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Abundance of the starling, *Sturnus vulgaris* L. in the breeding season in the vicinity of Gdańsk

[With 1 table and 2 figures]

Abstract: The methode of the estimation of the number of the starling in built-up area is described. The starlings built 53% of their nests in buildings, 42% in tree holes and only 5% in nest boxes. The density of nests with young was 12.15 nests/km².

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INTRODUCTION

The objectives of this paper are the abundance estimation of a breeding population of the starling and the manner of placing the nests.

The abundance estimation of birds is usually carried out in small census plots, from a few to several dozen hectares. Results obtained in this way are not adequate for characterizing the abundance in large areas (HEYL 1968; TOMIAŁOJĆ 1972), because the manner of carrying out the estimation allows for neither the mosaic character of the area nor the home range of birds (JABŁOŃSKI 1976). Therefore it is advisable not to convert the density results obtained in small areas into pairs per 1 km² (TOMIAŁOJĆ 1972) but give them

for 1 or 10 ha. As far as the starling is concerned only OELKE (1967) and JABŁOŃSKI (1976) have given the results of the abundance estimation carried out in large areas of more than 100 km².

TERRITORY

The investigations were carried out on the Sobieszewska Island situated between the arms of the Vistula River: Przekop, Martwa and Smiała; the northern boundary of this area is formed by the coast of the Gdańsk Bay. The area of the island is 35.6 km² out of which 30 % is ploughland, 21 % — meadows and pastures, 18 % — forests and 31 % — water, built-up areas, beaches, dunes and other types of waste land. There are 6 villages and hamlets, inhabited by about 6,000 people.

The forest covers a stretch of land adjoining the sea; its width is 0.5 — 1 km. It consists mainly of pine woods; decidous trees occur in a belt of 30–50 m at the southern edge of the complex and as small alder-birch-aspen clusters growing between the dunes. Other tree stands are usually near human hamlets. An exception is an avenue of trees 7 km long growing beside an asphalt road which goes through two hamlets, and half of this adjoins the edge of the forest.

The starling nesting in nest boxes and considered in this paper occupied boxes fixed by the local people, by foresters and by the Marine Office. Those starlings nesting in nest boxes hung by the Ornithological Station for experimental purposes have been omitted. There were relatively many of these boxes (in 1971 350 boxes were placed in 6 colonies; in 1972 the number of boxes increased up to 648 and the number and distribution of the colonies were changed), but it was assumed that the introducing of them had not resulted in any significant changes in the abundance and distribution of the „natural" part of the population inhabiting the investigated area because:

1) it had been noticed that starlings nested more readily in holes and in roofs than in boxes;

2) it had been found that in successive years nests had been built in the same places, which proved the great conservatism of starlings in this respect;

3) it had been found that the supply of nest boxes caused more birds to breed in their first full summer which, in the ordinary course, would have started to breed only in the following years (GROMADZKI in press).

METHODS

The investigations were begun in 1971 and continued in 1972 and 1973. Most of the material was collected by the author who also verified in the field most of the observations carried out by (different in the consecutive years) technical personnel.

The year 1971 was a trial one and only a part of material collected during that year has been used in the study. In the light of the material collected in 1972 the manner of carrying observations was simplified in 1973 — the details will be discussed later. The investigations involved the whole territory of the island but the observations were carried out only in those parts where the nesting of starlings was possible (e. g. in the forest no observations were carried out in stretches of young trees).

Each year the observations were carried out in two periods:

a) mid-April to the first days of May, i. e. the period of nest building and egg-laying (GROMADZKI in press). The observations were carried out from dawn till 8.00 A. M., on foot, from a bicycle or a motor bicycle and concerned places of the occurence of starlings, their display activity and where they built nests — such places are called „sites" later on. Data were marked on appropriate forms or schematic maps of an area where the sites were located with maximum accuracy (exact to a house or a tree). Greatest difficulties were encountered in the forest which was penetrated at intervals of several dozen metres: there starlings were discovered mainly by means of hearing.

Each part of the investigated area was visited during one morning at least but, if it was possible, observations were repeated during the following days.

b) 20, May — the first days of June, i. e. the period of intensive feeding of the young, when attemps were made at discovering as many nests with young birds as possible. The observations were carried out from about 5.00 to 10.00 A. M., at the time of the most intensive feeding of the young (BOGUCKI 1972); in exceptional cases they lasted till midday. In 1972 observations were carried out over the whole area, with most attention paid to the sites discovered earlier; in 1973 the investigations were limited to counting nests in sites only.

