Monitoring of the White Stork *Ciconia ciconia* population in Ukraine: results of the first six years

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The programme of monitoring the White Stork population in Ukraine started in 1992. Data were obtained on constant study plots that have as a rule from 3-5 to 30 occupied nests. Population density and breeding success are investigated. In the first year data from 8 study plots were received, for each of following years we have data from 20-40 plots. Up to March 1998 the monitoring database numbered 146 records (57 study plots in 17 regions of Ukraine). Average parameters of breeding success in Ukraine for this period are as follows: number of fledged young per breeding pair (JZa) 2.52 ± 0.06; per successful pair (JZm) 2.93 ± 0.05; proportion of unsuccessful pairs (% HPo) 14.14 ± 1.25 %. Despite a relatively high fraction of unsuccessful pairs, the breeding success was best in 1996. On several study plots in Central Ukraine the JZa and the JZm coefficients exceeded 4.0. Three nests had 6 fledglings and one nest even had 7. The worst year was 1997, when the percentage of HPo was highest and breeding success was lowest. Of all other years only 1994 had lower parameters than average. In 1995 % HPo was the lowest. There are regional differences in the breeding success. Broods of the White Stork fledge1-5 young as the norm. Six and seven fledglings occur only rarely in very good conditions. Results of the monitoring programme confirm that numbers of the White Stork are increasing in Ukraine. This trend became evident first in the north-east and central parts of the country.

Key words: White Stork *Ciconia ciconia*, monitoring, breeding success, number dynamics, Ukraine.

1. Introduction

The White Stork is a common and widely distributed bird species in Ukraine. Its present numbers are estimated at around 15,000 - 20,000 breeding pairs (GRISHCHENKO 1999). The eastern border of the breeding range in Ukraine runs through the extreme south-eastern regions and North Crimea.

Attempts to censuses the entire White Stork population of the country were carried out several times since 1931 (GRISHCHENKO 1996), but the data they yielded cannot be used as a basis for population monitoring. All these censuses were incomplete. Their precision never reached 100 %, besides they had some differences in methods, so the numbers are difficult to compare. Censuses every 5-10 years yield little information on breeding success, because this fluctuates greatly even between successive years. Today it is very difficult to organize complete and exact censuses of the White Stork in Ukraine. It is certainly impossible to do it every year because of the vast territory, the high number of storks and the lack of ornithologists and birdwatchers. Annual control of numbers and breeding success on constant study plots is a more realistic option. The net of plots enables us to obtain representative data and to monitor the status of the population within the whole country.

For monitoring the populations of the White and Black Ciconia nigra Storks we have designed a special programme (GRISHCHENKO 1994a, 1995a), using the project «Monitoring of raptors and owls in Europe» as an example (MAMMEN & STUBBE 1996, 1997; STUBBE 1996, etc.). Our programme has started in 1992. During the first year information on the White Stork was received from 8 study plots. For each of following years we have data from 20-40 plots. At the end of March 1998 the database numbered 146 records. Four annual reports were published (GRISHCHENKO 1994b, 1995c, 1995d, 1997c).

2. Material and methods

Data were obtained on 57 study plots in 17 regions of Ukraine (Fig. 1). On most of them observations were carried out from 2 to 5 years. These plots have as a rule from 3-5 to 30 occupied nests. The plot size is between 15-20 to 200-300 km^2, several plots are even larger. Both numbers of pairs as well as breeding success were monitored (arrival and departure times, causes of death, cases of wintering, etc. are also noted). Ten study plots in the Middle Dnieper area and north-east Ukraine were investigated by the author with colleagues. Other information was obtained from ornithologists, birdwatchers, teachers, students and school children. The distribution of study plots reflects sufficiently well the breeding density of storks. There are plots in flood plains of big rivers, where the population density is very high, and in the agricultural landscape with the relatively poor food supply.

Fig. 1. Study plots of monitoring programme.

