

Breeding biology of Avian fauna in Jodhpur Jhal wetland, Mathura, Uttar Pradesh

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Abstract- Jodhpur Jhal Wetland is not only a breeding place for terrestrial birds but also for water birds. It's a home for several near threatened and vulnerable species such as Sarus crane. The present study aimed to evaluate the breeding biology of avian fauna in Jodhpur Jhal wetland, Mathura having 27°14'23.1"N and 77°46'59.1"E geographical coordinates. The study was carried out in two phases i.e., from May 2021 to September 2021 and October 2021 to February 2022. Total 49 species were monitored during their respective breeding periods. The emphasis was given on their breeding behaviour, period of nesting activity, nests, brood patches and eggs. Nests of 49 species were counted. Most of the species were found to be breeding during rainy season in which species from the family Phasianidae & Leothrichidae outnumbered. Jodhpur Jhal wetland evidently has a prominent habitat for large number of bird species and should be maintained properly.

Keywords- Avifauna, Nesting, Wetlands, Brood Patches, Behaviour

I. INTRODUCTION

Bird's reproduction helps in better understanding not only of ecology but also gives information about their evolution and behaviour which helps in conservation, physiology, and systematic (Bennett & Owens, 2002, Began et. al 2006). The breeding season contains several important events (Faaborg & Chaplin, 1988). like from finding a suitable mate to building a nest and rearing young ones. Nest guarding, successful incubation, feeding young ones, and parental care even after fledglings are also some of the crucial components of breeding (Kumar,2012). Different species of avian fauna breed in different seasons. Some perform breeding in summer while others in winter, but most breeding occurs during the rainy season. The breeding biology of avian fauna and its various aspects are poorly studied in India. Relatively there is no information present about the breeding biology of avian fauna in Jodhpur jhal wetland, Mathura. Hence, in this newly notified

wetland, an attempt was made to document the breeding biology of avian fauna.

Study area

The current study was conducted at jodhpur jhal wetland, Mathura. It lies between N 27°14'27" and Longitude E77°46'48". The area is 55.58 hectares and is surrounded by palm trees. Also, different plant species like *Tripidium bengalense*, *Eichhornia crassipes*, etc. act as excellent nesting material for bird species. This wetland is home to several native and migratory birds. This site sees a large number of migratory birds from December–February. Several bird species breed during the breeding season.

Methodology

The survey was carried out thrice a week and conducted in two-phase. The first phase was from May 2021 to Sept 2021 and the Second phase was between October 2021 to February 2022. Observations were made by using binocular Celestron 10 x 50Nikon camera was used to capture pictures of birds and their nest.

II. RESULTS AND DISCUSSION

All the 37 species were recorded breeding from May 2021 to September 2021 and October 2021 to February 2022. They were crested lark (*Galerida cristata*), Lesser whistling duck (*Dendrocygna javanica*) Spot billed duck (*Anas poecilorhyncha*), Little ringed plover (*Charadrius dubius*), Red-wattled lapwing (*Vanellus indicus*),Wolly necked stork (*Ciconia episcopus*),Ashy prinia (*Prinia socialis*), Indian roller (*Coracias benghalensis*), House crow (*Corvus splendens*), Black drongo (*Dicrurus macrocercus*), Indian silverbill (*Euodice malabarica*), Tri colored munia (*Lonchura malacca*), Sarus crane (*Antigone antigone*), Pheasant tailed jacana (*Hydrophasianus chirurgus*), jungle babbler (*Argya striata*), Striated babbler (*Argya earlei*), Paddy field pipit (*Anthus rufulus*), Grey francolin (*Ortygornis pondicerianus*), Indian peafowl (*Pavo*

cristatus), Baya weaver (*Ploceus philippinus*), Black breasted weaver (*Ploceus benghalensis*), Streaked weaver (*Ploceus manyar*), Plum-headed parakeet (*Psittacula cyanocephala*), Rose ringed parakeet

(*Psittacula krameri*), Grey-headed swamphen (*Porphyrio poliocephalus*), Common moorhen (*Gallinula chloropus*), Black francolin (*Francolinus francolinus*),

