



Con il patrocinio del Comune di
Castiglione d'Adda



Cicogna bianca

ECO-ETOLOGIA
DI UN INDICATORE AMBIENTALE

Relatore:
ROBERTA CASTIGLIONI
NATURALISTA ZOOLOGA



Venerdì 17 Maggio 2024 - h 20.30

CENTRO CICOgne
Strada C.na Gerre
Castiglione d'Adda – Lodi

Prima dell'evento

Un'accoglienza speciale con le GEV del Parco Adda Sud
alla scoperta delle cicogne della stazione di ambientamento



Prima nidificazione di Cicogna bianca *Ciconia ciconia* in provincia di Bergamo (Lombardia)

ROBERTA CASTIGLIONI*, DAVIDE GUADAGNINI**, GIANFRANCO ALESSANDRIA*

*Centro Studi Fauna Vertebrata "Luigi Cagnolaro", Società Italiana Scienze Naturali – c/o Museo Civico Storia Naturale, Corso Venezia, 55 - 20121 MILANO (MI)

E-mail: darwin@darwininatura.it

**Parco Faunistico Le Cornelle – VALBREMBO (BG)



Dopo un secolo tornano le cicogne Nido e 4 piccoli
Alle Cornelle. Un esemplare maschio è arrivato nel 2015: ha atteso una compagna fino a quest'anno

BRUNO SILINI
È a Valbrembo, su una collina del Parco delle Cornelle, uno dei quattordici nuovi nidi di cicogna in Lombardia. Una preannuncia mancava da 100 anni. A presidiare la stagione riproduttiva della cicogna bianca ci ha pensato la Lipu (Lega italiana per la protezione degli uccelli) grazie alla sua rete di attenti birdwatcher.
Nel caso di Valbrembo la segnalazione è stata confermata dal Parco stesso per voce del suo direttore Davide Guadagnini. E da tre anni che un maschio di cicogna, a fine inverno, aspettava una compagna. Arrivato nel 2015 ha costruito un nido con rami secchi, foderato di paglia, su uno dei più alti alberi della zona. Il nido è stato scoperto nel 2017, dopo quattro uova che, quasi dopo due mesi di cova, sono nati quattro pulcini. L'evento straordinario è stato oggetto di uno studio scientifico presentato al Congresso nazionale della Riproduzione.



La cicogna femmina e maschio si sono alternati nella cura dei piccoli FOTO ROBERTA CASTIGLIONI



I pulcini, piccoli di cicogna nati in Bergamasca

Il nido costruito a Valbrembo





Photo Roberto Castiglioni



FIRST BREEDING OF WHITE STORK (*Ciconia ciconia* L., 1758) IN PROVINCE OF BERGAMO (LOMBARDY)

Roberta Castiglioni¹, Gianfranco Alessandria ¹, Davide Guadagnini²

¹ Centro Studi Fauna Vertebrata "Luigi Cagnolaro" – Società Italiana di Scienze Naturali – Milan, Italy
² Parco Faunistico Le Cornelle – Bergamo, Italy



Photo Roberto Castiglioni



Photo Roberto Castiglioni

Summary

We described the first nesting of White Stork in the province of Bergamo (Lombardy), that occurred in Valbrembo in 2017.

Introduction

This species is listed on Annex I of the EU Birds Directive, Annex II of the Bern Convention and Annex II of the Convention on Migratory Species. The species is protected according to article 2 of the law 157/92. The European population is estimated at 224,000-247,000 pairs and the trend is increasing (BirdLife International 2016). In Italy, it is protected from 1937 and 220-230 pairs are estimated in northwest of the peninsula (Gustin, et al. 2016). The White Stork became extinct as a breeding species in Italy during the 16th century (Brichetti & Fasola 1993; Aimassi 2002). The main reasons were probably related to habitat changes, to human persecution and shooting, also for food purposes (Gallo-Orsi et al. 1995). Today, hunting is still the most common cause of mortality of White Stork migrating over Italy, followed by collision with electric lines. In the last century, in 1959, a new nesting was repeated in Piedmont near Biella (Boano, 1981). Successively, there was an eastward expansion that involved Lombardy where the first attempts to nest took place in Pavia in 1978 (Gargioni 2016). In 2008, in Lombardy, 13-15 pairs were estimated with the increase of nesting (Vigier & Cucé, 2008). In 2016, LIPU reported 77 breeding pairs in Lombardy, in the province of Brescia, Lodi, Mantova and Pavia, with 165 fledged (Corozzi P., gruppo lavoro LIPU cicogna bianca). No attempts of nesting have ever been reported in the Bergamo province until the spring 2017.

Methods and results

In 2017 a pair of White Storks nested on the aviary (1000 m²) of "Le Cornelle Faunistic Park" in Valbrembo (Bergamo) at a height of 12 m, using as a support base an aviary support pole. The nest was built on the side of the aviary which is just a few meters from a very busy city road, especially during the weekend. There are 19 storks inside the aviary, some of which form reproductive pairs.

In 2015 and 2016 a ring-less male was observed on the aviary and began to build the nest, but no female arrived. This year a male arrived at the site on January 19 and a ring-less female on March 7 forming a breeding pair that was monitored daily in the various stages of reproduction. At the end of March incubation started. At the end of April (T^o 8-16) hatching took place and four chicks were born. On May 5 using a truck with lift platform, the nest was closely inspected making visible the emergence of the chicks hatched. Both male and female were feeding them.

The nest was built with dry branches and inside there was straw. Growth of the chicks has been monitored daily until their first fly, at mid of July. Since July 13, one of the four chicks has never returned to the nest. The other three young storks still remained near the nest until August 10, than finally leave the nest, while adults will stay there until mid-September.



Photo Roberto Castiglioni



Conclusion

This is the first confirmed *Ciconia ciconia* breeding in Bergamo province. Our report suggests that, as it happens near many breeding centres and zoos, the presence of some white storks inside the aviary of the park may attract wild storks in the area.

