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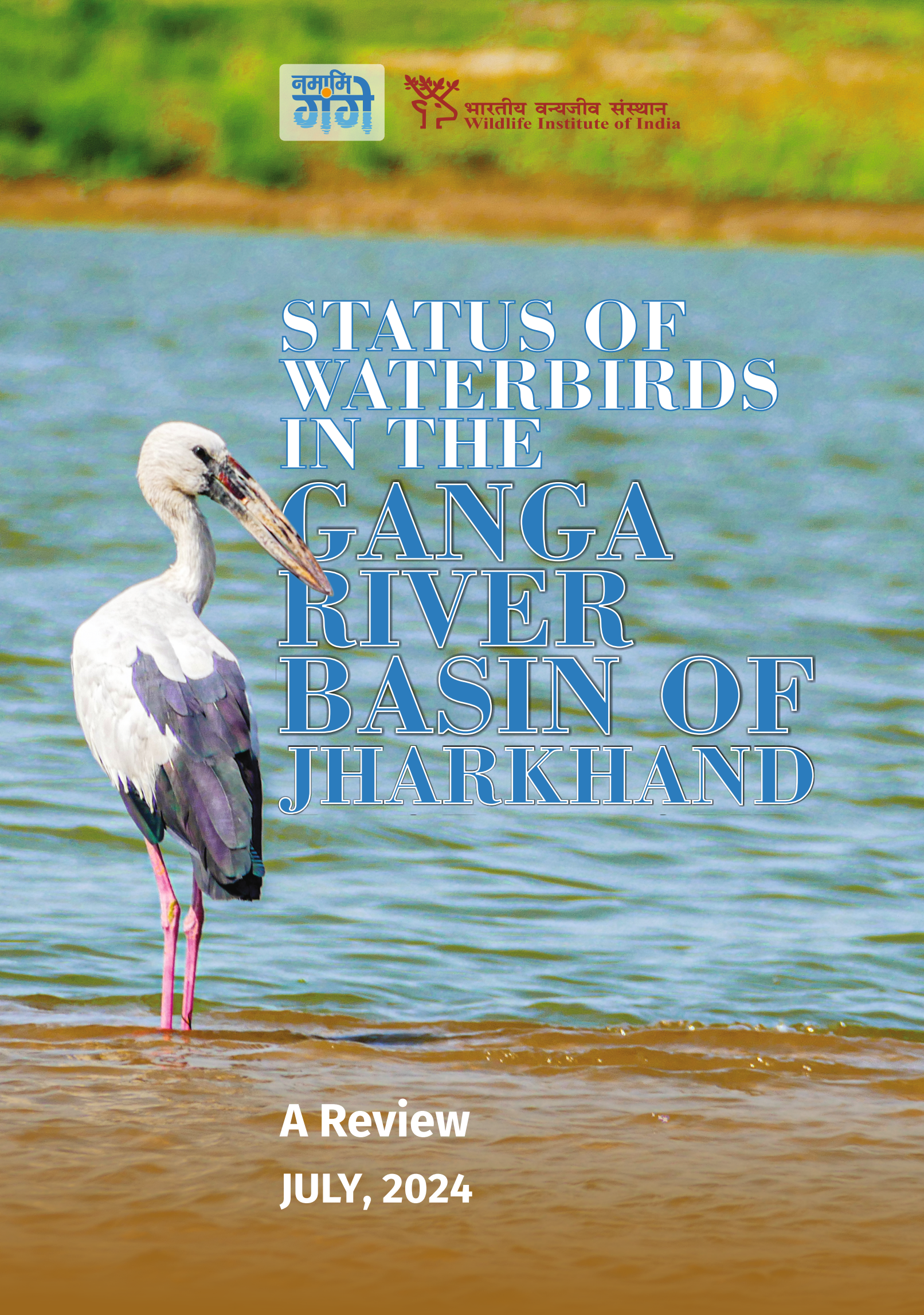

STATUS OF WATERBIRDS IN THE GANGA RIVER BASIN OF JHARKHAND

A Review

JULY, 2024



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PLANNING AND MANAGEMENT FOR AQUATIC SPECIES CONSERVATION AND MAINTENANCE OF ECOSYSTEM SERVICES IN THE GANGA RIVER BASIN FOR A CLEAN GANGA

