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The Breeding and Wintering of Glossy Ibis *Plegadis falcinellus* in Sardinia (Italy)

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ABSTRACT

Located in the centre of the western Mediterranean, the Island of Sardinia hosts a limited number of Glossy Ibises *Plegadis falcinellus* that are regularly spotted during migration and wintering but rarely during the breeding season. The first record of wintering ibises dates back to the 1982-1983 winter in the Gulf of Cagliari (south of the island). During the following years, the presence of wintering Glossy Ibises was regularly recorded with a maximum of 35 individuals. The first breeding record was documented in 1985 with five to six pairs in a mixed heronry, with Little Egret *Egretta garzetta* as the most abundant species, in the Stagno di Molentargius (Gulf of Cagliari). In the period between 1985 and 1993, the breeding of the Glossy Ibis has been regular but in low numbers in this site with a maximum of 12 pairs. Nonetheless, in the period between 1994–2013, the breeding has been occasional and away from this area with only one or two pairs. Finally, in recent years (2014–2018), the species has bred only in the Gulf of Oristano where it is apparently becoming a regular breeder in two sites (Arborea and Cabras) with a total population of maximum six to nine pairs. All of the breeding events took place within previously established colonies and, as it is common in the species, there are no records of monospecific colonies of Glossy Ibis in Sardinia

Introduction

Historically, in Sardinia the Glossy Ibis *Plegadis falcinellus* was considered as migratory and wintering species (Cara 1842; Lepori 1882; Arrigoni degli Oddi 1929). But the claims regarding the wintering, with no other evidence in the rest of Italy, was considered doubtful by other authoritative researchers (Salvadori 1864; Martorelli 1960). The first wintering records were ascertained in 1982 with a group of nine individuals in the Gulf of Cagliari. In 1985, in the same area in a mixed heronry 5-6 breeding pairs were discovered, representing the first breeding record of the Glossy Ibis in Sardinia (Grussu 1987). Subsequently the species was recorded as a regular migrant, regular wintering and irregular breeding

species on the island (Grussu *et al.* 2000; Grussu 2001; 2003; Grussu and Sardinian Ornithological Group, pers. obs.). In this note I summarize and update the available data on the species in Sardinia, with particular attention to breeding and wintering status. If not expressly indicated, all the data shown are of the Author (i.e. pers. obs.).

Study Area

Set in the centre of the western Mediterranean, N 38° 51' - 41° 15', E 8° 08' - 9° 50', Sardinia is about 200 km from Italy and North Africa (shortest straight distances), 400 Km from France and 500 Km from

the Iberian Peninsula. With an area of 24,088 square kilometres, it is the second largest island in the Mediterranean. Swamps and lagoons are frequent close to the coasts, especially in the south and in the Gulf of Oristano (West Sardinia), covering a total area of about 12,000 ha. The differing salt content of their waters, depending principally upon the waters flowing in from the streams and on sea water, gives rise to composite environments and causes the different distribution of botany and animal species. Overall the climate can be defined as warm-temperate and two-seasonal, with a succession of a warm dry period (summer) and a wet cold one (winter) separated by two intermediate seasons (autumn and spring). The average temperature in January is 10°C on the south west coasts and 6°C in the highest mountain areas of the interior (~1,800 m a.s.l.). Annual average rainfall is 500 mm on the southern coasts and 900 mm in the highest mountain areas of the interior, with historical peaks of 2,500-2,700 mm (Arrigoni 1968). The coasts and the south of the island are drier than the rest of the island owing to scarce rainfall, the long dry summer and the type of geological substratum.

Methods

Since the early 1980s the presence of the Glossy Ibis in Sardinia has been carefully monitored with each siting of the species being recorded and located on the map of the island. During the winter and the migration, the contingents, the habitats used by the species for feeding and the night roost were monitored. During the breeding period all the suitable areas were checked regularly to identify any breeding pairs and to evaluate the present population. Whenever possible, the breeding parameters, associated species and habitats used were detected for breeding pairs. In the period 1985-1993, a total of 30 nests were monitored with weekly checks in the Stagno di Molentargius (Gulf of Cagliari), analysing the measurements of eggs and nests, their position in the colonies and the reproductive success. I have measured the Glossy Ibis eggs using a Vernier caliber 0-150 mm with a 0.05 mm resolution. Further data on the parameters of reproduction were found, usually at a distance, in the area of the Sulcis and the Gulf of

Oristano where the species was recorded as an irregular breeder in the period between 1998 and 2018.

