Population Density and Breeding Ecology of the House Martin Delichon urbica in Pomerania (NW Poland)

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Population density and breeding ecology of the House Martin *Delichon urbica* in Pomerania (NW Poland)

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Abstract. Studies were carried out in 23 rural sample plots in NW Poland in 1985–1995 (total study area — 5 117 km^2, including 635 villages and other settlements). The density of the breeding population in the overall landscape varied between 2.2 and 16.2 nests/km^2, and in built-up areas from 207 to 1303 nests/km^2. In the first brood, begun in mid-May, the average clutch was 3.99 eggs; 47% of clutches contained 4 eggs, 23% — 3 eggs and 21% — 5 eggs. In the second brood the average clutch was 3.61 eggs. Clutches of 4 and 3 eggs accounted for 49% and 26% respectively of the total number of clutches.
49% of pairs from the first broods were also involved in second ones. Hatching success (number of young hatched compared with the number of eggs laid) was 94.3% in the first brood and 95.8% in the second. Fledging success (number of young fledged compared to the number hatched) was 97.5% and 95.1% respectively and final breeding success (number of fledglings compared to the number of eggs laid) was 91.9% and 91.2%. A statistical pair produced 5.3 young per breeding season.

Key words: House Martin, *Delichon urbica*, population density, breeding ecology

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INTRODUCTION

The House Martin is an abundant breeding species in Poland, but its numbers and breeding density in the agricultural landscape were studied only in the Wielkopolska and Silesia regions (Tomiałojć 1970, Kuźniak 1978, Kokurewicz 1988, Dyrcz et al. l991, Bednorz et al. 2000). Quantitative data on the phenology and breeding ecology are confined to the papers of Kokurewicz (1988) for Silesia and Kamiński & Wołosiuk (1995) for NE Poland. The aim of the present study was to investigate the abundance and population density of House Martins in the agricultural landscape of Pomerania (NW Poland), as well as timing and ecology of its breeding.

STUDY AREA

The study was conducted in the Pomerania region of NW Poland, in 23 rural sample plots covering 110.9–365 km^2 (Table 1, Fig. 1). The total area studied covered 5117.4 km^2, with 635 villages and settlements within it. The total built-up area was 69.22 km^2 (1.3% of the total study area) and varied from 1.10 km^2 to 5.11 km^2.

METHODS

Abundance and density of breeding population was studied in the years 1983–1995, while the timing and ecology of reproduction — in 1985–1995 (Tables 1, 2). Nests were counted simultaneously by teams, in 2–4 sample plots and marked on a 1:25 000 maps. All the farms and buildings in a given locality were checked. Counts were made in July, when the majority of nests had first-brood nestlings. Also fresh faeces and observations of the behaviour of adult birds allowed to distinguish occupied nests.

Research into the phenology and ecology of reproduction was carried out 13 plots in which counts were made (Table 2). The contents of nests

Fig. 1. Distribution of the sample plots studied within the area of Pomerania (NW Poland). 1–23 localities as in Table 1.

Table 1. Numbers and nest density of House Martins in sample plots studied. T — total area, B — built-up area.

