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ORIGINAL RESEARCH ARTICLE

Population trend of Grey and Purple Heron in National Chambal Sanctuary, Madhya Pradesh, India

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ABSTRACT

Data of two species of Herons were collected, during the annual census of major aquatic fauna in the National Chambal Sanctuary, Madhya Pradesh, India, over a period of 23 monitoring seasons. The survey was conducted by direct visual observation method from 1985 to 2016. During the surveys all the relevant information about the current status of Grey Heron (*Ardea cinerea*) and Purple Heron (*Ardea purpurea*) in different zone of the Chambal River was complied. A total of 5318 (Avg. 443.66±242.6) individuals of Grey Heron and 104 (Avg. 8.66±4.39) individuals of Purple Heron were sighted. The highest density of Grey Heron 22.32/km was observed in zone XI and Purple Heron 0.75/km in zone III. Similarly, the least density of Grey Heron 4.82/km was in zone I, VIII and that of Purple Heron 0.07/km was in zone X. The result of the present study indicates that Chambal River continues to be a good habitat for Heron population. The Heron shares similar habitat and similar level of anthropogenic pressure in the study area. This is the first attempt to document the population status and distribution of Heron in different habitat zone of the sanctuary.

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INTRODUCTION

River Chambal, a tributary of the Gangetic River system originates from the summit of Janapav Hill in the Vindhyan range of Mhow District of Indore in Madhya Pradesh, India. The river flows through the states of Rajasthan, Madhya Pradesh and Uttar Pradesh. Despite being one of the last remnant rivers in the greater Gangetic Drainage Basin have retained significant conservation value (Hussain *et al.*, 2013). It also serves as among the best over wintering sites for migratory birds and also designated as an important bird area-Site Code IN-UP-11 and IN-RJ-11 (Rahmani *et al.*, 2016). Herons are the most widespread, migratory species in India and are including in schedule-IV of the wild life Protection Act 1972. They are large wading birds and constitute indicator species in wetlands (Bird Life International, 2021). Heron are mainly piscivorous, however, as an opportunistic predator it also preys upon amphibians, reptiles' aquatic insects, and small mammals (Mistry and Patel, 2018). Earlier, reports of aquatic birds were reported by several workers but detailed studies on Heron are poorly studied in the Chambal River. Keeping in mind the significance of the river and associated fauna, the population trends and probable threats are important parameters that have to be assessed regularly with defined gaps. Its outcome has been influencing policy making and the public opinion.

MATERIALS AND METHODS

Study area

The National Chambal Sanctuary, thereafter (NCS), lies at 24.055°–26.050°N and 75.034°–79.018°E encompasses a 572km stretch of the river from Keshoraipatan in Rajasthan to Pachhnada in Uttar Pradesh, India (Figure 1). The sanctuary includes about 15km of river Yamuna after confluence with Chambal (Singh and Sharma, 2018). The main activities in the

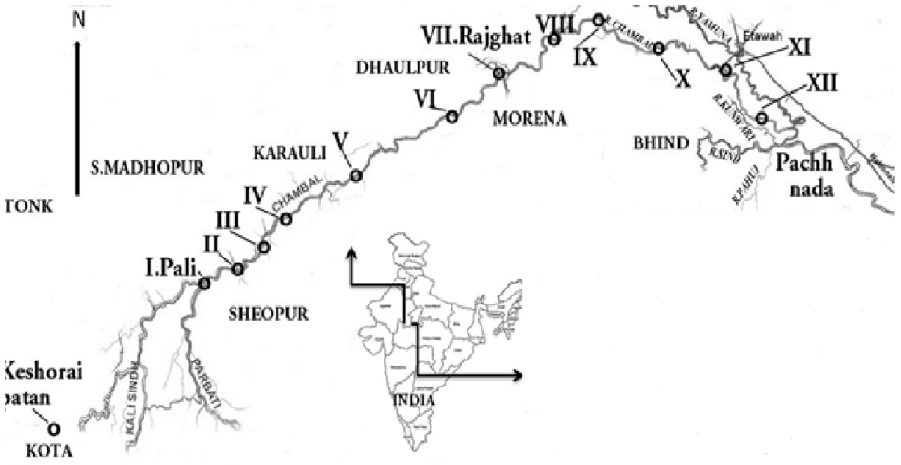

Figure 1. *Map of river Chambal showing study zones I (Pali-Rameshwar) to XII (Chakarnagar-Pachhnada).*

Table 1. Year-wise sightings of Grey Heron and Purple Heron in NCS from 1985-1986.