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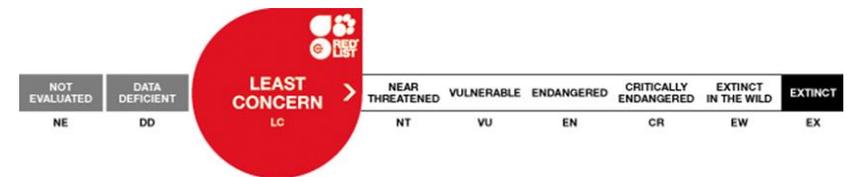
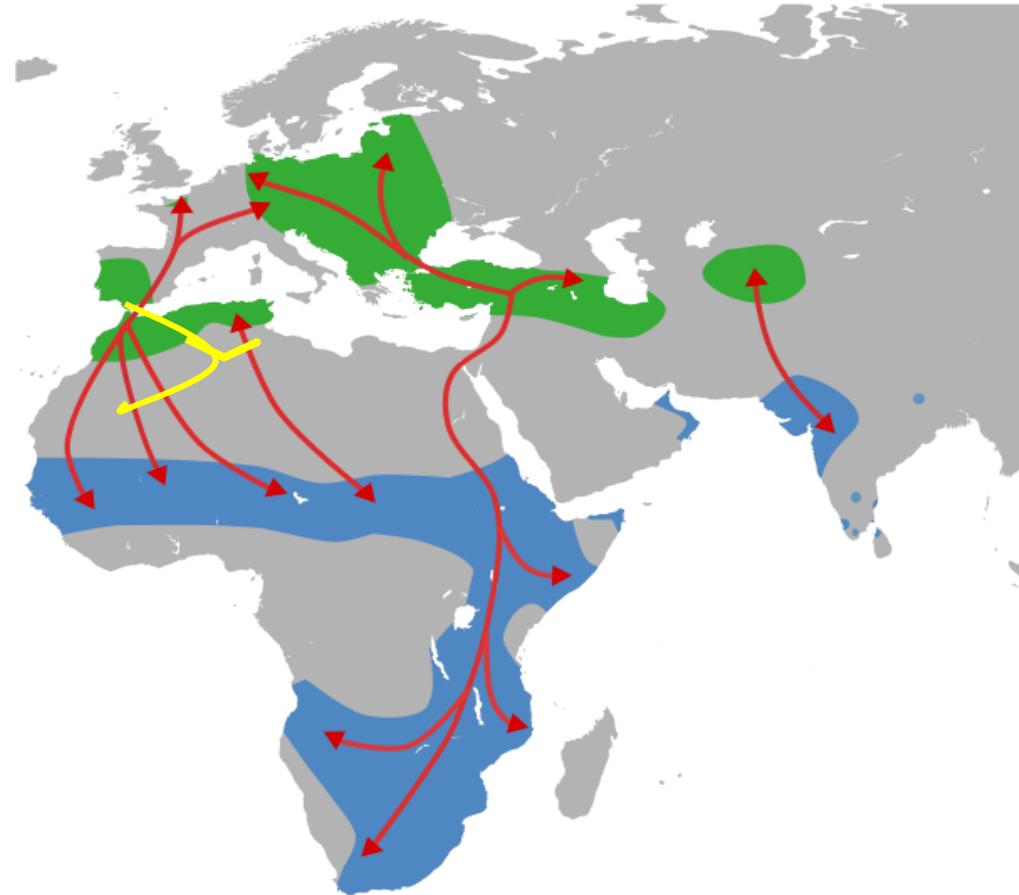
PHOTO ROBERTA CASTIGLIONI

- Specie gregaria con forte legame al nido

REGNO:	Animalia
PHYLUM:	Chordata
SUBPHYLUM:	Vertebrata
CLASSE:	Aves
SOTTOCLASSE:	Neornithes
SUPERORDINE:	Neognathae
ORDINE:	Ciconiiformes
FAMIGLIA:	Ciconiidae
GENERE:	<i>Ciconia</i>
SPECIE:	<i>Ciconia ciconia</i> (Cicogna bianca)

- Migratore regolare
- nidificante
- parzialmente svernante

- Popolazione mondiale: 700.000 coppie
- Popolazione europea: 450.000 coppie
- Popolazione italiana: 350 coppie



- **Lunghezza** (punta becco - piede) 100-102 cm
- **Apertura alare** 155-165 cm
- **Peso** 2,3-4,4 kg

In Europa è diffusa in 35 paesi, con una maggior abbondanza nei paesi orientali, in particolare la Polonia prevale con più di 50.000 coppie (Belardi *et al*, 2004)

