



## The Breeding of wading Birds under anthropogenic pressure: Case of the Glossy Ibis *Plegadis falcinellus* nesting in an urban area in Morocco (Beni Yakhlef, Mohammedia)

Abdeslam RIHANE<sup>1,3,4</sup>, Aymen NEFLA<sup>2</sup>, Rhimou EL HAMOUMI<sup>3,4</sup>, Mohamed CHLAIDA<sup>3,4</sup>

<sup>1</sup> Department of Life and Earth Sciences, Regional Center for Education and Training (CRMEF) Casablanca-Settat, Casablanca, Morocco)

<sup>2</sup> Department of Biology, Faculty of Sciences of Tunis, University of Tunis El Manar II 2092, Tunis, Tunisia

<sup>3</sup> Laboratory of Ecology and Environment, Ben M'sik Faculty of Sciences, Hassan II University, Casablanca, Morocco

<sup>4</sup> GREPOM-BirdLife, Residence Oum Hani 3, Avenue Ouali Al Had Sidi Mohamed – Salé, Morocco

Received 22 April 2020,  
Revised 12 July 2020,  
Accepted 15 July 2020

### Keywords

- ✓ Glossy Ibis.
- ✓ Heronry
- ✓ Breeding success
- ✓ Urbanization
- ✓ Anthropogenic pressure
- ✓ Morocco

[abdeslam.rihane@gmail.com](mailto:abdeslam.rihane@gmail.com)  
Phone: +212676427587;

### Abstract

The aim of this work is to describe the impact of anthropic pressure on the breeding sites of the Great Waders through the study of the Glossy Ibis breeding attempt in a highly urbanized area inside the metropolis of Casablanca. We investigated the breeding habitat use and evaluated the breeding success of the species. The expansion of a small reed bed area into the urban plan of AinTekki attracted Cattle Egrets that used it as a dormitory between 2015 and 2018. In 2019, 14 pairs of the Glossy Ibis nested, for the first time in this area, in association with Cattle Egret (160 pairs). The Hatching success was estimated at 100% and reproductive success reached 95.2% (2 young lost). Despite the importance of this site as a breeding area for this patrimonial species, it remains very small in area and heronry size. This habitat is currently threatened with extinction in the short term especially that all fields around it are concerned by the urban expansion and the wastewater will soon be connected to the sewerage network of Mohammedia. Currently no nesting birds occupy the site because of high disturbance caused by the intense activity of earthworks and compaction.

