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Eur J Wildl Res (2010) 56:83–87
DOI 10.1007/s10344-009-0313-0

SHORT COMMUNICATION

White Storks, *Ciconia ciconia*, forage on rubbish dumps in Poland—a novel behaviour in population

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Received: 9 November 2008 / Revised: 4 August 2009 / Accepted: 10 August 2009 / Published online: 25 August 2009

Abstract Information on the foraging of White Storks on rubbish dumps, a novel behaviour in Central European populations, is presented. Observations were first made in 1999 and to date; they have been recorded on sixteen locations in Poland. From one to 348 White Storks (median=2, *N*=116) were observed on rubbish dumps, and most of the records (86%) were of 1–3 birds. Birds foraging on rubbish dumps were recorded from late March to early September, but the highest numbers were seen during the summer months. Most of the birds (77%, *N*=171) were recorded foraging directly on an area where rubbish had been thrown, while a minor fraction (16%) was seen on neighbouring recultivated grassy areas. Dumps were used as an additional food source probably in areas where natural foraging grounds are limited. The increased frequency of observations during the summer months probably resulted from the greater nutritional needs of large nestlings which force the adults to find alternative food sources or foraging habitat shift by non-breeding birds.

Keywords White Stork · *Ciconia ciconia* · Foraging · Rubbish dumps

Communicated by H. Kierdorf

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Introduction

White Storks, *Ciconia ciconia,* in Europe have been associated with man-made habitats through the centuries. They are found in open habitats where man has settled and worked the land, rearing crops and animals (Creutz 1988, Schulz 1998; Profus 2006). Presently, most of the population nests in close proximity to human settlements, and open habitats in large river valleys are the major foraging places for this species. White Stork is a food opportunist, and its diet is composed of earthworms, *Lumbricidae*, insects (mainly beetles, *Coleoptera*, and locusts, *Orthoptera*), fishes, amphibians and small mammals—predominately voles, *Microtus* sp. (Cramp and Simmons 1977; Schulz 1998; Antczak et al. 2002; Antczak and Dolata 2006; Profus 2006).

With the intensive development of civilization, suitable foraging areas for the White Stork have shrunk, thereby decreasing its numbers or even threatening the extinction of the species in most West European countries (Bairlein 1991; Profus 1993; Araujo and Biber 1997; Profus 2006). In recent years, an increase in the numbers of this species in Spain and France has been recorded. Population development there is characterised by the wintering of some fraction of the birds on breeding grounds, their common colonial breeding, and the phenomenon of regular foraging of breeding birds on rubbish dumps or slaughter-house wastes (Tortosa et al. 1995, 2003). Similar foraging behaviour seems to be unknown in populations from Central and Eastern Europe, where significant part of the world population occurs (Schulz 1998). The aim of this paper is to present information on the foraging of White Storks on rubbish dumps in Poland—a novel behaviour in population. We want to determine spatial and temporal distribution of this phenomenon and to present some

aspects of dumps use, which may be important for understanding this process. We aim to draw the attention of researchers to this phenomenon.

Methods

Data concerning the foraging of White Storks on rubbish dumps were based on the authors' personal observations, and the responses to questionnaires distributed to several national mailing lists with a total of 1,468 subscribers. Since some individuals subscribe to several mailing lists, the realistic number of persons who received the questionnaire was about 600. The questionnaires ensured a randomness of samples and that the entire country was covered evenly since subscribers to the mailing lists live throughout all regions of the country. Moreover, researchers who work with White Stork were asked directly about their opinion of the phenomenon. Seventeen people answered the questionnaire which included questions about the place and date of observation, the number and age of birds, the place of foraging (were the birds on the immediate location of the rubbish or on the edges of the dump), the escape distance between the birds and machines and people working at the dumps, the distance to the nearest nest from the dumps and the breeding success in these nests.

Material concerning White Stork foraging on rubbish dumps came primarily from regular counts which were carried out. In Szczecin, Toruń, Kraków, Warszawa and Jastrzębie Zdrój, observations were made over several years, making it possible to identify when this phenomenon began within the Polish White Stork population. The other received data included single or irregular observations and have varying value. The place and numbers of birds observed was always given. The exact date of observation was given in most (85%, N=116) responses, while others (15%) included only the month and year. Most responses (92%) gave the place of foraging. Some records (60%) included the escape distance, bird's age (70%) and distance to the nearest nest (60%) and its breeding success (16%). To present the number of White Storks using rubbish dumps in subsequent months (Fig. 1.), records from occasional visits were excluded and only data from dumps with regularly conducted counts were used.

Results

In 1999–2008, a total number of 116 records of 1,069 White Storks foraging on rubbish dumps were collected. Information was obtained from 15 cities in Poland. There was an additional instance in Karczew near Warszawa of a bird foraging in a container with bones at a slaughterhouse (Table 1). The first record of White Storks foraging on rubbish dumps took place in 1999. The number of foraging birds varied from one to 348 (median=2, N=116). Most observations (86.5%, N=116) were of 1–3 birds. The highest concentrations of 348 and 300 birds were seen on 19 and 20 July 2007, respectively, on a rubbish dump in Augustów (NE Poland). On a rubbish dump in Kraków (S Poland), a maximum of 23–26 adult birds was seen between 16 and 20 July 2007. Near Szczecin-Kołbaskowo (NW Poland), the largest number of foraging birds (three adults and three juveniles) was seen on 19 August 2005 (Table 1).