The counting of nests in holes in trees did not present much difficulty because, in most cases, it was relatively easy to establish the number of holes in a given tree. The recording of nests was faciliated by voices and the appearance of nestlings looking out of the entrance of the holes and traces of their excreta outside. More individual nesting of starlings in trees was an additional facilitation — 4 nests were the maximum recorded in one tree (TOMIAŁOJĆ 1972, mentioned 7 nests in one tree). Counting nests built in the roofs of buildings was more complicated because very often starlings nested there in colonies. 20 nests were the maximum recorded in one roof. There was another hindrance — the impossibility of establishing the number of potential places for nest-building. In the case of nests in roofs it was possible only in exceptional cases to notice nestlings looking out, and the traces of excreta were no indication since roofs were covered by excreta of adult birds. Therefore, counting nests built in roofs required more time; this problem will be discussed in the next chapter.

I wish to express my gratitude to Mr Bolesław Galer for his help in collecting material and to Mr Waldemar Pągowski for his help in collecting and working out data. I would also like to give my thanks to all the colleagues who read the manuscript and remarked upon it, especially to Drs. Zdzisław Bogucki, Przemysław Busse, Wojciech Kania, Bogumiła Olech, Ludwik Tomiałojć and Ryszard Zając. I am particularly grateful to Mr Robert Spencer, who read and corrected the English text of this paper.

ACCURACY OF THE ABUNDANCE ESTIMATE

The accuracy of the abundance estimate of a population by the method used in the study depends on: the detectability of sites, the accuracy of nest counting in particular sites and on hatch losses. These three factors operated in the same way, always resulting in obtaining numbers lower than the true ones. The extent of losses due to the influence of weather, illnesses, predators etc., was difficult to determine. It can be assumed that the influence of these factors differs according to nest site and the habitat in which a nest occurs.

The detectability of sites is also different in the case of different habitats, but the negative effect of this factor may be reduced by a very careful examination of an area. In 1972, in spite of a thorough second survey of the area during the period of feeding young birds, only 5% of all the discovered nests were found in places where formerly no sites had been recorded.

On the average nests were discovered in only 59% of sites (1972 — 53%; 1973 — 65%). It is difficult to estimate which proportions of the remaining 40% were represented by apparent sites occupied by young non-breeding birds (Berthold 1964), by sites entered accidentally and by sites in which nests were built but were later destroyed. (The number of sites where building of nests was recorded but no young birds were found was 8% of the total amount of sites in 1972 and 3% in 1973). The agreement of this with the numbers recorded by Luniak (1977) is interesting; he too has estimated the error due to the recording of apparent sites as about 40%.

As has already been mentioned, the counting of nests in buildings presented considerable difficulties. Therefore, in order to obtain results as exact as possible it was necessary to observe each side of a roof for a long time. In 1972 a 15-minute observation of one side of a roof was considered a rule. In some cases the time of observation was 20 or more minutes which necessitated devoting a considerable amount of time for counting nests in one building only (in cases of buildings with three-sided roofs — up to an hour or more).

In order to discover the minimum observation period necessary to record the most detailed results, the time from moment of starting an observation to the discovery of successive nests was measured. These timing were taken in 20 sides of a roof each with 1 — 8 nests — 78 nests in all; on average the discovery of one nest took 2.5 min., the discovery of 8 nests — 7.5 min. (Fig. 1). The maximum recorded interval from the moment of starting an observation to the return of adult birds with food was 23 min.

By estimating the number of nests that would be discovered with the application of 1, 2,...n minutes time of observations of one side of roof it was concluded that in a 10 minute period of observation 96 % of nests were discovered (Fig. 2).

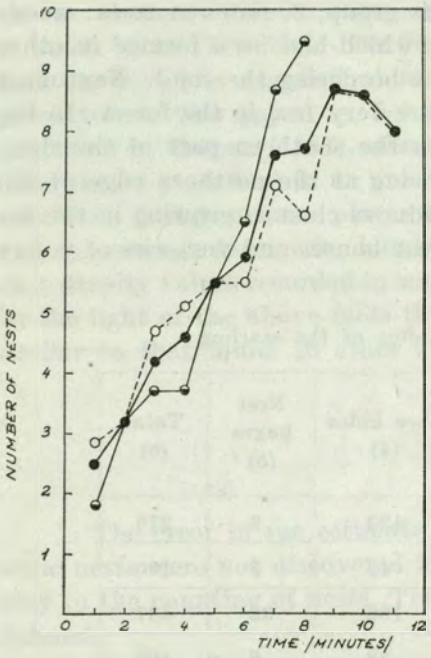

Fig. 1. Mean length of time necessary to find a definite number of nests in one side of a roof. ◐——◐ – 1972, ○- - -○ – 1973, ●——● – mean.

