



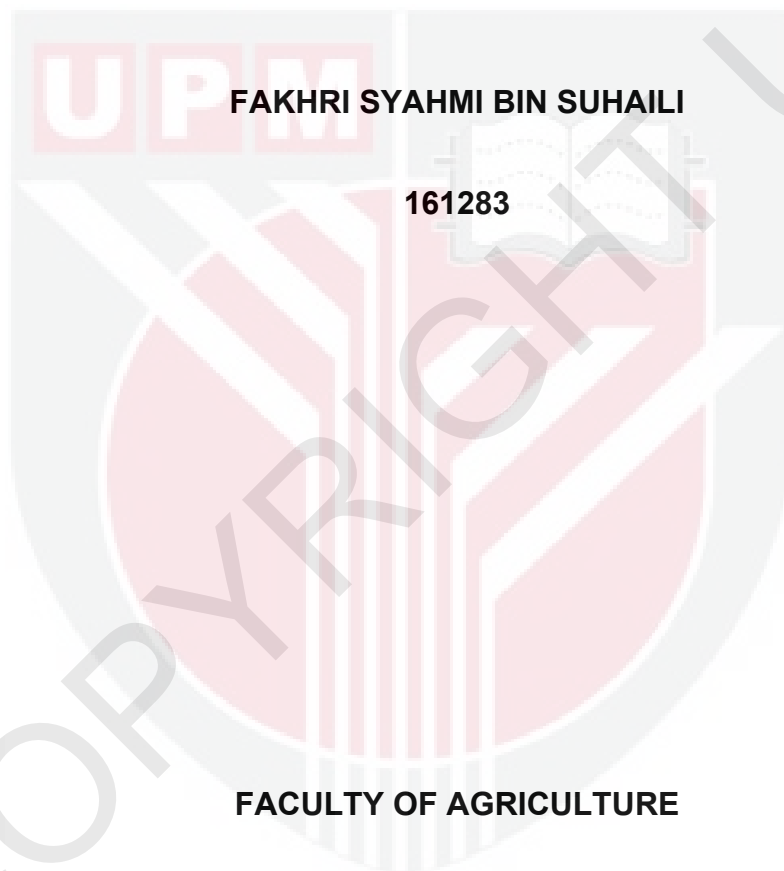
UNIVERSITI PUTRA MALAYSIA

THE BREEDING TREND OF NON-MIGRATORY COLONY OF BLACK-CROWNED NIGHT HERON AT PUTRAJAYA WETLANDS

FAKHRI SYAHMI SUHAILI

FP 2015 178

**THE BREEDING TREND OF NON-MIGRATORY COLONY OF BLACK-
CROWNED NIGHT HERON AT PUTRAJAYA WETLANDS**



FAKHRI SYAHMI BIN SUHAILI

161283

FACULTY OF AGRICULTURE

UNIVERSITI PUTRA MALAYSIA

SERDANG, SELANGOR

2014/2015

**THE BREEDING TREND OF A NON-MIGRATORY COLONY OF BLACK-
CROWNED NIGHT HERON AT PUTRAJAYA WETLAND**

By

FAKHRI SYAHMI BIN SUHAILI

(161283)

A project report submitted to Faculty of Agriculture,

Universiti Putra Malaysia,

In fulfillment of Final Year Project, SHW4999

for the award of degree

BACHELOR OF AGRICULTURE (ANIMAL SCIENCE)

DEPARTMENT OF ANIMAL SCIENCE

FACULTY OF AGRICULTURE

UNIVERSITI PUTRA MALAYSIA

SERDANG, SELANGOR

2014/2015

CERTIFICATION

This project entitled “**The Breeding Trend of A Non-migratory Colony of Black-Crowned Night Heron at Putrajaya Wetland**” is prepared by **Fakhri Syahmi Bin Suhaili** and submitted to the Department of Animal Science, Faculty Of Agriculture in partial fulfillment of the requirement of SHW4999 (Final Year Project) for the award of Degree of Agriculture (Animal Science).

