðhvørt tó tríggjar ferðir: Fyrstu urptin er í byrjanini av mai mánað, tann næsta er um miðjan juni og triðja urptin í byrjanini av juli mánað. Hvør boga fær í miðal 6,3 ungar um árið. Í miðal vóru 3,5 ungar í hvørjari urpt. Úrslit okkara vísa, at tey fyrstu árin varp gráspurvur fyrr og fyrr, fyrri hvørt árið. Hetta broyttist tó tey seinru árin sum kanningin vardi: Í 1989 vórðu fyrstu eggini vorpin meira enn fimm vikur fyrri enn í 1985, og næstu urptin næstan sjev vikur fyrr.

Introduction

Breeding success is a key variable in demographic studies of birds and an estimation of the natality of a species is

fundamental to understanding the population dynamics. For the Faroese house sparrow (*Passer domesticus*) information on breeding success is scarce, although it is among the most common sedentary birds in the Faroe Islands. As in other places, the Faroese house sparrow is a true companion of people, living in close association with human activities (Bengtson *et al.*, 2004). The colonization occurred in the late 1930s (Petersen, 1949; Bengtson *et al.*, 2004) and today it occurs abundantly all over the Faroes and breeds in most built-up areas (see Jensen and Kampp, 1997; Bengtson *et al.*, 2004). Previous studies of the Faroese house sparrows have addressed the colonization history and the current status of different local populations (Bengtson *et al.* 2004), variation in wingspan between populations (Jensen and Kampp, 1997) and movements and life-span (Magnussen and Jensen 2009).

The aim of the present paper is to describe and analyse data (1985-1992) on the breeding biology of Faroese house sparrow with respect to seasonal and annual variation in the timing of breeding and reproductive success.

Material and methods

During the years 1985 to 1992, nestlings were regularly ringed from nestboxes erected on buildings around the village Nólsoy. The aim of the project was mainly intended to describe movement and life-span of the Faroese house sparrow. However, the nestlings-data can also be used to describe the breeding biology of the Faroese house sparrows.

In 1985, the project started with only few nestboxes, but the number increased through the study period and, by the end, 16 nestboxes were installed on 13 buildings in the village. To observe the breeding activity and to keep a check on the nestling's age and the clutch they belonged to, nestboxes were visited daily. When nestlings were about 10 days old, just before they became fledglings, all nestlings from the nest box were ringed with a numbered aluminium ring and put back in their boxes. The brood size and the date, at which the nestlings were ringed, were registered. No records were collected about the eggs. According to Summers-Smith (1988) and our own observations, one egg is laid per day. The average clutch size is around five eggs. The eggs are incubated for 12 days. Nestlings were ringed when they were ten days of age. Thus, the laying date of the first egg was estimated to be 27 days prior to the ring-tagging.

It was assumed that multiple clutches at a single nest-site were laid by the same female. Thus, the interclutch interval was estimated as the number of days between successive clutches, and the breeding season was taken as the period between the first and last clutch.

The dates for egg laying in the different clutches were compared with meteorological data for years 1985 to 1992, published by Cappelen and Laursen (1998) and Jacobsen (2003). The meteorological data-sheet consists of monthly average values of 'hours of sunshine' and precipitation and monthly average, maximum and minimum temperatures.

Correlation analysis and ANOVA were

Year	No. boxes occupied	% females with subseq. clutches		Average brood size			Average date for ringing.					
		2nd	3rd	1st	2nd	3rd	1st	2nd	3rd			
1985	2	100	0	3.5 (2.1)	1.5 (0.7)	-	20 June (3.4)	12 August (0.0)	-	-	-	-
1986	5	60	0	3.6 (1.1)	4.3 (0.6)	-	21 June (12.9)	27 July (13.2)	-	-	-	-
1987	7	71	0	3.4 (0.8)	2.6 (0.9)	-	16 June (19.0)	19 July (11.6)	-	-	-	-
1988	9	67	11	3.2 (1.2)	3.2 (0.8)	4.0 (-)	2 June (17.2)	9 July (14.1)	1 August (-)	-	-	-
1989	8	75	38	3.7 (0.9)	4.0 (0.9)	4.0 (0.0)	11 May (1.4)	30 June (15.1)	20 July (17.2)	-	-	-
1990	9	78	11	3.8 (0.8)	3.3 (1.1)	2.0 (-)	22 May (3.9)	29 June (8.4)	6 August (-)	-	-	-
1991	10	50	30	4.1 (1.2)	4.0 (1.6)	2.5 (0.6)	19 May (2.0)	29 June (0.0)	1 August (0.0)	-	-	-
1992	6	17	0	3.7 (0.5)	3.0 (-)	-	10 June (10.1)	25 July (-)	-	-	-	-
Total	16	63	14	3.7 (1.0)	3.4 (1.2)	3.1 (0.9)	30 May (17.7)	9 July (18.0)	28 July (12.0)	-	-	-

