

POPULATION DEVELOPMENT, NEST SITE SELECTION AND CONSERVATION MEASURES FOR WHITE STORK *Ciconia ciconia* ALONG THE LOWER TAMIŠ RIVER (VOJVODINA, N SERBIA)

Bela štokrlja *Ciconia ciconia* ob spodnjem toku reke Tamiš (Vojvodina, S Srbija) – populacijski trendi, izbira gnezdišč in varstveni ukrepi zanj

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Number of breeding pairs, their spatial distribution, selection of nest sites and the breeding success of White Stork *Ciconia ciconia* was studied in 2004 in 20 villages adjacent to the lower Tamiš valley. 322 pairs, which occupied their nests for at least four weeks (HPa) during the first half of the breeding season, were found, 307 of which were HPm: pairs with fledged young. The number of breeding pairs in the 1957 – 2004 period grew in the area, but population in the entire Vojvodina fluctuated. The study area is the most important breeding area for White Stork in the province (30.7% of all breeding pairs) and the country: 27.4% of national population breeds there. One of the most important reasons for the high population density are very suitable feeding conditions. Most of the pairs with fledged young (HPm) had 3 chicks per pair (40.1%), followed by pairs with two chicks (32.5%), four chicks (15.2%), one chick (11.4%) and five chicks (2.4%). The majority of nests were situated on buildings (53.7%) and electric pylons (41.9%). There is a marked change in the breeding habits compared with those in the 1980's: straw and hay bales have been almost completely abandoned as nest sites since then. Out of the entire number of HPa, 58 (18%) are situated in seven villages adjacent to the first river sector, 213 (66%) in nine villages along the second sector (where the river has wide floodplain) and 51 (16%) in four villages along the third river sector.

Key words: White Stork, *Ciconia ciconia*, population development, Tamiš, Serbia, Vojvodina

Ključne besede: bela štokrlja, *Ciconia ciconia*, razvoj populacije, Tamiš, Srbija, Vojvodina

1. Introduction

At the national level, White Stork *Ciconia ciconia* census in Serbia was carried out in 1996. A breeding population of 872 pairs was counted, 93% of them in Vojvodina, indicating the region as the most important for breeding of this species (PELLE 1996). Surveys of breeding pairs of White Stork in Vojvodina have long tradition. Censuses in the province were carried out in 1957 (SZLIVKA 1959), 1974 (GAROVNIKOV 1977), 1979 (GAROVNIKOV 1980-81) and 2000 (GERGELJ *et al.* 2000). The parameters which were subject of census

routine included only total number of active nests (breeding pairs) in particular villages and the nest site selection. Breeding success was surveyed only during the 2000 census (GERGELJ *et al.* 2000).

As the last census carried out in 2000 confirmed that one quarter of all pairs breed in villages situated on the edge of the lower Tamiš valley (GERGELJ *et al.* 2000), this region has been subject of survey in 2004. The aim was to determine the number of breeding pairs along the lower Tamiš, breeding success and nest site selection. The results of this census are presented and discussed in this paper.

2. Study area and methods

2.1. Study area

The study area was part of the Tamiš River valley, which is situated in Serbia (between 40°50' N 45°28' E and 20°23' N 20°58' E) in central and southwest Banat (LAZIĆ 1996). Out of 359 km of this transboundary river, 118 pass through Serbia, between the village of Jaša Tomić and the river mouth at Pančevo (Figure 1). Fluvial erosion and very pronounced fluctuations of

the water level, as well as meandering, are the main river's characteristics. Extremely high water levels are usually recorded in April, extremely low in October (TOMIĆ 1989).