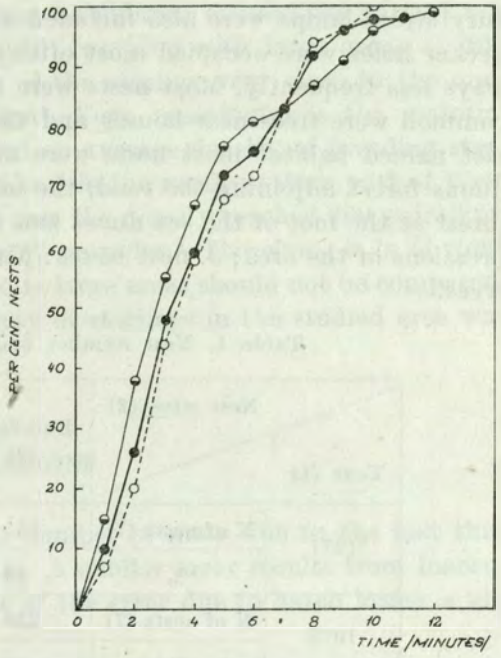

Fig. 2. Fraction of the total amount of nests built in roofs found during a given period of time, ◐——◐ – 1972, ○- - -○ – 1973, ●——● – mean.

Based on these results, in 1973 the 10-minute period of observation of one side was adopted, but in special cases it was 15 min. That year the time taken to discover nest was measured during the observation of 40 sides of roof where there were 137 nests – from 1 to 15 in each (Fig. 1). An increase in the time of an observation to more than 10 minute did not result in the discovery of any new nests.

According to Bogucki (1972), during the period of feeding nestlings a nest is visited every 2–3 minutes on the average, but limiting the time of an observation to this extent would make it possible to discover only 50 % of nests (Fig. 2).

With 9 nests in a side of roof, the average length of time required for their discovery decreased (Fig. 1) not exceeding 9 minutes and therefore the prolonging observation beyond 10 minutes was pointless.

NEST SITES

The nest sites of the starling can be divided into three main groups: 1. buildings: most commonly nests were built in roofs, especially those covered with pantiles. Starlings also nested in gables, under side lintels, in vent-holes and rarely in the nooks and crannies of walls. Nests built in the covers of mercury street lamps were also included into this group; 2. holes in trees: woodpecker holes were occupied most often; those which had been formed in other ways less frequently. Most nests were in trees bordering the road. Next most common were trees near houses and there were very few in the forest. In the last named habitat most nests were found in the southern part of the deciduous forest adjoining the road, the others being at the northern edge of the forest at the foot of the sea dunes and in deciduous clusters growing in the depressions of the area; 3. nest boxes: placed near houses and nurseries of young trees.

Table 1. Nest number and nest sites of the starling

Year (1) \ Nest sites (2)		Buildings (3)	Tree holes (4)	Nest boxes (5)	Total (6)
1971	N of nests (7)	135	133	8	276
	%	49	48	3	100
1972	N of nests (7)	238	166	33	437
	%	54	38	8	100
1973	N of nests (7)	235	175	18	428
	%	55	41	4	100
On the average (%) (8)		53	42	5	100

Over 50 % of the nests discovered were in buildings (Table 1), tree holes were in the second place. Only a small percentage nested in nest boxes. A similar low percentage of a population nesting in nest boxes (2–3 %, locally 5–15 %) has been reported by OELKE (1967) in the agricultural landscape of the north-western part of West Germany.

DENSITY OF THE NESTS

The density of nests with young birds per 1 km² of the investigated area was 12.28 in 1972 and 12.02 in 1973 (12.15 on the average). It might seem that the density of a starling population in the studied area was very low in comparison with the densities it reaches in other areas. LUNIAK (1977) has recorded

