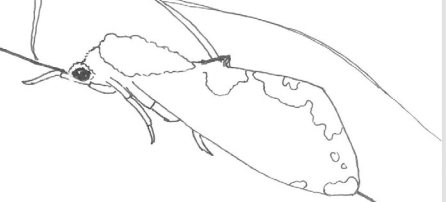
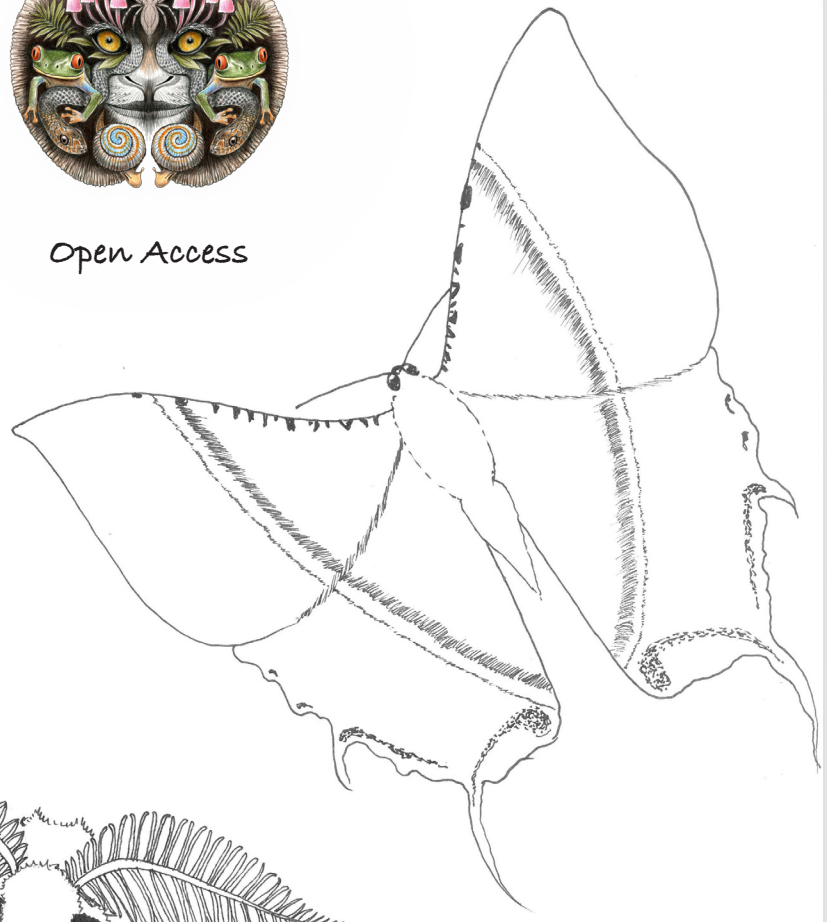
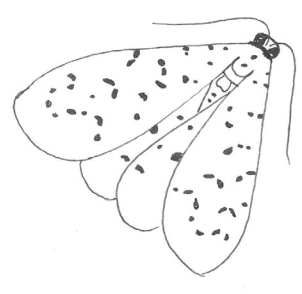


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Journal of Threatened Taxa



Open Access



10.11609/jott.2023.15.7.23463-23630
www.threatenedtaxa.org

26 July 2023 (Online & Print)
15(7): 23463-23630
ISSN 0974-7907 (Online)
ISSN 0974-7893 (Print)



ISSN 0974-7907 (Online); ISSN 0974-7893 (Print)

Publisher
Wildlife Information Liaison Development Society
www.wild.zooreach.org

Host
Zoo Outreach Organization
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Registered Office: 3A2 Varadarajulu Nagar, FCI Road, Ganapathy, Coimbatore, Tamil Nadu 641006, India
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Cover: Celebrating the unsung heroes—moths, our nocturnal pollinators. © Priyanka Iyer.



Population status of Oriental Darter *Anhinga melanogaster* Pennant, 1769 (Aves: Suliformes: Anhingidae) in Keoladeo National Park, India

Neha Imtiyaz¹  & Satish Kumar² 

^{1,2}Department of Wildlife Sciences, Aligarh Muslim University, Aligarh, Uttar Pradesh 202002, India.