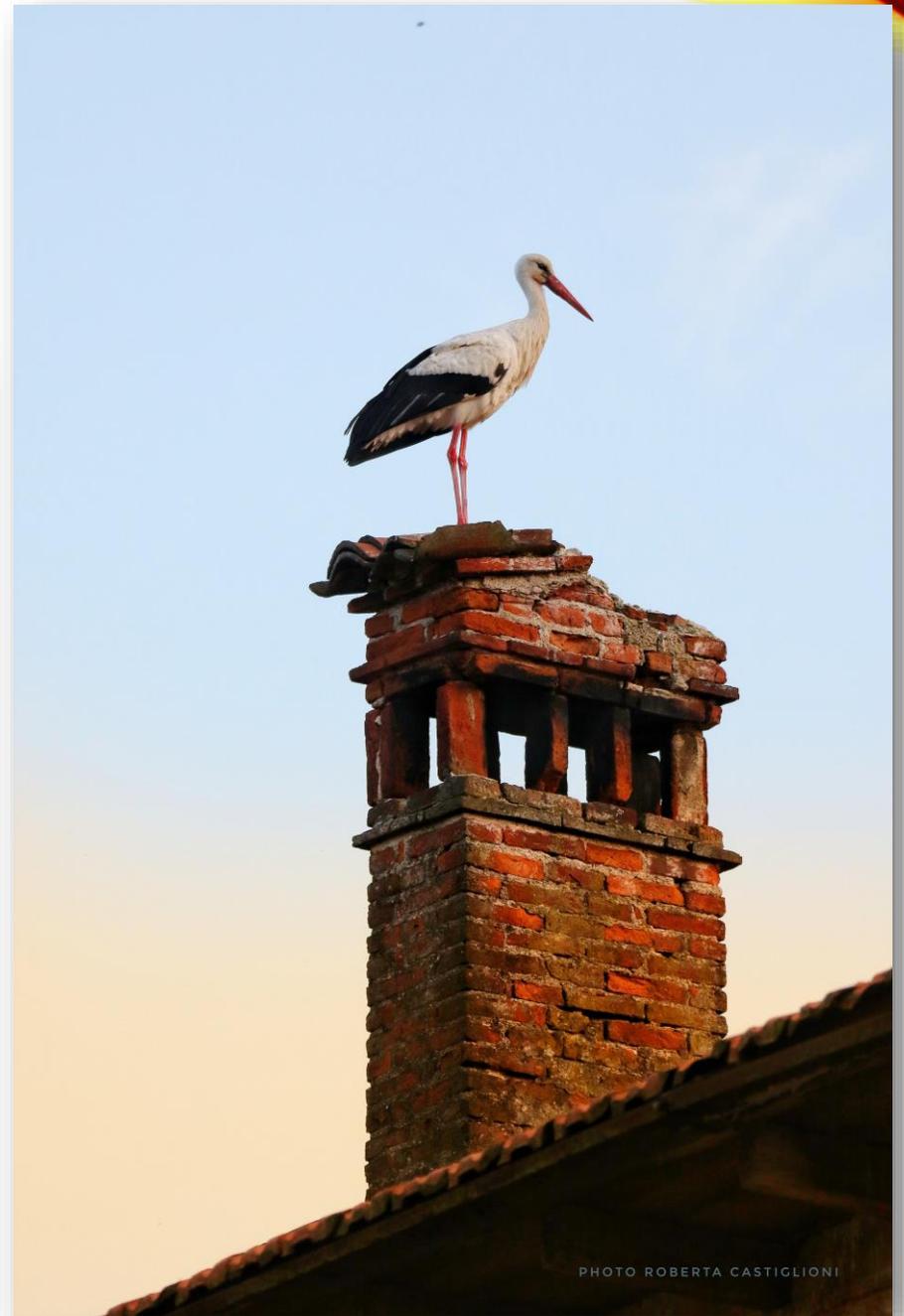


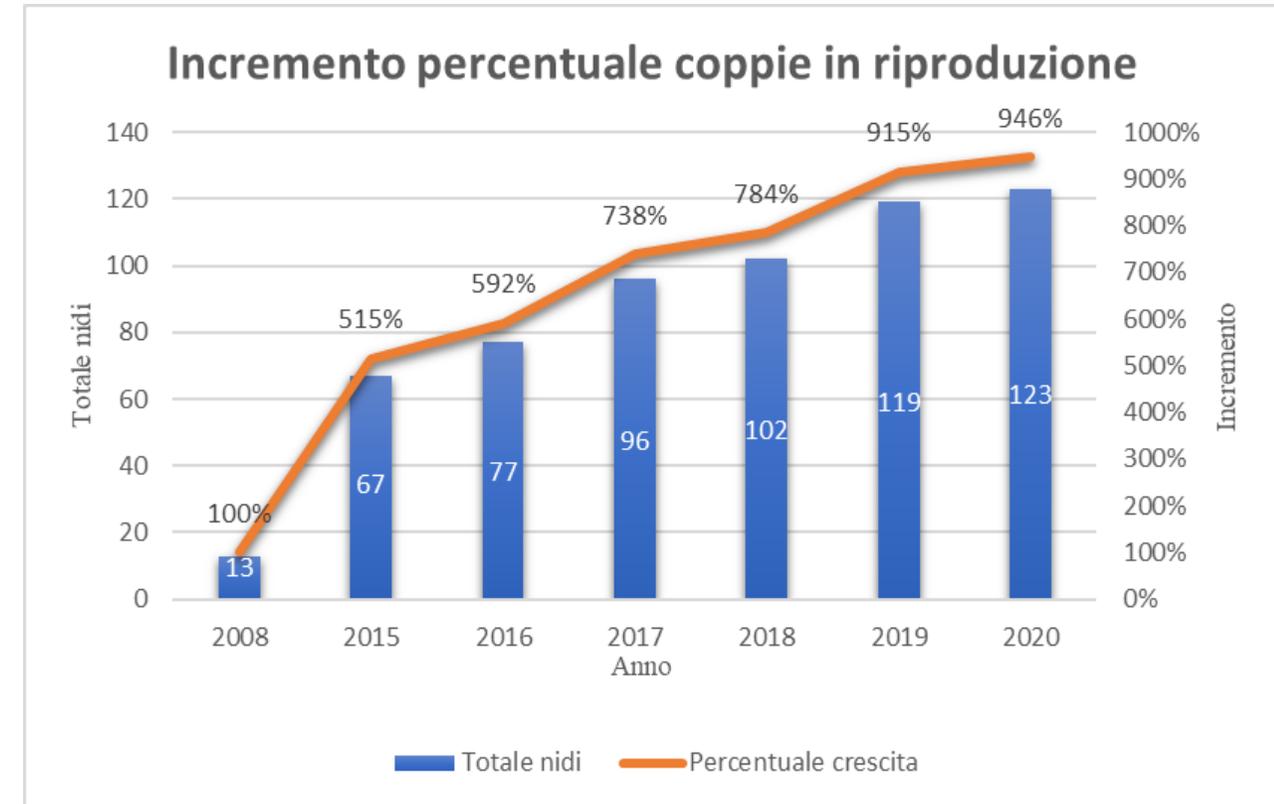


PHOTO ROBERTA CASTIGLIONI



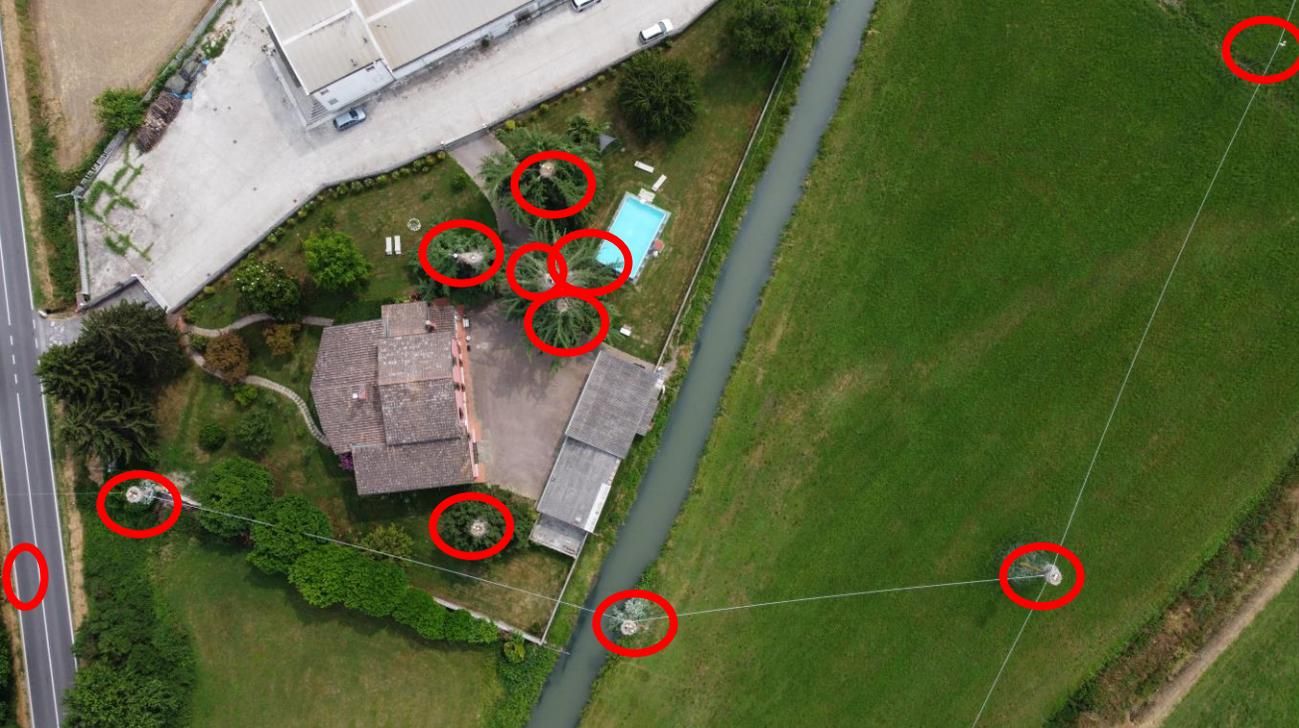
ARW
RICERCA E DIVULGAZIONE
NATURALISTICA

• CONSISTENZA POPOLAZIONE LOMBARDIA 2015-2020



Fonti: (Vigorita & Cucé, 2008) e (Rapporti LIPU 2015 – 2020)

- 1°nidificazione in Italia 1958 a Biella (Piemonte)
- 1° nidificazione in Lombardia 1978 (Pavia)
- 1985 primo Centro cicogne a Racconigi (Piemonte)



PARCO
ADDA SUD

Centro Cicogne Castiglione d'Adda (LO-CR)