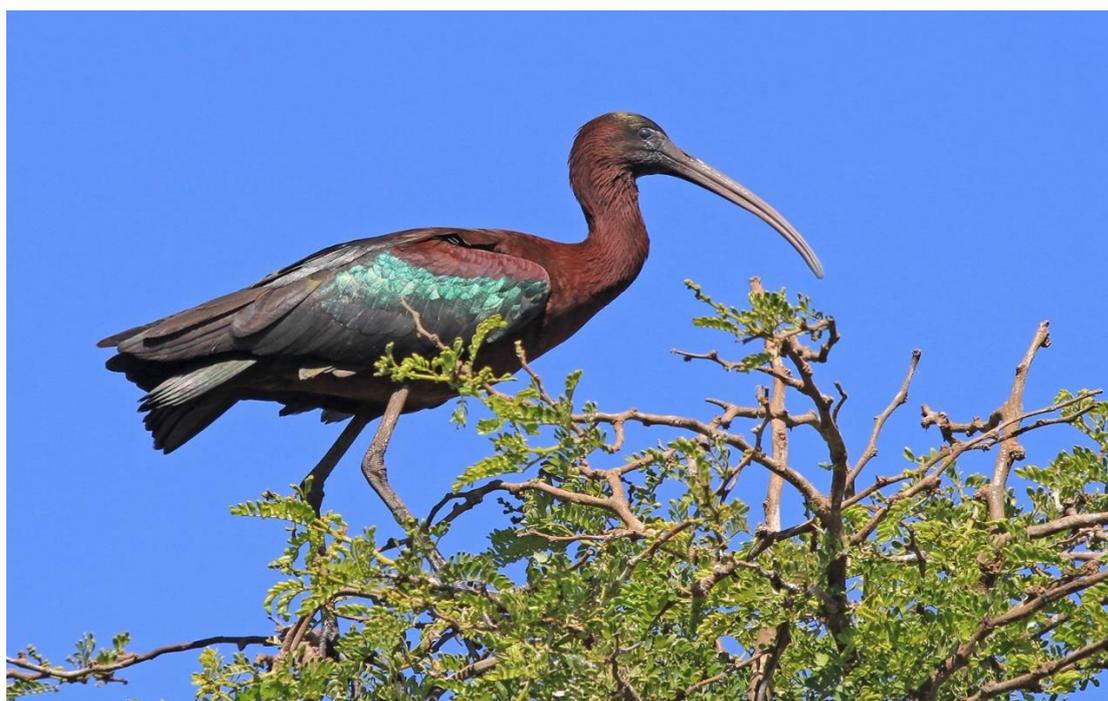
### 1. Introduction

The phenological status of the Glossy Ibis *Plegadis falcinellus* that was considered as a rare migratory and wintering species [1] have changed to migratory, wintering and occasional breeder [2][3][4]. However, according the annual Glossy Ibis's nesting records revealed in Morocco, its status deserves to be updated. In a note on the birds of Morocco [5], the Glossy ibis have different status: sedentary, breeding migrant, winter visitor and a passage migrant.

In North Africa, the species is recently recognized as a breeder in Algeria [6][7][8] after a long period where the species has been regularly observed during migratory passages and in the winter season. In Tunisia, the species had the same status, but the species' nesting was proven for the first time in 2008 [9]. Since this date, the breeding of the Glossy Ibis was carefully followed and studied [10][11][12].

In Morocco the Glossy Ibis had nested regularly in the north of the country during the end of XIX<sup>th</sup> and the begin of the XX century [13][14]. Then it nested in the palm grove of Marrakech in 1980 [15] and in Oued Massa in 1994 [16].

Recently the species nested in the Smir marshes near Tétouan in 2011 [17]. In 2013, a new breeding colony was observed at Fouarat (Kenitra) into a Cattle Egret's heronry [18]. In 2015, a heronry with a small Glossy Ibis's breeding pairs was observed in the pine forest (Assanaouber or David beach) as well as 9 juveniles at the Hassar dam with 40 adults from the 2<sup>nd</sup> decade of June. At the Sindibad Leisure Park in Casablanca, the presence of a Glossy Ibis's breeding colony mentioned in 2016 [19]. Also, in 2016, we discovered an additional nesting colony (40 nests in 2016 and 66 in 2017) within a large heronry in the Oulfa pond [20] in a highly urbanized area inside the metropolis of Casablanca. In 2017, the nesting of this species was reported in another heronry in Bouregreg near Rabat (marshes of Chellah) [21]. The latter is the largest in Morocco with approximately 240 active nests (M. Hilmi *com. Pers.*). All of the North African Glossy Ibis's nesting cases cited above have occurred in rural and natural areas. Exceptionally, Samraoui *et al.* and Boudraa *et al.*, noted the first and only successful reproduction of the species in an urban environment [22][23]. In fact, this study was the second signaling in North Africa and the first on Moroccan territory demonstrating the reproduction of the species in an urban environment. This work aims to shed light on the nesting of the Glossy Ibis in a recently discovered (2019) heronry in Aïn Tekki, a highly urbanized area, inside the metropolis of Casablanca. Our objective is to describe the impact of urbanization on the reproduction of species nesting near inhabited areas through the peculiarities of the space used for nesting and to evaluate the reproductive success of the chosen species (in this case it is the Glossy Ibis which is a species of patrimonial interest and newly installed as a breeder in Morocco).



