

# SIS Conservation

*Publication of the IUCN SSC Stork, Ibis and Spoonbill Specialist Group*

**ISSUE 1, 2019**

**SPECIAL ISSUE: GLOSSY IBIS ECOLOGY & CONSERVATION**



***Editors-in-chief:* K.S. Gopi Sundar and Luis Santiago Cano Alonso**

***Guest Editor for Special Issue:* Simone Santoro**

ISBN 978-2-491451-01-1

## The Glossy Ibis in Greece

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### ARTICLE INFO

#### Article history:

Received 03 August 2018

Received in revised form 12 August 2018

Accepted 23 August 2018

### KEY WORDS

*Plegadis falcinellus*, heron colonies, Greece

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### ABSTRACT

The Glossy Ibis *Plegadis falcinellus* is a well-known bird species in Greece since antiquity as evidenced by many ancient texts. In recent times, the species was initially confirmed nesting in 1960, in a colony consisting of approximately 1,000 pairs at Evros Delta, northeastern Greece and a few years later at three more wetlands. Its nesting population in Greece has been surveyed since 1985. Until 1990 it was recorded in at least three colonies with its nesting population presenting a negative trend ranging from 71 to 45 pairs. After 2003 its nesting population started increasing gradually reaching 639 pairs in 2017. During the same period its geographical nesting range expanded in eight colonies mostly in northern and western Greece. Glossy Ibis nests in reed beds, trees and bushes, in mixed colonies with ardeids, Great and Pygmy Cormorants (*Phalacrocorax carbo* and *Microcarbo pygmaeus*) and European Spoonbills *Platalea leucorodia*. Their colonies are situated at lakeshores, river deltas and freshwater marshes that are located in large, protected wetlands. Water pollution, as well as, degradation of wet meadows in certain wetlands are considered to be the main threats for the species. The recently recorded increase of the nesting population can probably be related to better surveillance and organized attempts for wetland management that takes place in Greece during the last decade, at least.

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## Introduction

The first known report of Glossy Ibis *Plegadis falcinellus* was written by the great Greek philosopher and zoologist Aristotle (384–322 BC). In his work “*Historia animalium*” (History of animals) he refers to two Ibises’ species, black and white (presumably

Glossy and African Sacred Ibis *Threskiornis aethiopicus*, respectively). Ibises were also known by the historian Herodotus (484–425 BC) who describes the “Black Ibis” and the Sacred Ibis, mentioning their presence in Egypt. Pausanias (110–180 AC), a Greek

geographer, also refers to Ibises in his work “*Arkadika*” describing the myth of Hercules and the Stymphalian birds (6<sup>th</sup> labour of Hercules according to the myth) that took place at Stymphalis Lake in Peloponnese, southern Greece (see also Pollard 1977).

In more recent times, the Glossy Ibis was first confirmed breeding in Greece in 1960 when a colony of at least 2000 birds was found at Evros Delta (northeastern Greece). A few years later, three smaller colonies were found, two in northern Greece (Ismaris and Kerkini lakes with approximately 40 and 10 nests, respectively) and one in western Greece (Amvrakikos Gulf with approximately 150 nests). The total nesting population during the 1960s was estimated at 1,500–1,840 pairs (Handrinos and Akriotis 1997; del Hoyo *et al.* 1997). During the 1970s at least one more colony was established at Prespa Lakes (northwestern Greece). The total nesting population during 1971–1973 was estimated to be more than 1500 pairs in four colonies (at least 1100 pairs at Evros Delta and 400 pairs at Kerkini Lake, Handrinos and Akriotis 1997). In the late 1980s, more systematic research on heron and cormorant colonies was carried out in Greece. The distribution and the population of the nesting herons and of the associated colonial species is now much better understood. However, the Glossy Ibis is considered poorly studied in Greece since no specific research on the species has been carried out so far, apart from monitoring nesting populations and nesting site distribution.

The species is protected according to the EU Bird Directive and it is included in the “Red Data Book of animals in Greece” as “Critically endangered” (Legakis and Maragou 2009).

The aim of this article is to describe the current status of the Glossy Ibis in Greece, as well as the 1985–2017 trend of its breeding population.