For the Black Stork we managed to obtain only fragmentary data up to now. The existing network of study plots on the White Stork, however, already enables us to obtain representative information. So far there are few plots in eastern and southern regions, but the main breeding areas are well covered. Population density is maximal in western and northern regions of Ukraine and is lowest in the steppes of the southern and south-eastern parts of the country (GRISHCHENKO *et al.* 1992; GRISHCHENKO 1996). In the south and southeast, therefore, it is difficult to obtain suffi-cient data, because study plots have to be very large and require much time and resources for surveying. The representativeness of the monitoring data is confirmed by results of the Vth International White Stork Census in 1994-1995. Coefficients of the breeding success calculated for the whole of Ukraine from the country-wide census data and coincides very well with data from the study plots (GRISHCHENKO in press).

In this paper I use the international designations that have been introduced by E. SCHÜZ (1952):

HPa - number of pairs occupying nests;
HPm - number of pairs with young about to fledge;
JZG - total number of fledged young;
StD - population density (HPa/100 km²);
JZa - av. number of fledged young per breeding pair (JZG/HPa);
JZm - average number of fledged young per successful pair (JZG/HPm);
% HPo - proportion of unsuccessful pairs.

3. Results

3.1. Breeding success

3.1.1. Annual dynamics

According to CREUTZ (1988) values of JZa above 2.0 and JZm above 3.0 indicate good years for the White Stork. By this measure, the first five years of the research period were favourable for the species in Ukraine. Breeding success was high and fluctuated little (Fig. 2). Only the year 1997 was poor with the lowest reproductive indices and an increase in the portion of unsuccessful pairs.

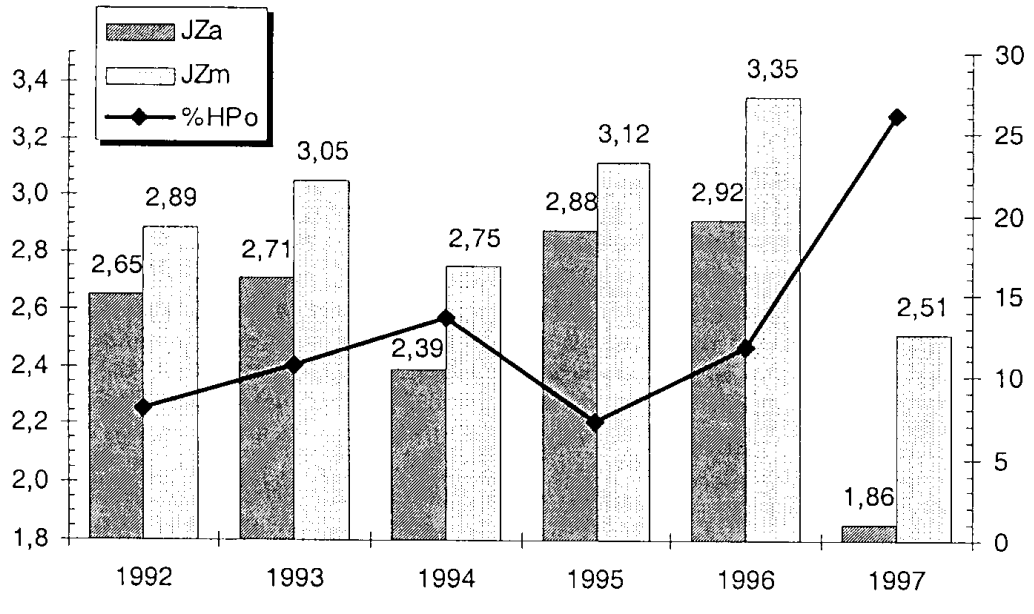

Fig. 2. Breeding success of the White Stork in Ukraine 1992-1997. Abbreviations see text.

The average parameters of breeding success for 1992-1997 are presented in the Table. In 1993 and 1995 the breeding success exceeded the average, in 1994 was much lower (Fig. 2), probably in connection with a long drought during the summer months. The year 1996 was remarkable because of two peculiarities: the

Table 1. Regional differences in breeding success of the White Stork in Ukraine (abbreviations see text).