Student Name:

Fakhri Syahmi Bin Suhaili

161283

Signature

Certified By:

Assoc. Professor Dr. Azhar bin Kasim

Department Of Animal Science

Faculty of Agriculture

Universiti Putra Malaysia

Serdang Selangor

Date:

ACKNOWLEDGEMENT

In the name of Allah S.W.T. the most merciful and compassionate, Alhamdulillah praise to Allah S.W.T. with his blessing given me the strength to complete this project.

First and foremost, I would like to express my heartfelt gratitude to my supervisor Assoc. Professor Dr. Azhar bin Kasim for his dedicated guidance, patience, concern, encouragement and critical discussion throughout the course of my study. My sincerely appreciation extended to Mr. A.J and all staff of Syarikat Alam Sekitar Malaysia Sdn. Bhd. (ASMA) for lending hand in helping me during the field work in Upper Bisa, Putrajaya Wetland also lecturers in Animal Science Department for helping me in the success of this study.

Finally, my sincerely gratitude to my family especially my mother also my friends who always support me and be by my side throughout the happiness and hardship until my project is finish.

Thank you.

TABLE OF CONTENT

TABLE OF CONTENTS

TITLE	PAGE
TITLE OF PROJECT	i
CERTIFICATION	ii
ACKNOWLEDGEMENT	iii
TABLE OF CONTENTS	iv
LIST OF FIGURES	vii
LIST OF GRAPHS	viii
ABSTRACT	ix
ABSTRAK	xi

TABLE OF CONTENTS

CHAPTER 1	INTRODUCTION	1
1.1	GENERAL	1
1.2	SIGNIFICANCE OF STUDY	2
1.3	HYPOTHESIS	2
1.4	OBJECTIVES	2
CHAPTER 2	LITERATURE REVIEW	3
2.1	PUTRAJAYA WETLAND	3
2.2	MIGRATION	4
2.3	BLACK-CROWNED NIGHT HERON	6
	2.3.1 PHYSICAL DESCRIPTION	6
	2.3.2 HABITAT	6
	2.3.3 DIET	7
	2.3.4 HABITS	7
	2.3.5 GEOGRAPHIC RANGE	8
	2.3.6 STATUS AND DISTRIBUTION	8
	2.3.7 BREEDING	9
	2.3.8 CLUTCH SIZE	10
	2.3.9 FORAGING BEHAVIOUR	11

CHAPTER 3	MATERIALS AND METHODS	12
3.1	PLACE OF STUDY	12
3.2	ANIMAL	14
3.3	MATERIALS	15
3.4	BIRD SURVEYS	16
3.5	STATISTICAL ANALYSIS	16
CHAPTER 4	RESULTS	17
CHAPTER 5	DISCUSSION	21
CHAPTER 6	CONCLUSION	24
	REFERENCES	25
	APPENDICES	34

LIST OF FIGURES

FIGURE	TITLE	PAGE
1	Map of the study in Putrajaya Wetlands, Malaysia	12
2	The three man-made islands	13
3	Black-crowned night Heron	14
4	Spotting scope	17
5	Binocular (10x42)	17

LIST OF GRAPHS

GRAPHS	TITLE	PAGE
1	Comparison between Island 1 and Stages of Nest for 3 Months	17
2	Comparison between Island 2 and Stages of Nest for 3 Months	18
3	Comparison between Island 3 and Stages of Nest for 3 Months	19

**THE BREEDING TREND OF NON-MIGRATORY COLONY OF BLACK-
CROWNED NIGHT HERON AT PUTRAJAYA WETLANDS**

BY

Fakhri Syahmi Bin Suhaili (161283)

2014/2015

Supervisor: Assoc. Prof. Dr. Azhar Bin Kasim

Keywords : Putrajaya Wetlands, Migratory Birds, Black-crowned night
Heron, Colony, Nesting