Table 1: Numbers of nestboxes occupied by house sparrows during the years 1985 to 1992 and proportion of females subsequently laying second and third clutches. Additionally, the averages of brood sizes and dates when the nestlings were ringed are presented. Standard deviations, referred as number of nestlings and number of days, respectively, are shown in brackets.

used for measuring the climatic effect on the date for egg laying for each of the three clutches. For comparing brood size among clutches, ANOVA was used. Calculations were performed on a SYSTAT 11 PC-program (SYSTAT, 2004).

Results

In total, 99 broods were investigated, 57% from the first, 35% from the second and 8% from the third brood. Of the 56 females laying the first brood, 63% also produced a second and 14% a third brood as well (Table 1). While the first and

second broods were produced throughout the whole research period, the third brood was only produced from 1988 to 1991. On average, each female had 1.8 broods per year.

Brood size: The number of nestlings in each brood varied between 1 and 6 (Figure 1). No significant statistical difference ($P=0.23$) was found between the average numbers of nestlings produced in the first (3.7), second (3.4) and the third broods (3.1) (Table 1). There was some variation in the annual average number of nestlings, ranging from 3.2 (1988) to 4.1 (1991) of the

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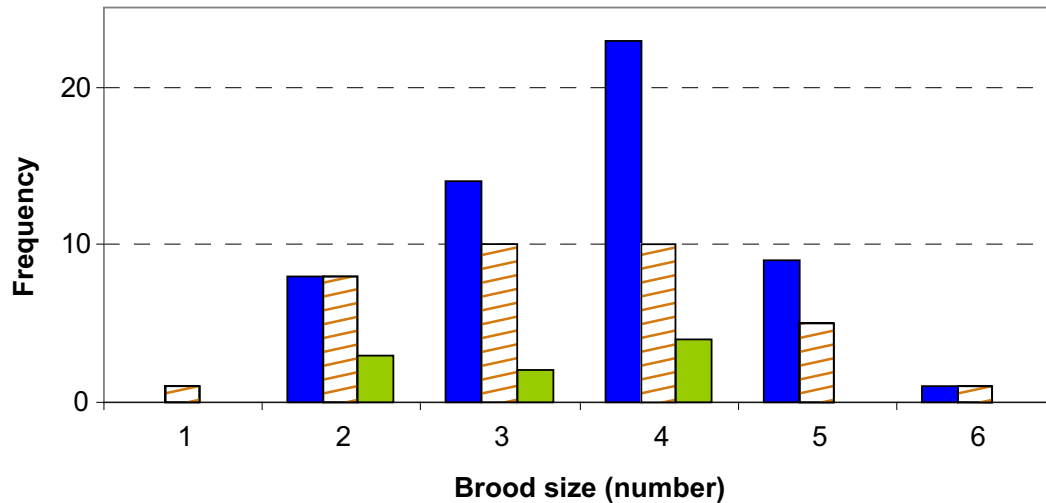


Figure 1: Distribution of brood-size from the first (■), second (▨) and third (■) broods, laid by Faroese house sparrows during the years 1985 to 1992.

first broods and between 1.5 (1985) and 4.3 (1986) of the second broods. Whereas the first and second brood sizes did not differ significantly among years ($P=0.77$ and 0.05 , respectively), the results from the third brood stood out with a significantly ($P = 0.02$) higher number of nestlings in the years 1988 and 1989. On average, the total number of nestlings produced per female per year vary between 4.2 (1992) and 8.2 (1989). Taken the whole research period into account, each female produced 6.3 nestlings per year, on average.

Date for egg laying: Overall, the time series for egg laying shows three more or less well defined peaks, with overlapping broods. The first clutch has a main peak of 25 April. Second clutch shows a broad range with a peak at the 30 May, while some parents were still taking care of their first brood. The third clutch was in approx. 4 July. By and large, the average time for laying eggs

of the first, second and third clutches was 3 May (SD. 18 days), 12 June (SD 18 days) and 1 July (SD 12 days), respectively (Figure 2). Comparing the interclutch intervals among years, they range from 34 (1987) to 53 days (1985), between the first and second clutches, on average 40 days, and from 22 (1988) to 37 (1990) days between the second and third clutches, on average 28 days. Duration of the breeding season vary between 34 (1987) and 76 days (1990), on average, 56 days.

