

# MONITORING PROGRAMME FOR WHITE STORK *CICONIA CICONIA*

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## Range

The species is widely distributed throughout the Palaearctic, from the Atlantic coast on the west to European parts of Russia on the east. The European population is divided into western and eastern flyway populations that migrate through the Gibraltar Strait and Bosphorus, respectively (BirdLife International 2013). The total global population is estimated to be 701,237 – 703,607 individuals, with Europe holding 672,000 – 674,000 individuals (96% of the global breeding population) (Wetlands International 2013).

## Distribution in Croatia

White Storks are distributed in the Pannonian lowlands and northern continental parts of Croatia that are bordered by the rivers Mura and Drava to the north, Danube on the east, and Kupa and Sava to the south ([http://www.ptice.hr/rezultati\\_prebrojavanja\\_rod\\_a\\_2012\\_godine.htm](http://www.ptice.hr/rezultati_prebrojavanja_rod_a_2012_godine.htm)). It breeds in villages and towns that are surrounded with appropriate wet habitats and extensively managed arable land. The highest breeding densities are found in the Lonjsko polje Nature Park (holding almost half of the national breeding population; Schneider 1989), along the River Sava floodplains, and Danube (Borovo) and Ilova Rivers (Marino Selo).

The current (2011) Croatian White Stork breeding population is estimated to be 1,100 – 1,300 pairs (Institute of Ornithology, unpublished). It is considered to be stable, but this is questionable given recent national survey data.

## Habitat

The White Stork favours open habitats, avoiding places with dense vegetation and extensive forest. During the breeding season they are associated with extensively managed arable land, wet meadows and pastures, shallow marshes and floodplains, rice paddies, fishponds, lakesides and irrigation ditches (BirdLife International 2013). After breeding, large flocks can be seen foraging in stubble or recently ploughed fields.

In Croatia the preferred habitat types according to the National Habitat Classification are:

For feeding: A.1. Permanent standing freshwaters; A.2.3.2. Permanent slow flowing waters; A.2.4. Channels; C.2. Central European wet meadows

For breeding: J.1. Villages

Storks are carnivores taking a wide range of food including insects, fish, amphibians, reptiles, small birds and small mammals that are picked up from the ground or in shallow water (Hancock et al. 1992).

## Phenology and population biology

White Storks are true Palaearctic migrants arriving in Croatia by the end of March and leaving the breeding areas by the end of August. White Storks nest solitarily or in loose colonies of up to 60 pairs as in Čigoč, the European stork village in Lonjsko polje Nature Park. Nests are built in human settlements on roofs, chimneys, electric poles and hay stacks. While the number of nests built on electric poles and artificial platforms is increasing, only a small percentage of nests are built on trees. Breeding starts after the arrival from wintering sites in mid-April and the clutch size varies from 1 to 6 eggs. Incubation lasts from 33-34 days with both parents taking turns (del Hoyo et al. 1992, Hancock et al. 1992). The nestling period is 58-64 days; after fledgling the young birds remain dependent on their parents for another 7-20 days (del Hoyo et al. 1992, Hancock et al. 1992). By late August most of the White Storks leave Croatia for their African wintering sites. Immature birds stay primarily on their wintering grounds until reaching sexual maturity at 3 years old.

## Pressures and threats

White Storks in Croatia are primarily threatened by habitat alteration from agricultural intensification (A02.01), drainage of wet meadows (J02.01, J02.03), conversion or abandonment of pastures (A02), river regulation and prevention of floods on floodplains (J02.04, J02.05). The use of biocides (A07) and pollution of surface waters (H01) significantly affect food availability and consequently reduce breeding success.

Nest destruction (E06.02) still occurs despite financial incentives to house owners to keep nests on their roofs or chimneys. Collision with power lines and electrocution (D02, C03.03) are further causes of mortality. All impacts combined prevent the expected population growth in the country.

## Conservation measures and description of national legislative protection

White Storks are a strictly protected species in Croatia under the Nature Protection Act (Official Gazette no. [139/08](#) i [57/11](#)). Penalties for the persecution of the birds or habitat destruction are set to HRK 14,400 (EUR 1,920) per specimen. In 2008 a nest protection programme was initiated that provides financial incentives to the owners of houses that hold stork nests (FZOEU 2010). This programme has been expanded to most of the counties inside the White Stork breeding distribution. However, the future of the programme is uncertain due to financial difficulties.