ABSTRACT

Putrajaya Wetlands which are about 12 years old is believed to be the largest man-made wetlands in this South East Asia and become the habitat of hundreds birds species including migratory birds with mixed-species colony. The mixed-species colony that can be found here are; Purple Heron (*Ardea purpurea*), Black-crowned Night Heron (*Nycticorax nycticorax*), Grey Heron (*Ardea cinerea*), little egret (*Egretta garzetta*), cattle egret (*Bubulcus ibis*) and Painted stork (*Mycteria leucocephala*). A natural establishment of a mixed-species colony in Upper Bisa, Putrajaya Wetland, Presint 16, Putrajaya (2° 56'04.01"N and 101° 42'12.33"E), provide an opportunity for the study of the breeding habitat of Black-crowned night heron. In this study, the number of nest according to the nest development (early nest, nest with eggs, nest with hatching eggs) were recorded in three man-made island, which each island

covered with different species of matured trees. The studies were conducted for 12 weeks from 30th May to 28th August 2014, which are beyond their migratory season and it took three hours, once in a week. Binocular and diascopes were used in this study. The first island has Ara (*Ficus benjamina*), a hardwood tree species with a lot of strong branches producing fruits and grows in an irregular shape from 10 to 25 meter high. The second island has Sea hibiscus (*Hibiscus tiliaceus*), a small tree species 5-10 meter tall, flowering, with a trunk up to 15cm in diameter and has a curved tree branch. The third island has Tembusu (*Fagraea fragrans*), a hardwood tree species, 10-20 meter tall, strong branchy and less branched. The average total of nest counted for the first month is 48 nests, second month with 40.67 nests and the last month with 19 nests. From the study, it was observed that the preference habitat of the Black-Crowned Night Heron are *Ficus benjamina*(50.85%) > *Fagraea fragrans*(39.24%) > *Hibiscus tiliaceus*(9.91%) from 1292 total nests record for 3 month period. This study showed that, Black-Crowned Night Heron can breed beyond their migratory and breeding season. This is because of the environment in this artificial wetland were conducive, also provide enough source of food and proved that Black-Crowned Night Heron become the residence of this wetland. This study is important for the future conservation of the mixed-species colony waterbird.

**CORAK PEMBIAKAN KOLONI BURUNG PUCUNG KUAK YANG TIDAK
BERHIJRAH DI WETLAND PUTRAJAYA**

Oleh

Fakhri Syahmi Bin Suhaili (161283)

2014/2015

Penyelia: Prof. Madya Dr. Azhar bin Kasim

Kata Kunci : Tanah Lembap Putrajaya, Burung Hijrah, Pucung Kuak,
Koloni, Sarang

ABSTRAK

Putrajaya dipercayai merupakan tanah lembap yang terbesar buatan manusia di Asia Tenggara dan menjadi habitat beratus-ratus jenis burung termasuk burung hijrah dengan pelbagai spesies koloni. Antara spesies burung air yang terdapat di tanah lembap ini adalah; Pucung Serandau (*Ardea purpurea*), Pucung Kuak (*Nycticorax nycticorax*), Pucung Seriap (*Ardea cinerea*), Bangau Kecil (*Egretta garzetta*), Bangau Kendi (*Bubulcus ibis*) dan Botak Padi (*Mycteria leucocephala*). Penemuan spesies campuran koloni di Upper Bisa, Wetland Putrajaya, Presint 16, Putrajaya memberi peluang untuk mengkaji habitat pembiakan Pucung Kuak. Dalam kajian ini, bilangan sarang mengikut perkembangan sarang (sarang awal, sarang dengan telur, sarang dengan telur menetas) telah direkodkan dalam tiga