Area	n	StD	JZa	JZm	% HPo
Ukraine	146	15,98 ± 0,92	2,52 ± 0,06	2,93 ± 0,05	14,14 ± 1,25
the Middle Dnieper	61	14,57 ± 1,36	2,64 ± 0,10	3,13 ± 0,08	15,79 ± 1,80
North-east Ukraine	24	15,16 ± 1,39	2,74 ± 0,15	3,04 ± 0,12	10,19 ± 2,82
West Ukraine	54	16,88 ± 1,69	2,27 ± 0,09	2,63 ± 0,07	13,77 ± 2,31
Kyiv region	25	17,52 ± 1,34	2,34 ± 0,16	2,86 ± 0,13	17,95 ± 3,21
Lviv region	12	23,30 ± 4,61	2,33 ± 0,17	2,58 ± 0,11	10,65 ± 4,62
Poltava region	22	12,45 ± 2,35	2,99 ± 0,11	3,53 ± 0,10	14,60 ± 1,99
Sumy region	16	14,71 ± 1,83	2,79 ± 0,16	3,00 ± 0,12	7,21 ± 2,79
Khmelnitskiy region	11	15,85 ± 2,32	2,29 ± 0,22	2,80 ± 0,20	16,55 ± 5,14
Cherkasy region	16	8,35 ± 0,80	2,55 ± 0,16	2,94 ± 0,13	13,25 ± 4,03

highest reproductive success and breeding of large numbers of young storks (GRISHCHENKO 1997b). The spring 1996 was cold and difficult for birds. However, storks raised many young: JZm and even JZa exceeded 4.0 on several plots. Three pairs had 6 fledged young and one had 7 (we observed the fledging of all 7 nestlings). Such big broods are very rare. The portion of pairs with 6 fledged youngs is, as a rule, less than 0.1-0.3 % in various countries (HAUFE 1984/85; JAKAB 1989; JERRENTRUP 1989; PELLE 1989; BOGUCKI 1994, etc.). Only few records of broods with 7 fledged young have been described in the literature (GRISHCHENKO 1997a).

The breeding success varied greatly on different study plots. During the long-term drought in summer 1996 the best breeding success was in flood plains of big rivers in Central and Northern Ukraine (GRISHCHENKO 1997b). In Western Ukraine the breeding success was lower. The portion of unsuccessful pairs was relatively high in 1996. In our opinion, the main reason for this was the high number of young storks that started breeding for the first time. In many cases the unsuccessful reproduction could be explained by abnormal behaviour of birds: very late nesting and egg laying, abandoned nests, nest building without laying of eggs, etc. We observed incubating storks and unfinished nests on several study plots even in the middle of July.

The year 1997 was the worst during the study period. The number of fledged young per pair was the lowest, the portion of unsuccessful pairs was highest, numbers of occupied nests decreased on many study plots. The regional variation of parameters was also very large. On some study plots the JZa coefficient was lower than 1.0, whereas % HPo exceeded 60 %. This is the level of the reproductive success characteristic for so-called «catastrophic years» (CREUTZ 1988). At the same time the breeding success was completely normal on several other plots. The summer of 1997 will be remembered in many countries for its natural desasters: summer floods, destructive storms, etc. Of course, unfavourable weather has aggravated the situation of storks. E.g. in the town of Koroleve in Transcarpathians a nest on a roof was half demolished by the storm in late June. Birds rebuilt it and continued breeding, but on 5 July a brick chimney, uprooted with armature metal rods during the preceeding storm, was thrown by the wind onto the nest (GRISHCHENKO 1998b).

3.1.2. Regional differences

There are regional differences in breeding success (Table). We have included in this Table the data for whole Ukraine, three large geographic regions and six administrative regions (oblasts), for which there are enough observations ($n > 10$). Western Ukraine includes 8 regions; North-eastern Ukraine - Chernigiv and Sumy regions; the Middle Dnieper area - Kyiv region, eastern part of Cherkasy region, western part of Poltava region, western and northern parts of Dnipropetrovsk region. The breeding success was significantly lower in Western Ukraine than in North-eastern Ukraine ($p < 0.01$ for JZa and JZm) and in the Middle Dnieper area (accordingly $p < 0.01$ and $p < 0.001$). The average population density on study plots is similar in these three areas (Table). The highest breeding success was in the Poltava region, where it was significantly greater than on average in the country ($p < 0.01$ for JZa and $p < 0.001$ for JZm).