Part of the breeding population is covered by existing protected areas and 59% of the whole breeding population is covered by the future NATURA 2000 network and 10 proposed SPA's.

Injured or young storks are regularly collected and treated in the animal rescue centres at Zaprešić and Rušćica, whose work is funded by the state.

Since the mid-1990s a nest protection programme has been jointly implemented by the government and the national electric power provider (HEP – Hrvatska Elektroprivreda) in order to safeguard nests built on electric pylons. As a result, many nests were transferred to new breeding platforms situated above the cables and thus preventing electrocution. This programme is continuing.

Apart from the protection of nests, measures for safeguarding feeding habitats are necessary, such as prevention of agricultural intensification, pesticide use and irrigation and river regulation projects.

## **Annexes of the Birds Directive**

- Annex I

### **Croatian Red List**

Least concern (LC) – 2010 (Croatian Red List, *in press*).

## **MONITORING PROGRAMME**

The basic scheme for White Stork monitoring consists of the following approaches: nest searching and mapping to establish breeding population size and range, two nest visits during the breeding season to establish breeding success, and counting of individual storks at preferred feeding and migratory stop-over sites. The monitoring should be organised within the White Stork Working Group scheme (or alternatively a Storks Working Group that covers both *Ciconia* species), led by the State Institute for Nature Protection and Institute of Ornithology.

Data should be shared in a timely manner with the State Institute for Nature Protection and Institute of Ornithology, as well as with the IUCN Stork, Ibis and Spoonbill Specialist Group (<http://www.wetlands.org/Aboutus/Specialistgroups/StorkIbisandSpoonbillSpecialistGroup/tabid/197/Default.aspx>). Data should be also supplied promptly to the relevant nature protection bodies (national and nature park administrations, as well as county institutions).

Since the White Stork is a strictly protected species, any research and monitoring activities require a special permit issued by MENP. In addition, the relevant nature protection bodies, landowners and land users should be notified prior to conducting fieldwork.

### **Nest mapping**

#### Objectives

The main objective of nest mapping is to locate White Stork nests to establish the breeding population size and range. Each stork territory can hold 1-2 nests, and nest mapping is the basic requirement for the White Stork monitoring programme.

As an output of this activity the exact positions of stork nests would be available that would allow subsequent nest visits in order to establish annual breeding success.

#### Fieldwork instructions

*Fieldworker requirements:* Nest mapping is a time-consuming activity. However, since the White Stork is a large and conspicuous species associated with human settlements it is one of the widely known species to the public. Therefore, a very large group of volunteers (from school kids to retirement people) can and are willing to assist. The minimum requirement is that fieldworkers/volunteers can identify a White Stork nest, which is normally simple because the nests are massive structures and unlikely to be confused with nests of any other species.

*Fieldworker availability:* Due to the relative simplicity of the task, a large number of fieldworkers and volunteers can be used, recruited from the general public and nature lovers (school children, bird watchers, nature lovers, students, retired people).

*Equipment:* Apart from appropriate shoes/boots and clothes, fieldworkers should be supplied with GPS units and a digital camera (which many volunteers have on their smart phones), and field forms.

*Fieldwork timing:* Nest mapping can take place year-round during favourable weather conditions. Fieldwork can last from the morning till evening hours to maximise the working day effort, but in most cases many volunteers would be “responsible” just for nearby nests.

*Methodology:* Potential stork breeding habitats (villages and settlements) should be carefully searched for nests. In most cases, the nests are built on conspicuous places: pylons along streets, roofs or chimneys. However, finding nests can be difficult in towns or larger settlements where the observer’s view is obstructed by high buildings. In these cases, the help of local people is needed. When a nest is found its exact position should be recorded by the GPS, and information entered on the field data form (Annex 1). If a nest cannot be located but storks are present (circling pair, frequent flights over houses etc.) during most of the breeding season, the case should be recorded as “breeding territory.

It is estimated that over 80% of the existing breeding population is already mapped and geo-coded. The exact position of nests are missing from newly established pairs, difficult-to-find nests in towns and larger settlements, and remote areas without observers.

