

## First Record of Mixed-species Heron Colony: Cattle Egret (*Bubulcus ibis*), Squacco Heron (*Ardeola ralloides*) and Little Egret (*Egretta garzetta*) Breeding at Famagusta Freshwater Lake in Cyprus

(Rekod Pertama bagi Koloni Heron Spesies Bercampur: Bangau Lembu (*Bubulcus ibis*), Heron Squako (*Ardeola ralloides*) dan Bangau Kecil (*Egretta garzetta*) Membiak di Tasik Air Tawar Famagusta di Cyprus)

I. CHARALAMBIDOU\* & S. GUCEL

### ABSTRACT

*This study constitutes the first record of a mixed-species heron colony and of a breeding population of Squacco Heron (Ardeola ralloides) in Cyprus. The colony, located at Famagusta Freshwater Lake, was surveyed from March to June 2007. The survey were terminated after 25 June when it was not possible to boat to the colony due to decreasing water levels. The total number of active nests, i.e. containing eggs and/or hatchlings, was 135 for Cattle Egret (Bubulcus ibis); 38 for Squacco Heron and 4 for Little Egret (Egretta garzetta). Cattle Egrets started nest building and egg laying at the beginning of March and hatching started by the end of March. Egg-laying and hatching continued throughout June, possibly due to second broods. Mean clutch size was  $3.5 \pm 0.8$  eggs (range 1-5; n=135). Mean hatching success was  $2.9 \pm 1$  hatched egg per nest (range = 1-5; n=54) and mean breeding success was  $2.8 \pm 1$  chick per nest (range = 0-5; n=36) for chicks surviving up to 15 days after hatching. Squacco Herons started nest building and egg laying by the end of May and hatching started by mid June. Egg-laying and hatching continued throughout June and probably in July and August. As surveys were terminated in June, it was not possible to collect sufficient data on the breeding chronology of this species. Mean clutch size was  $3.1 \pm 0.8$  egg (range 2-4; n=38), which was lower than European estimates. A multitude of activities at and around Famagusta Freshwater Lake pose potential threats to the conservation of the colony resulting in an urgent need for management of the wetland.*

*Keywords: Breeding success; Cattle Egret; clutch size; Famagusta Freshwater Lake; hatching success; Squacco Heron*

### ABSTRAK

*Kajian ini merupakan rekod pertama bagi koloni heron spesies bercampur dan bagi suatu populasi membiak heron squako (Ardeola ralloides) di Cyprus. Koloni ini terletak di Tasik Air Tawar Famagusta, telah ditinjau dari Mac hingga Jun 2007. Adalah tidak mungkin untuk meninjau selepas 25 Jun kerana paras air berada di bawah koloni. Jumlah bilangan sarang aktif iaitu yang mengandungi telur dan/atau anak ialah 135 bagi bangau lembu (Bubulcus ibis); 38 bagi heron squako dan 4 bagi bangau kecil (Egretta garzetta). Bangau lembu mula membuat sarang dan bertelur pada awal Mac dan anak mulai menetas pada akhir Mac. Bertelur dan menetas berlangsung sepanjang Jun, mungkin disebabkan oleh setarang kedua. Min saiz tarangi adalah  $3.5 \pm 0.8$  telur (julat 1-5; n=135). Min kejayaan menetas ialah  $2.9 \pm 1$ , telur tetap per sarang (julat = 1-5; n=54) dan min kejayaan membiak ialah  $2.8 \pm 1$  anak per sarang (julat = 0-5; n=36) bagi anak yang mandiri sehingga 15 hari selepas menetas. Heron squako mula membuat sarang dan bertelur di akhir Mei dan menetas pada pertengahan Jun. Bertelur dan menetas terus sepanjang Jun dan mungkin berterusan ke Julai dan Ogos. Oleh kerana tinjauan berakhir pada bulan Jun, tidak mungkin untuk mengutip data yang cukup mengenai kronologi pembiakan bagi spesies ini. Min saiz setarang ialah  $3.1 \pm 0.8$  telur (julat 2-4; n=38), yang lebih rendah daripada anggaran Eropah. Banyak kegiatan berlaku di tasik dan sekeliling Tasik Air Tawar Famagusta telah memberi potensi ancaman kepada pemuliharaan koloni bagi menghasilkan keperluan mendadak bagi pengurusan tanah basah.*