It is interesting that Poltava region was an original «oasis» with relatively good breeding success in 1997. In our opinion, it is connected first and foremost with the good food supply on this area (GRISHCHENKO 1998b). Several big rivers flow through this region with very good feeding conditions on the flood plains: the Sula, the Psel, the Vorskla, the Khorol, etc. On two study plots with a total area of 125 km^2 in the lower course of the Sula river the population density of the White Stork reached 32.8 pairs/100 km^2 in 1996 (GRISHCHENKO *et al.* 1996).

3.1.3. Number of young raised

Most White Stork pairs have 2-4 fledglings in Ukraine (Fig. 3), the most frequent brood size (always over 40% of all pairs) is 3 young. The portion of nests with 3 and 4 fledged young can be almost equal in very good years (33.7 % and 31.1 %, resp., in 1996). In very bad years the portion of broods with 2 young becomes maximal (43.5 % in 1997, 31.5 % pairs had 3 fledged young).

White Storks can lay up to 7 eggs per clutch (Bauer & Glutz von Blotzheim 1966; Cramp 1977; Hancock *et al.* 1992), but very rarely are more than 5 fledglings seen in a nest. Broods with 6 and particularly 7 fledged young are exceptional and only occur in years with very good food and weather conditions.

3.2. Numerical dynamics

A rapid increase of White Storks has been taking place in almost all countries of its breeding range, including Ukraine, during the past years (Schulz 1996a, 1996b; Kaatz 1997). This is confirmed by the data of our monitoring programme. Changes of population on our study plots can characterize the numerical dynamics in various regions and in the whole country. The long-term development of density (StD) on 11 plots in 7 regions is shown in Figure 4. We have used only the plots with observations during 5 or 6 years. Number are either increasing stable with small fluctuations. Only in 1997 numbers of occupied nests on many plots were depressed (cf. above).

Observations on study plots show peculiarities in numerical dynamics in different parts of the country. A population increase was first noticed in North-eastern Ukraine (except eastern regions, which are situated near the border of the breeding range, wave-like stork expansion to the eastern and slow increase occurred here in many years (Grishchenko *et al.* 1992). On the river Seym in Sumy region the population started to increase quickly in the early 1990s (Grishchenko 1995). On the study plot Mutin the number of stork nests has almost doubled in 5 years, on the study plot Khyzhky it increased by 50% in only 3 years (Grishchenko1998a). Only in 1997 was this process suspended. In Central Ukraine the increase started several years later, e.g. in the Middle Dnieper area in 1995-1996. In 1996 numbers also increased in Western Ukraine.

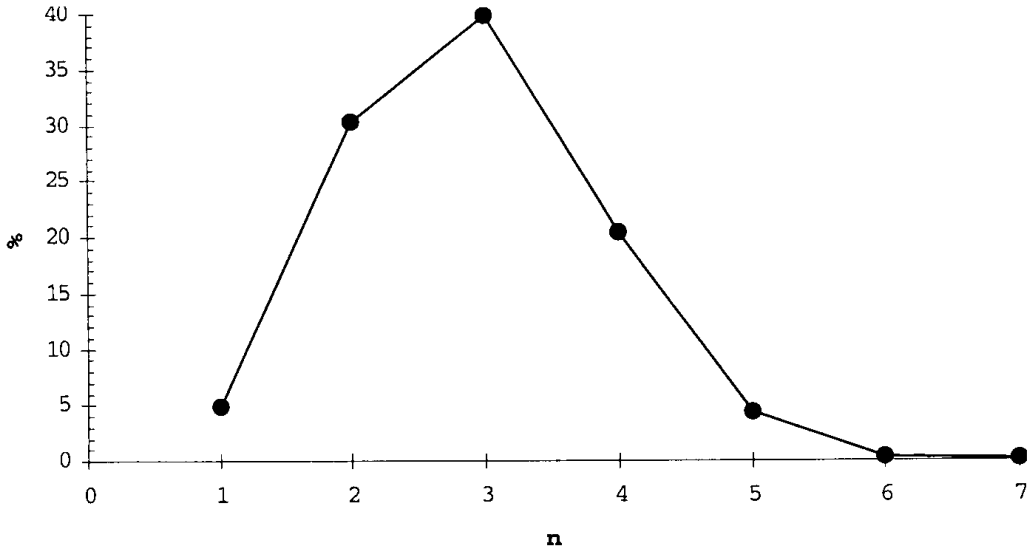

Fig. 3. Number of fledged young in nests in 1992-1997 (n = 1379).

