

## SOME ASPECTS REGARDING THE MIGRATORY DYNAMICS OF THE WHITE STORK (*Ciconia ciconia*) IN THE DOAMNEI RIVER HYDROGRAPHICAL BASIN (ARGEŞ COUNTY, ROMANIA)

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**Abstract.** The authors show a part of their researches regarding the presence and the behaviour in passage of the white stork (*Ciconia ciconia*) in the Doamnei River hydrographical basin, which covers some aspects concerning the migratory dynamics. The maximum of the passage was in April (in spring) and in August (in autumn). In some years, the spring passage was belated until in July. The spring migration was more intense than the autumn migration. Other considerations about the number of individuals of the flocks, direction of the displacement, and the daily dynamics according to the lapse of time were done.

**Keywords:** white stork (*Ciconia ciconia*), migration, Doamnei River hydrographical basin, Romania.

### INTRODUCTION

Data concerning the biodiversity from Romania are still missing at European level [11].

In Romania there are two species of stork, white stork (*Ciconia ciconia*) and black stork (*Ciconia nigra*), both protected by laws: Bern Convention, Bonn Convention, Bird Directive, etc. They are included in the Red Book of the Vertebrates from Romania [21]. The white stork is in SPEC 2 Category and vulnerable regarding the threat status and the black stork is in SPEC 3 Category and rare [10].

Regarding the birds migration across the Doamnei River hydrographical basin, there is a small number of papers and about the migration of the white stork there is no information [16-18, 20, 22]. Except some studies done in Rădăuţi Depression [24], in Romania, scientific researches about the presence and aerial behaviour in migration of the white stork have not been done until now; the researches about white stork were focused mainly on the distribution, size and dynamics of the population [2, 14]. About the migration, at the international level, the latest such studies are carried out mainly by radio and satellite tracking [7].

The hydrographical basin of the Doamnei River shelters many protected species in Romania, mainly in the upper sector, such as the glacial relict species: *Cottus transsilvaniae* [8], *Lissotriton montandoni* [5], and *Pelophylax lessonae* [6]. Close by, in the upper basin of the Vâlsan River lives the *Romanychthys valsanicola* [9] and in the area of Curburii Carpathians, the refuge of a *Bombina variegata* group has been recently identified [12].

The avifauna from the Doamnei River hydrographical basin benefits by good conditions for live, but until few years ago it was little studied. Our aim is to contribute with new data to its knowledge. Particularly, the researches about dynamics in migration of the white stork are important at a national level.

### MATERIALS AND METHODS

One of the main affluent of the Argeş River (tributary of the Danube Flow) is the Doamnei River. Its sources are in the Făgăraş and Iezer-Păpuşa Mountains. It crosses a great diversity of relief and habitats from the Moldoveanu Peak (2544 m) up to the point of confluence with the Argeş River (260 m) [3] along the 109.1 km of distance. The Doamnei River hydrographical basin covers 1822 km<sup>2</sup> (Fig. 1).

In the hilly floor, the vegetation is formed especially by woods of *Quercus robur* and *Q. petraea* and in the mountain floor this is composed principally by woods of *Fagus sylvatica*, *Carpinus betulus* and *Picea abies* [1]. The fauna is common for the hilly and mountain region from Romania and the climate is continental temperate, with mountain features in the north half and with hilly features in the south half [3].

White stork is a bird with white feathers and black remiges from the Ciconiiformes order ranged almost over all Europe [23]. In Romania it is wide-spread, breeding in rural and urban areas [19]. In the Doamnei River hydrographical basin it breeds in few localities. The food is represented principally by frogs and insects [15]. It is a very good soaring bird, using in migration the thermals of warm air.

We analysed the presence in migration by the aerial activity of the white stork in the Doamnei River hydrographical basin, as well as some aspects regarding his aerial behaviour, during 1998 – 2010 (March-September period). We noted, each observation, the date, the number of individuals, the exact time, the type of flight, the height of flight (visually approximated), the atmospheric nebulosity, the type of clouds, the temperature of the air at 2 meters height above the soil, the wind speed by Beaufort scale, the locality and the type of overflow ecosystem and other details, by case. The time allocated for observations was not constant along the diurnal part of the day.

Chiefly, the observations were effected in the hilly part of the area, preponderantly in the perimeter of the Dărmăneşti locality.

In this paper, we refer only to some aspects of the migratory dynamics.