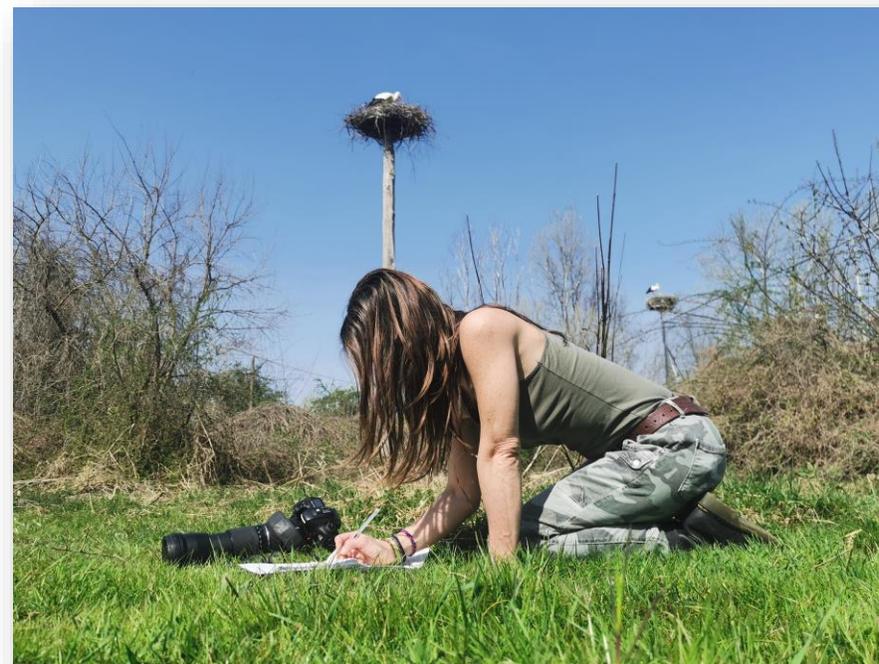
PARCO ADDA SUD





INDAGINI SCIENTIFICHE

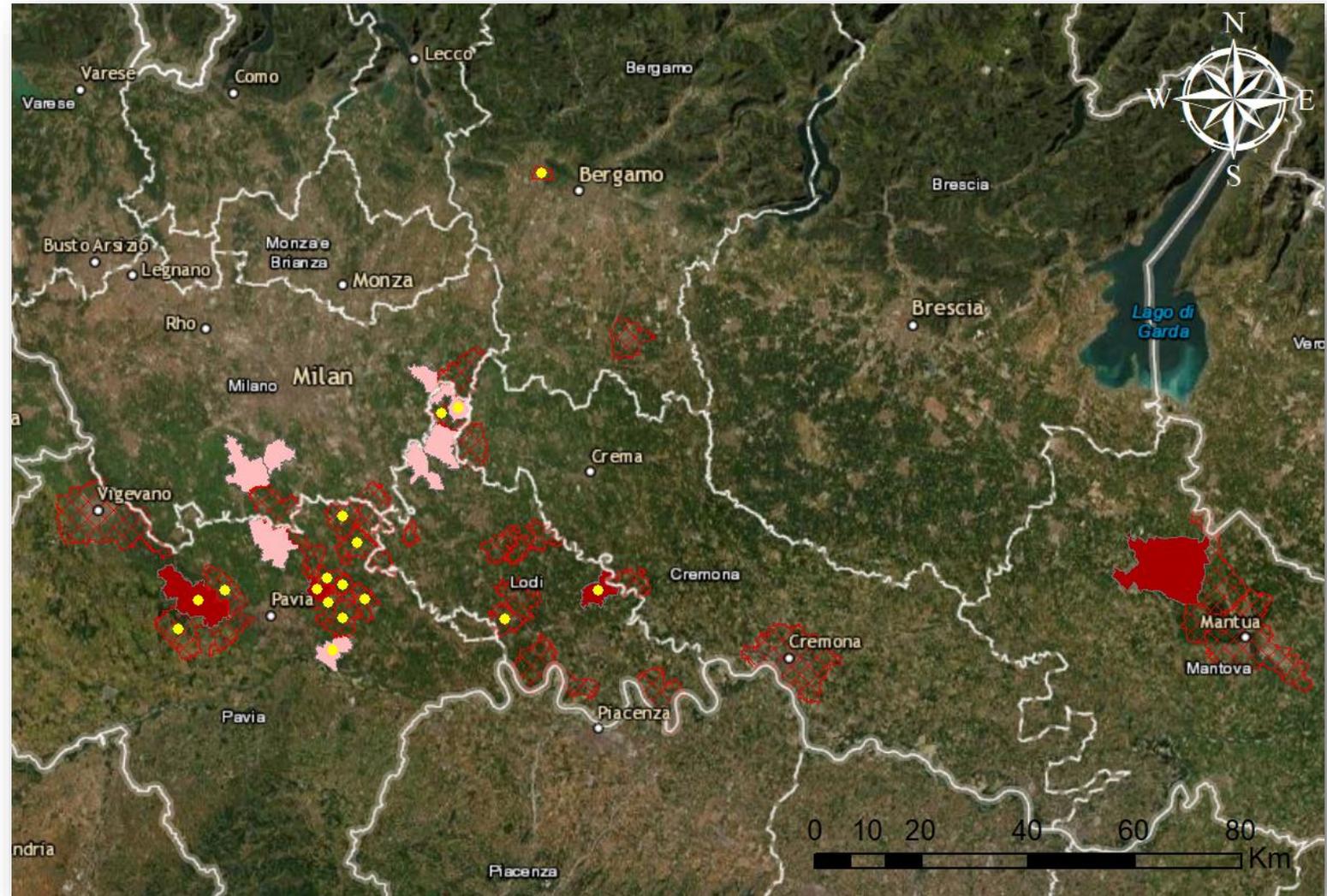
- **BIOLOGIA RIPRODUTTIVA E SUCCESSO ALL'INVOLO**
Monitoraggio 2021-2022
- **ETOLOGIA** Cure parentali/ruolo maschio- femmina





- 17 comuni monitorati (BG, LO, CR, PV)
- **100 nidi** monitorati (57 nel 2021; 43 nel 2022)
- 70 giornate di campo (560 ore)
- 350 ispezioni col drone (DJI mini 2)
- 175 ore di volo

- **INDAGINI BIOLOGIA RIPRODUTTIVA E SUCCESSO ALL'INVOLTO**
MONITORAGGIO 2021-2022





REPRODUCTIVE SUCCESS	OCCURRENCE %		
	2021	2022	Totale
Hatched eggs/eggs	70,63%	73,50%	71,92%
Young at 1 month/eggs	52,94%	57,60%	55,17%
Fledged/eggs	40,54%	55,37%	48,28%
Young 1 m/hatched eggs	74,40%	83,08%	78,82%
Fledged/hatched eggs	58,33%	80,95%	71,90%
Fledged/young at 1 month	83,33%	98,15%	92,53%

Rate	2021			2022			2021 + 2022		
	Nests	Mean	DS	Nests	Mean	DS	Nests	Mean	DS
	Eggs/nest	36	4,25	1,04	29	4,31	0,65	65	4,28
Hatched/nest	43	3,09	1,31	40	3,25	0,97	83	3,17	1,16
Young at 1 month/nest	46	2,37	1,40	43	2,60	1,06	89	2,48	1,26
Fladged/nest	32	1,81	1,42	42	2,52	1,05	74	2,22	1,28

BREEDING SUCCESS OF WHITE STORKS (CICONIA CICONIA) IN NORTHERN ITALY (LOMBARDY)

Roberta Castiglioni ¹

¹ DARWIN Ricerca e Divulgazione Naturalistica – Milano (Italy)

Email: darwin@darwinnatura.it



INTRODUCTION

The gaps in our understanding of White Stork ethology in Europe are quite evident. Certain aspects, such as the breeding behavior of the Italian population, remain unexplained, particularly when it comes to data about clutch size and brood size in the first two weeks after hatching. The difficulties of observing nesting activities within the nests have contributed to this lack of knowledge. Given that White Storks are altricial species and the majority of chick mortality occurs during these initial two weeks, the existing survival data (whether fledged or hatched) are often approximate and occasionally inaccurate.