pulau buatan, yang setiap pulau telah ditanam dengan pelbagai jenis tumbuh-tumbuhan. Kajian telah dijalankan selama 12 minggu iaitu dari 30 Mei hingga 28 Ogos 2014, di mana merupakan di luar musim hijrah Pucung Kuak dan ia mengambil masa sekurang-kurangnya tiga jam sehari, sekali dalam seminggu. Binokular dan diaskop pengesan telah digunakan dalam kajian ini. Pulau pertama telah ditanam dengan pokok Ara (*Ficus benjamina*), spesies pokok berkayu keras, dan berdahan kuat, bercabang, menghasilkan buah-buahan dan tumbuh dari 10 hingga 25 meter tinggi. Pulau kedua ditanam dengan pokok Bebaru bulu (*Hibiscus tiliaceus*), spesies pokok kecil iaitu 5-10 meter tinggi, berbunga, dengan batang hingga 15 cm diameter dan mempunyai cabang pokok yang melengkung. Pulau ketiga ditanam dengan pokok Tembusu (*Fagraea fragrans*) spesies pokok berkayu keras, 10-20 meter tinggi, berdahan kuat dan kurang berdahan. Jumlah purata sarang dikira untuk bulan pertama adalah 48 sarang, bulan kedua dengan 40.67 sarang dan bulan ketiga dengan 19 sarang. Melalui kajian ini, dapat diperhatikan bahawa habitat keutamaan bagi Pucung Serandau adalah *Ficus benjamina* (50.85%) > *Fagraea fragrans* (39.24%) > *Hibiscus tiliaceus* (9.91%) daripada 1292 jumlah sarang direkodkan selama 3 bulan. Lantas membuktikan bahawa, Pucung Kuak boleh membiak di luar musim hijrah dan musim membiak. Ianya berpunca daripada persekitaran di tanah lembap buatan ini adalah jauh lebih baik, sumber makanan yang mencukupi serta menjadikan burung Pucung Kuak sebagai spesies tetap di Wetland Putrajaya. Kajian ini penting untuk pemuliharaan spesies koloni campuran burung air pada masa hadapan.

CHAPTER 1

INTRODUCTION

1.1 General

Putrajaya was the idea of a former Prime Minister, Tun Dr Mahathir Mohammad in 1999. Putrajaya wetland is first large man-made freshwater wetland of Malaysia. It was constructed in 1997 by damming the upper reaches of Sungai Chua as efficient water treatment to trap the sediment and nutrients of surrounding catchments run-off before it enters into lake and provide habitat for mammals, birds, reptiles, amphibians, fish and invertebrates (Sim et al., 2008).

Artificial wetlands are man-made wetlands characterized by shallow or deep water, planted with herbaceous plants (e.g., sedges, reeds, rushes, grasses) generally designed to trap sediments and/or retain water for drinking or irrigation purposes (Vymazal 2010). These wetlands are rich in food resources (e.g., fish, amphibians, insects, snails, invertebrate larvae) for different bird species (Rajpar et al. 2010).

Moreover, they also increase landscape biodiversity, control floods and provide recreation (Hansson et al. 2005), remove pollutants such as suspended solids, nitrogen, phosphorous and ammonia (Vymazal 2010) and improve food and fiber production (Sim 2003). These areas are frequently or continually inundated with water from surrounding catchment areas throughout the year and may serve as suitable breeding grounds for avian species (Soulliere and Monfils 1996; Locky et al. 2005; Kuczynski and Paszkowski 2012).

Artificial wetlands have become an important habitat, particularly for wetland dependent wildlife species, such as birds, frogs, turtles, fishes and invertebrates, due to the loss of natural wetland habitats.

Birds are perhaps the most conspicuous and significant wildlife component and can serve as bio-indicators of wetland habitats, i.e., they indicate the current ecological status of the wetland habitat (Desai and Shanbhag 2007; Li and Mundkur 2007).

1.2 Significance of study

The plentiful aquatic lives in this artificial wetland, such as fishes in particular, are believed to have a positive impact on the breeding outcome of the Black-Crowned Night Heron.

The findings from this study can provide us with supportive data to indicate whether Black-Crowned Night Heron do breed all year round beyond the migratory season, thus do not fly back to its' origin.

1.3 Hypothesis

The favorable Putrajaya Wetland environment enables birds to breed all year rounds, thus help in conservation efforts.

1.4 The general objective of this study is:

- To study nesting habit when making nest together with other species.
- To determine breeding frequency under Putrajaya condition.