Results

Wintering

The first wintering assessments, recorded in the winter 1982-83 in the Gulf of Cagliari, in the south of the island, was the first one to be regularly documented in Italy and in the whole Europe (Grussu 1987). Indeed, Cramp and Simmons (1977) highlighted the winter presence of the species in the South of Spain; but this record was referred to the occasional presence of one bird (A. R. Johnson, pers. comm. 1986). After these first regular winter presence, the wintering of the Glossy Ibis was found regularly during all winters on the island until today (Grussu 2001; Grussu and GOS 2017) with small groups in:

- (i) the Gulf of Cagliari - regular in the 1982-2002 period and occasional (only one bird in winter 2012-2013) in the period 2003-2017 -,
- (ii) the Gulf of Oristano (West of the island) - present almost every year since 2001 and onward - and,
- (iii) occasionally elsewhere (e.g. Alghero/ North-West coast, 2013 year).

The maximum population size ever recorded has been 35 individuals (in 2005 and 2014) usually gathered in a single group, more rarely scattered (Figure 1). During the non-breeding season, the habitat utilized by the species is that of permanent or temporary coastal freshwaters wetlands, even with high organic pollution (swamps, lagoons, river mouths, irrigation channels and waste water of domestic or domestic activities) and rich in emerging vegetation with prevalence of *Phragmites australis*, *Juncus sp.*, *Typha latifolia*, *Typha angustifolia* and *Carex sp.*.

Breeding

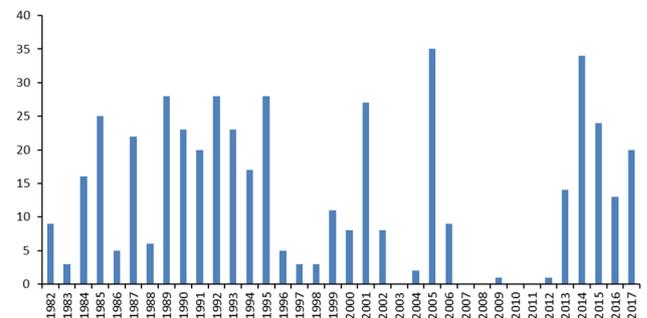
In the Gulf of Cagliari, after the uninterrupted presence of little groups during the non-breeding season since 1982, in 1985 the first breeding record of the species was recorded in the Stagno di

Molentargius. Five-six pairs were observed breeding in a mixed heronry with Little Egret *Egretta garzetta* (about 110 pairs), Western Cattle Egret *Bubulcus ibis* (one-two pairs, first breeding record in the whole Italy) and Squacco Heron *Ardeola ralloides* (two pairs, first breeding record in Sardinia) (Grussu and Secci 1985; Grussu 1987). In this site, the presence of Glossy Ibis breeding pairs was confirmed annually until 1993 with a variable number of pairs (three-twelve). Then, due anthropic disturbances, the population of the mixed-species colony moved to another site a few kilometres away, but the Glossy Ibis, despite being present during the breeding season and in the winter, has never been recorded as a breeding species in the Gulf of Cagliari (Grussu 1994; 1998; pers. obs.). In 1998, one-two pairs bred in the Sulcis area (South - West Sardinia) in the inland barrage of Cixerri/ Siliqua; breeding took place in a mixed heronry with Black-crowned Night Heron *Nycticorax nycticorax*, Little Egret, Western Cattle Egret and the Squacco Heron (Grussu 2000, pers. obs.).

After this last record, two breeding pairs were discovered in 2003 in a heronry of Little Egret and Western Cattle Egret in the Stagno di s'Ena Arrubia/ Arborea, in the Gulf of Oristano (Grussu 2003). The breeding on this site probably repeated again in 2014 with one-two pairs and certainly in 2017 and 2018 with five-seven pairs every year, always in association with the Little Egret and the Western Cattle Egret (pers. obs; G. Pinna, pers. comm.). Also, in the Gulf of Oristano the breeding was recorded in 2016 (at least two-three pairs) and probably also in 2017 and 2018 (some pairs) in a monospecific heronry of Purple Heron *Ardea purpurea* in the Stagno di Cabras.