Year	Grey Heron		Purple Heron	
	Total	Mean ±SE	Total	Mean ±SE
1985	48	4±5.11	0	0
1986	74	6.17±6.59	0	0
1987	17	1.41±2.02	2	0.16±0.38
1988	56	4.67±4.27	0	0
1990	129	10.75±6.74	5	0.41±0.79
1993	215	17.92±13.36	8	0.66±0.77
1994	187	15.58±8.53	0	0
1996	174	14.5±10.35	6	0.5±0.67
1997	179	14.92±13.19	8	0.66±0.77
2003	244	20.33±12.7	4	0.333±0.65
2004	168	14±9.4	6	0.5±0.79
2005	164	13.67±14.94	3	0.25±0.62
2006	245	20.42±18.13	6	0.5±1
2007	358	29.83±63.71	4	0.333±0.77
2008	1022	85.17±11.4	4	0.333±0.65
2009	327	27.25±20.86	6	0.5±1
2010	207	17.25±17.33	8	0.66±1.23
2011	220	18.33±11.57	4	0.33±0.49
2012	141	11.75±10.04	2	0.16±0.38
2013	320	26.67±23.21	7	0.58±0.79
2014	256	21.33±10.58	5	0.41±0.79
2015	290	24.17±21.75	7	0.58±0.9
2016	277	23.08±12.75	9	0.75±0.75
Total	5318	443.16±242.6	104	8.66±4.39

study area were sand mining, bank site cultivation; bathing, water abstraction and fishing (Sing and Rao, 2017). For the purpose of the survey, the entire stretch of NCS was divided into twelve study zones (Table 2 and Figure 1), with zero point at Pali (ghat) downstream Parbati- Chambal confluence marks the beginning of study zone I and Pachhnada marks the end of study zone XII.

Data collection

Depending on the navigability of the river all observations were carried out by 2-3 observers dedicated to spotting bird flocks on banks and in the water employing the same methods as followed by Wetlands International (2010). Since any long-term study of water bird population trends necessitates bird counts following the same consistent methodology (Wetlands International 2010), systematically every year since 1985. On navigability of the river all observations were carried out either from hand-rowing boat, or from boat fitted with low noise 20HP outboard engine maintained at constant slow speed. Visual census method was used for estimation of the bird population with the help of field binocular and occasionally a spotting scope. Whereas, representative points of their respective locations were recorded using a GPS (Garmin). Observers on each side were independent and communicate with each other about birds to avoid double counts of these groups. Birds were photographed with the help of canon SLR camera. The birds were estimated and recorded according to the stretch (Table 2). For identification of birds the pattern by Grimmette *et al.* (2011) was followed. Count was not made on days with rain and strong wind. All information on habitat was recorded on field data sheets and later entered into an excel spread sheet for analysis. Rainfall data available on the website of the India Meteorological Department (IMD, 2017) for 11 districts in the Chambal region was consulted to correlate rainfall and heron sightings. The districts consulted in this work are close to the river Chambal or are in the catchment areas of rivers Kali-Sindh and Parbat (Sharma and Singh, 2018).

RESULTS AND DISCUSSION

A total 5422 individual of Herons were observed in 12 study zone of the river in which 5318 (Avg. 443.16±242.6) individuals were of Grey Heron and 104 (Avg.8.66±4.39) of purple Heron. The highest number 848 (Avg.70.7±57.1) of Grey Heron was observed in zone XI and that of Purple Heron 15 (Avg. 1.25±0.78) was sighted in zone III. Similarly, the highest density (22.32/km^2) of Grey Heron was observed in zone XI and least density (4.82/km) in zone I. Likewise, the highest density (0.75/km) of Purple Heron was observed in zone III and lowest (0.07/km) in zone VIII and X. It was observed that the count of Grey and Purple Heron in each study zones was not uniform indicating that certain zone was good habitat for Heron sighting. When we compare the year wise data of Heron sighting with several workers in NCS such as Sharma and Singh, (1986) recorded 11 individuals in 1984, 52 in 1985, and 59 in 1986. Similarly, Sharma *et al.* (1995 and 2013) recorded 187and 220 heron. The survey result shows that highest individual of Grey Heron was observed in the year 2008 with an average of 85.17±11.4 and least in the year 1987 (171.41±2.02). Similarly, the highest individual of Purple Heron was observed in the year 2016 with an average of 0.75±0.7. It was also observed in the present survey that no Purple Heron were recorded in the year 1985, 1986, 1988 and 1994 (Table 2). It was also indicating a positive relation with Heron sighting, with rainfall data available for 2006–16 particularly in downstream. Rainfall data indicates that if rainfall is low, large waterbirds have a tendency to find water sources such as rivers, and numbers in rivers will be high during those years. Conversely, the opposite usually occurs in a high-rainfall year (Singh and Sharma, 2018). Although, comparison of the results of the earlier surveys and the present one though not fully valid due to difference in survey bias and study site selection.