a density of 6–360 pairs/km² for different habitats in Warsaw; MRUGASIEWICZ (1974) has recorded a density of 11–154 pairs/km² in the forests of the Milicki district; maximum densities of the starling — 809 and 782 pairs/km² have been given by TOMIAŁOJĆ and PROFUS (1977) for urban parks. Similarly high densities have been given by TOMIAŁOJĆ (1974) — 666 pairs/km² in a village park and by JAKUBIEC (1972) — 598 pairs/km² in a beech forest. However, all the above mentioned data result from abundance estimations carried out in small areas (3–45 ha). JABŁOŃSKI (1976), working with large areas — 100 and 120 km², has recorded abundances of the starling very close to the ones presented in this paper — 7–9 pairs/km². Very meaningful is the material presented by OELKE (1967), who recorded an average density of breeding starlings of 12.4 pairs/km² in an area of 183 km² in the north-western part of West Germany, though in some places in that area the density reached 300 pairs/km² and the average density for hamlets was 97 pairs/km². Therefore, it is obvious that density values recorded in small and in large areas should not be compared. In the light of the above facts the density of starlings in the studied area was similar to that found in other areas.

CONCLUSIONS

1. The error in the estimate of the number of nests due to the fact that some nests were not discovered is ca 5%. A similar error results from inaccuracy in the counting of nests. The value of the error due to hatch losses is undefined.

2. On the average, nests were discovered in 60% of sites.

3. In particular years, 49–55% of all the nests were recorded in buildings where starlings often nested in colonies of up to 20 nests in one building. Tree holes came second; 38–41% of nests were recorded there and 4 nests were the maximum for one tree. 3–8% of nests were recorded in nest boxes.

4. The total density of nests per 1 km² in the investigated area was 12.28 in 1972 and 12.07 in 1973. The recorded density was similar to that found of other areas bearing in mind that the abundance estimate has been carried out in large test areas. The values of densities in small and large test areas should not be compared.

REFERENCES

BERTHOLD P. 1964. Über den Fortpflanzungszyklus südwest-deutscher Stare (*Sturnus vulgaris* L.) und über bedingende Faktoren der Brutreife beim Star. Vogelwarte, Stuttgart, **22** (3/4): 236–275.

BOGUCKI Z. 1972. Studies on the Activity of Starlings *Sturnus vulgaris* L. 1758, in the Breeding Season. Acta zool. crac., Kraków, **17** (4): 97–121.

Gromadzki M. in press. Reproduction of the starling, *Sturnus vulgaris* L., in the Vistula Żuławy (Fens). Acta orn., Warszawa.
Heyl G. 1968. Zur Probeflächenanswahl nach statistischen Gesichtspunkten. Orn. Mitt., Stuttgart, **20**: 174–176.
Jabłoński B. 1976. Estimation of birds abundance in large areas. Acta orn., Warszawa, **16**: 23–76.
Jakubiec Z. 1972. Przyroda rezerwatu Muszkowicki Las Bukowy w województwie wrocławskim: Ptaki. Ochrona Przyrody, Kraków, **17**: 135–152.
Luniak M. 1977. Liczebność i produktywność lęgów szpaka *Sturnus vulgaris* L., w Warszawie, Acta orn., Warszawa, **16**: 241-274.
Mrugasiewicz M. 1974. Badania ilościowe awifauny lęgowej lasów w powiecie milickim. Acta Univ. Wrat., Wrocław, 223; prace zool., 6: 15–35.
Oelke H. 1967. Siedlungsdichte und Brutplatzwahl des Stares (*Sturnus vulgaris*) in der norddeutschen Kulturlandschaft. Orn. Mitt., Stuttgart, **19**: 31–34.
Tomiałojć L. 1968. Podstawowe metody badań ilościowych awifauny lęgowej obszarów zadrzewionych i osiedli ludzkich. Not. orn., Warszawa, **9**, (1/2): 1–20.
Tomiałojć L. 1974. Charakterystyka ilościowa lęgowej i zimowej awifauny lasów okolic Legnicy (Śląsk Dolny). Acta orn., Warszawa, **14**: 59–97.
Tomiałojć L., Profus P. 1977. Comparative analysis of breeding bird communities in two parks of Wrocław and in an adjacent *Querco-Carpinetum* forest. Acta orn., Warszawa, **16**: 117-177.

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STRESZCZENIE

[Tytuł: Liczebność szpaka, *Sturnus vulgaris* L. w sezonie lęgowym w okolicach Gdańska]

Celem pracy jest ocena miejsc umieszczania gniazd oraz ocena liczebności lęgowej populacji szpaka. Badania prowadzone były na Wyspie Sobieszewskiej, o powierzchni 35,6 km², leżącej między przyujściowymi ramionami Wisły a Zatoką Gdańską.