REFERENCES

- Acosta, M., Mugica, L., Blanco, D., López-Lanús, B., Antunes Dias, R., Doodnath, L. W., et al. (2010). Birds of rice fields in the americas. *Waterbirds*, 33(SPEC.ISSUE.1), 105-122.
- Alerstam, T., & Hogstedt, G. (1982). Bird migration and reproduction in relation to habitats for survival and breeding. *Ornis Scandinavica*, 13(1), 25-37.
- Arizaga, J., Cepeda, X., Maguregi, J., Unamuno, E., Ajuriagogeaskoa, A., Borregón, L., et al. (2014). The influence of the creation of a lagoon on waterbird diversity in urdaibai, spain. *Waterbirds*, 37(1), 111-118.
- Arthur, A. D., Reid, J. R. W., Kingsford, R. T., Mcginness, H. M., Ward, K. A., & Harper, M. J. (2012). Breeding flow thresholds of colonial breeding waterbirds in the murray-darling basin, australia. *Wetlands*, 32(2), 257-265.
- Ashkenazi, S., & Yom-Tov, Y. (1996). Herons and fish farming in the huleh valley, israel: Conflict or mutual benefit? *Waterbirds*, 19(SUPPL.1), 143-151.
- Ashkenazi, S., & Yom-Tov, Y. (1997). The breeding biology of the black-crowned night-heron (*nycticorax nycticorax*) and the little egret (*egretta garzetta*) at the huleh nature reserve, israel. *Journal of Zoology*, 242(4), 623-641.
- Ashley, M. C., Robinson, J. A., Oring, L. W., & Vinyard, G. A. (2000). Dipteran standing stock biomass and effects of aquatic bird predation at a constructed wetland. *Wetlands*, 20(1), 84-90.
- Ashoori, A., & Barati, A. (2013). Breeding success of black-crowned night heron (*nycticorax nycticorax*), little egret (*egretta garzetta*) and cattle egret (*bubulcus ibis*) (aves: Ardeidae) in relation to nest height in the south caspian sea. *Italian Journal of Zoology*, 80(1), 149-154.

- Ayas, Z. (2008). Nest site characteristics and nest densities of ardieds (night heron: *Nycticorax nycticorax*, grey heron: *Ardea cinerea*, and little egret: *Egretta garzetta*) in the nallihan bird sanctuary (sariyar reservoir, ankara, turkey. *Turkish Journal of Zoology*, 32(2), 167-174.
- Aynalem, S., & Bekele, A. (2008). Species composition, relative abundance and distribution of bird fauna of riverine and wetland habitats of infranz and yiganda at southern tip of lake tana, ethiopia. *Tropical Ecology*, 49(2), 199-209.
- Bennett, V. J., Fernández-Juricic, E., Zollner, P. A., Beard, M. J., Westphal, L., & Fisher, C. L. L. (2011). Modelling the responses of wildlife to human disturbance: An evaluation of alternative management scenarios for black-crowned night-herons. *Ecological Modelling*, 222(15), 2770-2779.
- Bertolino, S., & Gola, L. (2008). Nest site selection of two heron species in italy: A long-term study. *Waterbirds*, 31(3), 480-484.
- Blus, L. J., Rattner, B. A., Melancon, M. J., & Henny, C. J. (1997). Reproduction of black-crowned night-herons related to predation and contaminants in oregon and washington, USA. *Waterbirds*, 20(2), 185-197.
- Brunton, D. (1999). 'Optimal' colony size for least terns: An intercolony study of opposing selective pressures by predators. *Condor*, 101(3), 607-615.
- Coleman, J. M., Huh, O. K., & Braud Jr., D. (2008). Wetland loss in world deltas. *Journal of Coastal Research*, 24(1 SUPPL. A), 1-14.
- Crouch, S., Paquette, C., & Vilas, D. (2002). Relocation of a large black-crowned night heron colony in southern california. *Waterbirds*, 25(4), 474-478.
- Custer, T. W., Hensler, G. L., & Kaiser, T. E. (1983). Clutch size, reproductive success and organochlorine contaminants in atlantic coast black-crowned night-herons. *Auk*, 100(3), 699-710.