#### Data forms

The recommended field data form is provided in Annex 1.

### **Nest surveillance**

#### Objectives

Once stork nests are located and geo-coded more detailed monitoring can commence. The purpose of nest surveillance is to establish the number of breeding pairs and their annual breeding success (from brood size and number of fledged chicks).

#### Fieldwork instructions

*Fieldworker requirements:* White Stork nest surveillance can be performed by large numbers of fieldworkers and volunteers. The only requirements are that the person performing the monitoring is careful, patient and reliable during the work so that he/she does not jump to conclusions based on too little time spent at each nest during the survey.

*Fieldworker availability:* It is estimated that with a current population of some 1,300 breeding pairs in Croatia, a minimum of 14 regional coordinators (one per county) and up to 130 fieldworkers should be enough to carry out the national monitoring programme. In the worst case, one fieldworker can be responsible for up to 350 breeding pairs (e.g. in Sisacko-moslavacka county 322 breeding pairs were recorded during 2008, FZOEU, 2010).

*Equipment:* Apart from appropriate shoes/boots and clothes, fieldworkers should be supplied with binoculars and telescopes, GPS units, digital cameras, as well as field forms.

*Fieldwork timing:* To establish the breeding parameters, two visits nest to the nest should be done:

- 1) during the late incubation period, between 20 April and 20 May to establish whether the nest is occupied by a breeding pair and if incubation is in progress;
- 2) during the second half of the chick rearing period between 15 June and 10 July (but if ringing activities are planned, the best time is from the last week in May to 20 June). During the second visit, observers should confirm whether breeding proceeded to the chick rearing period, the number of chicks per pair, and number of pairs with nesting failures.

*Methodology:*

The main purpose of the **first visit** is to establish if the nest is occupied and incubation takes place. This should be performed without disturbing the breeding pairs. The visit should be made on a warm, sunny day, without wind. The nest should be approached in a way that the incubating adult is not disturbed, and observed using the telescope from a distance of 20-40 m. Incubating adults are usually visible from the nest, with their head and neck sticking out above the nest rim. Very often the other parent is nearby (on the same or nearby house) enabling the observer to record pairs and inspect the birds for the presence of colour rings on the legs (which should be recorded if present).

The main purpose of the **second visit** is to establish if breeding has proceeded to hatching chicks, or already failed. At this stage of breeding both parents are usually absent, searching for food. Any chicks should be large enough (at least half the size of adults) to be visible. The second visit should be made on a warm, sunny day, without wind. The nest should be approached with care: a parent may still be on the nest guarding or feeding the chicks. The number of fledglings in the nest should be established by watching the nest using the telescope for at least 15 minutes: often a few chicks are clearly visible, but some of them might be sitting/lying down in the nest and so time is needed before they move and show up. When the exact number of chicks in the nest has been established, it is possible to make a quick (10 minute long) search below the nest to collect food remains or feathers. Collected material should be packed in separate bags and appropriately labelled (date, nest number, location and name of the collector).

#### Selection of localities

Since the Croatian White Stork breeding population is only 1,300 pairs, annual monitoring of all breeding pairs (100%) is recommended. If this is not feasible for various reasons, all efforts should be made to gather breeding data from at least 80% of the breeding population. Experience shows that it is possible to survey all nests in one county during a two week period. Thus, with proper coordination and enough volunteers the whole national census can be performed within the time available.

#### Data forms

The recommended data form is provided in Annex 1.

## **Scientific research**

### Objectives

The main objective of scientific research is to gather additional data on White Stork biology, ecology and genetics to increase the overall knowledge of the species. This knowledge should help to improve efficacy of conservation efforts in the near future.

### Framework assignment

Several key questions and hypothesis should be researched and tested. Further studies are needed on aspects of life history and biology, such as population age structure, home range of adults, dispersal of immature birds and philopatry, diseases and causes of mortality. From an ecological perspective, studies on habitat use and the role of White Storks in floodplain ecosystems should be explored in detail. Studies on pesticides and pollutants are still needed to improve conservation efforts.

Since 2000 Croatia has participated in the international White Stork colour-ringing programme. This should be continued, and could be enhanced by undertaking telemetry studies (e.g. with cheap GPS data tags that can be easily recovered or downloaded when birds return to their nests).