## Methods

The information included in the present article was obtained both from literature (for Amvrakikos Gulf up to 1990 and for Prespa Lakes) and from our direct or indirect counts of nests and estimates of the number of nesting pairs. The main heronries with

Glossy Ibises have been systematically monitored (Kerkini Lake: yearly since 1988, Axios Delta: every 2–3 years, however, there are no data for the period 1991–2002, Prasoudi islet: yearly since 2011). The first national survey of heron colonies in Greece was carried out in 2003 and it was repeated in 2009 and 2014. In 2017, only the Glossy Ibis nesting population was monitored.

### *Survey of colonies*

All wetlands that could potentially host heronries were visited during the breeding season (from late April until early June). When a colony was found, the following data were collected: a) the geographic location (coordinates) of the colony, b) the type of vegetation and the tree species that hosted the nests, and c) the number of active nests for each species (Yfantis and Kazantzidis 2004; Kazantzidis *et al.* 2013). In two cases (Volvi Lake and Axios Delta) the nesting population of Glossy Ibis could only be roughly estimated from the number of adult birds recorded at the feeding grounds around the colony, during May or June. We assumed that a single bird in the feeding grounds represented a nesting pair, and that the other member of the pair was incubating.

The nest abundance of each species was recorded during the chick rearing period of most nesting pairs (late May and early June, Kazantzidis *et al.* 2013). Usually, we counted the active nests from outside the colony, either from the ground or from boats or from high observation towers, using binoculars and telescopes. In the cases that the colony was inaccessible, e.g. located in a reedbed, we estimated the number of nests by tallying the birds departing for the feeding grounds. Starting before dawn, we counted the exiting birds for approximately one hour (Fasola *et al.* 2011; Kazantzidis *et al.* 2013). We assumed that two birds correspond to one nest. In certain mixed colonies with Glossy Ibises (Kerkini Lake, Axios Delta and Prasoudi islet) we counted all the active nests of each species entering the colonies in the morning (6 – 9 am).

**Results**

*Population*

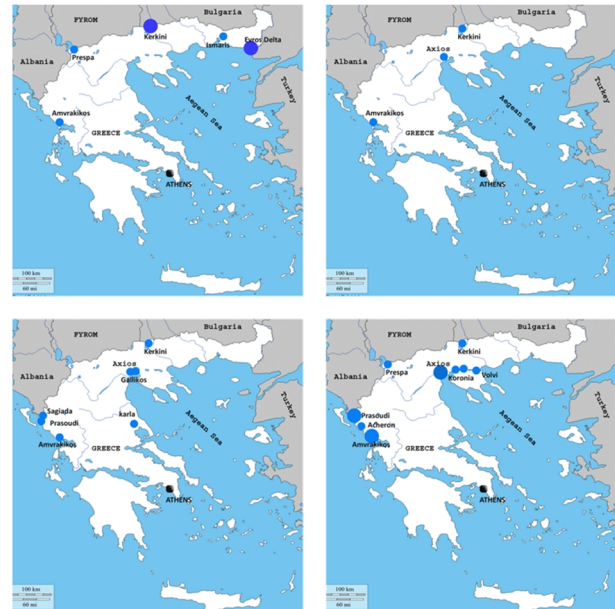
The situation of the colonies with Glossy Ibises during the 1980s, changed dramatically compared to the situation during the 1960s and the 1970s (Figure 1). Three colonies collapsed (Evros Delta, Ismaris and Prespa lakes) and a new one was established (Axios Delta). The breeding population of the species shrunk to barely 45-71 nests (Table 1). There are no data available for the 1990s regarding the total breeding population of the species.

In 2003, at least 95 nests of Glossy Ibis were counted in four colonies (Table 1, Figure 1). Six years later (2009), three more colonies were recorded and the number of nests increased to 116. In 2014 three colonies collapsed and three new colonies were established and the number of nests almost tripled reaching 373, the largest colonies being in western Greece (Table 1). During 2017, the number of nests had almost doubled from the previous count to 639 in eight colonies (one colony collapsed while two new colonies were established in northern Greece, Table 1, Figure 1).