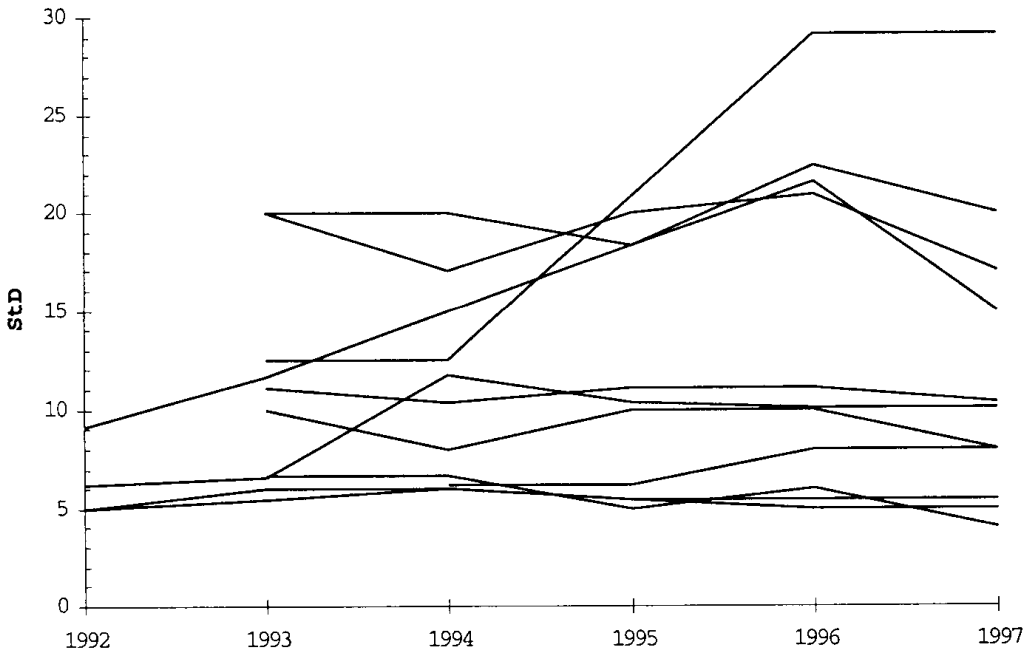

Fig. 4. Dynamics of the population density of the White Stork on separate study plots.

4. Discussion

Ukraine has very favourable conditions for breeding White Storks. High and relatively even parameters of reproductive success provide evidence of this. Only one year during the study period had parameters considerably lower than average. The worst year, 1997, was interesting in terms of the reasons of low breeding success. It was a poor year for White Stork in all of Europe (R. GUZIAK, H. HECKENROTH, M. JANAUS, CH. KAATZ, U. PETERSON, H. SCHULZ pers. comm.). Bad weather conditions alone cannot explain the sharp decline in breeding success. Floods and storms occurred not in all parts of Ukraine. For example, in the area of the Kanev Nature Reserve (study plot Kanev, Cherkasy region) weather was normal, however, 63.6 % stork pairs raised no young (this is the maximum value of the % HPo coefficient on study plots during all six years). In 1996 storms and drought occurred as well, but this was the best year in terms of breeding success.

It was determined that breeding success of the White Stork is positively correlated with the wintering conditions (DALLINGA & SCHOENMAKERS 1989). Favourable circumstances of the migration are also very important. The relationship is obvious: the reproductive potential and number of eggs laid depend on the physiological state of the storks after wintering and passage. Conditions in the breeding area can only exert modifying influence. In 1997 conditions in wintering areas in Africa and along migration routes were unfavourable. Already birdwatchers in Israel noted unusually low number of passing white storks in spring (U. PETERSON pers. comm.). Apparently part of the wintering population stayed in the wintering area. In addition, the passage of storks was delayed by the penetration of cold fronts to the Near East and Asia Minor. The result was a very late arrival of storks in 1997, a high fraction of unoccupied nests and a low number of nestlings. Poor summer weather on the breeding grounds worsened the situation still more.