¹nehaimtiyaz3@gmail.com, ²satishkumar.amu@gmail.com (corresponding author)

Abstract: Oriental Darter *Anhinga melanogaster* belonging to the family Anhingidae is a globally 'Near Threatened' species occurring in southern and southeastern Asia. The Keoladeo National Park (KNP), Bharatpur, Rajasthan is also known to harbour some population of this species where this study was carried out to assess the population status. Eight wetland blocks were surveyed in different seasons from January 2021 to December 2021 in KNP. The average population of Oriental Darter was found to be maximum (112.8 ± 43.8 SE, $n = 8$) in the winter season, whereas the least (1.8 ± 1.1 SE, $n = 8$) in the summer season. The maximum population size of darters among the eight wetland blocks was witnessed in Block D of KNP harbouring a mean population of 84.3 ± 20.2 SE ($n = 12$), whereas the minimum population occurred in Block F (0.3 ± 0.16 SE, $n = 12$). However, seasonally the total number of darters recorded in all eight wetland blocks during winter, summer and monsoon was 287, 83, and 212, respectively. The findings of the current study reveal that the KNP sustains a viable resident population of Oriental Darters. Further studies are therefore recommended for understanding the seasonal movement pattern and other ecological aspects for its long-term conservation planning.

Keywords: Bharatpur, distribution, Near Threatened, population size, Rajasthan, waterbirds, wetlands.

The Oriental Darter *Anhinga melanogaster* is a relatively large, sleek waterbird, that inhabits shallow inland wetlands, including lakes, rivers, swamps, reservoirs, estuaries, tidal inlets, mangroves, and coastal lagoons. They resemble cormorants and herons

in body structure and appearance. They are distributed throughout the oriental region and are resident birds in Pakistan, India, and Sri Lanka. Some populations of the species are also found in other countries including Nepal, Bangladesh, Myanmar, Thailand, Laos, Vietnam, Cambodia, Malaysia, Singapore, Brunei, Indonesia, and Timor-Leste (BirdLife International 2023). In India, darters are widespread, from coastal wetlands to about 300 m in the foothills of the Himalaya, and can also be found at 700 m in Periyar Lake in the Western Ghats (Image 1). Darter has been documented to breed in several locations across India, with KNP and Bhitarkanika Wildlife Sanctuary in Odisha serving as the species' well-known nesting sites (Rahmani 2005). In KNP, Oriental Darter appears to be a local migrant because there is variation in its numbers seasonally. It is an indicator species because its presence in a wetland ecosystem specifies that it holds sufficient fish as prey base. However, darters move away from their natal areas in response to drought conditions. It prefers clear, clean, stagnant water bodies (Kumar et al. 2005). Darters are colonial nesting species and prefer to nest with other waterbird species in the heronry, and move locally

Editor: H. Byju, Coimbatore, Tamil Nadu, India.

Date of publication: 26 July 2023 (online & print)

Citation: Imtiyaz, N. & S. Kumar (2023). Population status of Oriental Darter *Anhinga melanogaster* Pennant, 1769 (Aves: Suliformes: Anhingidae) in Keoladeo National Park, India. *Journal of Threatened Taxa* 15(7): 23596–23600. <https://doi.org/10.11609/jott.8500.15.7.23596-23600>

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Funding: The first author was awarded Junior Research Fellowship and subsequently Senior Research Fellowship by the University Grants Commission to conduct research.

Competing interests: The authors declare no competing interests.

Acknowledgements: We wish to thank the entire field posted staff of the Forest Department, Keoladeo National Park, in particular the Park Director, Mr Mohit Gupta (DCF) for the continuous help extended by him and equally to his predecessor, Dr. Ajit Uchoi. We are also thankful to the Chief Wildlife Warden, Rajasthan to issue research permit to conduct this study in KNP. All help extended by the Field Assistants Mr. Dinesh Kasna and Mr. Yogesh in the field is duly acknowledged. We are also thankful to one anonymous reviewer for going through the earlier drafts of this paper.



