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DISTRIBUTION AND ECOLOGY OF MUTE SWANS IN ZAMOŚĆ REGION (SOUTHEAST POLAND) IN 1991–1997

Ignacy Kitowski

Abstract. The settling down process in Mute Swans from Zamość region (SE Poland) in 1991–1997 was researched. 44 breeding localities were found. Over the concerned period of studies 23 to 36 breeding pairs of Mute Swans on 19–27 localities were recorded in the study area. The highest number of pairs nested on large fish ponds. Breeding pairs had on average 5.32 ± 1.79 ($n = 170$) cygnets after hatching. In the respected period swans started nesting on 23 new breeding sites, which amounted to 52.3 %. On three localities cygnets of ‘Polish forms’ *Cygnus olor immutabilis* were recognised.

Key words: Mute Swan, *Cygnus olor*, Poland, distribution, breeding, ‘Polish swan’.

Address: I. Kitowski, Dep. of Nature Conservation, Institute of Biology, Maria Curie-Skłodowska University, Akademicka 19, PL-20-033 Lublin, Poland; e-mail: kitowign@biotop.umcs.lublin.pl.

Распространение и экология лебедя-шипуна в Замостском воеводстве (Юго-Восточная Польша) в 1991–1997 гг. - И. Китовский. - Беркут. 13 (1). 2004. - Изучался процесс расселения лебедя-шипуна в регионе Замостья. Всего было обнаружено 44 места гнездования (рис.). 72,7 % пар гнездились на больших рыбопродуктивных прудах, 11,4 % – на маленьких прудах и прудах парков, 6,8 % – на запрудах, 4,5 % – на купальнях, по 2,3 % – на небольшом озере и островке на верховом болоте. Плотность гнездования составляла в разные годы от 0,33 до 0,52 пар/100 км². За период исследований появились 23 новых места гнездования. Наибольший прирост численности отмечен в 1995 г. – 8 новых пар. Выводки после вылупления состояли из $5,32 \pm 1,79$ птенца ($n = 170$, $lim = 1-9$). Обсуждаются различия в успешности размножения. Пары, гнездившиеся в новых местах, имели меньше птенцов. В трех местах обнаружены лебеди “польской формы” *Cygnus olor immutabilis*. 62,5 % вылупившихся лебедят дожили до первого полета. Анализируются причины гибели птенцов.