The data series revealed a temporal variation of the date of laying eggs, which occurred earlier and earlier until 1989 for then to be later again (Figure 2). In 1985, eggs in the first clutch were laid 24 May, on average, but 14 April in 1989. For the second clutch, the dates were 16 July and 3 June, respectively. For the first and the second clutches, there was a significant interannual variation in the date of laying

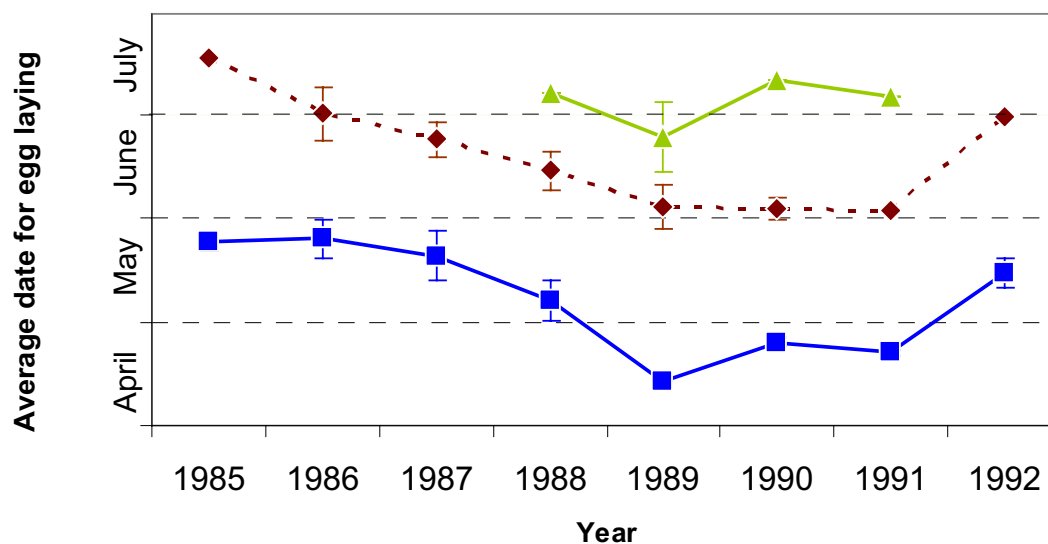


Figure 2: Temporal variation of the average date (\pm SE) of egg-laying by Faroese house sparrows of the first (■), second (◆) and third (▲) clutches.

eggs ($P=0.001$ and $P<0.000$, respectively), but not for the third clutches ($P=0.59$). However, no significant association was found between the date for egg laying and the meteorological conditions. The highest correlation was found between the date and 'hours of sunshine' in April ($r=-0.54$), but without being significant ($P=0.17$). For May, the correlation coefficient was $r=-0.40$ ($P=0.32$). The correlation coefficient between average temperature and date for egg laying was extremely low in April ($r=-0.001$), somewhat higher in May ($r=-0.341$), but still not significant ($P=0.41$).

Discussion

This study highlights part of the breeding biology of the Faroese house sparrow by using a time series of ringed nestlings. The time series is characterised by three more or less well defined peaks of ringed

nestlings, indicating that the Faroese sparrow produce two, occasionally three broods per season. Our investigation shows that the first and second broods were produced throughout the whole study period, but the third brood was only generated during the years when the first clutch was laid early (1988-1991). According to Summers-Smith (1988), the number of clutches laid per female is strongly related to the latitude. For house sparrows in the Faroe Island (situated at 62° N), we would expect 1.60 clutches on average for a season, which is somewhat lower than our finding (1.8). However, determining the exact number of breeding attempts is difficult, unless the birds have been marked individually. The ringing results used in the present investigation were mainly intended to describe movement and life-span of the Faroese house sparrow. Thus, birds were only marked with a numbered aluminium

ring and, consequently, it was not possible to follow individual females in the field in order to determine the number of clutches laid per female seasonally. Thus, our data are particularly based on nest-site information rather than individual bird recordings. However, presuming that multiple clutches at a single nest-site were laid by the same female is a realistic assumption is supported by the study carried out by Summers-Smith (1988) who showed that, once established, house sparrow pairs remain faithful to each other and their nest site for life.

We found that the interclutch interval for the Faroese house sparrow was 40 days between the first and second clutches, on average, and 28 days between the second and third clutches. This is similar to the results reached by Vincent (2005), who found the corresponding interclutch intervals for house sparrow in Leicester (UK) to be 40 days and 38 days, respectively.