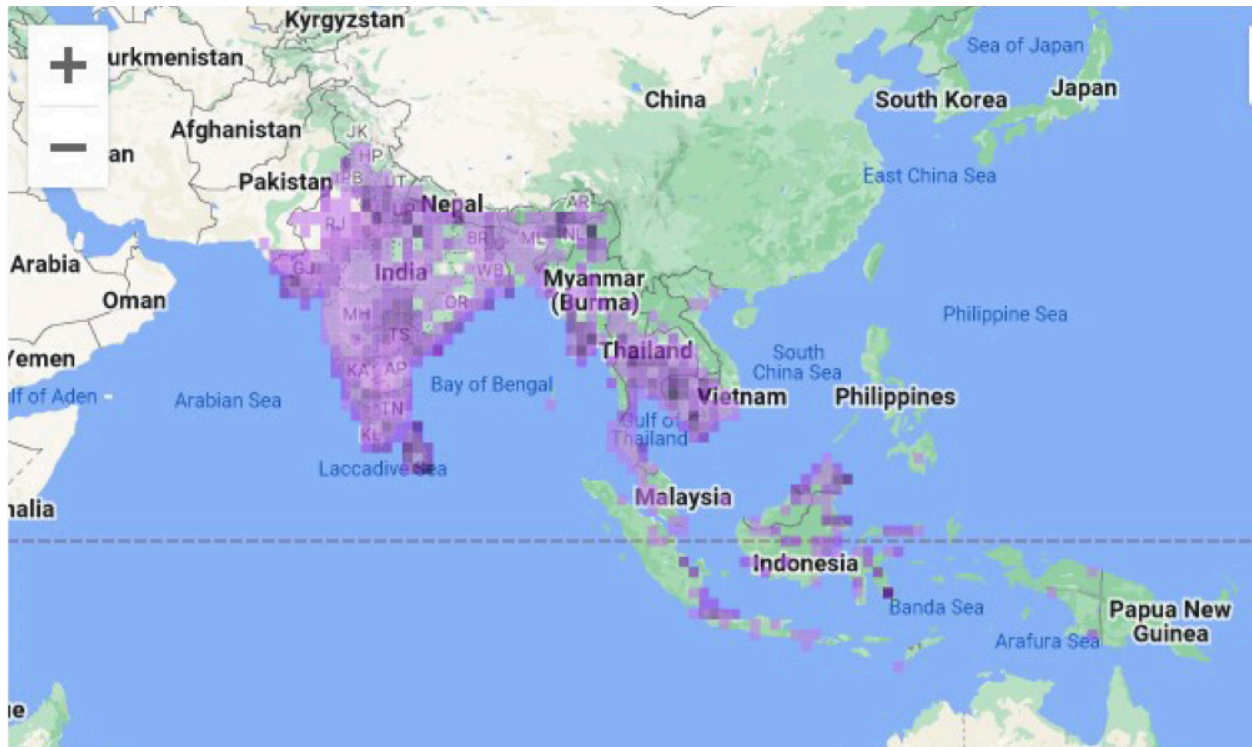


Image 1. Distribution range of the Oriental Darter. Source: www.ebird.org, downloaded on 12 May 2023.

depending on the water conditions (Ali & Ripley 1987; Daniel & Ugra 2003; Kumar et al. 2005).

Due to the decline in the population of the species, it has been listed as 'Near Threatened' by the IUCN Red List of Threatened Species. The population decline has been attributed to pollution, the draining of wetlands, hunting and stealing of eggs and nestlings (BirdLife International 2013). In India, it is legally protected under Schedule II of the Indian Wildlife Protection Act, 1972. There are no current population evaluations of darters from India (BirdLife International 2023). Based on its long-term abundance index over 25 years, current annual trend in abundance over the past five years and the size of its distribution range, its status has been classified as being of low concern in India (SoIB 2020). Keeping in mind the IUCN 'Near Threatened' status of the species, the present study was undertaken in KNP in Rajasthan aiming to estimate the population and the seasonal population fluctuations of the Oriental Darter.

STUDY AREA

KNP is located in Bharatpur district of Rajasthan ($27^{\circ}118' - 27^{\circ}200'$ N and $77^{\circ}484' - 77^{\circ}552'$ E) (Figure 1). It is a low-lying area in the floodplains of river Banganga and Gambhir, which are tributaries of river Yamuna covering an area of about 29 km². The Park

is flat with a gentle slope towards the centre, forming a depression, the total area of which is about 8.5 km² which receives migratory waterfowls every year (Vijayan 1987; Ishtiaq 1998). It is a Ramsar site as well as a World Heritage Site identified by UNESCO. The park, known locally as 'Ghana', is a mosaic of dry grassland, woodlands, swamps, and wetlands. The heronry in the park is formed by 15 species of birds, viz., Painted Stork *Mycteria leucocephala*, Asian Openbill *Anastomus oscitans*, Grey Heron *Ardea cinerea*, Purple Heron *Ardea purpurea*, Black-crowned Night Heron *Nycticorax nycticorax*, Great Egret *Ardea alba*, Intermediate Egret *Ardea intermedia*, Little Egret *Egretta garzetta*, Cattle Egret *Bubulcus ibis*, Black-headed Ibis *Threskiornis melanocephalus*, Little Cormorant *Microcarbo niger*, Indian Cormorant *Phalacrocorax fuscicollis*, Great Cormorant *Phalacrocorax carbo*, Oriental Darter *Anhinga melanogaster*, and Eurasian Spoonbill *Platalea leucorodia*.