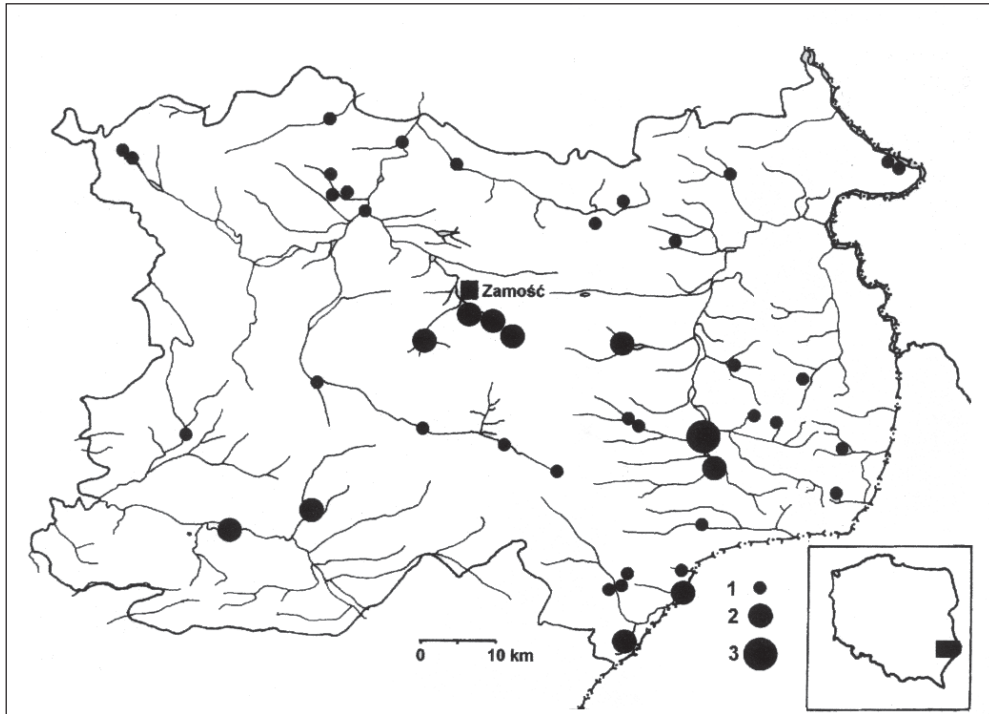
INTRODUCTION

In the 1930-ties and 1940-ties the Mute Swan (*Cygnus olor*) breeding sites in Poland used to be restricted to the regions of Pomerania and Mazuria (lake districts in the north of Poland) (Wieloch, 1984; Tomiałojć, 1990). However, by the end of 1980-ties Mute Swans expanded nearly all over Poland. The phenomenon was accompanied by changes in productivity and habitats of breeding (Wieloch, 1984). Since the expansion progressed from north and west directions, the areas of Poland that Mute Swans inhabited last concerned mainly south and east regions of the state, adjacent to the eastern border between Poland and Ukraine, namely Zamość and Przemyśl regions (Hordowski, Kunysz, 1991, Profus et al., 1992). The paper presents observations on the settling process and breeding effects for Mute Swan in the area of Zamość region in the 1990-ties.

STUDY AREA AND METHODS

The research was performed between 1991 and 1997 in the area of Zamość voivodship established at the end of 1998 and covered the area of 6980 km² with a population of nearly 500 thousand (Anonymous, 1997). Zamość region is a typical agricultural area. Arable land reaches nearly 60 % of its area. Woods cover about 20 %, whereas meadows and pasture only 2 % of it. The area consists a part of Vistula river basin waters to which gather the rivers Bug, San, Wieprz and their tributaries, namely Tanew, Por, Solokija, Huczwa, Wolica and Siniocha. The region is deficient in stagnant water. The mere water reservoirs are fish ponds that are usually located in the river valleys (Michalczyk, Wilgat 1998).

Observations were initiated in mid-February, when customarily water is filled into ponds, and interrupted at the end November



Distribution of breeding localities of Mute Swan in Zamość region in 1991–1997.

1 – 1 pair, 2 – 2–3 pairs, 3 – 4 pairs.

Места гнездования лебедя-шипуна в Замостском воеводстве в 1991–1997 гг.

when the ponds are being dried. A preliminary number of pairs that started breeding was recorded. It was especially important at the locations that could be easily penetrated by people, such as little ponds, rivers beds, etc. The research at that phase was focused on exact determination of the number of led cygnets, with particular attention paid to their number after hatching. In Zamość region it started in general in late May or early June. Determination of the number of led offspring was conducted till middle July, by this time most of the in-field-research was performed. At the later stage only selected sites were controlled and the activities were performed most frequently at the end of August-beginning of September to register the number of juveniles capable of flying (see Table 1).

Only the pairs whose nests were identified or cygnets detected were considered as breeding pairs. Similarly, as new breeding localities

(pioneer localities) solely the places that were sure not to have been occupied by other breeding pairs in the preceding years were classified. In other words, the first recorded brood on that localities were found.

RESULTS

A number of 44 of Mute Swans breeding localities (Fig.) was determined. On large fish ponds 32 breeding localities were recorded, which contributed to 72.7 %. Only 5 breeding sites were found on small ponds and park pools; it amounted to 11.4 %. Even smaller number of 3 breeding sites (6.8 %) was detected at rivers broads. At swimming sites merely 2 (4.5 %) localities were disclosed. Single breeding sites were found on a small lake (2.3 %) and on a peat-bog isle (2.3 %).

From year to year a number between 23 and 36 pairs, at 19 to 28 localities, was noted



Table 1

Breeding parameters of Mute Swans in Zamość region. The number breeding pairs is given as the index, if they are different from data included in this table

Параметры размножения лебедя-шипуна в Замостском воеводстве

Year	Number breeding localities (new occupied)	Pairs with nests	Number pairs with cygnets	Average number cygnets after hatch/pair with cygnets	Average number cygnets able to flight/pair with cygnets	Rate of survival to age of flight (number cygnets)
1991	21 (2)	24	22	5.77 (\pm 1.69) ⁽¹³⁾	3.70 (\pm 0.82) ⁽¹⁰⁾	0.67 (55)
1992	27 (8)	31	27	5.52 (\pm 1.48)	4.08 (\pm 1.16) ⁽¹²⁾	0.73 (67)
1993	27 (5)	32	27	5.27 (\pm 1.37) ⁽²⁶⁾	3.61 (\pm 1.50) ⁽¹³⁾	0.65 (72)
1994	24 (2)	28	28	5.46 (\pm 1.93)	2.69 (\pm 1.60) ⁽¹³⁾	0.62 (56)
1995	28 (5)	36	31	5.71 (\pm 2.0)	2.94 (\pm 1.43) ⁽¹⁷⁾	0.59 (84)
1996	19 (0)	23	20	4.35 (\pm 1.84)	2.00 (\pm 1.08) ⁽¹³⁾	0.52 (50)
1997	20 (1)	27	25	5.08 (\pm 1.85)	2.43 (\pm 1.45) ⁽¹⁴⁾	0.56 (61)

(Table 1). It yielded a small breeding density ranging from 0.33 to 0.52 breeding pairs/100 km². In the concerned period of conducted research swans started nesting on 23 new breeding sites, which contributed to 52.3 % of the overall number of 44 detected sites revealed during the study. Out of them a number of 8 swans lost their clutches. In 1995 the biggest increment in the number of nesting pairs occurred – 8 new pairs were identified in comparison to 1994 (Table 1). However, frosty winter of 1996 when average temperature in March dropped to -3.2°C , brought the severe reduction in number of breeding pairs by 36.1 % in comparison to 1995. In addition, at some traditional breeding sites late water filling of the ponds (Labunie-ponds: ‘Blonka’ 1993, Krasnobrod 1996, 1997) prevented the swans from breeding.