It is interesting that the wave of population increase in breeding storks went across Ukraine from east to west. This phenomenon may be explained as follows: Numbers started to increase in areas, where ecological capacity was far from saturation. For example, villages on the Seym river had as a rule no more than 1-2 stork nests in 1987-1988 (SEREBRYAKOV *et al.* 1989). Ten to twenty or even more nests can be found in the same conditions in Volynia or Lviv region (North-west Ukraine). Indeed, in central and western regions, where the population density of the White Stork was much higher, numbers increased much later and not so rapidly. The area eastwards from the Dnieper is in general very favourable for this species. It has many big rivers with the non-regulated flow and good food supply on flood plains and grasslands. Parameters of the breeding success are maximal in Poltava and Sumy regions (Table). This area is a good «bridge-head» for the further expansion of the White Stork to the east.

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5. References

BAUER, K. M. & U. N. GLUTZ VON BLOTZHEIM 1966: Handbuch der Vögel Mitteleuropas. Bd. 1. Frankfurt am Main.

BOGUCKI, Z. 1994: Wielkosc légu bociana bialego *(Ciconia ciconia)* w Wielkopolsce w latach 1971-1992. In: PTASZYK, J. (ed.): Bocian bialy *(Ciconia ciconia)* w Wielkopolsce. Prace Zakl. Biol. i Ekol. Ptaków UAM 3: 165-176. Poznan.

CRAMP, S. (ed.) 1977: Handbook of the Birds of Europe, the Middle East and North Africa. Vol. 1. Oxford University Press.

CREUTZ, G. 1988: Der Weißstorch. Neue Brehm-Bücherei Bd. 375. Ziemsen Verlag. Wittenberg.

DALLINGA, J. H. & S. SCHOENMAKERS 1989: Population changes of the White Stork since the 1850s in relation to food resources. In: RHEINWALD, G., J. OGDEN & H. SCHULZ (Hrsg.): Weißstorch - White Stork. Proc. 1st Int. Stork Conserv. Symp. Schriftenreihe DDA 10: 231-262.

GRISHCHENKO, V. 1996: Bestandsentwicklung des Weißstorchs in der Ukraine. In: KAATZ, C. & M. KAATZ (eds.): Jubiläumsband Weißstorch. Tagungsbandreihe des Storchenhofes Loburg in MRLU-LSA 3: 43-46.

GRISHCHENKO, V. 1997a: Sieben flügge Jungen in einem Horst des Weißstorchs. Orn. Mitt. 49: 100-101.

GRISHCHENKO, V. 1997b: Bruterfolg des Weißstorchs *(Ciconia ciconia)* in der Ukraine im Jahre 1996. In: KAATZ, C. & M. KAATZ (eds.): 4. und 5. Sachsen-Anhaltinischer Storchentag. Tagungsbandreihe des Storchenhofes Loburg in MRLU-LSA: 13-17.

GRISHCHENKO, V. N. 1994a: Programme of monitoring of the White and Black Storks populations in Ukraine. In: GRISHCHENKO, V. N. & Y. I. VERGELES (eds.): Materials 1st Conf. Young Ornithologists of Ukraine: pp. 143-144. Chernivtsi. (In Ukrainian).

GRISHCHENKO, V. N. (ed.) 1994b: Monitoring of the White and Black Storks populations in Ukraine. Annual report No 1. 1992. Chernivtsi. (In Ukrainian).

GRISHCHENKO, V. N. 1995a: Monitoring of the White Stork population in Ukraine. Bird Numbers 1995: p. 23. Pärnu.

GRISHCHENKO, V. N. 1995b: To the question on the number dynamics of the White Stork in north-east of Ukraine. In: BOKOTEY, A. A., V. O. POHRANYCHNY & I. V. SKILSKY (eds.): Problems of study and protection of birds; p. 37. Lviv-Chernivtsi. (In Ukrainian).

GRISHCHENKO, V. N. (ed.) 1995c: Monitoring of the White and Black Storks populations in Ukraine. Annual report

No 2/1993. Chernivtsi. (In Ukrainian).

GRISHCHENKO, V. N. (ed.). 1995d: Monitoring of the White and Black Storks populations in Ukraine. Annual report No 3/1994. Chernivtsi. (In Ukrainian).