*Kata kunci: Bangau lembu; heron squako; kejayaan menetas; kejayaan membiak; saiz tarang; Tasik Air Tawar Famagusta*

### INTRODUCTION

The Mediterranean region is important for colonial waterbird conservation (Erwin 1996). Populations of breeding colonial herons exist in France (Fasola & Hafner 1997; Tourenq et al. 2000), Italy (Fasola & Barbieri 2008; Fasola et al. 2010), Spain (Parejo & Sánchez-Guzmán 1999; Prosper & Hafner 1996), Greece (Kazantzidis &

Goutner 2008) and Turkey (Ayas 2008). In Cyprus, herons are predominantly passage migrants, en route between their nesting areas in the western Palaearctic and overwintering areas in Africa (Flint & Stewart 1992; Roth 2008). Six species are listed as occasional breeders (Richardson 2005, 2006, 2007; Whaley & Dawes 2005). In 2007, a mixed-species heron colony was discovered at Famagusta

Freshwater Lake, which is one of the most important wetlands in Cyprus for water birds (Charalambidou et al. 2008; Gucel et al. 2012; Kassinis et al. 2010, 2012).

The colony consisted of breeding Cattle Egrets (*Bubulcus ibis*), Squacco Herons (*Ardeola ralloides*) and Little Egrets (*Egretta garzetta*). It is well documented that, since the 19<sup>th</sup> century, the Cattle Egret has extended its breeding range from Africa to Europe, Asia, America and Australasia (Hemingway 1987; Maddock & Geering 1993; Parejo et al. 2010). In Europe, this species has a favourable conservation status, as does the Little Egret. In contrast, small and depleted European populations of Squacco Herons are of high conservation concern (BirdLife International 2004; Hafner et al. 2001).

The Squacco Heron and Little Egret are included in Annex I of the EU Birds Directive (Directive 2009/147/EC) and together with the Cattle Egret in Annex 2 of the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA 2008). Accurate estimates of species population sizes are imperative when setting conservation priorities (Carter et al. 2000; Thompson 2002). Consequently, information on these species is vital for their effective conservation in Cyprus and the Middle East flyways in general.

#### METHODS

Famagusta Freshwater Lake (35° 07' N, 33° 54' E) is located in a wetland complex formed by the estuaries of two rivers which discharge into Famagusta Bay on the East coast of Cyprus (Figure 1). The wetland complex consists of freshwater and saltwater lakes, forested river bank, tamarisk woodland, lagoons and sandy shores. It constitutes one of the most important ecosystems for water birds in Cyprus, extending over 50 km<sup>2</sup>. The study area

was 2 km<sup>2</sup>, representing 5% of the total wetland complex. The mixed heron colony was located at the southern part of Famagusta Freshwater Lake in a flooded area with Tamarisk trees (*Tamarix smyrnensis* Bunge) and an average water level of 1.5-2 m. The lake is a flood basin fed by rainwater and used for irrigating neighbouring agricultural fields. The water level in the lake rises during winter and falls progressively in summer. By the end of August, the Tamarisk woodland is usually completely dry.

The colony consisted of four clusters of nesting trees within 300 m radius. Each cluster was surveyed by two observers in a boat, conducting perimeter counts. From 8 March to 25 June 2007, the colony was visited twelve times, with seven to ten day periods between visits, to limit disturbance to the birds (Burger 1981). Additionally, the surveys were conducted between 7.00 and 10.00 h, to avoid disturbance during midday. As the season progressed, the average water level under the heronry decreased and the surveys were terminated when it was not possible to boat to the colony anymore.

During the surveys, nests were marked on a sketch and checked on consecutive visits, with a mirror attached to a pole. The species of heron using each nest and the nests' contents (number of eggs/chicks) were recorded. The number of total active nests (i.e. containing at least one egg or chick) were estimated. Hatching success was calculated as the mean number of hatched eggs per nest. Breeding success was calculated as the mean number of chicks per nest surviving up to 15 days after hatching. The chicks were seen in the nests until they were 15-20 days old, corresponding to about 20 days before fledging. Chicks can stay in the nest until they are 30 days old (Hafner & Didner 1997), however they often leave the nest and stand on nearby branches. Therefore, the numbers of fledged young in the colony were estimated from tally counts.