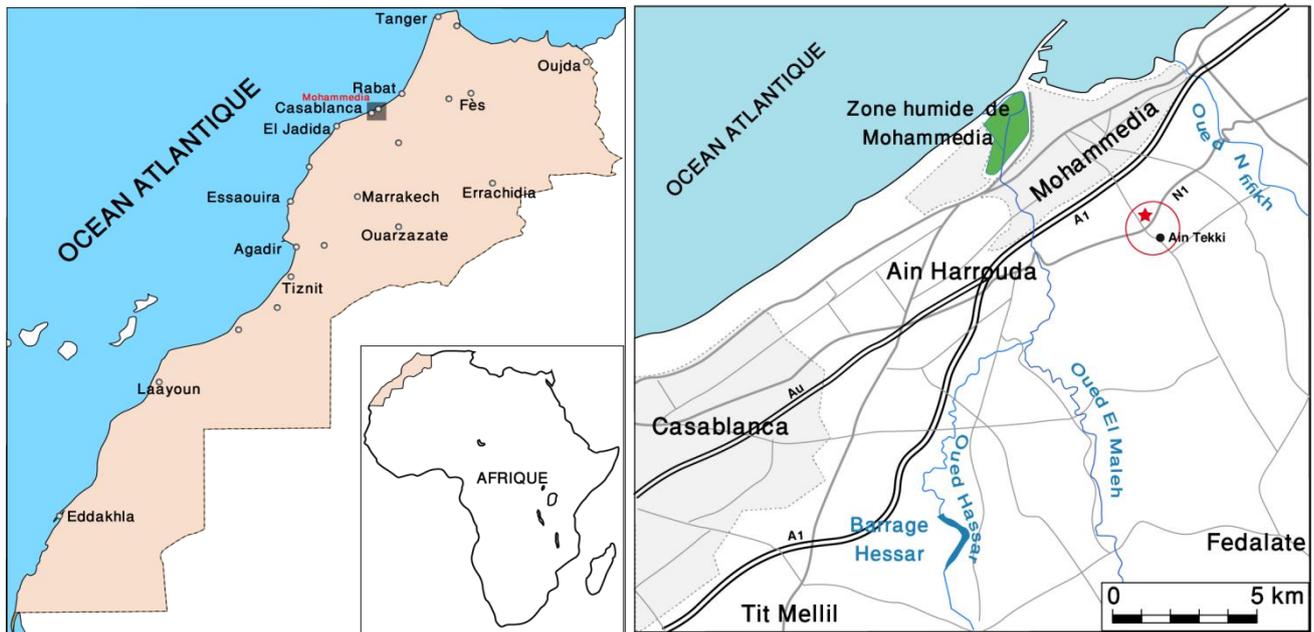
**Figure 1:** The Glossy Ibis *Plegadis falcinellus* in Aïn Tekki Marshes (Mai, the 9<sup>th</sup>,2019)

## 2. Material and Methods

### 2.1. Study area

The present study was carried out in the region of Beni Yakhlef (Mohammedia) where the vegetation in a marsh near Aïn Tekki was used before 2019 as a dormitory for the Cattle Egrets *Bubulcus ibis* and some Glossy Ibis *Plegadis falcinellus*. Recently, since April 2019, this roost (+33°40'00", -7°21'20") was used for the first time as heronry including breeding pairs of both species. The current heronry is located near the junction of the National n ° 1 and the Aïn Tekki-Mohammedia road at 2.65 km to the southwest

from the center of Beni Yakhlef and 0.9 km from Ain Tekki (Fig. 2). Currently, the site is located in a rapidly expanding urban area which was a completely rural area three years ago.



**Figure 2** : Location of the study area.(N1: The Nationale 1, A1: Highway 1, Au: urban highway, ○ : Study area, ★ : Herony location)

## 2.2. Collection of data

The herony was discovered in the middle of the incubation phase, a very critical period during which the breeding pairs showed a high sensitivity to the disturbance. Consequently, we limited ourselves to visiting the colony 3 times: April 18, 2019, May 09, 2019 and 25 May 2019. Most of the observations were made remotely using binoculars and high magnification cameras. Once inside the colony our presence did not exceed thirty minutes during which the nests were checked and all the changes recorded. The approximate age of the chicks and juveniles was determined from Tour du Valat [24] while the laying and hatching dates were determined by retro-calculation on the basis of an average incubation period of 3 weeks [9].