Status of Waterbirds in the Ganga River Basin of Jharkhand - A Review
July 2024

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JHARKHAND, NAMED AFTER ITS DOMINANT SCRUB VEGETATION KNOWN AS 'JHARIES', HAS A RICH HISTORY DATING BACK TO ANCIENT TIMES, INHABITED BY INDIGENOUS TRIBES LIKE THE SANTHAL, MUNDA, ORAON, AND HO. POST-INDEPENDENCE, THE DEMAND FOR A SEPARATE STATE FOR TRIBAL AREAS OF BIHAR LED TO THE FORMATION OF JHARKHAND ON NOVEMBER 15, 2000. THE STATE, ADMINISTRATIVELY DIVIDED INTO 24 DISTRICTS, HAS SIGNIFICANT MINERAL RESOURCES SUCH AS COAL, IRON ORE, AND BAUXITE, WHICH DRIVE ITS ECONOMY. JHARKHAND IS ALSO CULTURALLY RICH, WITH UNIQUE TRADITIONS AND ART FORMS LIKE CHHAU AND SANTHAL DANCES.



EXECUTIVE SUMMARY

Geographically, Jharkhand is situated in eastern India, featuring a landscape mostly of the Chhotanagpur plateau and the lower Gangetic plain, with an altitudinal range from 6 to 1366 m above msl. It has diverse soil types, including red, laterite, black, red micaceous, and sandy soils. The climate is tropical monsoon, with distinct summer, monsoon, and winter seasons, and an average annual rainfall of 945-1297 mm. Land use is dominated by agricultural land and deciduous forests. Jharkhand's biogeographic zones include the Deccan peninsula and Gangetic plain, with significant forest cover and a variety of flora and fauna, including the state animal, Asian elephant, and the state bird, Asian koel. The state features important rivers and wetlands, including the Ganga, Son, and Damodar rivers, and notable protected areas like Betla National Park and Udhwa Lake Bird Sanctuary.

The literature review followed PRISMA guidelines and utilized various online databases to compile the status of waterbirds from Jharkhand's rivers and wetlands.

Total 48 studies were identified based on our objective, from which 17 studies were utilised for the synthesis of report. The review recorded 95 waterbird species in the Ganga River basin of Jharkhand, with Charadriiformes being the most dominant order and Anatidae the dominant family. The highest number of species were found in Udhwa Lake Bird Sanctuary. Among the species, three were endangered, four vulnerable, and six near threatened. Only six studies were indexed in NAAS listed journals, indicating a need for more rigorous research. Most studies used direct observation and nest counts, with some employing point counts and transects.

Despite the presence of numerous wetlands, systematic scientific studies on waterbirds are limited. Conservation threats include habitat disturbances, hunting, and poaching. Increased focus on ecological studies, particularly in critical habitats like the Udhwa Lake Bird Sanctuary, is necessary for better conservation of waterbird species.





1. INTRODUCTION

Jharkhand is named after the dominant scrub vegetation called locally as 'jharies' (Singh, 2012). The region of Jharkhand has a rich history dating back to ancient times. Indigenous tribes such as the Santhal, Munda, Oraon, and Ho inhabit the state (Shilee & Shailee, 2002). During the British rule, Jharkhand was a part of the Bengal Presidency, known for its valuable minerals that attracted the British for mining and industrial development. After India became independent in 1947, there was a growing demand for a separate state for the tribal areas of Bihar. This resulted in the formation of Jharkhand on 15th November, 2000 (Kumar, 2018). It is a landlocked state and shares its borders with Bihar to the north, Uttar Pradesh and Chhattisgarh to the west, Odisha to the south, and West Bengal to the east. The Jharkhand is administratively divided into 24 districts, 45 subdivisions and 264 blocks (Census of India, 2011). Out of 24 districts in the state, 17 districts fall under Ganga River basin (India-WRIS, 2014).