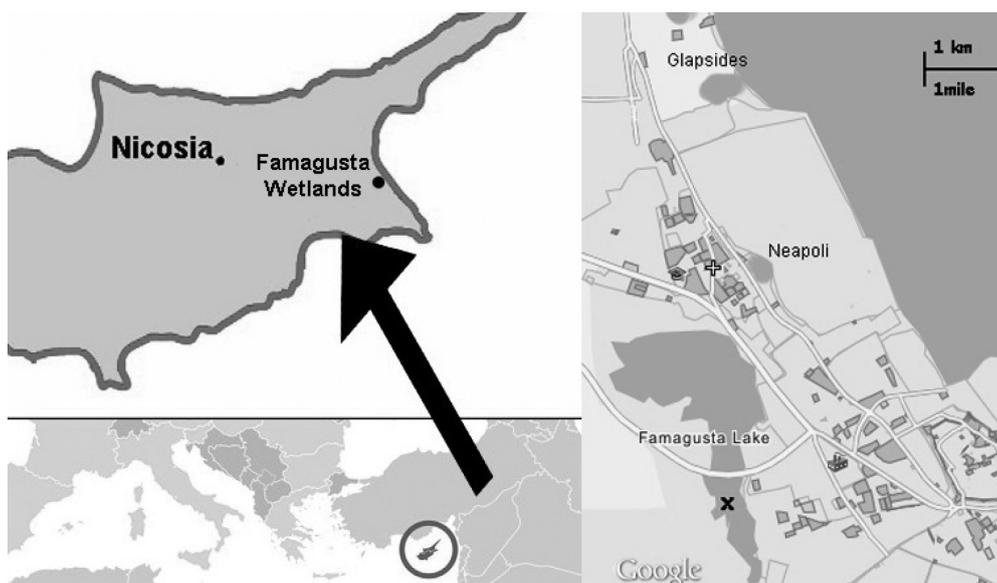


FIGURE 1. Location of Famagusta Wetland Complex (Famagusta Wetlands) in South East Cyprus. The mixed-species heron colony is marked at Famagusta (Freshwater) Lake with an X

## RESULTS

The first Cattle Egret nests with eggs were found on 8 March. Therefore, the start of nest-building and onset of egg-laying had already begun by the first week of March. Egg-laying continued until the end of June, with a peak between 31 March and 13 May. Hatching was first recorded on 27 March and continued in June (Figure 2). In total, 135 nests with known clutches were counted. Mean clutch size was  $3.5 \text{ eggs} \pm 0.8 \text{ eggs}$  (range 1-5 eggs;  $n=135$ ; Table 1). Mean hatching success was  $2.9 \pm 1$  hatched eggs per nest (range 1-5 eggs;  $n=54$ ) and mean breeding success was  $2.8 \pm 1$  chicks per nest (range 0-5 chicks;  $n=36$ ) for chicks surviving up to 15 days after hatching.

The first Squacco Heron nests with eggs were found on 31 May and with hatchlings on 17 June. Egg-laying and hatching continued through June (Figure 3), however, the surveys were terminated on 25 June as the water level under the heronry was less than 1 m, making it impossible to boat to the colony after that date. In total, 38 nests with known clutches were counted. Mean clutch size was  $3.1 \pm 0.8$  eggs (range 2-4 eggs;  $n=38$ ; Table 1).

The first Little Egret nests with eggs were recorded on 31 May and with hatchlings on 17 June. In total, four Little Egret nests were recorded. During all the observation periods, two Cattle Egret nests were recorded containing one unhatched egg each and six containing a dead hatchling. Four dead hatchlings and their remains were observed on branches outside nests. Only one Squacco Heron nest was recorded containing a dead hatchling.