## **Unsystematic data gathering**

### Objectives

The main objective of unsystematic data gathering is to collect information on preferred feeding and stop-over sites. During late summer (late July to early August) White Storks often gather in large flocks at favourable feeding sites e.g. ploughed fields, fishponds or wet meadows (e.g. in Lonjsko polje Nature Park). During migration White Storks can assemble in high numbers at roosting sites. These occasions are good opportunities to identify the most important feeding and roosting areas, as well as collect data on colour-ringed birds and increase knowledge about their home range or habitat use.

In addition, unsystematic data gathering covers instances of overwintering, injured or dead storks, including causes of death or injury. Such data can add to the overall knowledge of the distribution and ecology of the species, but also trigger conservation actions for example preventing collisions with electric cables.

### Fieldwork instructions

It is desirable that fieldworkers/observers have binoculars or telescopes and field forms. Fieldwork can be carried out year round; however, most of the data will be gathered during the April-August period when most of the birds are present. On each occasion, the observer should record date, place and number of birds seen, basic habitat, and behaviour (feeding, roosting). All effort should be made to read any colour rings (though because storks defecate on their legs as a cooling-off behaviour the rings may be obscured).

After any observation, the observer should immediately notify the regional coordinator about the findings via e-mail or telephone.

## Data forms

For unsystematic data gathering the regular A0 SINP data form should be used.

## **Evaluation of the conservation status components**

### Population size

The main population unit is one breeding pair = one breeding territory – an area that is occupied and defended by the breeding pair. Note that one pair can have more than one nest on the breeding territory. The interpretation of the data and calculation of the breeding success follows the well-established method of Schultz (1999) that was developed for White Stork surveys (Table 1):

**Table 1: Data interpretation codes for White Stork monitoring**

<b>Abbreviation</b>	<b>Description</b>	<b>Number (<i>established by monitoring</i>)</b>
AH	Total number of breeding pairs/territories in the surveyed area (nationwide or site based)	
HO	Number of unoccupied nests = abandoned territories	
HB	Number of nests that were visited by storks but not used for breeding = 2 <sup>nd</sup> or 3 <sup>rd</sup> nest on the same territory	
HPa	Number of breeding pairs (HPa=HPm+HPo+HPx)	
HPm	Number of pairs with fledglings (successful pairs)	
HPo	Number of pairs without fledglings (unsuccessful pairs) = number of pairs with nesting failures	
HPx	Number of pairs with unknown breeding success (nests that were not visited during a second survey or where nesting success was not established with certainty)	
JZG	Number of fledged chicks	
JZ <sub>0</sub>	Number of nests with 0 chick (JZ <sub>0</sub> =HPo)	
JZ <sub>1</sub>	Number of nests with 1 chick	
JZ <sub>2</sub>	Number of nests with 2 chicks	
JZ <sub>3</sub>	Number of nests with 3 chicks	
JZ <sub>4</sub>	Number of nests with 4 chicks	
JZ <sub>5</sub>	Number of nests with 5 chicks	
JZ <sub>6</sub>	Number of nests with 6 chicks	
JZa	Average number of chicks per breeding pairs (JZG/HPa)	
JZm	Average number of chicks per successful pair (JZG/HPm)	

### Breeding distribution map and range size

For the preparation of distribution maps and determining range size, the White Stork database maintained by the Croatian Society for Bird and Nature Protection can be used ([http://www.ptice.hr/rezultati\\_prebrojavanja\\_roda\\_2012\\_godine.htm](http://www.ptice.hr/rezultati_prebrojavanja_roda_2012_godine.htm)).

White Stork data are not considered sensitive, so exact GPS coordinates can be plotted on the map. Output and maps can be provided with exact coordinates or merged into the 10 x 10 km UTM grid square format as required.

### Main pressures and threats

This monitoring programme provides data on nest destruction and breeding habitat availability. Other potential causes of population changes or low breeding success are not specifically covered. However, the degree of breeding success would indicate foraging habitat quality in the surrounding area. Pressures and threats that affect foraging habitat availability and quality should be determined by additional research, remote sensing (e.g. extent of grassland, pasture and extensive agriculture distribution) or through other monitoring programmes designed for habitats.

### **References**

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