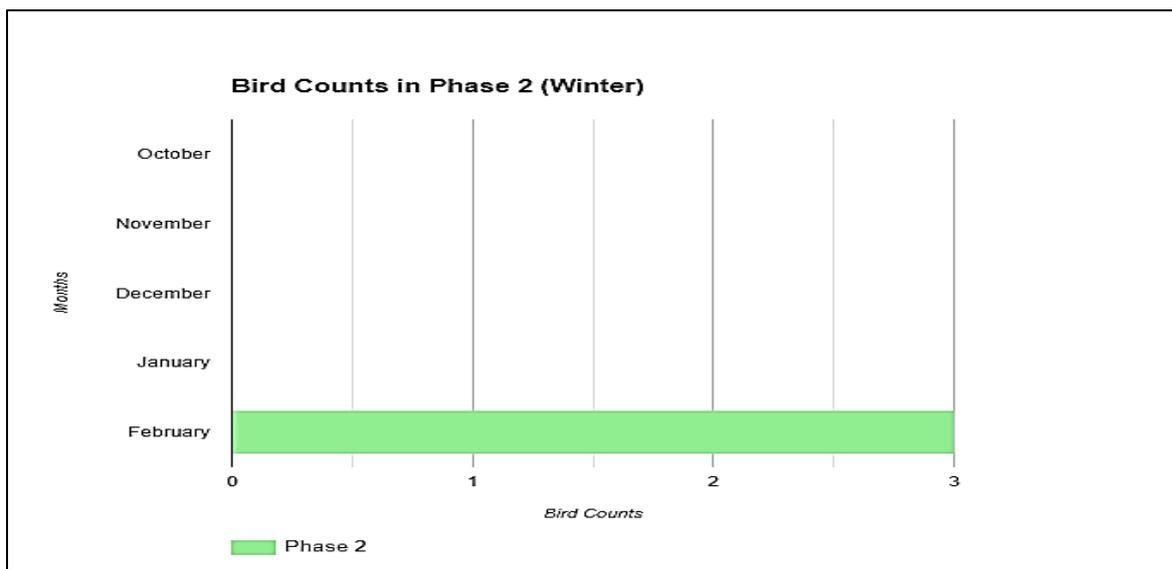
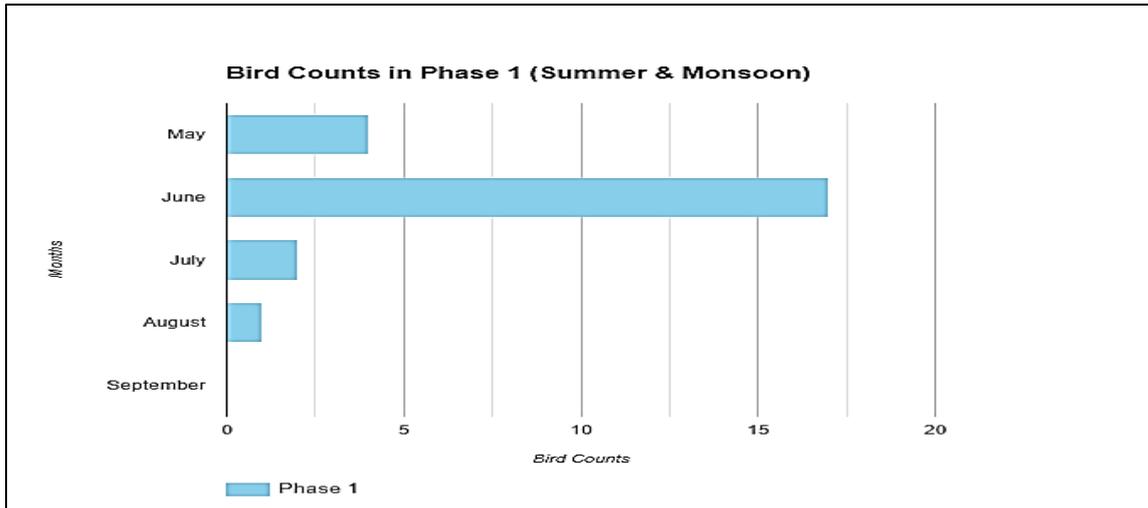
Bird Species	All Activities	Pre- Egg Laying	Egg laying	Chick Rearing
Crested lark	17/5 - 1/7	17/5 - 3/6	24/5 - 20/6	21/6 - 1/7
Lesser Whistling duck	3/6 - 31/7	3/6 - 7/6	29/6 - 30/6	25/7 - 31/7
Spot Billed Duck	8/6 - 4/8	8/6 - 10/6	4/7 - 6/7	1/8 - 4/8
Little Ringed Plover	18/6 - 23/7	18/6 - 23/6	27/6 - 1/7	19/7 - 23/7
Red – Wattled Lapwing	21/6 - 18/10	21/6 - 19/8	19/7 - 7/9	18/8 - 18/10
Woolly –Necked Stork	15/6 - 1/9	15/6 - 21/7	28/7 - 3/8	22/8 - 1/9
Ashy Prinia	29/6 - 7/8	29/6 - 3/7	5/7 - 10/7	17/7 - 7/8
Indian Roller	31/5 - 16/7	31/5	17/6	16/7
House Crow	21/6 - 30/8	21/6 - 28/6	29/6 - 5/7	27/7 - 30/8
Black Drongo	9/6 - 31/7	9/6 - 20/6	23/6 - 3/7	14/7 - 31/7
Indian Silverbill	20/5 - 1/7	20/5 - 29/5	2/6 - 12/6	15/6 - 1/7
Tri-Colored Munia	5/6 - 21/6	5/6	12/6	21/6
Sarus Crane	2/8 - 25/9	2/8	14/8	25/9
Pheasant Tailed Jacana	3/7 - 21/8	3/7 - 23/7	15/7 - 29/7	10/8 - 21/8
Jungle Babbler	15/2	15/2	-	-
Striated Babbler	24/5 - 27/6	24/5	8/6	27/6
Paddy Field Pipit	15/6 - 3/8	15/6 - 21/6	3/7 - 9/7	25/7 - 3/8
Black Francolin	28/6 - 5/8	28/6	21/7	5/8
Grey Francolin	18/6 - 16/7	18/6	27/6	16/7
Indian Peafowl	1/7 - 1/9	1/7 - 10/7	17/7 - 27/7	15/8 - 1/9
Baya Weaver	3/6 - 5/8	3/6 - 21/7	28/6 - 7/8	8/7 - 15/8
Black Breasted weaver	13/6 - 6/8	13/6 - 29/6	28/6 - 16/7	18/7 - 6/8
Streaked Weaver	24/6 - 30/8	24/6 - 19/7	8/7 - 1/8	27/7 - 30/8
Plum headed Parakeet	17/2	17/2	27/2	-
Rose-ringed Parakeet	9/2 - 28/3	9/2 - 11/2	-	-
Grey headed swamphen	21/6 - 8/8	21/6 - 26/6	13/7 - 16/7	5/8 - 8/8
Common Moorhen	15/6 - 19/7	15/6	29/6	19/7