AIMS

The research aims to gather data on breeding biology for comparison with other European countries and to provide insights into currently unknown reproductive phases.



Stork copulation



Nest with eggs



Chicks: 1 week



Young storks: 2 weeks



Fledglings: > 50 days

METHODS

Data used are based on successfully pairs. Since deposition is asynchronous, nests were examined more times in the spawning period and in the first few days of incubation. We consider "hatched" the chicks of 1-7 days. This is important to calculate correctly the reproductive success because, during these first days, many young storks die. We consider fledged the young present in the nest older than 50 days.

Data come from:

- 100 HPa (nesting pairs) (57 in 2021; 43 in 2022)
- 278 eggs examined
- 70 field observation days (560 h)
- 350 drone inspections (DJI mini 2)

Fieldwork was carried out:

- 2021/2022 (March-September)
- Lombardy districts (BG, CR, LO, PV)
- different types of habitat structure/supports

RESULTS

REPRODUCTIVE SUCCESS	OCCURRENCE %		
	2021	2022	Totale
Hatched eggs/eggs	70,63%	73,50%	71,92%
Young at 1 month/eggs	52,94%	57,60%	55,17%
Fledged/eggs	40,54%	55,37%	48,28%
Young 1 m/hatched eggs	74,40%	83,08%	78,82%
Fledged/hatched eggs	58,33%	80,95%	71,90%
Fledged/young at 1 month	83,33%	98,15%	92,53%

Rate	Nests			Mean			DS		
	2021	2022	2021 + 2022	2021	2022	2021 + 2022	2021	2022	2021 + 2022
Eggs/nest	36	4,25	1,04	29	4,31	0,65	65	4,28	0,89
Hatched/nest	43	3,09	1,31	40	3,25	0,97	83	3,17	1,16
Young at 1 month/nest	46	2,37	1,40	43	2,60	1,06	89	2,48	1,26
Fledged/nest	32	1,81	1,42	42	2,52	1,05	74	2,22	1,28

CONCLUSION

Data differs from other studies, highlighting the need for standardized data collection to understand the link between reproduction and the environment. White storks indicate habitat health in Central Europe, tied to food, nests, and weather. Italy's reproductive factors need more study. Burnhauser (1963) suggested 2.0 fledglings per pair for stability; Bairlain & Zink (1979) proposed 2.8. Despite Lombardy's population rise, if 2.2 breeding success maintains stability remains uncertain.

In other countries:

Poland applies a similar data collection methodology recording hatched eggs/laid: 76% (Kosicki, 2010). Mean clutch size (eggs/nest): Poland 3.81 (Kosicki, 2010), German 3.94 (Kaat & Stachowiak, 1987), Hungary 4.20 (Sasvan & Hegyi 2001), Switzerland 5.2 (Bloesch 1982). Mean hatched size (hatched/nest): Poland 3.17 (Kosicki, 2010). Mean fledged size (fledged/nest): Turkey 2.71, Poland 2.08 (Kosicki, 2010), Germany 1.5 (Struwe & Thomsen), Switzerland 1.7 (Montzi, 2001), Croatia 2.8 (Schneider, 1988), Greece 3.01 (Gauthier, 1995)



IT

CIO 2023

21° Italian Ornithological Congress

September 5-9, 2023
Varese, University of Insubria



• INDAGINI COMPORTAMENTO RIPRODUTTIVO

- 3 siti di raccolta dati: Zerbolò (PV), Castiglione d'Adda (LO), Valbrembo (BG)
- N° di coppie osservate: 18 (identificate ♂ e ♀)
- Osservazioni focali (focal sampling): 8 ore (h 9.00-17.00)
- 35 giorni di campo (280 ore) febbraio-luglio

Etogramma

- In cova
- In piedi al nido
- Rotazione uova
- Manutenzione nido
- Involò (direzione involò)
- Ritorno al nido
- Rigurgiti



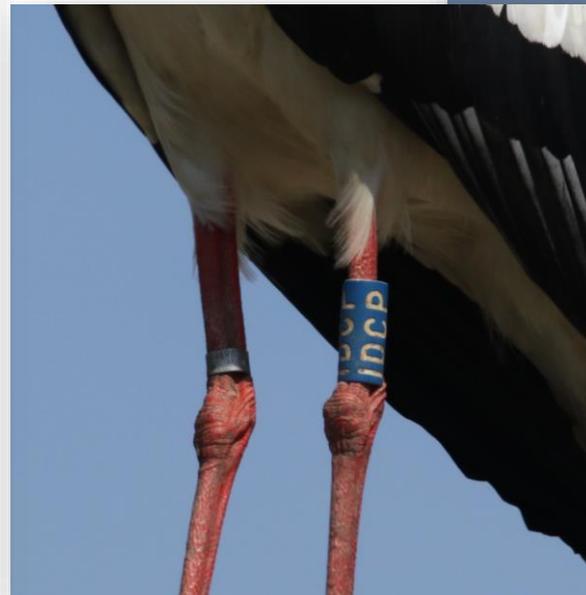


- ACCOPPIAMENTO
- E IDENTIFICAZIONE SESSO DEI SOGGETTI

PHOTO ROBERTA CASTIGLIONI



- **IMPORTANZA DELL'INANELLAMENTO**



- DEPOSIZIONE E CURE PARENTALI



PARENTAL CARE IN WHITE STORK (*Ciconia ciconia*)

Roberta Castiglioni¹ & Alberto Simoncelli²

¹ DARWIN Ricerca e Divulgazione Naturalistica – Milano (Italy)

² Università degli Studi di Milano

Mail: darwin@darwininatura.it



INTRODUCTION

Lack (1969) estimates that 92% of birds forms pair bonds, but emphasizes that pair bond and biparental care are not synonymous. Cockburn (2006) estimates that 81% of species makes biparental care. White Storks form strong pair bond but the breeding behavior is poorly known.