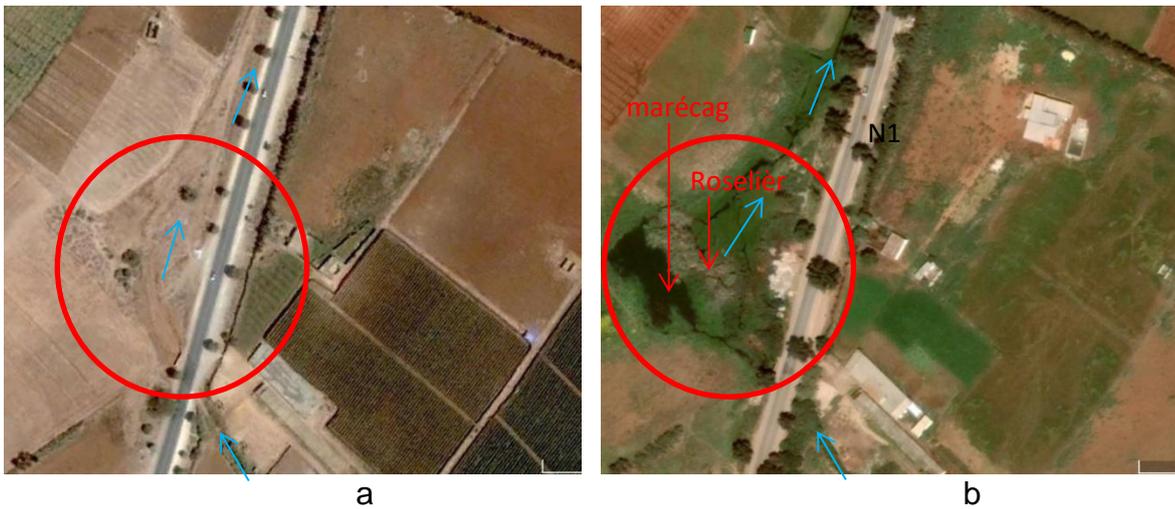
Hatching rate = (number of hatchlings / number of eggs laid)\*100

Reproductive success = (number of fledglings / total number of hatchlings)\*100.

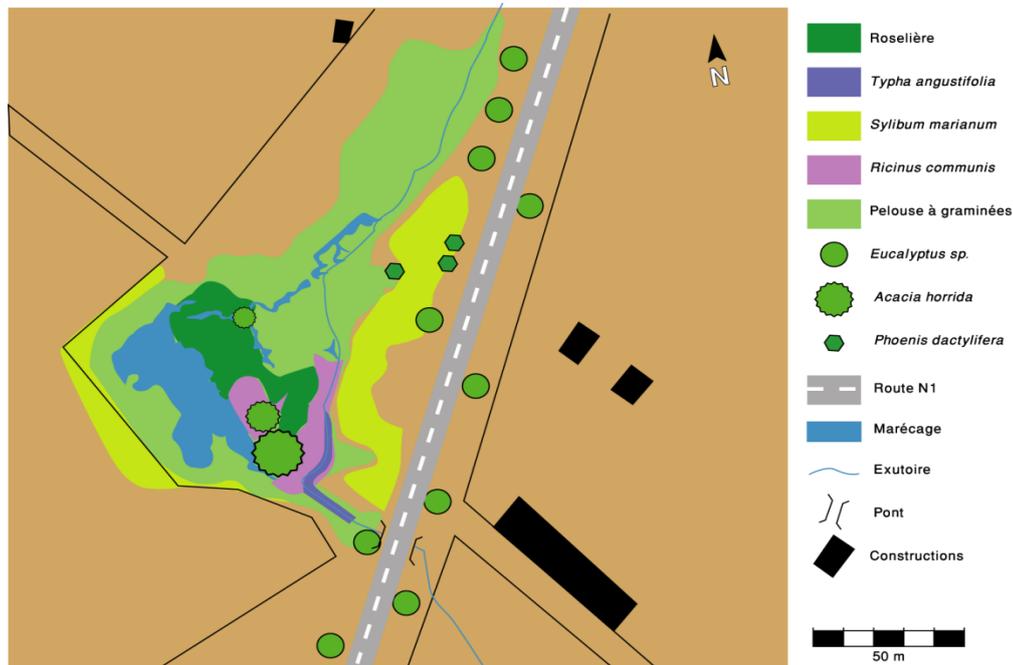
## 3. Results

### 3.1. Installation of the herony and hydro-phytological particularities of the site

The site corresponds to a marsh of raw sewage from Ain Tekki in which vegetation based on *Phragmites australis*, *Typha angustifolia*, *Ricinus communis* and some *Acacia horrida* (Fig. 4). Before the installation of new districts in Ain Tekki, the flow of wastewater in the outlet was very low and its water was mainly used upstream in the irrigation of small fields (Fig. 3a). With the installation of the new districts of Ain Tekki, the flow of wastewater increased and part stagnated north of the National 1 road leading in a few years to the installation of a small reed bed which attracted a population of the Cattle Egret (Fig. 3b, 4). In 2016, some Glossy Ibis started using this dormitory. This marsh is doomed to completely disappear soon given the rapidly and constantly increasing of the demand for real estate in the region.