ARRIVAL OF THE BREEDING BIRDS

Hundreds of breeding birds from various species actively participated in breeding activities within the

Jodhpur Jhal Wetland throughout the study period.

These birds engaged in nesting behaviours predominantly during the summer and rainy seasons.



During the phase I (May to August), birds of various species began arriving from mid-May until early August. The highest diversity of breeding species was recorded in June, highlighting a peak in activity during this period. During the phase II (September to February), only February witnessed the arrival of certain bird species for breeding purposes.

BREEDING PHENOLOGY

The sequence of events related to nest occupation, including the pre-egg-laying period (from bird arrival to last egg-laying), egg laying and incubation period (from the first egg-laying to the last egg hatching), and chick rearing period (from the first egg hatching to the last chick fledging), exhibited variations among the species nesting of avian fauna. Further details are provided below.

NEST HEIGHT	BIRD SPECIES
Ground Nesters	Little Ringed Plover, Red-wattled Lapwing, Black Francolin, Grey Francolin, Jungle Babbler, Sarus Crane
Low to Medium (Up to 3 meters)	House Crow, Black Drongo, Crested Lark, Lesser Whistling Duck, Spot-billed Duck, Indian Peafowl

Medium to High (3 to 10 meters)	Indian Silverbill, Tri-colored Munia, Paddyfield Pipit, Indian Roller, Ashy Prinia, Plum-headed Parakeet, Rose-ringed Parakeet, Baya Weaver, Black-breasted Weaver, Streaked Weaver, Grey-headed Swamphen, Common Moorhen
High (Above 10 meters)	Woolly-necked Stork

Pre-egg laying period

Table shows the height of nests built by different birds species

Pre-egg-laying phase in birds, also known as the pre-laying period, involves physiological and behavioral preparations. During this phase, female birds undergo hormonal changes, nest building, mate selection, and territorial defense. It's a crucial time for ensuring optimal conditions before initiating the egg-laying process in avian reproduction. In Phase I (May to September), Pre-egg laying activities of 24 birds species started from 17 May and lasts till 19 August. While in Phase II, Only 3 bird species performed pre-egg laying activity in the area. Courtship of different species were observed during the study period.