Sample plot	Year	Area (km²)		Number of nests	Nests/km²	
		T	B		per T	per B
Słupsk (Sp)	1983	260.6	4.20	2515	9.6	598.8
Sławno (Sw)	1983-94	284.2	3.32	2670	9.4	804.2
Czaplinek (Czp)	1983	365.0	3.47	4522	12.4	1303.2
Damnica (Da)	1984-85	167.8	2.80	1506	9.0	537.9
Chociwel (Ch)	1984	157.9	2.25	2558	16.2	1136.9
Luzino (Lu)	1985	110.9	2.04	437	3.9	214.2
Rzeczenica (Rze)	1985	274.9	2.22	1062	3.9	478.4
Bytów (By)	1986	188.7	4.80	1422	7.5	296.2
Cewice (Ce)	1986	187.9	2.92	1196	6.4	409.6
Czarna Dąbrówka (CzD)	1986	327.1	4.24	2626	8.0	619.3
Karsin (Ka)	1986	169.2	5.11	2534	15.0	495.9
Konarzyny (Ko)	1987	104.9	1.10	1059	10.1	962.7
Lipnica (Lip)	1987	306.1	2.22	1383	4.5	623.0
Malechowo (Ma)	1987	226.6	3.77	1962	8.7	520.4
Miastko (Mi)	1988	461.0	4.36	3163	6.9	725.5
Świeszyno (Św)	1988	132.6	2.37	854	6.4	360.3
Tczew (Tcz)	1988	164.4	4.19	1426	8.7	340.3
Smołdzino (Sm)	1988	257.2	1.53	1892	7.4	1236.6
Wejherowo (Wej)	1994	193.5	3.81	788	4.1	206.8
Dębnica Kaszubska	1994	271.2	3.57	1210	4.5	338.9
Czarne (Czr)	1994	235.0	2.01	512	2.2	254.7
Wysoka (Wy)	1995	123.0	1.59	1859	15.1	1169.2
Krajenka (Kr)	1995	147.7	1.33	548	3.7	412.0
Total		5117.4	69.22	39704	ca 8.0	610.7

Table 2. Number of nests examined for breeding ecology during the first (I) and second (II) brood in sample plots studied (see Fig. 1 and Table 1). ( ) — repeated laying.

Plot	I	II
Lu 1985	30	30
Ka 1987	30	22
Ma/1 1987	15	9
Ma/2 1988	30	19
Ust 1988	34	30
Mi 1989	60	14
Sp 1989	51	10
Św 1980	52	6
Tcz 1989	21 (1)	9
Sw/1 1994	34	20
Wej 1995	30 (2)	14
Sw/2 1995	20(2)	9
DKa 1995	15	14
Total	422 (5)	206

were checked in some localities, and a nesting calendar run for each nest between April and the end of September. If the first brood in the nest was successful, the next one was considered as the second brood. If the first attempt of breeding was unsuccessful, the next clutch in the nest was considered to be the repeat laying and was included into the first brood data. Data on phenology and breeding ecology of the population studied were combined for all localities and years on the basis of 5-day intervals (pentads). The following breeding parameters were studied: hatching success (i.e. number of young hatched compared to number of eggs laid), fledging success (i.e. number of young fledged compared to number of hatchlings), breeding success (number of fledglings compared to number of eggs laid) and production of young (number of fledglings reared by a breeding pair).

RESULTS AND DISCUSSION

Nesting population density

The total densities in the 23 rural sample plots studied varied from 2.2–16.2 nests per km^2 (Table 1). The highest values were obtained from plots abundant in lakes number (Chociwel, Karsin and Czaplinek). The overall mean density for the sample plots studied was 7.98 nests per km^2 (SD = 5.87, CV = 48.5%, n = 23).

The nest density in built-up areas also varied markedly: 206.8–1303.2 nests per km^2 (Table 1). Total mean density for built-up areas was 610.7 nests/km^2 (SD = 338.1, CV = 55.4%, n = 23).

The overall mean density obtained for areas studied (c. 8 nests/km^2) was much higher than those given for large areas of rural landscape in northern and western Europe. A review of studies presented by Glutz & Bauer (1985) and Cramp (1988) provides that in northern regions of Denmark there were ca. 1 breeding pair per km^2, in Great Britain as a whole 1.6 pairs/km^2 were found (albeit with 3.7 for rural areas of Oxfordshire), for the Neusiedlersee (Austria) ca. 6 and for Languedoc (France) some 6.5 pairs/km^2. The densities obtained in this study for built-up areas are also found to be higher than those noted for other regions of Europe (cf. data in Glutz & Bauer 1985 and Cramp 1988).

Timing of reproduction

House Martins studied produced two broods (Fig. 2). The start of laying was noted from the third pentad of May (1985) to the first pentad of June (1987). 85.5% of pairs started egg laying between the fifth pentad of May and the third of June. The main wave of hatching — encompassing 94.5% of broods — was between the third pentad in June and the second in July. The greatest part (94%) of young began to leave nests in July.