The river regulations started in 1728 and were completed in 1977, when part of the river stretch was included into the Danube-Tisa-Danube hydro system (TOMIĆ 1989). However, despite the fact that the greater part of the stretch is currently canalized (from the state border downstream to Botoš (the first sector in the text below) and from Opovo to the river mouth (the third sector in the text below), the river is free-flowing between Botoš and Opovo (the second sector in the text below) with intensive meandering, preserved river branches (near Farkaždin and Baranda), oxbows (near Čenta), floodplain meadows (near Tomaševac, Uzdin, Farkaždin, čenta and Botoš) and alluvial forests. Three sectors are different from the hydrological point of view. The first is 33 km long, the second 42 km, the third 43 km (LAZIĆ 1996). The widest river valley, regularly flooded, follows the boundaries of the second sector. Its widest parts are situated between Čenta and Baranda (10.6 km) and between Orlovat and Uzdin - 9.3 km. Five large fishponds are situated in the valley: Sutjeska (900 ha) near Sutjeska, Sveti Nikola (400 ha) at Neuzina, Uzdin (430 ha) near Uzdin, Baranda (1005 ha) between Baranda, Sakule and Opovo, and Čenta (120 ha) near Čenta (BUGARČIĆ 1999).

2.2. Methods

The census was carried out during the breeding season in 2004, from late May to mid August, in particular between 4 Jul and 18 Jul, in the phase of breeding cycle when chicks are visible from the ground, as recommended by the International White Stork Census methodology (SCHULZ 1999). This allowed simultaneous survey of nest site selection and breeding success. The following data were recorded: nest occupancy, nest site selection (with the following categories: building, electric pylon, tree, straw/hay bales, other) and number of fledged chicks. Only nests occupied by a pair for at least four weeks during the first half of the breeding season are considered to be occupied (SCHULZ & THOMSEN 1999). All nests situated on man-made buildings (houses, churches, observation towers and local power stations) were taken as single category, having in mind that further separation of this category was in many cases impossible. Besides settlements, all other potential breeding areas were surveyed.

While counting StDBiol, I took in account surface data for the river valley given by LAZIĆ (1996).



Figure 1: The study area of the lower Tamiš River

Slika 1: Raziskovano območje spodnjega toka reke Tamiš

Table 1: Number of breeding pairs of White Stork *Ciconia ciconia* in villages along the lower Tamiš River in 2004**Tabela 1:** Število gnezdečih parov bele štokrlje *Ciconia ciconia* v vaseh vzdolž spodnjega toka reke Tamiš v letu 2004

Settlement / Naselje	HPa	HPm	Nesting sites / Gnezdišča				
			Building/ Zgradba	Electric pylon/ El. drog	Trees/ Drevesa	Hay bales/ Bale sena	Other niches/ Ostale niše
Sakule	31	29	24	6	0	0	1
Uzdin	30	28	23	4	1	0	2
Botoš	30	28	0	30	0	0	0
Čenta	28	28	18	9	1	0	0
Idvor	26	25	20	3	2	0	1
Baranda	26	25	24	2	0	0	0
Orlovat	21	17	1	19	0	0	1
Neuzina	21	19	1	20	0	0	0
Opovo	17	17	14	3	0	0	0
Jabuka	13	13	12	0	1	0	0
Boka	12	12	4	8	0	0	0
Tomaševac	11	11	1	9	0	0	1
Sefkerin	11	11	11	0	0	0	0
Glogonj	10	10	9	1	0	0	0
Farkaždin	10	9	6	2	0	2	0
Sutjeska	9	9	2	7	0	0	0
Sečanj	7	7	3	4	0	0	0
Ban. Despotovac	4	4	0	4	0	0	0
Jaša Tomić	3	3	0	2	0	1	0
Šurjan	2	2	0	2	0	0	0
Total	322	307	173	135	5	3	6

Abbreviations of the breeding parameters follow the methodology of International White Stork Census (SCHULZ & THOMSEN 1999; Table 5 in the appendix).

White Stork nests situated on wires of power pylons, as well as birds themselves, can cause a short-circuit, if they complete electric circuit between live and ground wire. Having results of nests site selection from 2004, in order to minimize the conflict and following the best practice in protection of nests situated on the wires (e. g. PERRENOU *et al.* 1996, MUŽINIĆ 1999), the most problematic nests in the study area placed on overhead wires on electric pylons in 2004 were supported by erection of platforms on top of the pylons before the start of the breeding season in 2005 (between 9 and 30 March). The metal platform was designed in order to create space (70 cm) between the nest and the wires. During the erection process, old nests were taken down from the wires, after which initial layer of branches was fixed at the bottom of the platform on the ground. Then platform was erected and fixed to

the pylon top. Nest acceptance was checked between 29 May and 10 Jul 2005.