28.92 for the autumn passage, almost triple than that registered for the spring passage (10.91).

Considering the number of individuals per observation (or group, Table 4), in spring, the biggest weight (36.68%) was that of the flocks with 10 – 49 individuals; in autumn, the biggest weight was that of the flocks with 5 – 9 individuals (28.57%). For the whole period, the biggest weight (35.31%) was again that of the flocks with 10 – 49 individuals.

In autumn, we established that the white storks migrated usually in large groups, in 21.43% of cases they having 50 – 99 individuals and, in 7.14% of cases, over 99 individuals (in spring, respective percentages being just 1.38% and 0.35%).

About the direction of movement (Table 5), we can say that in spring, 27.62% of the observed individuals

displaced toward North-West (NW), 20.61% displaced toward North (N), 15.45% toward North-East (NE), 13% toward North-North-East (NNE) and 12.37% toward North-North-West (NNW), in other direction of movement few individuals being observed. The resultant of movement was  $7.37^0$  in trigonometric sense relative to the South-North axe, its value (in percents) being 74.28%. In autumn, relying on more limited data, we can say that the principal sense of migration was toward South (S, in 66.91% of all cases), followed by South-South-East one (SSE, 29.38%). The resultant of displacement had  $6.39^0$  in trigonometric sense relative to North-South direction, its value (in percents) being 94.41%.

**Table 2.** The repartition by decades of the observations and observed individuals during 1998 – 2010.

Decade	1-10	11-20	21-31	1-10	11-20	21-30	1-10	11-20	21-30	1-10	11-20	21-30	1-10	11-20	21-31	1-10	11-20	21-31	1-10	11-20
	III	III	III	IV	IV	IV	V	V	V	VI	VI	VI	VII	VII	VII	VIII	VIII	VIII	IX	IX
Number of observations	0	11	64	72	36	27	30	11	10	13	9	1	4	1	0	2	5	5	2	0
Percentage of observations	0	3.81	22.15	24.91	12.46	9.34	10.38	3.81	3.46	4.50	3.11	0.35	1.38	0.35	0	14.29	35.71	35.71	14.29	0
Number of individuals	0	76	602	624	276	225	375	95	289	202	139	24	186	40	0	9	30	305	61	0
Percentage of individuals	0	2.41	19.09	19.79	8.75	7.14	11.89	3.01	9.17	6.41	4.41	0.76	5.90	1.27	0	2.22	7.41	75.31	15.06	0

**Table 3.** The ratio number of observed individuals/number of observations.

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Number of observed individuals/Number of observations	0	0	9.04	8.33	14.88	15.87	45.20	28.67	30.50	0	0	0