In total 49% of pairs from the first broods were also involved in second ones, continued between the last days of June and the fourth pentad of September (Fig. 2). Second-brood clutches began to be laid between the last pentad of June (1995) and the last pentad of July (1989). The majority (72.4%) of second broods were started in the second half of July. Hatching occurred mainly in August (96% of nests) and the greatest wave of young left the nests between mid-August and mid-September.

The absolute terms and periods of intensification of breeding by House Martins in the study area lay entirely within the ranges given for the Central European population by Glutz & Bauer (1985) and Cramp (1988). Authors above suggested that the main factors modifying the timing of breeding on the local scale were the weather (especially temperature), food resources and the age structure of the population. Kokurewicz (1988) indicated in Silesia two peaks for the onset of laying first clutches, which reflected differences in the times of starts made by older and younger females. The present study found no such differences for first broods (Fig. 2), probably because of the overlapping of results from the different years.

Clutch size and the production of eggs

Complete (incubated) clutch of the first brood comprised 1–7 eggs, while second brood clutches had between 1 and 5 eggs. The most frequent size was 4 eggs and four-eggs clutches made the great-

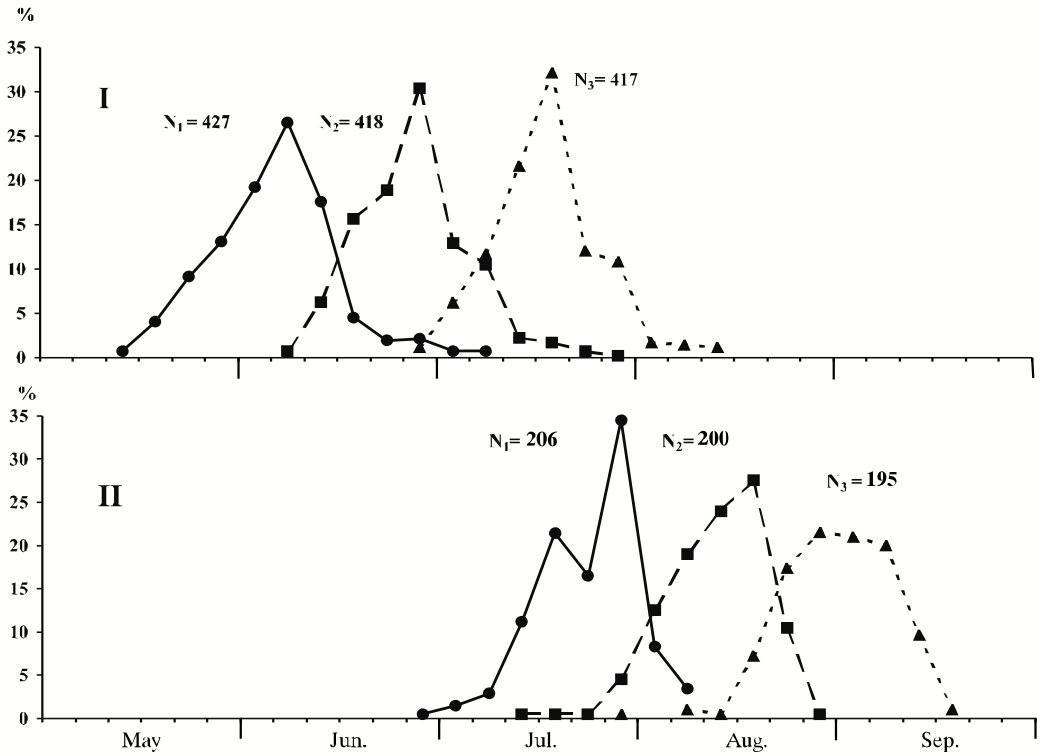

Fig. 2. Start of egg laying (N_1 — clutches), dynamics of hatching (N_2 — broods) and fledging (N_3 — broods) in the first (I) and second (II) broods.

est contribution to the overall production both of first-brood and second-brood eggs (Fig. 3).

The mean size of first-brood clutches ($\bar{x}$ = 3.99, SD = 0.94, n = 427), was significantly greater (t-test, t = 4.71, df = 627, $p < 0.001$) than that of those of the second brood ($\bar{x}$= 3.61, SD = 0.93, n = 202).