AIMS

The research focused on **biparental care** and reproductive behavior. Both males and females incubate eggs and care for the brood, but:

how much each of them collaborates?

METHODS

- Site Selection: Lodi – Pavia – Bergamo
- 18 pairs
- 5 pairs with sex identified before incubation (rings or natural markings).
- February-July 2022
- Focal animal sampling: 9:00 AM – 5:00 PM
- 7 behavior categories identified for ethogram
- 270 observation hours
- Division of the study period into 4 phases.

RESULTS

- Time spent by each individual:
 - Incubating
 - Standing at the nest
 - Off the nest
- N° of times each parent turned the eggs
- N° and frequency of feeding acts for chicks
- N° of times adults exchange at the nest
- Frequency of nest maintenance acts

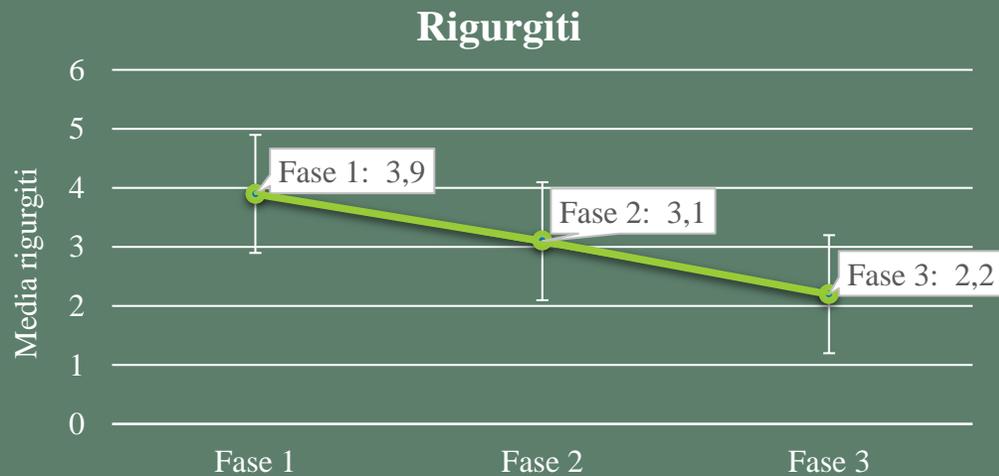
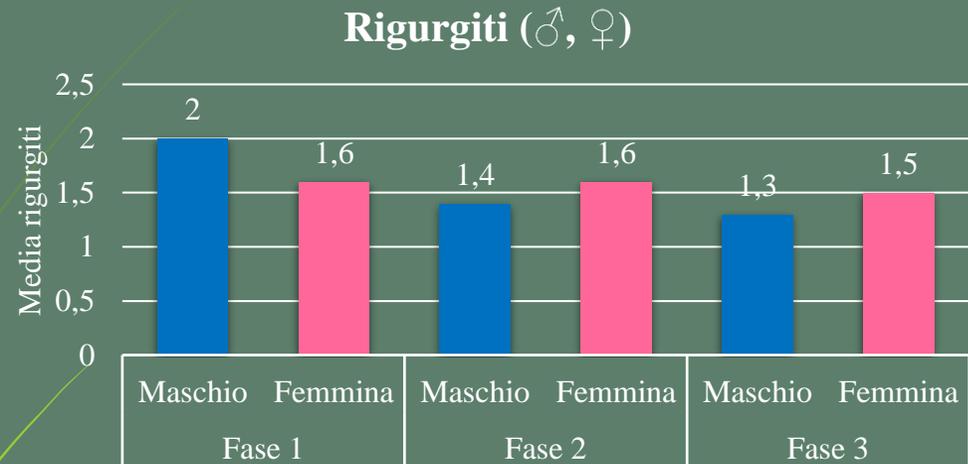


CONCLUSION

- No significant behavioral differences based on gender, in the rearing of offspring.
- Males and females implement an **equal division of roles** throughout the breeding season.
- The decrease in the number of regurgitations during the various weaning phases is statistically significant.
- As time goes by, parental nest changes become less frequent, in line with the decrease in the number of feeding acts for chicks.
- There is a noticeable trend of increasing duration of the time spent away from the nest across the different weaning stages.
- The time spent standing next to the partner on incubation duty is limited to moments of duty change, egg rotation, and partner monitoring. These observations contrast with literature.

Atti alimentari dei genitori verso la prole

Risultati



- UP-DOWN DISPLAY E BILL CLATTERING

SEXUAL DIMORPHISM IN THE ACOUSTIC SIGNAL OF THE EUROPEAN WHITE STORK (CICONIA CICONIA, L. 1758): A PILOT STUDY

October 2021

DOI: [10.13140/RG.2.2.18794.85446](https://doi.org/10.13140/RG.2.2.18794.85446)

Conference: XI Convegno Nazionale della Ricerca nei Parchi - Bussolengo /Verona) 1-3 Ottobre 2021

Roberta Castiglioni · Rosaria Santoro



La frequenza dominante e la durata degli elementi varia significativamente tra i due sessi!