**Table 4.** The weight of the observations according to the number of individuals per observation (flock).

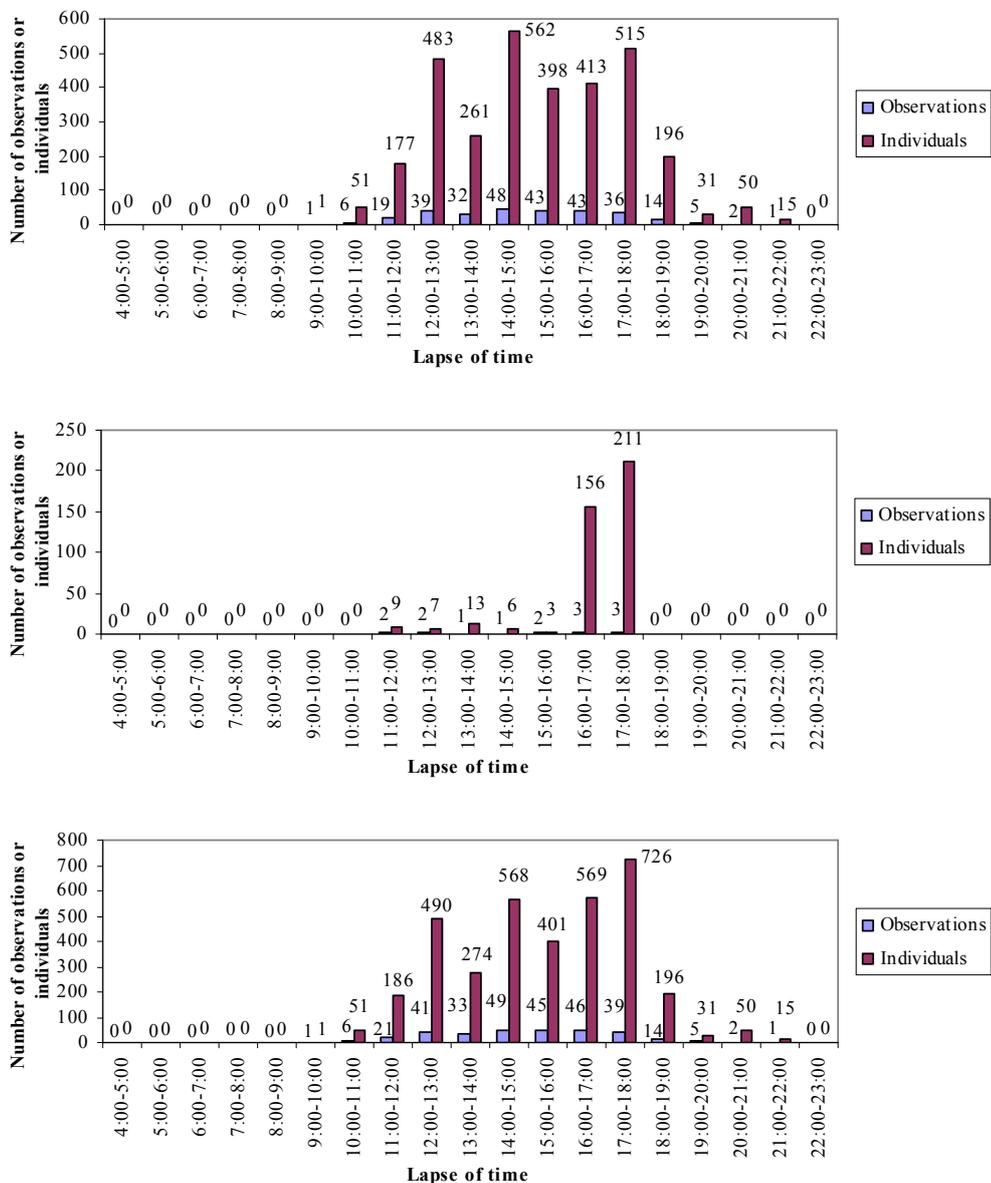
Number of individuals/observation	1	2	3 - 4	5 - 9	10 - 49	50 - 99	> 99
Spring	15.92	11.42	14.53	19.72	36.68	1.38	0.35
Autumn	14.29	14.29	7.14	28.57	7.14	21.43	7.14
Period	15.84	11.55	14.19	20.13	35.31	2.31	0.66

Regarding the number of the observations and the number of observed individuals per hour, in the spring season, we remarked an important presence in flight between 12:00 and 18:00, the maximum being from 14:00 to 15:00. In the autumn season, the most observations were noted between 16:00 and 18:00 and

the most of the observed individuals were registered between 17:00 and 18:00. Per total, the maximum of the observations was from 14:00 to 15:00 and the maximum of the observed individuals from 17:00 to 18:00 (Fig. 2).

**Table 5.** The distribution by the displacement sense of the individuals.

The sense of displacement	Spring		Autumn	
	Individuals	Percentage	Individuals	Percentage
N	650	20.61	0	0
NNE	410	13	0	0
NE	487	15.45	0	0
ENE	71	2.25	0	0
E	25	0.79	2	0.49
ESE	18	0.57	0	0
SE	7	0.22	0	0
SSE	0	0	119	29.38
S	69	2.19	271	66.91
SSW	0	0	6	1.48
SW	1	0.03	0	0
WSW	0	0	0	0
W	81	2.57	0	0
WNW	73	2.32	0	0
NW	871	27.62	0	0
NNW	390	12.37	7	1.73



**Figure 2.** The distribution of the observations number and of the observed individuals' number during the spring (top), autumn (middle) and per total (bottom) during 1998 – 2010.

## DISCUSSIONS

The number of the observations and the number of the observed individuals depended by the seasonal and circadian rhythm of the white stork activity, the weather conditions, and the time we allocated for monitoring, which varied largely from the first years of observation to the latest. In this area the spring passage was more important than the autumn passage. The maximum of the passage was in April with the peak between 1 and 10 April (in spring) and in August with the peak between 21 and 31 August (in autumn). Considering the monthly ratio between the number of observed individuals and the number of observations we can say that, generally, the flocks increased in the individuals from the beginning of the spring migration to its ending. In autumn, this conclusion must be viewed under reserve.