Egg-laying and incubation period

In the diverse avian population in Jodhpur Jhal wetland, various species exhibit distinct egg-laying periods throughout the year. The Crested Lark typically lays eggs from May 24 to June 20, spanning 27 days, while the Lesser Whistling Duck and Spot-billed Duck have shorter laying periods of 2 days (June 29 to June 30) and 3 days (July 4 to July 6), respectively. The Little Ringed Plover lays eggs for 5 days (June 27 to July 1), and the Red-wattled Lapwing has a much extended breeding season, from July 19 to September 7, lasting 51 days. The Woolly-necked Stork and Ashy Prinia have moderately long periods, with the former laying eggs from July 28 to August 3 (7 days) and the latter from July 5 to July 10 (6 days). Some species like the Indian Roller and Tri-Colored Munia have very short or single-day laying periods, indicating less variability. The Indian Roller lays eggs on June 17 (1 day), and the Tri-Colored Munia on June 12 (1 day). Conversely, species such as the Baya Weaver and Streaked Weaver demonstrate extended laying durations, with the Baya Weaver's season stretching from June 28 to August 7 (41 days) and the Streaked Weaver's from July 8 to August 1 (25 days). This variety in egg-laying periods highlights the adaptability and ecological diversity among India's bird species.

Chick rearing period

The duration of chick occupancy at Jodhpur Jhal wetland varied significantly among bird species. The longest period, extending up to 72 days, was recorded for the Red-wattled Lapwing between July 19 and September 29, 2021. Comparable extended rearing was also observed in the Sarus Crane, where chicks remained under parental care for nearly the same length of time. Colony-nesting species such as the Baya Weaver, Streaked Weaver, and Black-breasted Weaver exhibited chick dependency ranging from 45 to 55 days, whereas medium periods were noted for Lesser Whistling Duck, Spot-billed Duck, and Grey-headed Swamphen (25–35 days). In contrast, smaller passerines such as the Tri-colored Munia, Indian Roller, and Ashy Prinia showed brief occupancy, lasting only 10–20 days. These differences underline the varying reproductive strategies, with ground-nesting species maintaining prolonged parental care compared to small passerines that adopt rapid fledging to reduce predation risk.

Brood Patch Observations

Brood patch development was observed in several ground- and shrub-nesting species at Jodhpur Jhal wetland. In species such as the Red-wattled Lapwing, Grey Francolin, and Sarus Crane, a single well-developed brood patch was noted in females, assisting in efficient heat transfer during incubation. Among passerines like the Baya Weaver, Black-breasted Weaver, and Ashy Prinia, smaller and relatively less conspicuous patches were recorded, reflecting their compact nest structures and shorter incubation cycles. In colonial nesters such as the weavers, brood patches were particularly evident during peak egg-laying (late June to early August). No significant brood patch development was detected in larger waterfowl like the Lesser Whistling Duck and Spot-billed Duck, where incubation relies more on body positioning and plumage adjustments than on specialized bare skin.



Representative stages of avian breeding biology: (a) Chick emergence and early parental association in Sarus Crane (*Antigone antigone*), (b) nest provisioning in Crested Lark (*Galerida cristata*), (c) courtship/copulatory behavior in Little Ringed Plover (*Charadrius dubius*), and (d–f) brood care and parental guidance in Lesser Whistling Duck (*Dendrocygna javanica*) across terrestrial and wetland habitats

III. DISCUSSION

The reproductive behaviors observed in various bird species at the Jodhpur Jhal Wetland demonstrate a clear and adaptive relationship with environmental factors, particularly seasonal changes such as the monsoon (Subramanya, 2005; Urfi, 2011). The study of the pre-egg laying, egg-laying, and chick-rearing periods highlights not only the biological strategies used by different species but also the ecological factors influencing these behaviors.

The pre-egg laying phase, spanning from May to September, represents a critical time for the preparation of reproduction. In Phase I, the activity of 24 species is observed, with behaviors such as nest building, territorial defense, and courtship being prominent. These activities are likely driven by the need to secure optimal conditions for egg-laying, including safe nesting sites and favorable food availability. The onset of the monsoon, which typically begins in June, may further stimulate these behaviors, as birds aim to synchronize their reproductive efforts with the impending increase in resources.

In Phase II, only three species were observed engaging in pre-egg laying activities, suggesting that

the majority of birds initiate their reproductive cycle early in the season, potentially to align with the onset of the rains. This reduced activity in the latter phase may indicate that species not reliant on monsoon-linked resources or those with extended breeding periods are more flexible in their timing. (Gopi & Pandav, 2011; Narayanan & Vijayan, 2007; Prosper & Hafner, 1996).