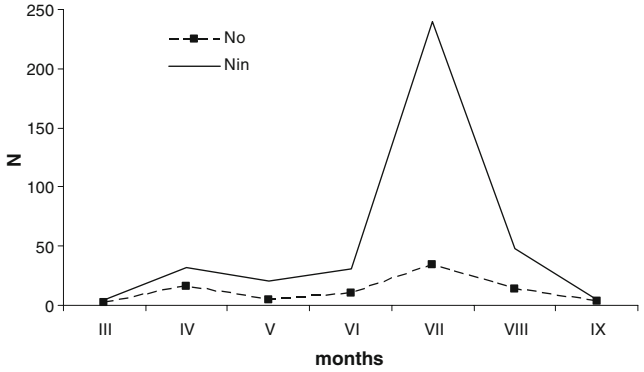

Fig. 1 Records of White Storks, *Ciconia ciconia*, foraging on rubbish dumps in Poland (N_o=98, N_{in}=411)

The earliest observations of White Storks on rubbish dumps were made on 18 March 2008—seven adults in Białystok (NE Poland) and on 24 March 2005 and 25 March 2007, two adults in both cases in Kraków and on 27 April 1999, in Siedlce. The last birds were seen on 5 September 2005 and 6 September 2006 in Kraków (two adults in both cases). Of 98 observations on 411 birds, dated in detail, most of them took place during summer months. The number of White Storks foraging on rubbish dumps reached its peak during July (Fig. 1.). In August, young birds also started to appear on the dumps and made up 25% of all the birds observed in this month (N=48).

White Storks foraging on rubbish dumps are not timid, and the escape distance from machines and people working at the dumps averaged at 13 m (SD=6.2, 1.5–30, N=17). It appears that the birds differentiate between people who are there all the time from those who are there sporadically e.g. those who come for bird-watching purposes. In the latter case, the foraging distance from the observer was generally larger and ranged from 30 to 50 m.

The distance from the dump to the nearest nest averaged 1,381 m (SD=886, 400–3,000, N=16). The influence of birds feeding on dumps on their breeding success was not

Table 1 Records of White Storks *Ciconia ciconia* foraging on rubbish dumps in Poland

Location (region of Poland)	Number and age of birds	Dates	Source
Siedlce (C)	1 (ad, *N*=1)	27 April 1999	ZK
Toruń (N)	1–2 (ad, *N*=3)	July–August 1999–2006	MM, GN
Jasło (S)	1–2 (ad)	June–July 2002–2006	BK
Kozienice (C)	1–2 (ad)	Spring–Summer 2002–06	MR
Karczew near Warszawa (C)	1 (ad, *N*=1)	Spring 2003	MJ
Oświęcim (S)	1 (ad, *N*=4)	June–July 2003–2005	JB, PR
Kraków (S)	M_e=2 (ad and juv, 1–26, *N*=68)	March–April, July–September 2003–07	RK, DW
Szczecin-Sieraków (NW)	1 (ad, *N*=1)	Spring 2004	ŁB
Jastrzębie Zdrój (S)	M_e=1 (ad, 1–4, *N*=16)	April–August 2005–06	R. Kruszyk
Szczecin-Kołbaskowo (NW)	M_e=2 (ad and juv, 1–6, *N*=6)	May–August 2005	Borek 2006, ŁŁ
Szczecin-Klucz (NW)	1 (ad, *N*=1)	19 August 2005	Borek 2006
Nowa Sól (W)	1 (ad, *N*=1)	31 July 2006	SR
Łubna near Warszawa (C)	3 (ad, *N*=1)	14 August 2006	MGM
Białystok (NE)	1 (ad, *N*=2) 7 (ad, *N*=1)	March–April 2007 18 March 2008	MP
Augustów (NE)	348 (ad and 1 juv, *N*=1) 300 (ad, *N*=1)	19 July 2007 20 July 2007	PZ
Brzeg (SW)	M_e=5 (ad, 2–9, *N*=5)	July–August 2007	MGM, MB

Letters given in location column indicate region of the country and items inside parenthesis given in number and age of birds column indicate *ad* adult, *juv* juvenile, M_e median number of birds, min–max number of birds, *N* number of records

ZK Zbigniew Kasprzykowski, *MM* Michał Maniakowski, *GN* Grzegorz Neubauer, *BK* Bartosz Kwarciany, *MR* Maciej Rębiś, *MJ* Marek Jobda, *JB* Jacek Betleja, *PR* Piotr Rymarowicz, *RK* Rafał Korbut, *DW* Damian Wiehle, *ŁB* Łukasz Borek, *ŁŁ* Łukasz Ławicki, *SR* Sławomir Rubacha, *MGM* Mateusz Grzegorz Matysiak, *MP* Michał Polakowski, *PZ* Piotr Zięcik, *MB* Maciej Buchalik

determined due to lack of data. However, in Jasło, out of three nests (located 900 m, 1,500 m and 5,000 m from the dump), only the nest located closest to the dump was occupied by birds which often foraged there. A similar situation was observed in Jastrzębie Zdrój, where out of two nests, only birds which foraged on the dump breed successfully.