3. Results

In the study area, 360 nests were counted, 322 of which were occupied. Occupied nests were found only in settlements: there were no nests outside them. Nests were found in each of 20 villages bordering the river floodplain (Table 1). Out of all 322 breeding pairs, 58 (18%) were situated in seven villages adjacent to the first river sector, 213 (66%) in nine villages along the second sector, and 51 (16%) in four villages along the third river sector.

Breeding success of all breeding pairs (JZa) was 2.58, and 2.60 of all breeding pairs that raised chicks (JZm). Most of the pairs with fledged young (HPm) had 3 chicks per pair (40.1%), followed by pairs with two chicks (32.5%), four chicks (15.2%), one chick (11.4%) and five chicks (2.4%; Table 2). There is no

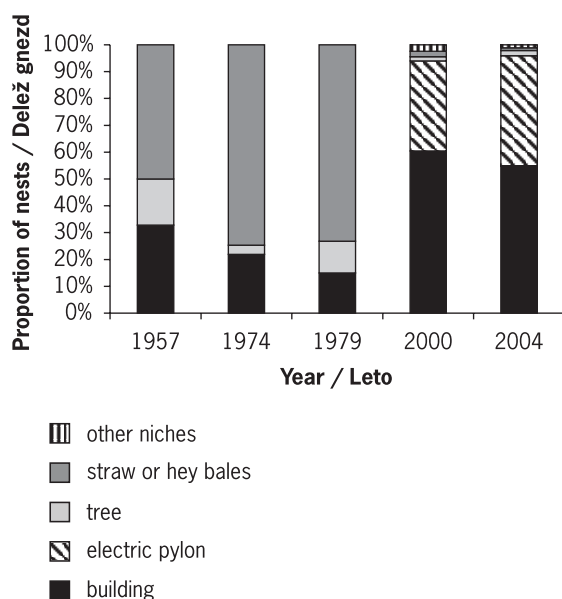


Figure 2: Changes in White Stork *Ciconia ciconia* nest site selection in the lower Tamiš valley

Slika 2: Spremembe v izbiri štokljinega gnezdišča bele štoklje *Ciconia ciconia* v dolini spodnjega toka reke Tamiš

correlation between the pairs' breeding success within different villages (density groups; Figure 3). The vast majority of nests were situated on buildings (53.7%) and electric pylons (41.9%; Table 1). "Biological" potential density (StDBiol) was 26.9 pairs / 100 km².

The majority of nests on the pylons were situated on the non-isolated wires. Out of 135 these nests in the study area (Table 1), 37 nest-isolation platforms were erected before the beginning of the breeding season, in March 2005. 29 of them (78.3%) were accepted already in that year (Table 4).

4. Discussion

The number of breeding pairs in the 1957 – 2004 period grew (Table 3). Despite the fact that in some censuses the coverage of all villages was not complete in the entire valley, the trend is very indicative. However, population in the entire Vojvodina fluctuated in the same period (SZLIVKA 1959, GAROVNIKOV 1980-81, GAROVNIKOV 1977, PELLE 1996).

The breeding success (Table 2) was lower than in 2000, when JZm in the same area was 3.38, similar to the whole province where JZm was 3.14 (GERGELJ *et al.* 2000). A possible reason for this is the difference in the level of precipitation between the two years. The year 2000 was the driest in Serbia since the very beginning of weather surveys in Serbia (REPUBLIC

HYDROMETEOROLOGICAL SERVICE OF SERBIA 2001), while the territory of Vojvodina was extremely wet in 2004 (REPUBLIC HYDROMETEOROLOGICAL SERVICE OF SERBIA 2005). Similarly high reproductive success of the White Stork in 2000 was recorded in Switzerland (BOETTICHER-STREIM 1991). It has been proved that the breeding success is in negative correlation with the level of precipitation (BERT & LORENZI 1999).

Absence in correlation of breeding success with density of breeding pairs (Figure 3) opposes the one in the Sava River valley in Croatia, where White Storks breeding in high densities have had higher breeding success, indicating that food resources were evenly distributed and almost unlimited (SCHNEIDER-JACOBY 1993).