We remarked that in some years there were flocks in spring migration after the months March, April and May, more precisely in June (1999 – 32 individuals, 2000 – 6 individuals, 2005 – 16 individuals, 2006, a very warm year – 201 individuals, 2007 – 43 individuals, 2008 – 40 individuals and 2010 – 16 individuals), when we consider that these storks may be young (and non-breeding in these years) birds founded in slow migration. The individuals registered in July (87, 50, 45 and 40 individuals at 4, 5, 10 and 20 July 2006, and 4 individuals at 3 July 2008, displacing toward NNW, NNE, ENE, NNE, respectively NE), may be also immature birds or juveniles that just abandoned their nests ranging toward North in searching for food territories.

Preponderantly, in spring the individuals travelled in groups of 10 – 49 individuals and in autumn in groups of 5 – 9 individuals. In autumn, the weight of the flocks having over 50 individuals was much bigger than that of the spring. The maximum of the individuals observed together was 130 at 21 May 2008 (in spring) and 150 at 26 August 1999 (in autumn).

The majority of the individuals flew toward North-West and North, in the spring migration, and toward South, in the autumn migration. Our data confirm the conclusions of the other authors, which demonstrated that the birds transit the Southern Carpathians through the corridors Rucăr-Bran and Cozia-Turnu Roşu and even over the mountains [4, 13, 16, 22]. It was some special situations when the birds were seen flying in opposite direction than the correct one (probably wandering in search for places suitable for nesting or feeding): 18 individuals toward East-South-East (ESE) at 12 June 2006, 7 individuals toward South-East (SE) at 1 May 2000, 31 individuals at 6 May 2001, 4 individuals at 5 June 2005, 14 individuals at 29 April 2007, 14 individuals at 6 May 2007 and 6 individuals at 8 May 2007 toward south (S) and 1 individual toward South-West (SW) at 13 May 2006. At the moment of the observations, the weather was quite good, with 19 – 23 °C temperature of the air, sky covered by clouds at middle level and moderate wind. Equally was in the autumn passage, when 7 individuals (1.73%), at 1 August 2006, flew toward North-North-

West in good conditions of weather (27°C, clouds at middle level, weak wind).

The main transit registered during the day was at noon in spring and in the afternoon in autumn. In spring, the earliest observation was performed at 9:50 and the latest at 21:00 while, in autumn, the earliest observation was effectuated at 11:25 and the latest at 17:50. We mention that the time is expressed in the Romanian Standard Hour (similarly with the Winter Hour = Summer Hour + 1 hour).

We can jump to the following conclusions related to the dynamics in migration of the white stork in the Doamnei River hydrographical basin for the 1998-2010 period:

- The spring passage was more important than the autumn passage.
- The maximum of the passage was in April with the peak between 1 and 10 April (in spring) and in August with the peak between 21 and 31 August (in autumn).
- Generally, in spring, the flocks increased in individuals from the beginning of the migration to its ending.
- In spring, in some years, there was a delayed migration.
- Preponderantly, in spring the individuals travelled in groups of 10 – 49 individuals and in autumn in groups of 5 – 9 individuals.
- In autumn, the weight of the flocks containing over 50 individuals was much bigger than that of the spring.
- The majority of the individuals flew toward North-West and North, in the spring migration, and toward South, in the autumn migration.
- The main transit registered during the day was at noon, in spring, and in the afternoon, in autumn.

## REFERENCES

- [1] Alexiu, V., (1998). Vegetația masivului Iezer-Păpușa. Studiu fitocenologic. Cultura Press, Pitești, 362 p.
- [2] Baltag, E.Ș., Bolboacă, L.E., Ștefan, A., (2009): White stork (*Ciconia ciconia*) population in Moldova (Romania), distribution, size and dynamics. Analele Științifice ale Universității „Al. I. Cuza” Iași, s. Biologie animală, LV: 187-197.
- [3] Barco, A., Nedelcu, E., (1974): Județul Argeș. Academiei Press, Bucharest, 168 p.
- [4] Chernetsov, N., Berthold, P., Querner, U., (2004): Migratory orientation of first-year white storks (*Ciconia ciconia*): inherited information and social interactions. The Journal of Experimental Biology, Published by The Company of Biologists, 207: 937-943.
- [5] Covaciu-Marcov, S.D., Cicort-Lucaciu, A.Ș., Dimancea, N., (2009): What do the newly discovered *Lissotriton montandoni* (Caudata, Salamandridae) populations from Iezer Mountains, Romania, have to say about the species' southern distribution limit? North-Western Journal of Zoology, 5: 429-433.
- [6] Covaciu-Marcov, S.D., Sas, I., Ilieș, A., (2010): *Pelophylax lessonae* (Amphibia) in Râul Doamnei, Argeș County, Romania. How have we arrived here? Bihorean Biologist, 4(1): 83-87.
- [7] Fiedler, W., (2009): New technologies for monitoring bird migration and behaviour. Ringing & Migration, British Trust for Ornithology, 24: 175-179.