**Figure 3:** evolution of Aïn Tekki marsh between 2008 (a) and 2019 (b). (→Flow direction)



**Figure 4:** Distribution map of the main vegetation in the Aïn Tekki marsh

### 3.2. Vegetation Use

Aïn Tekki's heronry is very small with an area around 1,400 m<sup>2</sup>, largely occupied by the reed bed. This heronry hosted 174 breeding pairs including 160 nests of the Cattle Egret and 14 nests of the Glossy Ibis. Nests of this latter species are grouped in the southern part of the marsh with the majority built on acacia (n = 9, 64.3%) (Fig. 5a) followed by reeds (n = 4, 28.6%) and only 1 nest formed on a castor shrub (7.1%).

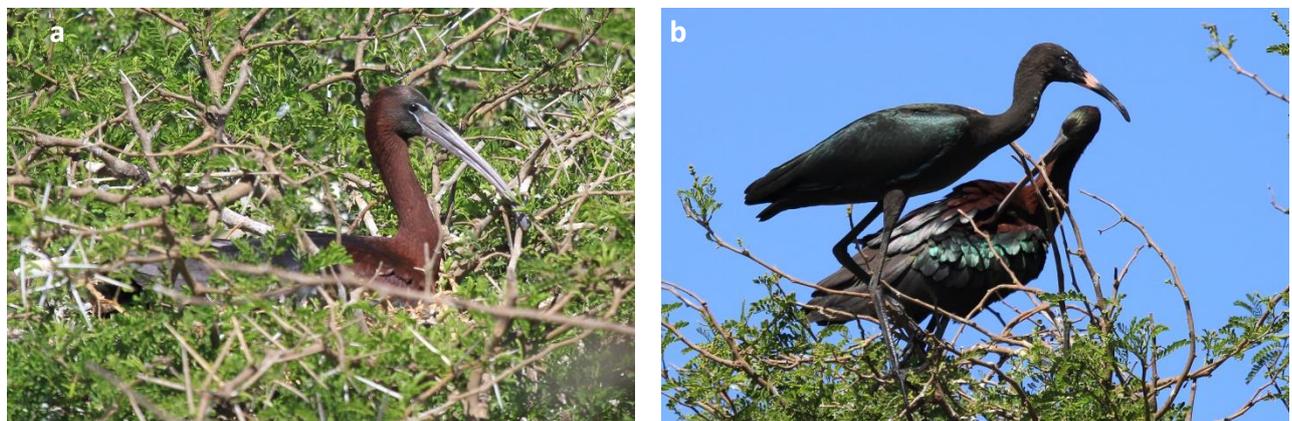
### 3.3. Reproduction success

During the first visit on 04/18/2019, all nests were brooded including those of the Glossy Ibis. On 05/09/2019, 10 nests contained chicks of different ages, while the other 4 showed adults still incubating very young chicks. Estimated egg-laying and hatching periods were shown in Table 1.

- A single brood with 3 large chicks were able to flying and feed in the marsh and grassland (Fig. 5b).
- 2 broods with 3 chicks each were able to move between the Acacia branches and fed by the adults (Fig. 6a).
- 3 other broods with young chicks and still maintain their nests with one of the parents (Fig. 6b).
- 4 broods with 3 chicks each formed a nursery in the reed bed. The chicks regroup and separate each time. We have noticed that the adults feed all the chicks begging for food on site (Fig. 7).

**Table 1:** Summary of the observations of May, 09<sup>th</sup> ,2019 and estimation of the laying and hatching periods

	Number of chicks	approximate stage after hatching	Hatching period	Egg-laying period
Brood 1	3	5 (1 month)	4/4/2019	3/13/2019
Brood 2 & 3	6	4	4/10/2019	3/20/2019
Brood 4, 5, 6 & 7	12 (nursery)	3	4/18/2019	3/29/2019
Brood 8	3	2	4/25/2019	4/4/2019
Brood 9,10 & 11	9 ( fuzz)	1-2	4/29/2019	4/8/2019
Brood 12, 13 & 14	9 (hatchlings)	1	5/2-8/2019	4/11-18/2019