Table 2: Breeding success of White Stork *Ciconia ciconia* at villages in the lower Tamiš valley in 2004

Tabela 2: Gnezditveni uspeh bele štoklje *Ciconia ciconia* v vseh vzdolž spodnjega toka reke Tamiš v letu 2004

Parameter	Value/ Vrednost
H	360
HPa	322
HPm	307
HB1	16
HB2	6
HPo	16
HPx	33
HPm1	28
HPm2	94
HPm3	116
HPm4	44
HPm5	7
JZG	798
JZa	2.48
JZm	2.60

It is estimated that recently 1000 – 1100 pairs bred in Vojvodina, and 1100 – 1250 in the entire Serbia (PUZOVIĆ *et al.* 2003), which makes the Tamiš River valley the most important breeding area for White Stork in the province (30.7% of breeding pairs breed there) and the country: 27.4% of the national population breed there. One of the most important reason for such a high population density are very suitable feeding conditions, which are considerably

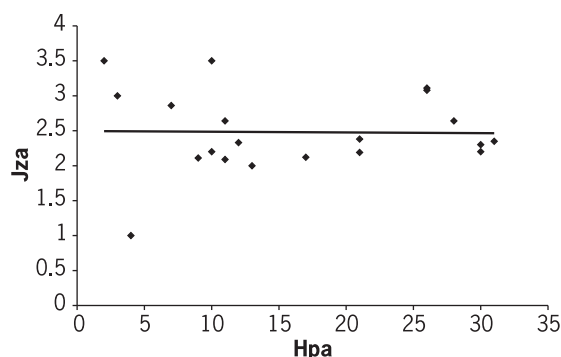


Figure 3: Correlation between the number of occupied nests of White Stork *Ciconia ciconia* per village and the breeding success in the lower Tamiš valley (Spearman $\rho = -0.049$, $df = 18$, NS, two-tailed test, H_0 is not rejected)

Slika 3: Korelacija med številom zasedenih gnezd na vas in gnezditveni uspeh bele štoklje *Ciconia ciconia* v dolini spodnjega toka reke Tamiš (Spearman $\rho = -0.049$, $df = 18$, NS, dvorepi test, H_0 ni zavrnjena)

more favourable than in other areas in Serbia where regional censuses are conducted (e.g. RAŠAJSKI 1988, KULIĆ 2004).

The highest concentration of breeding pairs along the second Tamiš sector is due to the very favourable local feeding conditions in this wide inundation stretch, particularly in the preserved, extensive, temporarily flooded meadow and pastures that follow the river along both banks in this stretch. Findings of SCHNEIDER-JACOBY (1993), EICHELMANN (1999) and ŠTUMBERGER & VELEVSKI (2001) also prove that these are optimal foraging habitats for the White Storks and, when covering large areas, they support high breeding densities. These habitats are almost completely missing along the first and the third sectors (*own data*). It has already been proven that foraging areas during the breeding season in favourable areas

Table 3: Development of breeding population of White Stork *Ciconia ciconia* in the lower Tamiš valley between 1957 and 2004

Tabela 3: Razvoj gnezdeče populacije bele štoklje *Ciconia ciconia* vzdolž spodnjega toka reke Tamiš med letoma 1957 in 2004

Census year/ Leto popisa	HPa	Source / Vir
1957	58	SZLIVKA 1959
1974	178	GAROVNIKOV 1977
1979	221	GAROVNIKOV 1980-81
2000	250	GERGELJ <i>et al.</i> 2000
2004	322	<i>this paper</i>

are situated in immediate vicinity of nests (OŽGO & BOGUČKI 1999).