RICERCA E DIVULGAZIONE NATURALISTICA



FAUNA VERDEBONA

SEXUAL DIMORPHISM IN THE ACOUSTIC SIGNAL OF THE EUROPEAN WHITE STORK (*CICONIA CICONIA*, L. 1758): A PILOT STUDY

MAIL AUTHOR: darwin@darwinnaturata.it

Roberta Castiglioni (1,2), Rosaria Santoro (1)

1 DARWIN Ricerca e Divulgazione Naturalistica - Milano - Italy
2 Centro Studi Fauna Verdebona Luigi Cagnolari (Società Italiana di Scienze Naturali) - Milano - Italy



INTRODUCTION The noninvasive call-based sexing method has proved useful for many bird species. This method does not require the capture and manipulation of birds for gene sampling, body measurements, or cloaca inversion and therefore obviates any potential trauma. Sex differences in the voices of monomorphic birds may arise from respective differences in the morphology and size of vocal apparatus between genders (Volodin et al., 2015). The European white stork is known to have no readily observable sexual differences in external appearance or behaviour, however, males are on average larger than females in head measurements (depth and width of the bill) (Cwiertera et al., 2009). The stork shows an intriguing acoustic communication behaviour by clapping its mandibles together to make a 'kata-kata-kata' sound, called 'clatter'. Both sexes of the European white stork produce clatter in the context of courtship and in agonistic situations, throughout the year. Thus, the existence of sex differences in bill morphology in the European white stork should predict an associated sexual dimorphism of clatter. In this preliminary study, we intend to examine the acoustic structure of the clatter produced by male and female of 7 wild pairs, both in courtship and non-courtship contexts, to determine whether sexual acoustic differences exist. Additionally, we intend to visually inspect the male and female rhythm pattern of the clatter.

METHOD **Subjects and recordings:** We examined 7 male and 7 female European white storks. All of the birds were recorded at South Adda Regional Park (Cremona, Lombardy). Individual birds were identified by rings. Clatter was recorded in spring season 2021. All clatter, along with video images of the performing birds, was recorded with a Sony FDR-AX53 video recorder. There was no systematic difference in recording distance for male and female birds. Our recordings included clatter made in both courtship and non-courtship contexts. **Analysis of acoustic structure:** A clatter bout consists of sound elements that are repeated multiple times (Fig. 1). Each element is produced by one clap of the mandibles. All recorded sounds were analyzed with PRAAT, version 4.2.34. We analyzed two spectral measurements of clatter and three temporal measurements (table below). The inter-onset interval (IOI) (Sasahara et al. 2015) was calculated to describe the rhythm of both females and males clatter (Fig. 1). To obtain frequency measurements, power spectra (frequency resolution, 1 Hz) were generated for ten elements of each fourteen clatters (Fig. 1). The temporal structure of clatter and the IOI was analyzed manually using an onscreen cursor with sound spectrogram. Fourteen Phase-space plots were built in order to visually analyse the rhythm of the clatters of the subjects (Ravignani 2017). **Statistical analyses:** The Mann Whitney U non parametric test was used to establish statistical significance between sex by using R-statistics software.

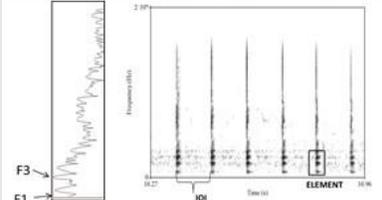
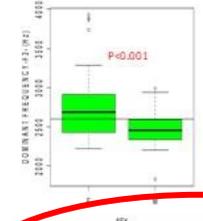


Figure 1. Spectrogram of a clatter sequence. It shows elements and the IOI. On the left the power spectra with the two frequency peaks (F1 and F2) marked.

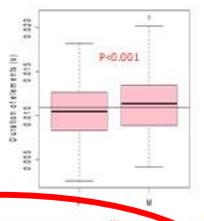
ACOUSTIC MEASUREMENTS	Descriptions	Female		Male	
		Mean	DEV.ST	Mean	DEV.ST
F1 (Hz)	Fundamental frequency	696,80	70,14	693,33	80,53
Dominant frequency (F3) (Hz)	Frequency at the highest peak of amplitude	2710,62	393,34	2488,13	224,35
Elements duration (s)	Element duration per clatter	0,0105	0,0032	0,0113	0,0034
Clatter duration (s)	Total duration of the clatter	7,51	2,94	6,55	2,65
Number of elements	Number of elements per clatter	57,71	30,63	52,57	23,75
N/C	Number of elements per clatter / Total duration of the clatter	0,141	0,038	0,128	0,023

RESULTS

ACOUSTIC PARAMETERS

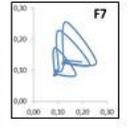


DOMINANT FREQUENCY (F3) (Hz)

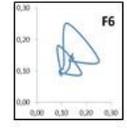


ELEMENT DURATION (s)

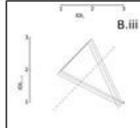
RHYTHMIC PATTERNS phase-space plots (Ravignani, 2017)



F7

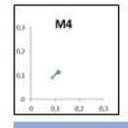


F6

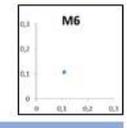


B.iii

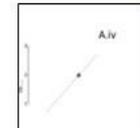
Females: motif accelerando or ritardando; similar triangles "smeared" along the diagonal



M4



M6



A.iv

...Males: isochronous!

DISCUSSION AND FUTURE WORK The results of the acoustic analysis of this pilot study showed that the clattering sounds of European white storks are sexually dimorphic in the dominant frequency parameter and in the element durations. The difference in bill morphology between the two sexes could account for the sexual dimorphism in these parameters as it was shown in the Oriental white stork (Edda-Fujitara, et al., 2004). Bill morphology also may affect the movement of the jaws and consequently the duration of elements in this species (Volodin et al., 2015). Finally, the preliminary analyses of pattern of rhythm show that the clatter of Male seems to be isochronous and Females shows a repetition of triangles along the diagonal which could correspond to specific motifs (Ravignani, 2017). In the future, it could be interesting to conduct a correlation analysis between bill morphology and acoustic structure to gain insight into the causation of the sexual dimorphism in the acoustic signals and analyze rhythm in the couple courtship context.

The dominant frequency and the duration of elements varied significantly between the two sexes!



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*... che la
natura ci possa
stupire
sempre ...*