## DISCUSSION

This study confirms the expansion of breeding Cattle Egret populations to Cyprus, where it was previously listed as a scarce passage migrant (Flint & Stewart 1992). Recent data indicated the occasional breeding of this species (Richardson 2006, 2007, 2008; Whaley & Dawes 2005) and the possible establishment of a resident population (Kassinis et al. 2010). Cattle Egrets were first recorded breeding at Famagusta Freshwater Lake in 2004 (Richardson 2006). Interestingly, their presence in the area has probably attracted other Ardeidae, such as the

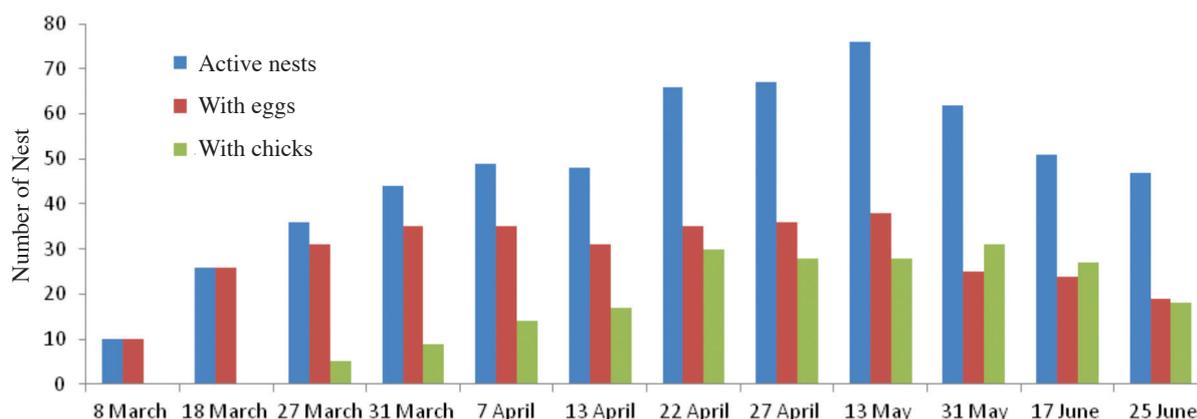


FIGURE 2. Number of active nests (i.e. containing at least one egg or chick) of Cattle Egret *Bubulcus ibis* counted from 8 March to 25 June 2007, in a mixed-species heron colony at Famagusta Freshwater Lake, Cyprus

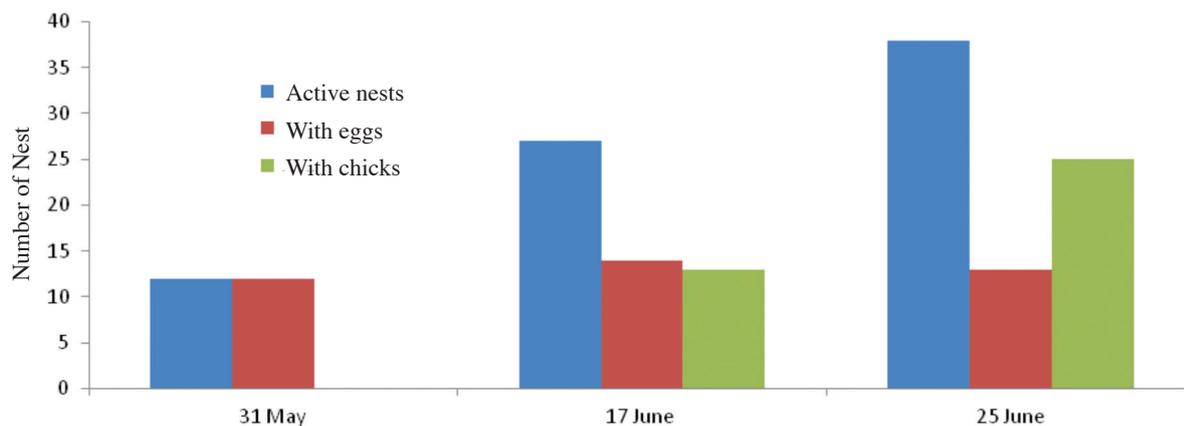


FIGURE 3. Number of active nests (i.e. containing at least one egg or chick) of Squacco Heron *Ardeola ralloides* counted from 31 May to 25 June 2007, in a mixed-species heron colony at Famagusta Freshwater Lake, Cyprus

TABLE 1. Number of nests in relation to clutch size (i.e. number of eggs per nest), and mean clutch size, in Cattle Egret and Squacco Heron nests, in a mixed-species heron colony at Famagusta Freshwater Lake, Cyprus

Clutch size	Cattle Egret No. of nests	Squacco Heron No. of nests
1	3	
2	11	10
3	43	14
4	67	14
5	11	
Total no. nests	135	38
Mean clutch size	3.5 ± 0.8	3.1 ± 0.8

Black-crowned Night Heron (*Nycticorax nycticorax*) (Charalambidou et al. 2008), showing similarities to mixed colonies elsewhere (Fasola et al. 2010; Kazantzidis & Goutner 2008; Parejo et al. 2010; Tourenq et al. 2000). In 2010, 8-10 nests of Glossy Ibis (*Plegadis falcinellus*) were also recorded in the colony, constituting the first breeding record of this species in Cyprus (Gucel et al. 2012).