- Cuthbert, F. J., Wires, L. R., & McKearnan, J. E. (2002). Potential impacts of nesting double-crested cormorants on great blue herons and black-crowned night-herons in the U.S. great lakes region. *Journal of Great Lakes Research*, 28(2), 145-154.
- Davis Jr., W. E. (2004). Black-crowned night-heron vibrates bill in water to attract fish. *Southeastern Naturalist*, 3(1), 127-128.
- Deng, J., & Frederick, P. (2001). Nocturnal flight behavior of waterbirds in close proximity to a transmission powerline in the florida everglades. *Waterbirds*, 24(3), 419-424.
- Dies, J. I., Ramón, N., & Prosper, J. (2003). Winter breeding by black-crowned night heron in eastern spain. *Waterbirds*, 26(3), 379-382.
- Erwin, R. M., Haig, J. G., Stotts, D. B., & Hatfield, J. S. (1996). Reproductive success, growth and survival of black-crowned night-heron (*nycticorax nycticorax*) and snowy egret (*egretta thula*) chicks in coastal virginia. *Auk*, 113(1), 119-130.
- Erwin, R. M., Hatfield, J. S., & Link, W. A. (1991). Social foraging and feeding environment of the black-crowned night heron in an industrialized estuary. *Bird Behaviour*, 9(1-2), 94-102.
- Etezadifar, F., & Barati, A. (2013). Nest-site selection of western reef heron (*egretta gularis*) in relation to mangrove (*avicennia marina*) structure in the persian gulf: Implication for management. *Forest Ecology and Management*, 310(0), 74-79.
- Fasola, M. (1984). Activity rhythm and feeding success of nesting night herons *nycticorax nycticorax*. *Ardea*, 72(2), 217-222.
- Fasola, M., & Hafner, H. (1997). *Nycticorax nycticorax* night heron. *BWP Update*, 1(3), 157-165.

- 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.
- Fitzsimmons, K. M., Zachritz II, W. H., Hanson, A. T., & Saucedo, J. A. (2008). Evaluation of submerged surface flow (SSF) constructed wetlands for recirculating tilapia production systems. *Aquacultural Engineering*, 39(1), 16-23.
- Gatto, A., Quintana, F., & Yorio, P. (2008). Feeding behavior and habitat use in a waterbird assemblage at a marine wetland in coastal Patagonia, Argentina. *Waterbirds*, 31(3), 463-471.
- Gavin, M. C., & Solomon, J. N. (2009). Active and passive bait-fishing by black-crowned night herons. *Wilson Journal of Ornithology*, 121(4), 844-845.
- Gonzalez-Gajardo, A., Sepúlveda, P. V., & Schlatter, R. (2009). Waterbird assemblages and habitat characteristics in wetlands: Influence of temporal variability on species-habitat relationships. *Waterbirds*, 32(2), 225-233.
- Grasman, K. A., Echols, K. R., May, T. M., Peterman, P. H., Gale, R. W., & Orazio, C. E. (2013). Immunological and reproductive health assessment in herring gulls and black-crowned night herons in the Hudson-Raritan estuary. *Environmental Toxicology and Chemistry*, 32(3), 548-561.
- Greenwood, R. J. (1982). Observations on black-crowned night heron breeding success in a North Dakota marsh (*Nycticorax nycticorax*). *Canadian Field-Naturalist*, 95(4), 465-467.
- Hall, C. S., & Kress, S. W. (2008). Diet of nestling black-crowned night-herons in a mixed species colony: Implications for tern conservation. *Wilson Journal of Ornithology*, 120(3), 637-640.

Hassan, D. M. H., John, J. L., Ahammu, H., Arffin, H. S. J., Loon, C. W., & Mohanlall, P. (1999). *Putrajaya Wetlands*,

Hayashi, Y., Tanaka, M., Tsumura, H., & Fujimaki, Y. (2010). Breeding of the night heron in south-western hokkaido, japan. *Journal of the Yamashina Institute for Ornithology*, 41(2), 204-206.

Hickman, S. (1994). Improvement of habitat quality for nesting and migrating birds at the des plaines river wetlands demonstration project. *Ecological Engineering*, 3(4), 485-494.

Hothem, R. L., & Hatch, D. (2004). Reproductive success of the black-crowned night heron at alcatraz island, san francisco bay, california, 1990-2002. *Waterbirds*, 27(1), 112-125.