The studied breeding pairs had shortly after hatching an average number of 5.32 cygnets (5.32 ± 1.79 , $n = 170$), which ranged wide from 1 to 9 cygnets. The reduced further by frosty late winter of 1996 (average temperature of January – March -6°C) number of pairs was followed by a reduction in the number of hatched chicks for a pair with cygnets (Whitney-Mann U test results: $Z = -2.24$, $n_1 = 31$, $n_2 = 20$, $P < 0.025$, see Table 1). Breeding

pairs from pioneer breeding sites tended to have fewer cygnets hatched than the ones that had been breeding on sites for more than one season; the respective average numbers were 4.40 ± 1.76 and 5.41 ± 1.76 (Whitney-Mann U test: $Z = -1.96$, $n_1 = 15$, $n_2 = 155$, $P < 0.05$). The same studied performed in the period of developing flying capabilities of cygnets, yielded 1–7 cygnets/pair with cygnets; $M = 3.09 \pm 1.41$, $n = 92$. (Table 1).

Only on 3 localities ‘Polish forms’ *Cygnus olor immutabilis* of cygnets were detected (Table 2). Between 1995 and 1997 white cygnets accounted for mere 2 % of the overall number of 391 cygnets ($n = 391$) with standard plumage. Noted failures ($n = 21$) resulted from a number of factors, namely: human intervention such as deliberate startling adult swans or stealing eggs, nests flooding, abandoning nests due to poisoning, or other unknown reasons; the respective occurrences of the listed reasons happened 13, 3, 1, 1, and 4 times, which corresponded to 61.9 %, 14.3 %, 4.8%, and 23.8 %. Mortality factor for chicks until they were able to fly, was determined for a number of 92 pairs, including 2 pairs that lost their clutches. The pairs had altogether after hatchings 455 chicks, that is 4.81 ± 1.89 cygnets/pair with cygnets, out of which 278



Table 2

Recorded broods of "Polish" form of Mute Swan *Cygnus olor immutabilis*
 Обнаруженные выводки "польской" формы лебедя-шипунa *Cygnus olor immutabilis*

Localities	Year	Number cygnets in brood	Number white cygnets	% white cygnets in brood	% of broods with cygnets	% of all cygnets
Lubycza Krolewska	1995	4	3	75.0	6.7	2.3
Laszczow	1995	6	1	16.7	–	–
Laszczow	1996	5	2	40.0	5.3	2.4
Laszczow	1997	5	1	20.0	8.7	1.7
Dub	1997	6	1	16.7	–	–

(62.5 %) reached the age of flying capability (Table 1).

Only for 28 cygnets the reasons of their death after hatching were clearly identified and grouped as caused by animated or unanimated factors. For the first group of 11 cygnets, death was attributed to predation of Foxes (*Vulpes vulpes*), drowning in pond locks, poisoning with chemicals, and shooting; respective occurrences – 4, 4, 2, and 1. Another group of 11 young swans capable of flying collided fatally with electric lines and trees. Other 6 juveniles died from starvation in winter.

DISCUSSION

Zamość region, as it has been indicated earlier, represents the breeding area of Mute Swans in Poland that were inhabited last (Wieloch, 1984; Tomiałojć, 1990; Hordowski, Kunysz, 1991; Profus et al., 1992). Breeding of swans in Zamość region was preceded by nesting on localities situated towards north (Bienczak, 1973; Dyrz et al., 1973). The first hatching of Mute Swans in Zamość region happened in 1976–1979 on Laszczow fish ponds (Wieloch, 1984). The first breeding records were collected from fish ponds located in Nieledeu, Dub and Chmielek (I. Kitowski, unpubl. data). In the late 1980-ties and 1990-ties first broods were noted on fish ponds in Labunie, Pniówek, Bockow, and Wieprzow Tarnawacki (Profus et al., 1992). Cases of

broods on fish ponds in Hrebenne, Rogow, Zaborce and Wierzbica as well as on mudded meadows of Wieprz river near Tarzymiechy (I. Kitowski, unpubl. data) were also recorded then. In Zamość region 23–36 pairs of Mute Swans were bred (Table 1). It seems that the population originating from late 1980-ties of 12–13 breeding pairs reported by Profus et al. in 1992, as well as the 5 latter ones from localities reported above that were not mentioned by Profus in his report, (altogether 17–18 nesting pairs) has – increased 1.3–2 times (Table 1). Such an increase in the nesting pairs in Zamość region can result from expanded breeding range of the species in Poland (Wieloch, 1984; Tomiałojć, 1990; Włodarczyk, 1999) and in Europe (Lesinger, 1994; Wieloch, 1997; Heath et al., 2000).