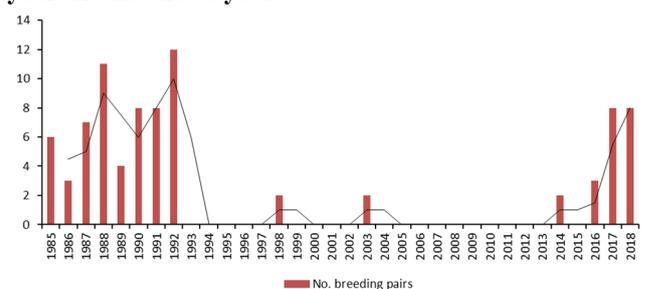
In summary, for the first nine years (1985-1993) the population (three-twelve pairs) remained localized in the first breeding site (Stagno di Molentargius, Gulf of Cagliari - South Sardinia). After the abandonment of the colony and until the 2014 year, the breeding was found only occasional and away from this area: in the Gulf of Oristano and in the Sulcis area (respectively South-West and West Sardinia).

Figure 1. Winter population size (maximum number of birds in the whole island in each winter) of Glossy Ibis in Sardinia, up to 2017. X axis shows year and Y axis shows number of Glossy Ibises



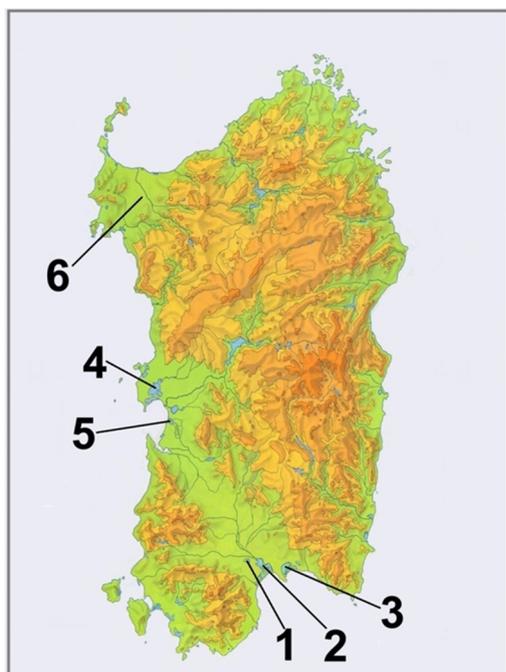
After 2014, the Glossy Ibis has been observed breeding only in the Gulf of Oristano where it is apparently becoming a regular breeder in some sites. In the period between 1985-2018 the breeding of the Glossy Ibis in Sardinia occurred 15 times with a maximum population of 12 pairs (1992); for nine years the breeding has been recorded in the Gulf of Cagliari, for five years in the Gulf of Oristano and one time in the south-eastern part of the Island (Figures 2, 3). All the breeding events took place within pre-existing heronries and there are no records of monospecific colonies of Glossy Ibis in Sardinia.

Figure 2. Breeding population size (maximum number of pairs in Y axis) of Glossy Ibis in Sardinia up to 2018 year. X axis shows year



Habitat

Figure 3. -Breeding and wintering wetlands of Glossy Ibis in Sardinia. Gulf of Cagliari: 1-Basin of Cixerri (breeding), 2-Stagno di Cagliari (wintering), 3-Stagno di Molentargius (breeding and wintering). Gulf of Oristano: 4-Stagno di Cabras (breeding and wintering), 5-Stagno di s'Ena Arrubia (breeding and wintering). North West coast: 6-Alghero area (wintering)



In the Stagno di Molentargius the breeding (1985-1993 period) occurred in a wetland of about 1,400 ha located in an urban context in the Gulf of Cagliari (South Sardinia). The heronry was located in an area with high organic pollution, with the nests built on the Common Reed *Phragmites australis* of 1-4 m height. The Stagno di Cabras is a lagoon of about 2,200 ha in the Sinis area, in the northern part of the Gulf of Oristano (West Sardinia). The breeding of the Glossy Ibis on this site (period 2016-2018) occurred on groups of Common Reed of 1-4 m height. The Stagno di s'Ena Arrubia (190 ha) is a lagoon in the central part of the Gulf of Oristano. The breeding conditions on this site (2003, 2014, 2017 and 2018) are extraordinary as the nests are built directly on the ground or on the vegetation, an islet covered with low shrubs of *Salicornia* *Halocnemum strobilaceum* and other *halophilous* vegetation.