GRISHCHENKO, V. N. (ed.). 1997c: Monitoring of the White and Black Storks populations in Ukraine. Annual report No 4/1995. Chernivtsi. (In Ukrainian).

GRISHCHENKO, V. N. 1998a: On the ecology of the White Stork in the area of number increasing. In: GRISHCHENKO, V. N. (ed.): Materials of the third confer. of young ornithologists of Ukraine; pp. 31-34. Chernivtsi. (In Ukrainian).

GRISHCHENKO, V. N. 1998b: Breeding success of the White Stork in Ukraine in 1997. In: GRISHCHENKO, V. N. (ed.): Materials of the third confer. of young ornithologists of Ukraine; pp. 34-39. Chernivtsi. (In Ukrainian).

GRISHCHENKO, V. 1999: Die Situation des Weißstorchs *Ciconia ciconia* in der Ukraine. In: SCHULZ, H. (ed.): Weißstorch im Aufwind? Int. Weißstorchtagung: pp. 289 - 303. Hamburg.

GRISHCHENKO, V. N., M. N. GAVRILYUK & E. D. YABLONOVSKA-GRISHCHENKO 1996: To the ornithofauna of the Lower Sula. Berkut 5: 24-25. (In Ukrainian).

GRISHCHENKO, V. N., V. V. SEREBRYAKOV, V. E. BOREYKO & I. A. GRISHCHENKO 1992: Recent state of the White Stork *(Ciconia ciconia)* population in Ukraine. Rus. J. Ornithol. 1: 147-156. (In Russian).

HANCOCK, J. A., J. A. KUSHLAN & M. P. KAHL 1992: Storks, Ibises and Spoonbills of the World. Academic Press.

HAUFE, M. 1984/85: Der Weißstorch im Kreise Lüchow-Dannenberg. Bund für Vogelschutz Ostwestfalen e. V. 8: 20-24.

JAKAB, B. 1989: Der Weißstorch in Ungarn: Bestandsänderungen und ihre Ursachen. In: RHEINWALD, G., J. OGDEN & H. SCHULZ (eds.): Weißstorch - White Stork. Proc. 1st Int. Stork Conserv. Symp. Schriftenreihe DDA 10: 105-113.

JERRENTRUP, H. 1989: Vergleich zweier Teilpopulationen des Weißstorchs *(Ciconia ciconia)* im Nestos-Delta, Nordostgriechenland. In: RHEINWALD, G., J. OGDEN & H. SCHULZ (eds.): Weißstorch - White Stork. Proc. 1st Int. Stork Conserv. Symp. Schriftenreihe DDA 10: 127-136.

KAATZ, C. 1997: Die Bestandssituation des Weißstorchs in Deutschland und speziell in Sachsen-Anhalt. In: KAATZ, C. & M. KAATZ (eds.): 4. und 5. Sachsen-Anhaltinischer Storchentag. Tagungsbandreihe des Storchenhofes Loburg in MRLU-LSA: 28-35.

PELLE, I. 1989: Status und Verbreitung des Weißstorchs in Jugoslawien 1984. In: RHEINWALD, G., J. OGDEN & H. SCHULZ (eds.): Weißstorch - White Stork. Proc. 1st Int. Stork Conserv. Symp. Schriftenreihe DDA 10: 115-120.

SCHULZ, H. (Ed.) 1996a: Internationale Weißstorchtagung. Kurzfassungen der Beiträge. Hamburg.

SCHULZ, H. 1996b: Bestandssituation des Weißstorchs und Zukunftsperspektiven - Zusammenfassung der Ergebnisse des 5. Internationalen Weißstorchzensus 1994/95. In: SCHULZ, H. (ed.): Internationale Weißstorchtagung. Kurzfassungen der Beiträge. Hamburg.

SCHÜZ, E. 1952: Zur Methode der Storchenforschung. Beitr. Vogelkd. 2: 287-298.

SEREBRYAKOV, V. V., V. N. GRISHCHENKO & I. A. GRISHCHENKO 1989: Numbers of the White Stork in Ukraine according to data of the questionnaire census in 1987-1988. Kyiv. (In Russian).

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