All nest sites that White Storks use traditionally in Vojvodina are used in the Tamiš valley as well. However, there is a marked change in the breeding habits compared with those in the 1980s (starting from 1979, as RAŠAJSKI (1988) describes the situation for S Banat): straw and hay bales have been almost completely abandoned as nest sites since then (Figure 2). The most probable cause for this are changed practices of straw and hay conservation (in stables, under roofs), as well as evident absence of these nesting places in recent years (*own data*). The same trend was proven for Hungary, but sharp increase of electric pole usage for White Stork breeding started at least one decade earlier than in the Tamiš valley and the entire Vojvodina (LOVÁSZI 1999). Use of trees as nest sites in the study area decreased between 1957 and 2004 as well (Figure 4), although reasons for that are not clear. One of the suggested reasons can be absence of old trees suitable for breeding (A. ŽULJEVIĆ, *pers. comm.*), which happened, for example, in Slovenia (DENAC 2001). Numerous concentrated tree-breeding White Stork pairs are site-specific in Vojvodina (KANJO 2000).

Table 4: Results of the White Stork *Ciconia ciconia* nest-protection program in the lower Tamiš valley in 2005

Tabela 4: Rezultati programa za zaščito štokljin *Ciconia ciconia* gnezd v dolini spodnjega toka reke Tamiš v letu 2005

Village/ Vas	Erected/ Postavljeno	Accepted/ Sprejeto
Orlovat	10	6
Neuzina	10	9
Botos	8	7
Sutjeska	4	3
Tomasevac	3	2
Sakule	2	2

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5. Povzetek

Leta 2004 je avtor prispevka v 20 vaseh, meječih na spodnji tok reke Tamiš v Vojvodini, ugotavljal število gnezdečih parov, izbiro gnezdišč in gnezditveni uspeh bele štokrlje *Ciconia ciconia*. Zabeleženih je bilo 322 parov, ki so v prvi polovici gnezditvenega obdobja zasedali gnezda najmanj štiri tedne (HPa), 307 izmed katerih so bili pari s speljanimi mladiči (HPm). V obdobju 1957 – 2004 je število gnezdečih parov v tem območju naraslo, medtem ko je populacija bele štokrlje v celotni Vojvodini nihala. Preučevano območje je najpomembnejše gnezditveno območje za belo štokrljo tako v Vojvodini (30,7% vseh parov) kot v celotni državi (27,4% srbske populacije). Eden izmed najpomembnejših razlogov za visoko populacijsko gostoto bele štokrlje v tem območju so nadvse ugodne prehranjevalne razmere. Večina parov s speljanimi mladiči (HPm) je imela po tri mladiče (40,1%), njim pa so sledili pari s po dvema (32,5%), štirimi (15,2%), enim (11,4%) in petimi mladiči (2,4%). Večina gnezd je bila spletenih na stavbah (53,7%) in električnih drogovi (41,9%). Sicer pa so se v precejšnji meri spremenile gnezditvene navade bele štokrlje v primerjavi s tistimi v osemdesetih letih prejšnjega stoletja: odtlej so bile kot gnezdišča skoraj povsem opuščene slamnate bale. Od celotnega števila parov s speljanimi mladiči jih 58 (18%) živi v sedmih vaseh, meječih na prvi rečni sektor, 213 (66%) v devetih vaseh vzdolž drugega sektorja (z veliko poplavno ravnico), 51 (16%) pa v štirih vaseh vzdolž tretjega rečnega sektorja.

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APPENDIX / DODATEK

Table 5: Abbreviations of White Stork *Ciconia ciconia* breeding parameters used in the text (after SCHULZ & THOMSEN 1999)

Tabela 5: Okrajšave za gnezdilne parametre bele štorke *Ciconia ciconia*, uporabljene v tekstu (po SCHULZ & THOMSEN 1999)

H	nest
HPa	pair which has occupied a nest for at least four weeks during the first half of the breeding season
HPm	pair with fledged young
HPmx	pair with x fledged young
HPo	pair without fledged young which has occupied a nest for at least four weeks during the first half of the breeding season
HPx	pair with unknown breeding success which has occupied a nest for at least four weeks during the first half of the breeding season
HB1	single bird visiting the nest, no binds to the nest
HB2	two birds (pair) visiting the nest, no binds to the nest
JZG	total number of fledged young in a defined area per year
JZa	breeding success, average number of fledged young per pair related to all HPa of a defined area
JZm	breeding success, average number of fledged young per pair related to all HPm of a defined area
StDBiol	“biological” population density, number of pairs (HPa) per 100 km ² of potential feeding habitat