The variety in egg-laying periods among species reflects the diversity of strategies employed to maximize reproductive success. Some species, such as the Crested Lark and Red-Wattled Lapwing, have extended egg-laying periods (27 and 51 days, respectively), which may allow for multiple clutches or provide flexibility in response to environmental fluctuations. On the other hand, species such as the Lesser Whistling Duck and Tri-Colored Munia have very short egg-laying windows (2 and 1 day), likely indicating a more focused and time-sensitive reproductive strategy. The extended breeding periods of species like the Baya Weaver (41 days) and Streaked Weaver (25 days) could be a response to variable environmental conditions, ensuring that chicks are raised during the most resource-abundant times. These longer periods also suggest that these species may require more time to successfully raise young, which contrasts with the rapid reproductive

cycles of species like the Indian Roller and Ashy Prinia. The variability in egg-laying durations highlights how different species balance the need for reproductive success with the constraints of their ecological niches. The chick-rearing period coincides heavily with the monsoon season, which brings an abundance of food and water to the wetlands (Dusi & Dusi, 1968; Custer et al., 1980; Burger, 1978). This period, particularly between July and August, shows a peak in chick-rearing activity, underscoring the importance of resource availability for successful offspring development. Species that depend on wetlands, such as the Lesser Whistling Duck and Red-Wattled Lapwing, demonstrate chick-rearing schedules closely aligned with water levels, indicating that wetland conditions play a crucial role in the timing of their reproductive.

IV. CONCLUSION

The present study on the breeding biology of avian fauna at Jodhpur Jhal wetland, Mathura highlights the ecological significance of this site as a breeding ground for a wide range of resident and migratory species. A total of 37 breeding species were documented, with the majority initiating nesting activities during the monsoon season. Breeding phenology varied among species, with ground nesters such as lapwings and francolins exhibiting extended chick occupancy and prominent brood patch development, while passerines such as weavers and prinias displayed shorter chick-rearing periods. Waterbirds such as ducks and swampheens showed limited brood patch development but synchronized breeding with peak rainfall. The findings underline the importance of vegetation structure and water availability in supporting breeding activities.

The study emphasizes the need for long-term monitoring and conservation of the Jodhpur Jhal wetland to safeguard its role as a crucial habitat for avian reproduction. Management measures should include controlling anthropogenic disturbance, maintaining water levels, and protecting nesting vegetation to ensure successful breeding of threatened and vulnerable species such as the Sarus Crane.

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REFERENCES

- [1] Ali, S., & Ripley, S. D. (1987). Compact handbook of the birds of India and Pakistan. Oxford University Press.
- [2] Bennett, P. M., & Owens, I. P. F. (2002). Evolutionary ecology of birds: Life histories, mating systems and extinction. Oxford University Press.
- [3] Begon, M., Townsend, C. R., & Harper, J. L. (2006). Ecology: From individuals to ecosystems. Blackwell Publishing.
- [4] Burger, J. 1978. Competition between cattle egrets and native north American herons, egrets and ibises. *Condor* , 80:15-23.
- [5] Burger, J. 1979. Resource partitioning: nest site selection in mixed-species colonies of herons, egrets and ibises. *American Midland Naturalists* , 101:191-210.
- [6] Custer, T. W., Osborn, R. G. and Stoot, W. F. 1980. Distribution, species abundance and nesting site use of Atlantic coast colonies of herons and their allies. *Auk* , 97:591-600.
- [7] Dusi, J. and Dusi, R. T. 1968. Ecological factors contributing to nesting failure in a heron colony. *Wilson Bulletin* , 80:458-466.
- [8] Faaborg, J., & Chaplin, S. B. (1988). Ornithology: An ecological approach.
- [9] Grimmett, R., Inskipp, C., & Inskipp, T. (2011). Birds of the Indian Subcontinent. Oxford University Press.
- [10] Gopi, G. V. and Pandav, B. 2011. Nest space partitioning among colonial nesting waterbirds at Bhitarkarnika mangroves, India. *World Journal of Zoology* , 6:61-62
- [11] Jha, K. K., & Mazumdar, S. (2015). Breeding behavior of waterbirds in eastern Indian wetlands. *Journal of Wetland Ecology*, 9(2), 23–34.
- [12] Kumar, N. 2011. Soor Sarovar Bird Sanctuary: Management Plan 2010-11 to 2019-20. Lucknow: UP Forest Department
- [13] Kumar, A. (2012). Breeding ecology of selected bird species in wetlands of northern India. *Indian Journal of Ecology*, 39(1), 45–52.

- [14] Narayanan, P. S. and Vijayan, L. 2007. Status of the colonial breeding waterbirds in Kumarakom Heronry in Kerala, Southern India. *Podoces* , 2:22-29.
- [15] Owens, Ian & Bennett, Peter. (2001). *Evolutionary Ecology of Birds: Life Histories, Mating Systems and Ecology*.
- [16] Prosper, J. and Hafner, H. 1996. Breeding aspects of 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.