**Figure 5:** a) adult in incubation, b) juvenile in flight with an adult (stage 5). (A. Rihane, 5/9/2019).



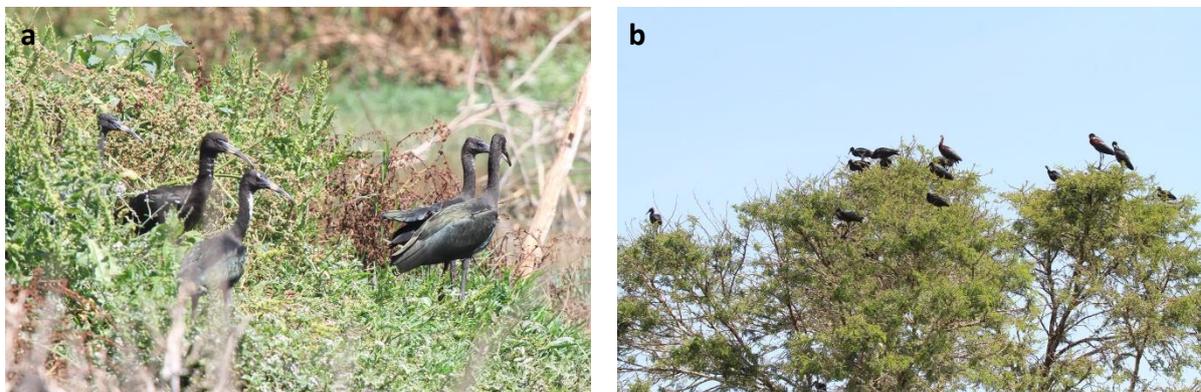
**Figure 6:** a) juveniles moving between branches (stage 4), b) chicks in the nest (stage 1-2). (A. Rihane, 4/9/2019)

On 05/25/2019, a total of 40 chicks are counted with 4 adults in the marsh and on the large Acacia. Nine chicks remain on the tree while the others feed alone or in the company of 4 adults in the marsh (Fig. 8). Chicks which do not leave the tree correspond to the last broods which were probably a week old on 05/09/2019.

If we consider the observations at the Oulfa marsh in Casablanca [19], revealing 3 eggs laid / nested as an average number of eggs laid by the species near the study area, a total of 42 eggs were laid by 14 pairs. The hatching success was then estimated at 100% and the breeding success reached 95.2% (40 fledglings counted in flight from 42 hatchlings).



**Figure 7** : Four nearby nests whose chicks sometimes form a nursery (↓chicks, ○nest).(A. Rihane, 4/9/2019).



**Figure 8**: a) Autonomous juveniles feeding alone in the marsh (stages 5-6), b) gathering during disturbances on the large Acacia (different stages). (A. Rihane, 5/25/2019).

### Discussion and Conclusion

Several breeding sites of the Glossy Ibis (a species of patrimonial interest) are located near urbanized or urbanizing areas, which constitute a threat to this species recently established in Morocco as a breeder after a long disappearance. This is the case of the Oulfa site in Casablanca, the Pine forest site in Benslimane, the Bouregreg site in Rabat, the Fouarate site in Kenitra and the Smir near Tetouan. The current state of the Ain Tekki site in Mohammedia provides an example of this type of impact. The Ain Tekki site is the only one known as a breeding area for the Glossy Ibis near Mohammedia despite the very high numbers of individuals in the neighborhoods, especially in Oued Hassar.

The first specimens (26 individuals) were observed in the region in August 2009 moving along Oued El Maleh and its estuary. Likewise in the same area a juvenile was observed in 7/16/2011. Generally the Hassar dam, an area not far from the new site, receives the highest numbers of individuals. The first Glossy Ibis specimens (13 individuals) were recorded there in June 2013. In June 2014, another group frequented the region where one adult was banded at Doñana National Park (PVC: LPF and metal: ESI7106166).

The first juveniles (16 with 42 adults) were observed in the region (Oued Hassar dam) in June 2014, but the original heronry was not known. In June 2016 at the same place, 9 juveniles were feeding with 39 adults.

Ain Tekki site has passed in 2019 from a dormitory including Cattle Egrets and Glossy Ibis to a mixed heronry despite the incessant disturbances of the national 1 and RP 3307 and real estate activities as well as agricultural and pastoral activities. This is in agreement with the trend of the species in the marsh of Boussedra in El Bouni et Chatt (Annaba) at Algeria where the species has nested in an suburban environments but the number of breeding pairs was lesser (14 pairs versus 26 pairs in Chatt and 124 pairs in Boussedra) [22][23].