Our results showed that each female produced 6.3 nestlings per year, on average. This is somewhat higher than found for house sparrow in the Leicester study, where the annual production was found to be 4.67 young per female, for the rural area, and 4.21 for the suburban area (Vincent, 2005). However, our results are within the range, reported by Summers-Smith (1988). Over the world, he found the average annual reproduction for house sparrow to vary from 2.3 to 7.7 young/pair/year, on average 4.51.

Although the current investigation is based on the number of fledglings, the number of laid eggs must have been

somewhat higher, primarily because of incomplete hatching and secondly because not all hatchlings survive until fledged (see Summers-Smith, 1988; Hole *et al.*, 2002; Vincent, 2005; Anderson 2006; Mock *et al.*, 2009). For house sparrows, the clutch size normally ranges from 2 to 5 eggs, with modal values being 4 in the UK and 5 in continental Europe and North America (Summers-Smith, 1988). These numbers have been supported additionally by Vincent (2005) who, in a comprehensive investigation in Leicester, found the clutch size to vary between one and six eggs, with the mean clutch size being 4.0. Thus, our results suggest that the reproductive output from the Faroese house sparrow seems to be in the order of size expected for this part of the world (Summers-Smith, 1988; Anderson, 2006).

Overall, the present investigation showed that the main time for egg laying of the first, second and third clutches was in the beginning of May, in the middle of June and the beginning of July, respectively. Our results show the duration of the breeding season to be of 57 days for the Faroese house sparrow. This is somewhat shorter than estimated by Summers-Smith's (1988) regression equation, which results in a breeding season of 67 day duration for the Faroese house sparrow.

According to Summers-Smith (1988), the beginning of the breeding season for house sparrow is delayed with increasing latitude. The commencement of the breeding season found in this study for house sparrows in the Faroe Islands (approximately 3 May) is in accordance with corresponding findings on this

species in the literature: Summers-Smith (1988) concluded that the breeding season ought to begin 2 May in the Faroe Islands, which is within the range of our observations. However, our investigation shows considerable annual differences between the initiations of the breeding seasons, ranging from 14 April to 25 May in the study period. Despite the substantial variation (41 days in a 7-year study), it is comparable to Polish findings (33 days in a 14-year study) reported by Summers-Smith (1988).

Our study shows that during the first period of the study, the breeding season became earlier each year, for then to be later again during the second part. Comparing results, the breeding seasons for the first and second brood were more than four weeks and almost seven weeks earlier, respectively, in 1989 than in 1985. For many small passerines, formation of egg starts after an increase in the temperature (Garcia-Navas *et al.*, 2008). According to Summers-Smith (1988), the start of the breeding of house sparrow is clearly influenced by temperature, and as a consequence, the temperature difference may surely be a relevant factor, affecting the annual variations at the same locality. However, in our study, no significant correlation was found between the start of the breeding season and the average temperature. Comparing the date for egg laying with meteorological data, light condition (hours of sunshine) gave the highest correlation. This is also in accordance with Anderson's (2006) statement, that the timing of testes enlargement in house sparrows is closely

related to the amount of sunshine. It is well established that supplementary feeding advances the start of reproduction of many species (Verhulst and Nilsson, 2008). Basically, the number of hours of sunshine is a proxy for the feeding conditions for the house sparrow, both for the adults, which mainly feed on plants and for the young, which are fed with insects. Thus, the earlier date for egg laying could partly be related to better sunlight conditions.

Today, house sparrow occurs abundantly all over the Faroes and are confined to breed in virtually all built-up areas in a close association with man (Bengtson *et al.*, 2004). Preferred nest sites are usually located in crevices on building and other humans structures. The most common sites are: recess between the wall and the roof of houses, rafters in buildings and in vines on the exterior wall of buildings. The breeding information in the current study is based on data collected from nestboxes, erected on houses. Since these man-made birdhouses give protection and insulation advantages compared to many natural nests (Summers-Smith, 1988; Garcia-Navas *et al.*, 2008), our findings of the reproductive output might probable be higher, and the date for egg laying earlier, than obtained for Faroese house sparrows breeding in building structures.

In conclusion, it can be stated that the Faroese house sparrow produces two, occasionally three, broods per season. Eggs of the first, second and third clutch are normally laid in the beginning of May, in the middle of June and in the beginning of July, respectively. For the whole period, the average brood size was 3.5 nestlings.

During a year, a female produced 6.3 nestlings, on average.

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