**Table 1 - Number of Glossy Ibises' pairs/nests in colonies recorded during the period 1985-2017 in Greece. (? : probably nesting, +: nesting with unknown population). \* The count was carried out in 2016**

Wetland/Year	1985-1986	1988	1989	1990	2003	2009	2014	2017
Kerkini Lake	60	10	14	15	5	4	41	45
Volvi Lake							16	11
Koronia Lake east								7
Koronia Lake west								8
Gallikos Delta					13	5		
Axios Delta	?	51	50	30		37	51	190
Acherontas River								5
Sagiada marshes							4	
Prasoudi islet					22	15	120	191
Amvrakikos Gulf	+	+	+	+	55	43	135	187*
Karla Reservoir							8	
Prespa Lake							5	+
<b>Total # of nests</b>	<b>71</b>	<b>&gt;61</b>	<b>&gt;64</b>	<b>&gt;45</b>	<b>95</b>	<b>116</b>	<b>373</b>	<b>639</b>

**Figure 1. Distribution of colonies with Glossy Ibises in Greece (blue dots) during the 1960s and 1970s (upper left), 1980s (upper right), 2003-2009 (lower left) and 2014-2017 (lower right). Big dots: >120 nests of Glossy Ibis, small dots: <120 nests of Glossy Ibis**



*The distribution of colonies*

Glossy Ibis, overall, have been recorded nesting in at least 14 sites (colonies) in 11 wetlands in Greece (all mentioned in Tables 1 and 2 and two more sites that were recorded in the 1960s, namely Evros Delta and Ismaris Lake). The distribution of Glossy Ibises' colonies was associated to the distribution of the largest wetlands and they were recorded mostly in eastern, northern and western Greece.

*Characteristics of the breeding areas*

The wetland types where the colonies were located are identified as: a) freshwater lakes, including two reservoirs; Kerkini and Karla, b) river deltas and c) river banks or marshes created along river banks (Table 2). In 2017 five out of eight colonies were around lakes. These colonies were small (7-45 nests of Glossy Ibis), totalling 71 nests (11% of the 2017 nesting population of Glossy Ibis in Greece). Two of the largest colonies were located in river deltas with 381 nests (60% of the total nesting population of Glossy Ibis in 2017, Table 2). At least two colonies

(one in 2017) were located along river banks. The three largest colonies in 2017 (88.9% of the breeding population in 2017) were in river deltas and on river banks. At least 66.7% of the breeding population in 2017 (in five colonies) nested in areas with rice fields (Table 2). All wetlands where the species was recorded nesting are protected areas (National Parks or Special Protected Areas).

**Table 2. Characteristics of the wetlands with Glossy Ibises colonies in Greece. “Vegetation” refers to the vegetation type where the nests of Glossy Ibises were situated. “Rice fields” indicates the presence of rice fields around the colony that serves as feeding habitat for Glossy Ibises (Y=present). “% (2014)” indicates the percentage of Glossy Ibises’ nests to the total number of nests of all nesting species in each colony in 2014**

Wetland/Year	Wetland type	Vegetation	Ricefields	% (2014)
Kerkini Lake	Lake	Trees	Y	0.5
Volvi Lake	Lake	Reedbeds/Trees	-	1.7
Koronia Lake east	Lake	Reedbeds/Trees	-	
Koronia Lake west	Lake	Reedbeds/Trees	-	
Gallikos Delta	River/Marsh	Trees	Y	
Axios Delta	Delta	Trees	Y	5.8
Acherontas River	River	Trees	-	
Sagiada marshes	Marsh	Trees	Y	

### Characteristics of the colonies

Glossy Ibis always nested in mixed colonies, with Ardeids, European Spoonbill *Platalea leucorodia*, Great Cormorant *Phalacrocorax carbo sinensis* and Pygmy Cormorant *Microcarbo pygmeus*. The number of other species associated with the Glossy Ibis ranged from 2 to 9 (mean  $5.6 \pm 2.1$  SD species per colony not including the Glossy Ibis). Glossy Ibis nested always in colonies with Little Egret *Egretta garzetta* and in 81.3% of the cases with Squacco Heron *Ardeola ralloides*, Black-crowned Night Heron *Nycticorax nycticorax* and European Spoonbill (75.0%).