The approximate date of the first egg laying is the second decade of March. The hatching period started and quickly ended from the first decade to end of April. In the other heronries as the forest of David, the breeding activity continues in June with recording some incubation cases. The hatching success was estimated at 100% whereas the breeding success (calculated at the flight) was 95.2%. This rate is close to recorded in the breeding sites of Casablanca region: 100% at Oulfa and 97.2% near Bouznika (to be published) (Table 2).

In all observed cases in the region, the breeding of the Glossy Ibis was highly related to the presence of a great number of Cattle Egret's breeding pairs with a ratio of 14/160 (or  $\approx 1/11$ ) in the present site, 66 / 600 (i.e.  $\approx 1/9$ ) at Oulfa in Casablanca and 96/3010 ( $\approx 1/32$ ) in Bouznika.

Finally, the considerable productivity of the species producing 40 fledglings from 42 hatchlings as well as its phenological status change to a sedentary breeder, through its regular reproduction in the Moroccan territory, represent a promising and essential research perspective to better understand the dynamics of Glossy Ibis populations with regard to the variability of prevailing ecological factors.

Despite the importance of this area for the reproduction of this patrimonial on Maghreb scale, it remains very small in terms of surface and heronry size. It seems to be threatened of disappearance in the short term. This had happened to Ain Tekki's Heronry. In the beginning of 2020, the preparation and excavation work in the immediate vicinity of the site has kept away Cattles Egret and Glossy Ibis that were unable to breed in this site this year [24-28].

**Table 2:** Comparative data on the nesting of the Glossy Ibis in the Casablanca region

	Oulfa 2016 (Rihane et al, 2017)	Oulfa 2017 (Rihane et al, 2017)	Ain Tekki 2019 (present study)	Pine Forest 2019 (forthcoming)
Number of nest	40	54	14	96
Number of eggs per nest	3-4	3	3	3
Number of chicks per nest	3	3	3	3
Number of mortality cases	0	0	2	8
Month of the first laying	May	April	March	March
Breeding success	100 %	100 %	95,2 %	97,2%

## References

1. J. Franchimont, A. El Ghazi, M. Thévenot, P. Bergier. Liste Gomac révisée et statuts des espèces régulièrement observables au Maroc. *Porphyrio*, 9 (1/2) (1997) 28-44
2. M. Thévenot, R. Vernon, P. Bergier.. *The birds of Morocco*. British Ornithologists' Union checklist series n° 22, Tring, UK (2003) 594 pp.
3. M.A. El Agbani, A. Qninba, M. Radi, R. El Hamoumi, I. Cherkaoui, O. Himmi, M. Dakki, *Les oiseaux d'intérêt patrimonial au Maroc. Publications du GREPOM*, Rabat, 3 (2011) 55 pp + annexes.
4. P. Bergier, M. Thévenot, A. Rihane, M.A. El Agbani, A. Qninba. Liste des oiseaux du Maroc. *Go-South*, 14 (2017) 43-68.
5. I. Cherkaoui, A. Bouajaja. Liste des oiseaux du Maroc. GREPOM Birdlife, Maroc (2014) 1-29.
6. G. Belhadj, B. Chalabi, Y. Chabi, Y. Kayser, M. Gauthier-Clerc. Le retour de l'Ibis falcinelle (*Plegadis falcinellus*) nicheur en Algérie. *Aves*, 44 (2007) 29-36.
7. A. Bouchecker, R. Nedjah, F. Samraoui, R. Menaï, B. Samraoui. Aspects of the breeding ecology and conservation of the Glossy Ibis in Algeria. *Waterbirds*, 32 (2009) 345-351.
8. R. Nedjah, A. Bouchecker, L. Touati, F. Samraoui, and B. Samraoui. Ecology and Conservation of Glossy Ibis in Algeria: Synthesis and Perspectives. *SIS Conservation* 1 (2019) 39-42.
9. R. Ouni, A. Nefla, A. El Hili. Nidification de l'Ibis falcinelle *Plegadis falcinellus* au Cap-Bon, Tunisie. *Alauda*, 77 (2) (2009) 115-120.
10. A. Nefla, R. Ouni, S. Nourira. The breeding status of the Glossy Ibis *Plegadis falcinellus* in the Lebna Dam in Cap Bon, Tunisia. *Journal of Life Sciences*, 6 (2012) 776-782.
11. A. Nefla, R. Ouni, S. Nourira. Première nidification de l'Ibis falcinelle *Plegadis falcinellus* au Parc National de l'Ichkeul (Tunisie septentrionale). *Alauda*, 82 (2014) 357-358.
12. A. Nefla, R. Ouni, S. Nourira. Past and present of Glossy Ibis *Plegadis falcinellus* in Tunisia. *Stork, Ibis and Spoonbill Conservation* 1 (2019) 16-20.
13. S.G. Reid. Winter Notes from Morocco. *The Ibis*, (5) 3 (1885) 241-255.
14. H. Vaucher, A. Vaucher. Liste des Oiseaux observés au Maroc de 1884 à 1914. *Revue Française d'Ornithologie*, 4(1915) 94-96, 107-111, 134-137.
15. D. Barreau, P. Bergie. L'avifaune de la région de Marrakech (Haouz et Haut Atlas de Marrakech, Maroc). 1. Le cadre. *Alauda*, 68: 301-310; 2. Les espèces: non passereaux. *Alauda*, 69 (2000) 167-202; 3. Les espèces: passereaux. *Alauda*, 69 (2001) 261-309.
16. E. Rousseau. Nouveau cas de reproduction de l'Ibis falcinelle *Plegadis falcinellus* au Maroc. *Alauda*, 62 (1994) 313-314.
17. M. Amezian, R. El Khamlichi, A. Elbanak . Breeding of Glossy bis *Plegadis falcinellus* in the mixed heronry adjacent to Smirmarshed, Northern Morocco. *Alauda*, 80 (2012) 33-38.
18. B. Maire, K. Lâïdi, A. Mathurin. . La valeur patrimoniale croissante de la zone humide de Fouarat (Kenitra) pour quelques espèces-clés de l'avifaune marocaine. *Go-South bull.*, 10 (2013) 198-202.
19. Beaugé. Glossy Ibis breeding at Casablanca. *Go-South bull.*, (2016). Posted on 4 avril 2016 by Go-South. : est la seule note (post) sur cette colonie comme postée sur le site du bulletin Go-South.
20. A. Rihane, R. El Hamoumi, S. El Malki. Reproduction de l'Ibis falcinelle *Plegadis falcinellis* au sein d'une héronnière dans l'étang de l'Oulfa (Casablanca, Maroc). *8ème Journées Internationales «Oiseaux d'Eau Et Zones Humides», les zones humides face aux changements climatiques, quel défis? Et quelles orientations ?*, Ecole Supérieure de Technologie de Khénifra - Khénifra, 19-20 mai 2017.