Glutz & Bauer (1985) indicated 2–6 eggs as the most frequent clutch size of House Martin clutches, while Cramp (1988) — 3–5 eggs, and the absolute range 1–7. North-eastern Poland clutches comprised 2–5 eggs (Kamiński & Wołosiuk 1995). Mean clutch size in Europe was said to vary between 4.04 and 4.51 in first broods, and between 3.17 and 3.39 in second ones, with only rare exceptions (Møller 1984). In the case of the studied Pomeranian population, the mean first-brood clutch size was rather lower than those given for most regions of Central Europe, while that for second broods was higher. It is possible that the lower mean clutch size noted for first

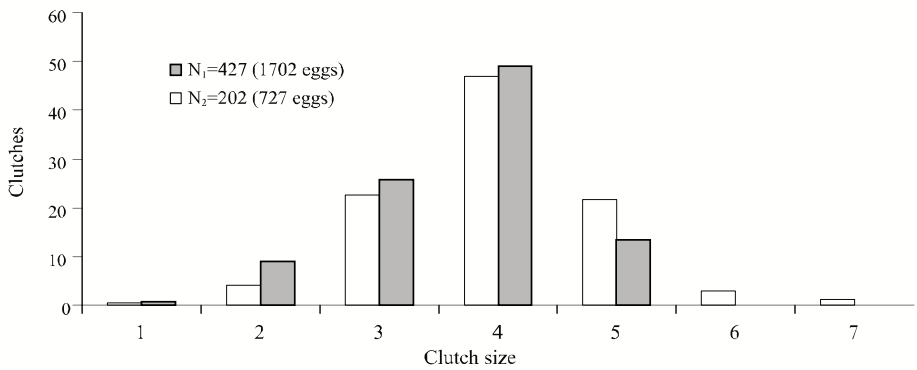

Fig. 3. Clutch size in the first (N_1) and in the second (N_2) brood.

Table 3. Production of young and breeding success in two broods (I, II).

Parameters	I		II		Total	
Breeding pairs	422		206		422	
Hatching success (eggs laid)	94.3%	(1702)	95.8%	(729)	94.8%	(2431)
Fledgling success (hatchlings)	97.5%	(1605)	95.1%	(699)	96.8%	(2304)
Breeding success (fledglings)	91.9%	(1565)	91.2%	(665)	91.7%	(2230)
Fledglings/breeding pair	3.7		3.2		5.3	

broods reflects what was as already mentioned, an exceptionally high breeding density of House Martins. Seasonal dips in mean clutch sizes for House Martins have mostly been explained by reference to the non-simultaneous onset of breeding by older and younger females, where the latter produce clutches with a smaller number of eggs (e.g. Rheinwald & Gutscher 1976, Hund & Prizinger 1985, Kokurewicz 1988).

Breeding success and the production of young

Figures for hatching, fledging and overall success were high in both first and second broods (Table 3). Most values given from other parts of Europe for hatching success, fledging success and overall success are lower than those presented here, with the respective figures being, for example: Czechoslovakia 84.7, 89.1 and 75.4% (Balat 1974) or 85.7, 63 and 55.8% (Kondelka 1978); for England 85.8, 94.2 and 80.8% (Bryant 1975 after Cramp 1988) and for Western Germany 78.8, 91.3 and 71.9% (Hund 1976). While some authors (e.g. Kokurewicz 1988) have noted considerable declines in breeding success as the season progresses, the success obtained by first and second broods of the population studied here is seen to be almost identical (Table 3). It was despite of lower mean clutch size and a number of pairs engaging in second breeding that is less than half as great as the number founding first broods.

CONCLUSIONS

1. The agricultural areas of Pomerania (NW Poland) are seen to have relatively high densities of breeding pairs of House Martins — 8 nests/km^2 of landscape and 611 nests/km^2 of built-up areas. This may reflect a lack of the negative impact of industry and large urban agglomerations, which were not present in the study area.

2. The relatively low mean first-brood clutch size may be linked to the high density of the population in the study area.

3. The breeding success in the two broods was almost identical, though the mean number of young per breeding pair was more than 10% higher in the first brood. This made 70% contribution to the overall production of young, because more than twice as many pairs commenced first broods as second ones.