Badania rozpoczęto w roku 1971 (który potraktowano jako próbny) i kontynuowano w latach 1972 i 1973. Obserwacje prowadzono (tylko na tych partiach terenu, których pokrycie stwarzało możliwości gnieżdżenia się szpaków) w dwóch okresach: a) w połowie kwietnia — początku maja, kiedy to rejestrowano miejsca występowania szpaków nazywane „stanowiskami"; b) 20 maja — początek czerwca, kiedy liczono gniazda z młodymi na wykrytych wcześniej stanowiskach.

Gniazda wykryto tylko na 59% stanowisk, zaś 5% wszystkich znalezionych gniazd zostało wykrytych w miejscach, w których wcześniej nie stwierdzono stanowisk.

Celem uchwycenia minimalnego, niezbędnego do uzyskania jak najdokładniejszych wyników, czasu obserwacji, zmierzono czas upływający od momentu rozpoczęcia obserwacji do wykrycia kolejnych gniazd (rys. 1). Przy założeniu 10 minutowego okresu obserwacji jednej połaci dachu wykryciu ulega 96 % gniazd (rys. 2).

Miejsca umieszczenia gniazd przedstawiono w tabeli 1.

Zagęszczenie gniazd z młodymi na 1 km² badanej powierzchni wyniosło 12,28 w roku 1972 i 12,02 w roku 1973.

Podpisy do tabel i wykresów:

Tabela 1. Liczba i miejsca umieszczenia gniazd szpaka. (1) — rok, (2) — miejsce umieszczenia gniazda, (3) — budynki, (4) — dziuple, (5) — skrzynki lęgowe, (6) — razem, (7) — N gniazd, (8) — średnio.

Wykres 1. Średnia długość odcinka czasu potrzebnego do wykrycia określonej liczby gniazd w jednej połaci dachu. Oś rzędnych — czas (w minutach), oś odciętych — liczba gniazd, ◐——◐ — 1972, ○- - -○ — 1973, ●——● — średnia.

Wykres 2. Frakcja ogólnej liczby gniazd założonych w dachach, wykrywana w ciągu danego odcinka czasu. Oś rzędnych — % gniazd, oś odciętych — czas (w minutach), ◐——◐ — 1972, ○- - - -○ — 1973, ●——● — średnia.

РЕЗЮМЕ

[Заглавие: Численность скворца, *Sturnus vulgaris* L. в гнездовом периоде в окрестностях Гданьска]

Целью работы была оценка местоположения гнезд и оценка численности гнездовой популяции скворца. Исследования произвели на Собешевском острове площадью 35,6 км², расположенном между рукавами дельты Вислы и Гданьской бухтой.

Исследования начали в 1971 г. (рассматривая их как пробные) и продолжили в 1972 и 1973 гг. Наблюдения производили только в таких местах, в которых растительный покров давал возможность гнездования, двоекратно на протяжении сезона: а) в середине апреля — начале мая, когда регистрировали местонахождения скворцов, названные „стациями"; б) 20 мая — начало июня, когда производили учет гнезд с птенцами на обнаруженных раннее стациях.

Гнезда обнаружили только в 59% стаций, а 5% (по отношению ко всем найденным гнездам) констатировали в местах не отмеченных раннее как стации.

Для определения минимального, необзодимого для получения как можно более точных результатов, времени наблюдения измерили период времени от момента начала наблюдения до обнаружения очередного гнезда (рис. 1). Исходя из принятого 10-минутного периода наблюдения одного ската крыши, крытой голландской черепицей, можно обнаружить 96% гнезд (рис. 2).

Места расположения гнезд представлены на таблице 1.

Плотность гнезд с птенцами на 1 км^2 исследованной поверхности составила 12,29 в 1972 г. и 12,02 — в 1973.

Подписи к таблицам и графикам:

Таблица 1. Количество и места расположения гнезд скворца. (1) — год; (2) — места расположения гнезд; (3) — здания; (4) — дупла; (5) — скворечники; (6) — всего; (7) — N гнезд; (8) — в среднем.

График 1. Средняя продолжительность периода времени, необходимого для обнаружения определенного количества гнезд на одном скате крыши. Ось ординат — время в минутах, ось абсцисс — количество гнезд, ◐——◐ — 1972, ○- - - -○ — 1973, ●——● — в среднем.

График 2. Доля гнезд, обнаруживаемых на протяжении данного отрезка времени, по отношению к общему количеству гнезд основанных на крышах. Ось ординат — % гнезд, ось абсцисс — время в минутах, ◐——◐ — 1972, ○- - - -○ — 1973, ●——● — в среднем.

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