Glossy Ibis nests were placed on a) trees, mostly willows *Salix* spp., Tamarisks *Tamarix* spp. and Alder *Alnus glutinosa*, in five colonies with 235 nests or 36.8% of the nesting population in 2017; b) reed beds

of *Phragmites australis*, two colonies with at least 187 nests or 29.3%; c) bushes of several plant species including wild olive trees *Olea* spp. (Prasoudi islet) and Tamarisks (Koronia Lake), three colonies with 191 nests or 29.9% of the population; d) mixed vegetation with reedbeds, trees and/or bush: three colonies at Koronia and Volvi Lakes with 26 nests or 4.0% (Table 2).

The proportion of Glossy Ibis nests on the total number of nests in mixed colonies ranged from 0.5% (Kerkini Lake) to 26.6% (Prasoudi islet, Table 2) in 2014.

### Wintering and migrant population

Glossy Ibises overwinter in Greece only rarely (two birds at Kerkini Lake during winter 2017-2018). They are very common during spring migration with large flocks of 1000 birds recorded in coastal areas of western and eastern Greece (Handrinos and Akriotis 1997). On the other hand, Glossy Ibis is absent or very rare during the autumn migration period.

### Threats

Since no systematic research has been conducted on the Glossy Ibis in Greece, we can only assume that pollution and marshland drainage threatened the wetlands in Greece during the 1980s and the 1990s (Tsiouris and Gerakis 1991; Zalidis and Mantzavelas 1994), probably affected many waterbird species including the Glossy Ibis.

### Discussion

The period between 1960-2017 can be divided in 3 sub-periods. The first one, during the 1960s and 1970s, with high numbers of nesting Glossy Ibises. A second one in the 1980s and 1990s, when the nesting population almost collapsed (BirdLife International/European Bird Census Council 2000). Afterwards (after 2003), the nesting population recovered with a gradual range expansion.

During the 1960s and 1970s, the species was distributed mostly (75-100% of the breeding population) in northeastern Greece. During the 1980s the species abandoned the northeastern region and

established colonies in northern Greece (90-100% of the breeding population) and in western Greece (approximately 10%). In 2014 and 2017 the majority (60%) of the breeding population was recorded in western Greece and the rest in northern Greece. So, there is a gradual shift in the nesting population from northeastern Greece to northern and subsequently to western Greece.

The largest heron colonies are distributed in ecosystems with high diversity of feeding habitats e.g. deltaic ecosystems with freshwater marshes, saltmarshes and coastal area. Rice fields provide excellent feeding opportunities, and support the presence of several heronries that include Glossy Ibises (Kazantzidis *et al.* 2013; Mpoukas *et al.* 2017). The absence of Glossy Ibises during the autumn migration agrees with the fact that the birds nesting at the northern coasts of the Black Sea migrate to western Africa crossing the northern Balkans to the Adriatic and Italy avoiding Greece (Schogolev 1996). Similar movements (loop migration) have been recorded for many shorebird species in Greece (Kazantzidis *et al.* 2009).

According to recoveries in Greece of birds ringed abroad, it seems that, the majority of Glossy Ibises come from Ukraine. However, the number of recovered birds is very small (four) (Akriotis and Handrinos 2004).

The increase of the nesting population of Glossy Ibis in Greece coincided with the restoration of certain wetlands and the establishment of management authorities at the main protected areas and National Parks including all areas with large heron colonies with Glossy Ibis. The legal protection framework and the proper management that resulted in the reduction of disturbance and illegal activities have provided the appropriate conditions for the population of Glossy Ibis to increase. Similar increases were recorded in some (but not all) conspecifics e.g. European Spoonbill, Great and Pygmy Cormorant, Squacco Heron etc. There are two examples related to the impact of restoration of Greek wetlands on birds: Karla Lake (Thessaly) and Koronia Lake (central Macedonia). Karla Lake was drained in the 1960s, and has been partially restored recently (Zalidis *et al.* 2004). Following the restoration of the lake, many waterbirds started nesting including herons,

cormorants, pelicans and Glossy Ibises (2009). Koronia Lake was heavily polluted and drained during the 1990s due to water mismanagement. In 2015, following the outset of the restoration works, two heron colonies have been established where Glossy Ibises also nested.

#### Acknowledgements

We thank the Hellenic Ornithological Society and the Management Authorities of National Parks for supporting the surveys at heronries with Glossy Ibis.

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