Furthermore, our study has confirmed the existence of a breeding population of Squacco Herons in Cyprus. This species is classified as a common passage migrant from March to June and August to September (Flint & Stewart 1992). Squacco Herons have small nests which they build in dense vegetation, making them difficult to detect even during nest surveys (Barbraud et al. 2004; Hafner 1977) and it seems that this species has been overlooked in Cyprus. In general, there are few published data on the breeding biology and demography of this European species' population (Delord et al. 2003).

The suitability of Famagusta Freshwater Lake as a breeding habitat for colonial herons may be the result of a variety of factors. The suitability of flooded woodland including *Tamarix* sp. as a nesting habitat (Dragonetti & Giovacchini 2009; Tourenq et al. 2000) provides protection against terrestrial predators and human disturbance (Fasola & Alieri 1992), as well as nesting material (Kushlan & Hafner 2000). Access to feeding areas in the vicinity is equally important. The lake is situated near agricultural land where grazing livestock are present, providing suitable habitat for Cattle Egret (Prosper & Hafner 1996). A variety of permanent and temporary freshwater marshes available in the wider wetland area, constitute suitable foraging habitat for Squacco Herons, while Little Egrets prefer brackish and saltwater lagoons (Hafner 1977) which are not common in the area and may explain the fewer nests of this species in the colony.

The total estimated number of active nests at the colony was at least 177, including 135 Cattle Egret, 38 Squacco Heron and 4 Little Egret. More nests were probably built in July and August, but it was not possible to survey them as the colony could not be visited after June. The beginning of nest building and egg laying for Cattle Egrets started

at the beginning of March, two to four weeks earlier than recorded elsewhere, e.g. Algeria (Si Bachir et al. 2000), Italy (Dragonetti & Giovacchini 2009) and Spain (Parejo et al. 2010). Consistent activity throughout June may relate to second broods (Dragonetti & Giovacchini 2009; Prosper & Hafner 1996), although data was not sufficient to identify whether these were replacement clutches or true second broods. The range in clutch sizes (1-5 eggs) and mean clutch size (3.5 eggs), support existing knowledge (Voisin 1991). Values of hatching (2.9 eggs/nest) and breeding success (2.8 chicks/nest) are also within ranges found in other studies (Dragonetti & Giovacchini 2009).

The beginning of nest building and egg laying for Squacco Herons started by the end of May, three to four weeks later than recorded elsewhere, e.g. France (Delord et al. 2003). Hatching began by mid-June and continued throughout the month. The range in clutch sizes (2-4 eggs) was similar to clutches (3-4 eggs) recorded in southern Africa and Madagascar and smaller than clutches (4-6 eggs) recorded in Europe (Voisin 1991). Consequently, mean clutch size (3.1 eggs) was smaller than values (4-4.7 eggs) reported in Europe (Delord et al. 2003; Hafner 1977; Sterbetz 1960-1961) despite the decrease in clutch sizes observed in Europe during the last 30 years, partly due to an increase in Cattle Egret populations (Hafner et al. 2001).

The first record of a mixed-species heron colony in Cyprus has been presented here. Various activities taking place at and around Famagusta Freshwater Lake such as housing and other developments, agriculture, grazing, fishing, hunting, garbage and sewage dumping, pose potential threats to the conservation of the colony. Currently, much wetland habitat is being lost and degraded in Cyprus, resulting in an urgent need for the conservation of Famagusta Freshwater Lake and of wetlands throughout the island (Gucel 2006). The effective management of wetlands and the provision of high quality habitats for water birds are critical issues in water bird conservation (Ma et al. 2010). Conservation decisions concerning protected bird species are often based on data about their population sizes and trends

(BirdLife International 2004) and where available, breeding parameters (Erwin 1996).