The results of present study and the earlier studies indicates that the birds mainly visit NCS largely for feeding purpose and the extent of nesting in the sanctuary is expected to be very low to nil (Sharma and Singh, 2018). One of the main limitations in Chambal is the non-availability of large tree. The prominent aquatic fauna in river Chambal shares similar habitat and similar level of anthropogenic pressure. Some of the stresses are due to fluctuating water flow, because of agricultural practices close to the river bank, impacts of intensive fishing activities, and illegal sand mining (Singh and Rao, 2017). Both aquatic and semi-aquatic vegetation were observed along the entire stretch of the Chambal River. The most frequent and unique floral families occurring in the sanctuary were Potamogetonaceae, Alismataceae and Hydrocharitaceae (Table 2). The information of bird's density and distribution in each zone, of the sanctuary together with the knowledge of other aspects of ecology and habitat requirements, will provide the baseline data, for the conservation of the sanctuary as a whole. Moreover, the identification of species -wise locality is a valuable aid because in future a researcher interested in a particular species (Singh and Sharma, 2022). The study indicates that river Chambal may have played a vital role in supporting bird's populations as well as giving alternate refuge for local migrants during years with extreme ecological conditions. The river appears to be a better bird's habitat with better availability of fish, aquatic vegetation and long stretches of flowing water along low-lying sandy banks (Sharma *et al*., 2018). Although, Gharial, Dolphin and turtle are well protected in the sanctuary, similar management plan for birds' conservation could be devised, considering the anthropogenic and natural stresses that the habitat is currently facing.

Table 2. Characteristic features of sampling sites with details on geo-features, sampling size, and the level of disturbances.

Zone	Location Latitude/Longitude	River length (km)	*Site description	**Disturbance
I	Pali-Ramshwar 25.517°N,76.346°E	22	Aquatic vegetation such as *Hydrilla verticillate*, *Aponogeton natans* and filamentous algae at few places. Along rocky bed at certain locations.	F/SM/AP/WA/FY
II	Ramshwar- Khirkhiri 25.544°N,76.437°E	15	Submerged vegetation like *Vallisneria*, *Spiralis*, *Hydrilla*, *Verticillata*, *Naias* minor, *Potamagaton crispus P. pectinatus* and *Sagittaria sagittifolia* were observed.	F/SQ/AP/WA/FY
III	Kharkhari- Baroli 26. 041°N,76.537°E	20	Rocky bed on both sides. Aquatic vegetation like *Vallisneria*, *Spiralis*, *Hydrilla*, *Potamagaton* were observed.	SQ/ F/ WA/FY
IV	Baroli-Atar 26. 063°N, 76.567°E	48	Rocky banks and sandy island on both sides. River bed is sandy, aquatic vegetation such as *Hydrilla*, *Vallisneria*, *Limnophyton* and algae were observed.	SQ/F
V	Atar-Sarsaini 26.154°N77.148°E	65	Mid river island Rocky and sandy river beds are present. No major aquatic vegetation except Algae, Water *hyacinth* and *Hydrilla* at few places.	S/F/ SQ/WA/AP/FY
VI	Sarsaini- Rajghat 26.299°N, 77.434°E	35	Sandy banks and rocky bed. Deep water pools at few locations. Submerged vegetation like *Vallisneria*, *Hydrilla*, *Verticillata*, *Naias* minor, *Potamagaton crispus* were observed.	SM/SQ/F/WA/FY
VII	Rajghat-BabusinghGhar 26.394°N,77.542°E	35	Sandy bank islands with deep and shallow water pools at certain places. *Hydrilla*, *Vallisneria spiralis* and Water hyacinth were observed.	SM/AP/F/WA/FY
VIII	BabusinghGher-Usedghat 26.442°N,78.063°E	40	Sandy river bed. *Hydrilla*, *Limnophyton obtusifolium*, *Ipomoea aquatic*, *Sagittaria sagittifolia were* observed at certain places.	SM/AP/WA/FY
IX	Usedghat -Ater 26.494°N, 78.125°E	40	Deep pools and sandy river bed. *Ipomoea aquatic*, *Hydrilla verticillata* were observed.	SM/WA/AP/FY
X	Ater-Barhi 26. 467°N, 78.314°E	40	Sandy river bed with deep pools up and downstream from this place. No major aquatic vegetation was observed from this site except *Hydrilla* and *Potamagton*.	SM/ F/WA/AP/FY
XI	Barhi- Chakernagar 26.417°N, 78.560°E	38	Deep water pool and sandy bank on both sides. *Hydrilla*, *Vallisneria* and *Potamagton*, *Saccharum spontaneous*, *Eichhornia crassipes* were observed.	F/WA/AP/FY
XII	Chakernagar-Pachhnada 26.327°N, 79.053°E	37	Deep pools and sandy river bed. *Hydrilla*, *Vallisneria* and *Potamagton* were observed.	F/WA/AP/FY

Note: **SM=sand mining, F=fishing, WA=water abstraction, AP=agriculture practice, SQ=stone querying, FY=ferry; * Site description adopted from: Singh and Rao, 2017.

Conclusion

The NCS is provided with incidental conservation benefits for avian diversity. The distribution pattern of Heron from Pali to Rajghat in the upstream and Rajghat-Pachhnada in the downstream indicates crucial habitat for birds' population. Low rainfall recorded in the adjoining area of Chambal River indicates a significantly increased in Heron sightings particularly downstream. It is important to continue the monitoring of water birds in the National Chambal Sanctuary.

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