- [8] Freyhof, J., Kottelat, M., Nolte, A. (2005): Taxonomic diversity of European *Cottus* with description of eight new species (Teleostei: Cottidae). *Ichthyological Exploration of Freshwaters*, 16: 107-172.
- [9] Freyhof, J., Kottelat, M., (2008): *Romanichthys valsanicola*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.1, www.iucnredlist.org downloaded on 01 April 2010.
- [10] Hagemeyer, E.J.M., Blair, M.J., (1997): The EBCC Atlas of European Breeding Birds: their Distribution and Abundance. T & AD Poyser London, 903 p.
- [11] Hartel, T., Moga, C.I., Öllerer, K., Demeter, L., Sas, I., Ruști, D.M., Balog, A., (2008): A proposal towards the incorporation of spatial heterogeneity into animal distribution studies in Romanian landscapes. *North-Western Journal of Zoology*, 4: 173-183.
- [12] Hofman, S., Spolsky, C., Uzzell, T., Cogălniceanu, D., Babik, W., Szymura, J.M., (2007): Phylogeography of the fire-bellied toads *Bombina*: independent Pleistocene histories inferred from mitochondrial genomes. *Molecular Ecology*, 16: 2301-2316.
- [13] Klemm, W., (1969): Der Weisstorch-Bestand im Gebiet von Sibiu (Hermannstadt) in Siebenbürgen 1963 u. 1967. *Die Vogelwarte, Stuttgart*, XXV, 1: 25-27.
- [14] Kósa, F., (2005): Rezultatele recensământului berzei albe (*Ciconia ciconia*) în România în 2004. *Migrans, Târgu Mureș*, VII, 2: 1 – 3.
- [15] Linția, D., (1954): Păsările din R. P. R.. Academiei Republicii Populare Române Press, 2: 6-10.
- [16] Mătieș, M., (1969): Cercetări avifaunistice de-a lungul bazinului mijlociu și superior al Argeșului între 1 ianuarie – 31 mai 1968. *Muzeul Județean Argeș. Studii și Comunicări*, 2: 73-90.
- [17] Mătieș, M., (1971): Contribuții la cunoașterea migrației carpatice a păsărilor. *Revista muzeelor*, 3: 251-254.
- [18] Mătieș, M., (1986): Les routes de migration des oiseaux en Roumanie. *Travaux du Museum d'Histoire Naturelle „Grigore Antipa” București*, XXVIII: 247-264.
- [19] Munteanu, D., Papadopol, A., Weber, P., (2002): Atlasul păsărilor clocitoare din România. *Publicațiile Societății Ornitologice Române*, 16: 22.
- [20] Munteanu, D., Rășinaru, R., (1996): Migrația de primăvară a codobaturii albe (*Motacilla alba*) în România. *Naturalia, Studii și Cercetări, Pitești*, II-III: 399-403.
- [21] Munteanu, D., (2005): Barza neagră (*Ciconia nigra*). p. 94. Barza albă (*Ciconia ciconia*). p. 95. In Botnariuc, N., Tatole, V., (eds.): *Cartea Roșie a Vertebratelor din România. Academia Română, Muzeul Național de Istorie Naturală „Grigore Antipa”*.
- [22] Rudescu, L., (1958): Migrația păsărilor. Științifică Press, Bucharest, pp. 105-124.
- [23] Svensson, L., Mullarney, K., Zetterstrom, D., Grant, P.J., (2009): *Collins Bird Guide. The most complete guide to the birds of Britain and Europe*. Harper Collins Publishers Ltd., pp. 84-85.
- [24] Trelea, S., (2002): *Avifauna Depresiunii Rădăuți*. Risoprint Press, Cluj Napoca, 17: 192 p.

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