Hu, J., & Liu, Y. (2014). Unveiling the conservation biogeography of a data-deficient endangered bird species under climate change. *Plos One*, 9(1)

Ismail, A., & Rahman, F. (2013). Does weather play an important role in the early nesting activity of colonial waterbirds? A case study in putrajaya wetlands, malaysia. *Tropical Life Sciences Research*, 24(1), 1-7.

Ismail, A., Rahman, F., & Zulkifli, S. Z. (2012). Status composition and diversity of avifauna in the artificial putrajaya wetland and comparison with its two neighboring habitats. *Tropical Natural History*, 12, 137-145.

Isola, C. R., Colwell, M. A., Taft, O. W., & Safran, R. J. (2000). Interspecific differences in habitat use of shorebirds and waterfowl foraging in managed wetlands of california's san joaquin valley. *Waterbirds*, 23(2), 196-203.

Jungsoo, K., & Tae-Hoe, K. (2007). Clutch size, reproductive success, and growth rate of black-crowned night herons *nycticorax nycticorax*. *Waterbirds*, 30(1), 129-132.

Kawana, K. (2010). Singing activity of the japanese night heron. *Journal of the Yamashina Institute for Ornithology*, 42(1), 96-101.

- Kelly, J. P., & Condeso, T. E. (2014). Rainfall effects on heron and egret nest abundance in the san francisco bay area. *Wetlands*,
- Kim, J., & Koo, T. -. (2009). Nest site selection and reproductive success of herons and egrets in pyeongtaek heronry, korea. *Waterbirds*, 32(1), 116-122.
- Kingsford, R. T., & Auld, K. M. (2005). Waterbird breeding and environmental flow management in the macquarie marshes, arid australia. *River Research and Applications*, 21(2-3), 187-200.
- Kushlan, J. A., & Steinkamp, M. J. (2007). Seabird nesting and conservation in the northern bahamas. *Waterbirds*, 30(4), 613-623.
- Levengood, J. M., Wiedenmann, L., Custer, T. W., Schaeffer, D. J., Matson, C. W., Melancon, M. J., et al. (2007). Contaminant exposure and biomarker response in embryos of black-crowned night-herons (*nycticorax nycticorax*) nesting near lake calumet, illinois. *Journal of Great Lakes Research*, 33(4), 791-805.
- Li, B. C., Jiang, P. P., & Ding, P. (2007). First breeding observations and a new locality record of white-eared night-heron *gorsachius magnificus* in southeast china. *Waterbirds*, 30(2), 301-304.
- Locky, D. A., Davies, J. C., & Warner, B. G. (2005). Effects of wetland creation on breeding season bird use in boreal eastern ontario. *Canadian Field-Naturalist*, 119(1), 64-75.
- Maccarone, A. D., & Hamilton, B. L. (2014). Diurnal and nocturnal foraging activity by black-crowned night-herons (*nycticorax nycticorax*) at an artificial weir. *Waterbirds*, 37(2), 220-224.
- Maeda, T. (2005). Bird use of rice field strips of varying width in the kanto plain of central japan. *Agriculture, Ecosystems & Environment*, 105(1-2), 347-351.

- Mashiko, M., & Toquenaga, Y. (2013). Increasing variation in population size and species composition ratio in mixed-species heron colonies in japan. *Forktail*, (29), 71-77.
- Medeiros, M. J., Emond, E. E., & Ploger, B. J. (2000). An unusual type of sibling aggression in black-crowned night herons. *Condor*, 102(2), 438-440.
- Montesinos, A., Santoul, F., & Green, A. J. (2008). The diet of the night heron and purple heron in the guadalquivir marshes. *Ardeola*, 55(2), 161-167.
- Morton, S. R., Brennan, K. G., & Armstrong, M. D. (1993). Distribution and abundance of herons, egrets, ibises and spoonbills in the alligator rivers region, northern territory. *Wildlife Research*, 20(1), 23-43.
- Müller, C., & Volet, B. (2013). Rare and unusual records of breeding, migrating and wintering bird species in switzerland, 2012. [Seltene und bemerkenswerte Brut- und Gastvögel und andere ornithologische Ereignisse 2012 in der Schweiz] *Ornithologische Beobachter*, 110(4), 419-436.
- Newman, S. H., Padula, V. M., Cray, C., & Kramer, L. D. (2007). Health assessment of black-crowned night-herons (*nycticorax nycticorax*) of the new york harbor estuary. *Comparative Biochemistry and Physiology Part B: Biochemistry and Molecular Biology*, 148(4), 363-374.
- Olsen, A. R., & Eberdong, M. (2014). A rapid field assessment of the rufous night-heron population of palau, micronesia. *Western Birds*, 45(3), 231-235.
- Parejo, D., & Sanchez-Guzman, J. M. (1999). Effects of agricultural development on colonial ardeid populations in southwestern spain. *Waterbirds*, 22(2), 302-306.
- Parkes, M. L. (2005). Inter-nest infanticide in ardeids. *Waterbirds*, 28(2), 256-257.