21. M. Hilmi, La vallée du Bouregreg, valeurs ornithologiques et proposition d'aménagement. *Mém. Master G. E.D. D. Fac. Sci. Ben M'sik, Univ. Hassan II, Casablanca* (2019) 46 pp + annexes.
  22. B. Samraoui, A. Boucheker, R. Nedjah, A. Youcefi and F. Samraoui. First banding scheme of Glossy Ibis *Plegadis falcinellus* in Algeria. *Aves Ichnusae* 10 (2012) 30-37.
  23. W. Boudraa, M. Bara, MDE. Khemis, M. Boumaaza, Z. Bouzlama, M. Houhamdi. Nidification réussie de l'Ibis falcinelle *Plegadis falcinellus* dans un milieu humide urbain en Algérie. *Alauda*, 83 (2015) 143-148.
  24. Tour de Valat. Stages of development observed in Glossy Ibis. Institut de recherche pour la conservation des zones humides méditerranéennes, Camargue Gardoise, (2018) pp.18 <https://tourduvalat.org/wp-content/uploads/2017/12/Stages-of-development-observed-in-Glossy-Ibis.pdf>
  25. A.D. Maccarone and K. C. Parsons, Factors affecting the use of a freshwater and an estuarine foraging site by egrets and ibises during the breeding season in NY City. *Colonial Waterbirds* 17(1) (1994) 60-68.
  26. W. Post, Nest survival in a large ibis-heron colony during a three-year decline to extinction. *Colon. Waterbirds* 13 (1990) 50-61.
  27. A. L. Spaans, On the present breeding status of the scarlet ibis *Eudocimus ruber* along the north-eastern coast of South America, *Biological Conservation*, 7(4) (1975) 245-253
  28. K. J. Brandis, G. Bino, J. A. Spencer, D. Ramp, R. T. Kingsford, Decline in colonial waterbird breeding highlights loss of Ramsar wetland function, *Biological Conservation*, 225 (2018) 22-30
- (2020) ; <http://www.jmaterenvirosci.com>