METHODS

The total count method (Bibby et al. 2000) was employed to assess the population status of darters in the study area. The Park management has divided the whole wetland into eight blocks (B, D, E, F, K, L, N, G) and we adopted these blocks as such for our surveys (Image

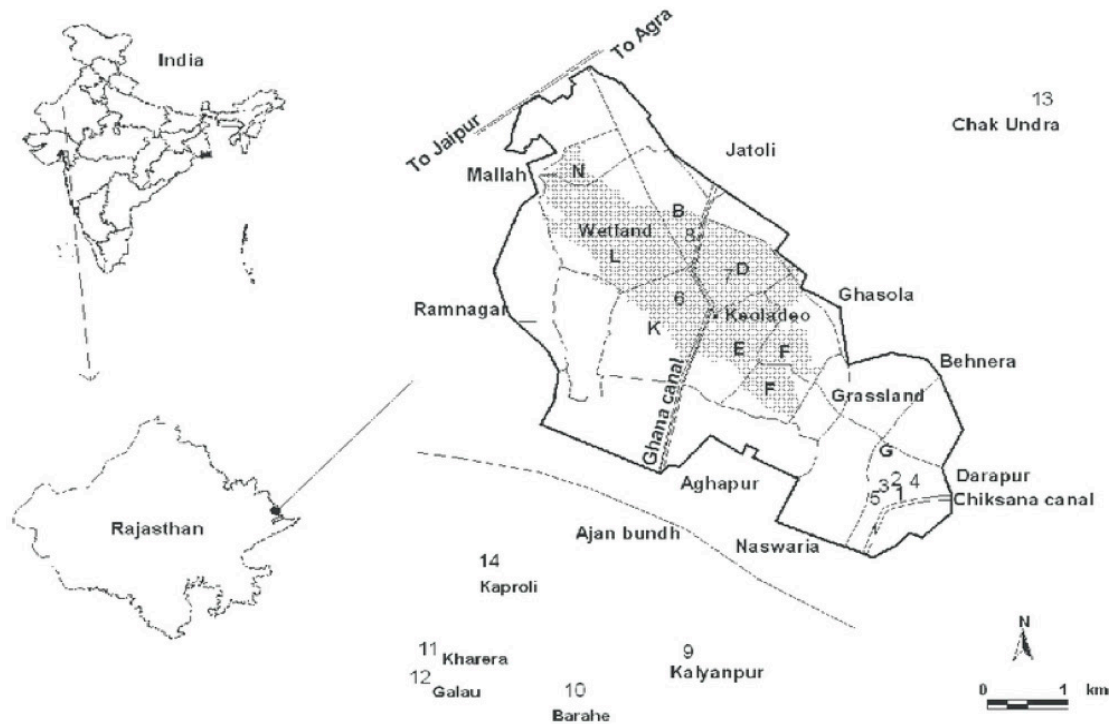


Figure 1. Block wise map of Keoladeo National Park. Source: Verma & Prakash 2007.

1). Data were collected in such a way that all three major seasons were covered, viz.: summer (March–June), monsoon (July–October), and winter (November–February). Darters were counted in each block using 8 x 32 binoculars (Bibby et al. 2000). Simultaneous counts were made on fortnightly basis from elevated points by two observers in each block from 0060–0080 h during summer and monsoon seasons and from 0080–1000 h during winter season due to fog in early morning hours. Precautions such as reaching early in the park and sensitizing and briefing tourists were exercised to avoid disturbance to darters during counts.

RESULTS

Oriental darters are mainly piscivorous birds that occur singly, or in flocks of small size (usually 3–6 individuals). However, rarely large flocks of up to 20 birds were seen (n = 6). Although several piscivorous waterbirds co-exist with Oriental Darters in KNP, their major competitors with similar food habits of diving and capturing fish are Great Cormorant *Phalacrocorax carbo*, Indian Cormorant *Phalacrocorax fuscicollis*, and Little Cormorant *Microcarbo niger*. It was observed that darters were distributed heterogeneously within the wetland sites, largely in response to the availability of water, and lack of submerged vegetation. Overall, the mean population size of darters was found to be

maximum (84.3 ± 20.2 , n = 12) in ‘block D’ and minimum (0.3 ± 0.16 , n = 12) in ‘block F’ of KNP (Table 1).

Total number of darters recorded in all eight blocks during winter, summer and monsoon were 287, 83, and 212, respectively (Table 2). Among all the wetland blocks in KNP, the highest population was recorded in block D in all the seasons, namely winter (195), summer (49) and monsoon (176). On the other hand, the lowest population of darters was recorded in block F in all the seasons, i.e., one individual in winter and none in summer (Table 2).