The majority of observations (77.2% of individuals, *N*=171) dealt with birds foraging directly on the area where the rubbish had been thrown. The birds foraged the freshest trash, dumped directly from trucks, competing with gulls, *Laridae*, and corvids, *Corvidae*. A minor fraction of birds (16.4%) was recorded on neighbouring recultivated parts of the dumps overgrown with grass. Eight birds (6.4%) were seen perched on lamps located in the dump.

Discussion

The phenomenon of White Storks foraging on rubbish dumps is exceptional among the Central and East European populations. Information collected in Poland indicates that this novel behaviour started to appear at the turn of the century and is in the beginning stage. However, the number of places, where White Storks forage on dumps seems to grow every year. Foraging on rubbish dumps is common for populations living in southwestern Europe—the Iberian Peninsula and France (Tortosa et al. 1995, 2002, 2003; Blanco 1996; Peris 2003; Massemin-Chalet et al. 2006). The permanent source of food has an influence on the breeding success and changes in migration habits that increase the number of settled birds. On the other hand, foraging on rubbish dumps carries a greater risk of food poisoning (Peris 2003; Andrzejewska et al. 2004).

Instances of White Storks foraging on rubbish dumps can be related to changes in the use of farmland. During the recent years, the amount of abandoned fields and meadows has increased in Poland. The distribution of places where White Storks foraged on dumps indicates that this phenomenon occurs frequently in areas with the lowest population density (Jakubiec and Guziak 2006). The low population density of White Storks in the western and southern parts of the country probably results from the unavailability of foraging grounds for this species. A recent decrease in the number of White Storks in the Górny Śląsk region (upper Silesia) is explained by the reduction of green pastures (Profus 2006).

The use of rubbish dumps for foraging can be conducive to the colonisation of White Storks in foothill terrain as well as the functioning of nests in areas with unfavourable foraging conditions, which has been seen in recent years. Besides climatic and environmental factors (Tryjanowski et al. 2005), changes in foraging behaviour can determine colonisation success. Nesting in sub-optimal terrain (i. e. foothills or urbanised areas) is hazardous for White Storks. Using alternative food sources can be significant in breeding success and can influence the functioning of local populations, as is the case in Western Europe (Tortosa et al. 2002, 2003). Urbanised land, shaped by industry or foothills can perhaps be occupied thanks to the use of dumps as an additional food source. This can be confirmed by the increased frequency of birds seen during the summer months, when the greater need for feeding large young birds forces adults to look for alternative food sources. On the other hand, records of high concentrations of White Storks in northeastern Poland indicate that non-breeding birds started to use rubbish as a food resources as well. Non-breeding birds in Poland group together and are usually found in rich foraging areas i.e. fields and pastures (Antczak et al. 2002; Antczak and Dolata 2006). The peak number of birds seen in July could result from a concentration of neighbouring breeding birds as well as the appearance of non-breeding and passage birds.

The use of dumps by foraging White Storks along the migration routes and on winter grounds is a common phenomenon (Ciach and Kruszyk in prep.). It occurs in places located on traditional winter grounds (South Africa), but mainly concerns places found relatively close to breeding grounds—in North Africa and the Middle East. The wintering of White Storks in these regions has been recently recorded. The shortened migration distance of the Central European population (Fiedler 2001; Chernetsov et al. 2006, see discussion in Kania 2006) can also be related to the use of an easily accessible food source in the form of rubbish. In the southwestern European population, migrating short distances, the use of rubbish dumps is a common phenomenon both in breeding and wintering grounds (Tortosa et al. 1995, 2002, 2003; Blanco 1996; Peris 2003; Massemin-Chalet et al. 2006). Although it is speculative, it can not be excluded that the experience of birds in using rubbish dumps is gained during their stay on non-breeding grounds and may be transfer to breeding grounds.

Current distribution and breeding ecology of White Stork resulted from large-scale modifications of the environment (Tryjanowski et al. 2006). Consequences of development of behaviour described in this paper may have a major impact on different future aspects of the ecology of the species e.g. changes in population trends, its distribution and density, shortening of migration distance and breeding success.

Acknowledgements We wish to thank Jacek Betleja, Łukasz Borek, Maciej Buchalik, Marek Jobda, Zbigniew Kasprzykowski, Rafał Korbut, Bartosz Kwarciany, Łukasz Ławicki, Michał Maniakowski, Mateusz Grzegorz Matysiak, Grzegorz Neubauer, Michał Polakowski, Maciej Rębiś, Sławomir Rubacha, Piotr Rymarowicz, Damian Wiehle and Piotr Zięcik for providing their unpublished data from Poland. Paweł T. Dolata, Piotr Profus, Piotr Tryjanowski and anonymous reviewers kindly offered valuable comments on the draft of this paper.

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