## REFERENCES

- AEWA. 2008. *Agreement on the Conservation of African-Eurasian Migratory Waterbirds*. Agreement Text and Annexes. UNEP/AEWA Secretariat, Bonn, Germany.
- Ayas, Z. 2008. Nest site characteristics and nest densities of Ardeids (Night Heron: *Nycticorax nycticorax*, Grey Heron: *Ardea cinerea*, and Little Egret: *Egretta garzetta*) in the Nallihan Bird Sanctuary (Sarıyar Reservoir, Ankara, Turkey). *Turkish Journal of Zoology* 32(2): 167.
- Barbraud, C., Kayser, Y., Cohez, D., Gauthier-Clerc, M. & Hafner, H. 2004. Detection probability of nests of Squacco Herons in southern France. *Journal of Field Ornithology* 75(2): 172-175.
- BirdLife International. 2004. *Birds in Europe: Population Estimates, Trends and Conservation Status*. BirdLife International, (BirdLife Conservation Series No. 12), Cambridge, UK.
- Burger, J. 1981. The effect of human activity on birds at a coastal bay. *Biological Conservation* 21(3): 231-241.
- Carter, M.F., Hunter, W.C., Pashley, D.N. & Rosenberg, K.V. 2000. Setting conservation priorities for landbirds in the United States: The partners in flight approach. *Auk* 117: 541-548.
- Charalambidou, I., Gücel, S., Kassinis, N., Turkseven, N., Fuller, W., Kuyucu, A. & Yorgancı, H. 2008. *Waterbirds in Cyprus 2007/08*. University of Nicosia, BioDer, Game Fund, UNDP-ACT. Nicosia, Cyprus.
- Delord, K., Kayser, Y., Barbraud, C. & Hafner, H. 2003. Variability in breeding parameters of the Squacco Heron *Ardeola ralloides*. *Bird Study* 50: 300-305.
- Dragonetti, M. & Giovacchini, P. 2009. Aspects of breeding biology of Cattle Egret *Bubulcus ibis* in a Grosseto province colony (Tuscany, central Italy). *Avocetta* 33: 199-204.
- Erwin, R.M. 1996. The relevance of the Mediterranean Region to colonial waterbird conservation. *Colonial Waterbirds* 19: 1-11.
- Fasola, M. & Alieri, R. 1992. Nest site characteristics in relation to body size in herons in Italy. *Colonial Waterbirds* 15: 185-192.
- Fasola, M. & Barbieri, F. 2008. Factors affecting the distribution of heronries in northern Italy. *International Journal of Avian Science* 120(4): 537-540.
- Fasola, M. & Hafner, H. 1997. Long-term monitoring and conservation of herons in France and Italy. *Colonial Waterbirds* 20: 298-305.
- Fasola, M., Rubolini, D., Merli, E., Boncompagni, E. & Bressan, U. 2010. Long-term trends of heron and egret populations in Italy, and the effects of climate, human-induced mortality, and habitat on population dynamics. *Population Ecology* 52(1): 59-72.
- Flint, P.R. & Stewart, P.F. 1992. *The Birds of Cyprus: An Annotated Checklist*. 2<sup>nd</sup> ed. British Ornithologists Union, Zoological Museum, Tring, Herts HP23 6AP, UK.
- Gücel, S. 2006. *Management and Assessment of the Ecology of Cyprus' Wetlands*. Outline recommendations for wetland management in Cyprus. Report, UNDP-ACT 47401-06-001.
- Gücel, S., Charalambidou, I., Kassinis, N., Turkseven, N., Fuller, W., Kuyucu, A. & Yorgancı, H. 2012. *Waterbirds in Cyprus 2009/10*. BA/UES-CCEIA/ CGF/, Nicosia, Cyprus.
- Hafner, H. 1977. Contribution à l'étude écologique de quatre espèces d'Ardeidés (*Egretta garzetta*, *Ardeola ralloides*, *Ardeola ibis*, *Nycticorax nycticorax*) pendant leur nidification en Camargue. PhD Thesis, University of Toulouse, France (Unpublished).
- Hafner, H., Bennetts, R.E. & Kayser, Y. 2001. Changes in clutch size, brood size and numbers of nesting Squacco Herons (*Ardeola ralloides*) over a 32-year period in the Camargue, South France. *International Journal of Avian Science* 143: 11-16.