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STRESZCZENIE

[Ekologia lęgowa oknówki na Pomorzu]

Liczebność i zagęszczenia oknówki były dotąd badane na Śląsku (Tomiałojć 1970, Kokurewicz 1988, Dyrcz et al. 1991) i w Wielkopolsce (Kuźniak 1978, Bednorz et al. 2000). Brak ocen z terenów rolniczych. Dane dotyczące ekologii lęgów tego gatunku w Polsce odnoszą się tylko do populacji gniazdujących na Śląsku (Kokurewicz 1988) i w Polsce Północno-wschodniej (Kamiński & Wołosiuk 1995).

Badania prowadzono na terenie 23 gmin wiejskich w północno-zachodniej Polsce (Fig. l, Tab. l) o powierzchni 5117 km^2 (111–365 km^2). Na obszarze tym było 635 wiosek, osad i osiedli o łącznej powierzchni terenów zabudowanych 69.22 km^2 (1.10–5.11 km^2) zajmujących 1.3% badanego terenu.

Liczenia gniazd w poszczególnych gminach (Tab. l) oraz badania ekologii lęgów w wybranych miejscowościach (Tab. 2) prowadzono w latach 1985–1995. Inwentaryzację gniazd prowadzono w zespołach kilkuosobowych posługując się mapą terenu gminy w skali 1:25000 oraz spisem wszystkich wiosek, osiedli i osad. W każdej miejscowości sprawdzano wszystkie zagrody i budynki, licząc znalezione gniazda. Liczenia prowadzono w lipcu, kiedy w większości gniazd znajdują się jeszcze młode z pierwszego lęgu lub pod gniazdami widoczne są ich odchody, co łącznie z obserwacjami zachowania dorosłych jaskółek (wlatywanie do gniazd) pozwalało na odróżnienie gniazd zajętych od niezajętych.

Badania ekologii lęgów prowadzono kontrolując zawartość wybranych 15–60 gniazd co 2–4 dni w okresie od kwietnia do końca września. Lęgi zakładane w danym gnieździe w terminie do trzech tygodni po niepowodzeniu pierwszego lęgu uznawano za lęgi powtarzane i wliczono do łącznej puli pierwszych lęgów. Lęgi pojawiające się w gniazdach, w których pierwszy lęg zakończył się pomyślnie uznawano za drugie lęgi.

Zagęszczenie gniazd na zbadanym terenie (Tab. 1) wykazywało prawie 8-krotną (CV = 48) rozpiętość między skrajnymi wynikami, a na terenach zabudowanych 6-krotną (CV = 55%) (Tab. l). Najwyższe zagęszczenia stwierdzono w gminach, w których znaczną część powierzchni zajmowały zbiorniki wodne (np. Chociwel, Karsin, Czaplinek).

Zarówno zagęszczenie gniazd w krajobrazie rolniczym jak i w wioskach i osiedlach Pomorza, znacznie przewyższa wyniki uzyskane w innych rejonach Europy (Glutz & Bauer 1985, Cramp 1988), co prawdopodobnie było związane z brakiem negatywnych oddziaływań przemysłu i wielkich aglomeracji miejskich.

Na terenie badań oknówki wyprowadzały dwa lęgi (Fig. 2), przy czym do drugich przystępowało ok. 49% par. Terminy gniazdowania oknówki na Pomorzu pokrywają się z podawanymi dla centralnych obszarów Europy w opracowaniach Glutza & Bauera (1985) oraz Crampa (1988).

Zniesienia z 4 jajami miały największy udział w produkcji jaj w obydwu lęgach (Fig. 3).

Sukces wyklucia, sukces wylotu i ogólny sukces lęgowy osiągnęły w obydwu lęgach wysokie wskaźniki (Tab. 3) na tle populacji z innych rejonów europejskiego areału lęgowego oknówki (np. Balat 1974, Hund 1976, Kondelka 1978, Cramp 1988). Mimo, że ogólny sukces lęgowy był prawie identyczny w obu lęgach, pierwszy lęg dostarczył 70% ogółu wychowanych młodych.

PODZIĘKOWANIA

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