Birkhead et al. in 1983 showed that the size of clutch in Mute Swans is determined by the age of females. Studied by them younger females (4 year old) laid fewer eggs compared to the older ones (7 years) and consequently had smaller number of cygnets after hatching. Differences in the number of cygnets hatched at permanent breeding sites and at the pioneer ones where the breeding was performed for the first time, can be explained by that. Pioneer sites could have been occupied by pairs resulting from mating young Swans. Nevertheless, the quality of occupied territory plays the role as well when it comes to food resources (Scott, Birkhead, 1983; Włodarczyk, 1999).



Swans from breeding pairs from Zamość region registered a hatching success at the level of 5.32 ± 1.79 cygnets/pair with cygnets. Lower hatching success values were reported in Europe, i. e. 4.6 cygnets/breeding pair in the area of former German Democratic Republic (Rutschke, 1987), 4.2 cygnets/breeding pair in the area of Republic of Ireland (Collins, 1991). Other studies reported even lower values for hatching success, namely 2.3 cygnets/breeding pair in Ayrshire, Scotland (Leach, 1988), 2.57 cygnets/breeding pair in Staffordshire, England (Coleman et al., 1991).

Over the period when young swans were developing their flying abilities, the studied pairs had on average 3.09 ± 1.41 cygnets/pairs with cygnets. When comparing the results to the data from the North America, the value is smaller than the ones reported by Chasko (1986) for Connecticut, and Knapton (1993) for Ontario, or Reese (1980) for Chesapeake Bay, where the following respective values of 5.4 ± 0.42 , 4.9 ± 1.93 , 3.9 ± 0.77 cygnets/pairs with cygnets were found, and the population of 75, 31, and 151 swans were examined. The parameters for Zamość region are also lower than reported for other regions of Poland where the number of cygnets per pairs with cygnets amounts to an average of 4.1 ± 1.83 , 4.1 ± 1.84 , and 4.5 ± 2.09 in south-west Poland (Milicz fish ponds), northern Poland (Gdańsk area) and Central Poland (Lodz region), respectively (Czapulak, Wieloch, 1991, Włodarczyk, 1999). The results for Zamość region are, however, significantly better than British data reported by Coleman et al (1991), and Leach (1988) who found respectively 1.97 and 1.6 cygnets fledge/breeding pair, as well as Irish data where the values of 2.7 cygnets fledge/breeding pair (Collins, 1991) were reported.

In the studied area only 62.5 % of all hatched cygnets lived to the first flights period. Similar results were reported for North America by Knapton (1993) – 63 %, whereas higher survival rate reaching 76.7 % and 82 % was noted by Coleman et al. (1991) and Reese (1980), respectively. Surprisingly high – 92 % – survival rate for cygnets was reported by

Rutschke (1987) in the studies performed in the area of former German Democratic Republic. Relatively smaller than the one reported for the area in question survival rate for cygnets reaching the value of 33.6 % was observed in North America by Willey and Hall (1972).

Birkhead et al. (1983) found that mean temperature over 3 months of the winter preceding breeding greatly impacted both the date and number of eggs laid by swans. Naturally, it is related to the number of cygnets after hatching. The relation was used to explain the low number of cygnets registered in 1996. Females spending harsh winter spent more time accumulating nutritional elements for the embryo and necessary to built egg shells (Perrins, 1996). Predation of foxes influenced also breeding success of swans though its overall impact upon the entire population is hard to estimate. It may, however, gain significance since the population of foxes in Poland keeps growing (Beresiński, Panek, 2000).

In Zamość region cygnets of 'Polish form' were observed 16 years after the first breeding record of swans (Wieloch, 1984) and 9 years after the first documented observation of white cygnets in the area of SE Poland (Czapulak, Wieloch, 1988). The rate of broods with white cygnets in the overall pool of all pairs that led offspring, as well as the of white cygnets in the overall number of chicks, proved similar to the rates reported for SE Poland in 1986 (Czapulak, Wieloch, 1988). It was, however, lower when compared to the values observed in the West and Central Poland (Czapulak, Wieloch, 1988; Czyz, 1997; Włodarczyk, 1999). The rate of white cygnets in all cygnets in Zamość region was found to fall into the range of the lowest values in Europe (Wieloch, Czapulak, 1991).

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