- Hafner, H. & Didner, E. 1997. *A Squacco Heron*. BWP Update 1: 166-174.
- Hemingway, J. 1987. *An African Bird Makes its Move Around the World*. Smithsonian pp. 60-69.
- Kassinis, N., Gücel, S., Charalambidou, I., Turkseven, N., Fuller, W., Kuyucu, A. & Yorgancı, H. 2010. *Waterbirds in Cyprus 2008/09*. University of Nicosia, BioDer, Game Fund, UNDP-ACT. Nicosia, Cyprus.
- Kassinis, N., Gücel, S., Charalambidou, I., Turkseven, N., Fuller, W., Kuyucu, A. & Yorgancı, H. 2012. *Waterbirds in Cyprus 2010/11*. BA/UES-CCEIA/ CGF/, Nicosia, Cyprus.
- Kazantzidis, S. & Goutner, V. 2008. Abundance and habitat use by herons (Ardeidae) in the Axios Delta, northern Greece. *Journal of Biological Research* 10: 129-138.
- Kushlan, J.A. & Hafner, H. 2000. *Heron Conservation*. London: Academic Press.
- Ma, Z.J., Cai, Y.T., Li, B. & Chen, J.K. 2010. Managing wetland habitats for waterbirds: An international perspective. *Wetlands* 30(1): 15-27.
- Maddock, M. & Geering, D. 1993. Cattle Egret migration in south-eastern Australia and New Zealand: An update. *Notornis* 40: 109-122.
- Parejo, D. & Sánchez-Guzmán, J.M. 1999. Effects of agricultural development on colonial ardeid populations in southwestern Spain. *Waterbirds* 22: 302-306.
- Parejo, D., Sánchez-Guzmán, J.M. & Avilés, J.M. 2010. Breeding biology of the Cattle Egret *Bubulcus ibis* in southwest Spain. *Bird Study* 48(3): 367-372.
- Prosper, J. & Hafner, H. 1996. Breeding aspects of the colonial Ardeidae in the Albufera de Valencia, Spain: Population changes, phenology, and reproductive success of the three most abundant species. *Colonial Waterbirds* 19: 98-107.
- Richardson, C. 2005. *Cyprus Bird Report 2004*. BirdLife Cyprus, Nicosia, Cyprus.
- Richardson, C. 2006. *Cyprus Bird Report 2005*. BirdLife Cyprus, Nicosia, Cyprus.
- Richardson, C. 2007. *Cyprus Bird Report 2006*. BirdLife Cyprus, Nicosia, Cyprus.
- Richardson, C. 2008. *Cyprus Bird Report 2007*. BirdLife Cyprus, Nicosia, Cyprus.
- Roth, T. 2008. Outward (autumn) bird migration at the Southeastern Peninsula and Cape Greco, Cyprus: The phenologies of regular migrants. *Sandgrouse* 30(1): 77.
- Si Bachir, A., Hafner, H., Tourenq, J.N. & Doumandji, S. 2000. Structure de l'habitat et biologie de reproduction du héron garde-boeuf, *Bubulcus ibis*, dans une colonie de la vallée de la Soummam (Petite Kabylie, Algérie). *Revue d'écologie (Terre Vie)* 55: 33-43.
- Sterbetz, I. 1960-1961. The Squacco Heron in the Sasér Bird Sanctuary. *Aquila* 67-68: 39-70.
- Thompson, W.L. 2002. Towards reliable bird surveys: Accounting for individuals present but not detected. *Auk* 119: 18-25.

- Tourenq, C., Bennetts, R.E., Sadoul, N., Mesleard, F., Kayser, Y. & Hafner, H. 2000. Long-term population and colony patterns of four species of tree-nesting herons in the Camargue, South France. *Waterbirds* 23: 236-245.
- Voisin, C. 1991. *The Herons of Europe*. Poyser, London: T. & A.D.
- Whaley, D.J. & Dawes, J.C. 2005. Heron breeding records in Cyprus 2003-2004. *Sandgrouse* 27: 160-161.

I. Charalambidou\*  
Department of Life and Health Sciences  
School of Sciences and Engineering  
University of Nicosia  
Cyprus

S. GuceI  
Institute of Earth, Ocean  
Atmosphere and Environmental Sciences  
Near East University, Nicosia  
Cyprus

\*Corresponding author; email: charalambidou.i@unic.ac.cy

Received: 10 March 2013  
Accepted: 12 May 2013