Jharkhand is known for its abundant mineral resources, particularly coal, iron ore, and bauxite. The mining industry plays a significant role in the state's economy, but has also led to environmental and social challenges, including displacement of tribal communities and ecological degradation (Kumar et al., 1999). Jharkhand is rich in cultural heritage, with its indigenous tribal communities preserving their unique traditions, languages, and art forms. Folk dances like Chhau, Jhumair, and Santhal dance are an integral part of the state's cultural identity (Ramakrishnan, 2023).

1.1 Geophysical attributes and Climate

Jharkhand is a state located in the eastern part of India. It is situated between 22°28' - 25°30' N latitude and 83°22'- 87°40' E longitude with altitudinal range between 6 and 1366 m above msl (Mahto et al., 2021). Total geographic area of the state is 79,714 km^2, of which about 23,605 km^2 (29.6%) is under forest. Physiography of Jharkhand is mostly of Indian Peninsular region (Chhotanagpur plateau) and small region of lower Gangetic plains. Geo-morphologically, Jharkhand is divided into nine regions (Department of Mines & Geology, Government of Jharkhand, 2011-2012):

i) **Ranchi plateau:** largest part of Chhotanagpur plateau with an average elevation of 700 m above msl.

ii) **Hazaribagh plateau:** lies to the north of Ranchi plateau with an average elevation of 610 m above msl.



iii) **Koderma plateau:** refrered as Hazaribagh lower plateau, elevated 243 m above the plains of Bihar

iv) **Pat region:** locally known as Netarhat plantation surface. Highest plateau region of Chhotanagpur plateau with an average elevation of 100 m above msl.

v) **Simdega-Singhbhum uplands:** characterized by rugged hills, steep hill sides, cliffs and narrow valleys.

vi) **Manbhum area:** Lowest step of the Chhotanagpur plateau with an average elevation of 300 m above msl.

vii) **Palamu plateau:** lies at a lower height then the surrounding areas of Chhotnagpur plateau and merges with the Pat region in the south.

viii) **Rajmahal plateau:** Rajmahal hills are formed by Mesozoic volcanic basaltic traps and Gondwana sediments in the form of Intra-Trappean Beds, which forms a plateau in the Sahebganj and Pakur districts of eastern Jharkhand.

ix) **Damodar valley:** this valley is between Ranchi and Hazaribagh plateau.

Jharkhand is rich in large deposits of coal, iron ore, bauxite, limestone, copper, mica, graphite and uranium (Department of Mines & Geology, Government of Jharkhand, 2011-2012). The major soil types in Jharkhand are red soil (Damodar valley and Rajmahal area), laterite soil (western part pf Ranchi, Palamu, parts of Santhal Parganas and Singhbhum), black soil (Rajmahal area), red micacious soil (Koderma, Jhumri Telaiya, Barkagaon and Mandar hills area) and sandy soil (Hazaribagh and Dhanbad). Soil in the region is formed by disintegration of rocks and stones (Shukla, 2021).

The state has a humid to sub-humid tropical climate. The summer season is from February to May, monsoon is from June to September and winter is from October to January. The average annual rainfall varies between 945-1297 mm with maximum rainfall between July and September. The temperature being 6 °C (minimum) in winter to 47 °C (maximum) in summer (Wadood & Kumari, 2009).

1.2 Demography

According to Census of India (2011), Jharkhand is the 13th most populous state in India. The state makes up about 3.5% of the country's population. The population density of the state is 414 per km^2. The total population of the state is 32,988,134, of which male and female are 16,930,315 and 16,057,819, respectively. The sex ratio in