Instead, in the Sulcis area, the breeding (1998) was discovered in the internal artificial basin of Cixerri, with the nests built on a semi-submerged forest of *Eucalyptus* *Eucalyptus* sp., 10-15 m high.

Breeding parameters

In Sardinia, the first eggs were found in the third week of April (earlier date 21 April 1987); but they usually occur between mid to late May or the first days of June. The latest record corresponds to mid - June. However, on June 19th 1992, in the Gulf of Cagliari a nest was found still under construction, but unfortunately, it was not possible to verify the egg laying and/ or the breeding success (Grussu 1987, pers. obs.). In this heronry, groups of nests of Glossy Ibis (up to five together), were often built close together and egg laying was synchronized (Grussu 1987; 1994, pers. obs.).

In a total of 30 nests monitored in the Stagno di Molentargius, I recorded the following measurements:

- (i) maximum diameter 28-50 cm,
- (ii) internal cup diameter 15-29 cm,
- (iii) depth cup 1.5-10.5 cm,
- (iv) nest thickness 11-62 cm,
- (v) distance of upper edge from the water 14-210 cm.

Although the nests are usually not in contact with water, in 1988 I found a nest built directly leaning on the water.

The size of brood is usually three-four (one-five) eggs, laid at 24 h intervals.

Out of a total of 37 complete broods controlled, 80% of these (n = 30) had 3-4 eggs and the rest of the broods with 2 or 5 eggs, with only one nest of a brood with single egg. Out of a total of 47 eggs checked in the Stagno di Molentargius (1985-1992) I recorded the following measurements:

- (i) maximum diameter 53.0 (46.1-58.3, \pm 2.48 SD) mm,
- (ii) minimum diameter 37.2 (32.4-40.0, \pm 1.77 SD) mm.

An accurate study on the reproduction has been made in the period between 1985-1992 in the colony of the Stagno di Molentargius. In a total of 15 nests of

which I have followed the whole reproductive cycle (egg laying, hatching and growth of juveniles), I was able to record the following parameters:

(i) eggs laid: 56 (average clutch size of 3.7/nest, \pm 0.79 SD),

(ii) hatched eggs: 53 (hatching success of 94.6%, average brood size 3.53 pullus / nest, \pm 0.74 SD),

(iii) juveniles reared 49 (survived success of 92.4%, average of 3.2 young / nest, \pm 1.22 SD).

The egg mortality was 5.35% during the incubation phase, and chick mortality was of 7.54%. I verified the breeding success of 23 nests in total and I noticed a productivity of 3.0 juveniles / pair.

Discussion

Sardinia hosts a regular migrant and wintering population and irregular breeding population of the Glossy Ibis. Despite the limited population recorded during the winter period (max 35 individuals) and breeding (max 12 pairs in one site), this is an important percentage of the population of this species in the whole of Italy (Volponi 2019). The breeding of the species in Sardinia is also important for the whole Glossy Ibis population of the central Mediterranean where recently the breeding has only been recorded in Sicily (2-4 pairs in the early years of the century) (Corso 2005), in Tunisia (max 18 pairs, period 2008-2017) (Nefla 2019) and in Algeria (Nedjah *et al.* 2019). Of these records, only breeding in Algeria has been regular in the last few years and it involves an important number of pairs (up to 400 pairs in 2016 and an average of 250 pairs in the period 2013-2017; Nedjah *et al.* 2019). In Sardinia, the first historical breeding population, that of the Stagno di Molentargius, became extinct in 1993 due to heavy anthropic disturbances consequent to the realization of the Regional Natural Park. This caused the destruction of the whole heronry (hosting 700 pairs of three species of Ardeidae), which was at that time the most important in Sardinia. The sites recently utilized for the breeding of the Glossy Ibis in the Gulf of Cagliari and in the Gulf of Oristano are under legal protection and that of Stagno di Molentargius is within a Natural Regional Park. In both areas there are many mixed heronries which potentially attract Glossy Ibis breeding pairs. However, these areas are

threatened by anthropogenic disturbance (fishing, hunting), fire of vegetation, water regime changes, etc. It is essential to encourage the regular breeding and therefore increase the still small population of the species for the protection of the Glossy Ibis in Sardinia. This aim can be achieved only by designing specific interventions of protection of the heronries by limiting the anthropic disturbance, restoring the in-situ habitats and by starting appropriate environmental management programs.

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