DISCUSSION

Oriental Darters were found to be territorial in their foraging grounds as they were quite aggressive towards conspecifics whenever they attempted to come close. The distribution pattern of darters was not uniform in the wetland. Such a pattern of distribution can be attributed to the availability of food and the appropriate water depth preferred by these piscivorous birds.

Population counts of Oriental Darter in KNP indicate distinct variation in its population size (Table 2). The average population of the species was highest in winter followed by monsoon and the population of the bird inhabiting the wetland was lowest in the summer season. This may be because in winter, the wetland area is full of water and the prey species of the bird are abundant.

Table 1. Mean population of the Oriental Darter in Keoladeo National Park in different seasons (2021).

Wetland block	Wetland area (in ha)	Season-wise mean population \pm SE			Overall mean population (\pm SE)
		Winter	Summer	Monsoon	
B	1.31	9.0 \pm 0.7	3 \pm 1.9	33 \pm 1.9	15.0 \pm 3.9
D	1.38	112.8 \pm 43.8	28 \pm 7.9	121 \pm 34.3	84.3 \pm 20.2
E	1.55	10.5 \pm 2.1	1.8 \pm 1.1	NS	6.1 \pm 1.9
F	3.06	0.5 \pm 0.2	0.0 \pm 0.0	NS	0.3 \pm 0.16
K	2.28	14.3 \pm 0.7	4.3 \pm 1.4	NS	9.3 \pm 2.0
L	4.5	29.2 \pm 6.8	2.8 \pm 1.8	NS	16 \pm 5.9
N	0.65	4.8 \pm 0.4	1.0 \pm 1.0	NS	2.8 \pm 0.8
G	0.67	2.0 \pm 0.0	0.2 \pm 0.2	NS	1.1 \pm 0.3

NS—Not surveyed

Table 2. Maximum and minimum population of Oriental Darter during different seasons in Keoladeo National Park (2021).

Wetland block	Winter		Summer		Monsoon	
	Max	Min	Max	Min	Max	Min
B	11	8	8	4	36	28
D	195	34	49	12	176	34
E	15	7	5	0	NS	NS
F	1	0	0	0	NS	NS
K	15	12	8	2	NS	NS
L	42	16	8	0	NS	NS
N	6	4	4	0	NS	NS
G	2	2	1	0	NS	NS
Total	287	83	83	18	212	62

NS—Not surveyed

The mean population of darters was relatively low in blocks G and F because they were less suitable for them due to more submerged vegetation. Also, the post-monsoon period in the park coincides with the post-fledging period of darters, which are therefore seen in higher numbers in winter after the completion of their breeding season.

The Oriental Darter is an obligate piscivore that prefers to forage in shallow waters. However, the African Darters *Anhinga melanogaster rufa* have been reported to dive in waters <5 m deep (Ryan 2007). In summer, water is available only in some of the blocks in the park where darters can be found feeding. Among different sites in the wetland area of the park, Block D was found to support the maximum population of Oriental Darter, which may be due to abundant prey in the deep-water system of the block and partly it can also be correlated with the presence of less submerged and emergent grass species, thereby offering less hindrance

to the foraging darters. Most authors have suggested that food resources have been found to influence the distribution and selection of specific habitat types by animals (Johnson 2000; Johnson & Sherry 2001; Narasimmarajan et al. 2012). Furthermore, our results are in accordance with the study of Hustler (1992) who asserted that while diving, African Darters maintained their buoyancy at 2–4 m depth though they may utilize the whole water column. The findings of the current study reveal that the wetland sustains a viable resident population of Oriental Darter in the park. The study further provides information on seasonal variation in its population in the KNP. Ten individuals of Oriental Darter were colour banded during this study but the recapture rate or resighting of the marked individuals was extremely low both within the park and the satellite wetlands in its surroundings. On an average, one individual out of the 10 marked darters was resighted in a month. A large sample size of Oriental Darter is thus

required for colour banding to have better recapture rate. In order to understand the dynamics of movement pattern of darters whether they are local migrant in KNP or distant migrants, a conventional radio-telemetry or satellite telemetry or colour banding a large sample size or adequate numbers of darters may be more useful to validate it.

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c/o Wildlife Information Liaison Development Society,
43/2 Varadarajulu Nagar, 5th Street West, Ganapathy, Coimbatore,
Tamil Nadu 641006, India
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ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

July 2023 | Vol. 15 | No. 7 | Pages: 23463–23630

Date of Publication: 26 July 2023 (Online & Print)

DOI: 10.11609/jott.2023.15.7.23463-23630

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