- Rais, M., Anwar, M., Mehmood, T., & Hussain, I. (2011). Bird diversity and conservation at kallar kahar lake with special reference to water birds. *Pakistan Journal of Zoology*, 43(4), 673-681.
- Rajpar, M. N., & Zakaria, M. (2013). Assessing an artificial wetland in putrajaya, malaysia, as an alternate habitat for waterbirds. *Waterbirds*, 36(4), 482-493.
- Riehl, C. (2001). Black-crowned night heron fishes with bait. *Waterbirds*, 24(2), 285-286.
- Rojas, L. M., McNeil, R., Cabana, T., & Lachapelle, P. (1999). Behavioral, morphological and physiological correlates of diurnal and nocturnal vision in selected wading bird species. *Brain, Behavior and Evolution*, 53(5-6), 227-242.
- Santiago-Quesada, F., Masero, J. A., Albano, N., & Sánchez-Guzmán, J. M. (2014). Roost location and landscape attributes influencing habitat selection of migratory waterbirds in rice fields. *Agriculture, Ecosystems and Environment*, 188, 97-102.
- Scofield, R. P., Worthy, T. H., & Tennyson, A. J. D. (2010). A heron (aves: Ardeidae) from the early miocene st bathans fauna of southern new zealand. *Records of the Australian Museum*, 62(1), 89-104.
- Shimada, T., Bowman, A., & Ishida, M. (2000). Effects of flooding on a wetland bird community. *Ecological Research*, 15(2), 229-235.
- Shugart, G. W., & Rohwer, S. (1996). Serial descendant primary molt or staffelmauser in black- crowned night- herons. *Condor*, 98(2), 222-233.
- Tourenq, C., Benhamou, S., Sadoul, N., Sandoz, A., Mesléard, F., Martin, J. - ., et al. (2004). Spatial relationships between tree-nesting heron colonies and rice fields in the camargue, france. *Auk*, 121(1), 192-202.

- 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(2), 236-245.
- Tremblay, J., & Ellison, L. N. (1979). Effects of human disturbance on breeding of black-crowned night herons. *The Auk*, , 364-369.
- Uzun, A. (2009). Do the height and location of black-crowned night heron (*nycticorax nycticorax*) nests affect egg production and breeding success? *Waterbirds*, 32(2), 357-359.
- Uzun, A., & Uzun, B. (2008). Comparison of nestling nutrition and growth of black-crowned night heron, *nycticorax nycticorax*, and little egret, *egretta garzetta*. *Zoology in the Middle East*, 44, 110-113.
- Van Turnhout, C. A. M., Hagemeyer, E. J. M., & Foppen, R. P. B. (2010). Long-term population developments in typical marshland birds in the netherlands. *Ardea*, 98(3), 283-299.
- Vymazal, J. (2014). Constructed wetlands for treatment of industrial wastewaters: A review. *Ecological Engineering*, 73, 724-751.
- Wong, L. C., Corlett, R. T., Young, L., & Lee, J. S. Y. (1999). Foraging flights of nesting egrets and herons at a hong kong egrettry, south china. *Waterbirds*, 22(3), 424-434.
- Wyman, K. E., Wires, L. R., & Cuthbert, F. J. Colonial waterbird site occupancy dynamics reflect variation in colony site environments in the U.S. great lakes. *Journal of Great Lakes Research*, (0)