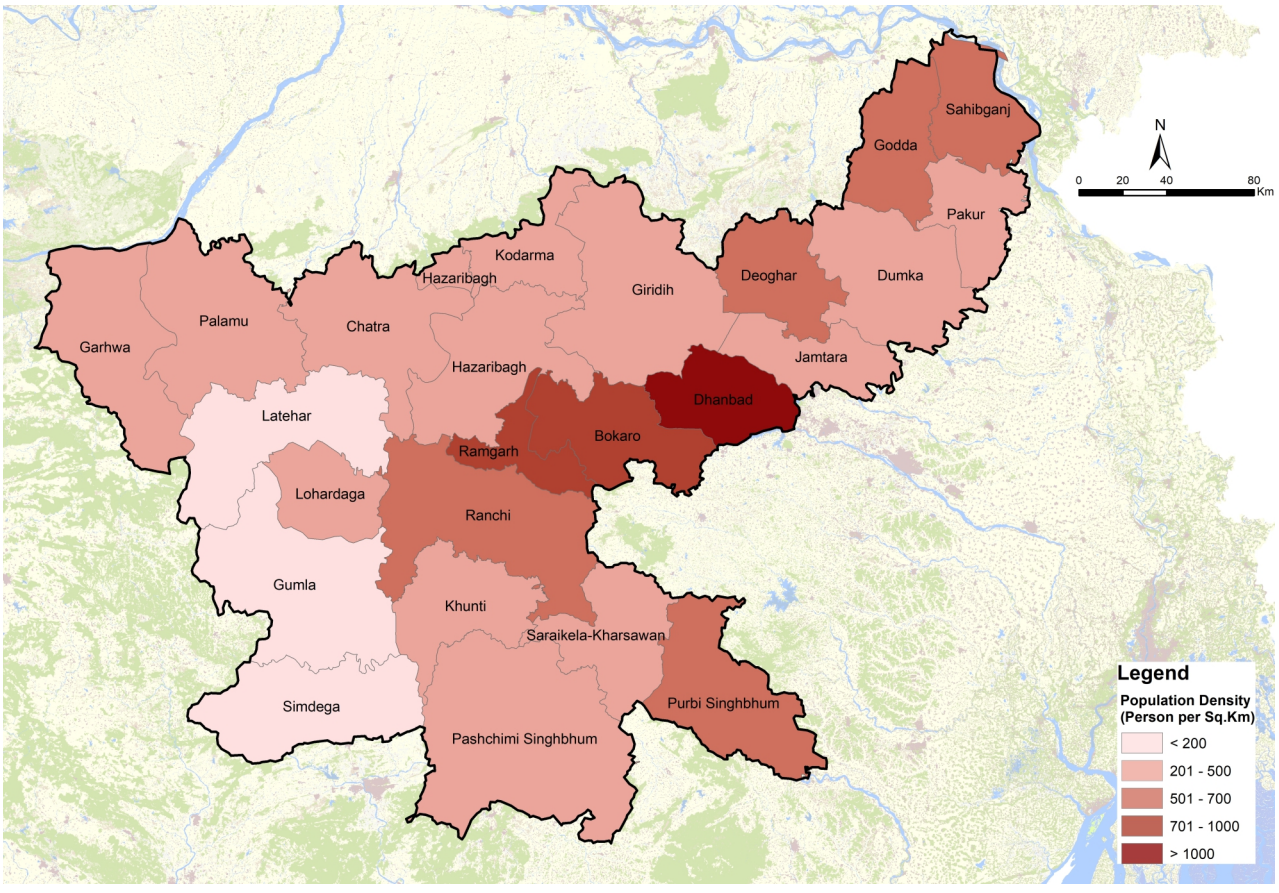


Figure 1.1 Population densities in the different districts of Jharkhand

Jharkhand is about 940 females per 1000 males. The state has a population growth rate of 22%. The literacy rate in the state is about 67%. The population consists of 28% Scheduled tribes, 12% Scheduled castes and 60% others. Scheduled tribes constitute one of the important segments of population of Jharkhand. There are 32 tribes in the state and these tribes in Jharkhand are classified on the basis of their cultural types. Out of 24 districts, 18 districts falls under Ganga River basin. The highest population density is in the district Dhanbad (1316 per km^2) followed by Bokaro (715 per km^2) and Ramgarh (708 per km^2) (Figure 1.1).

Table 1. Demographic details of the different districts of Jharkhand (Census of India 2011)

District Name	Population			Area (sq. km)	Person per sq. Km
	Persons	Male	Female		
Garhwa	13,22,784	6,83,575	6,39,209	4093.00	323
Chatra	10,42,886	5,33,935	5,08,951	3718.00	280
Kodarma	7,16,259	3,67,222	3,49,037	2540.00	282
Giridih	24,45,474	12,58,098	11,87,376	4962.00	493
Deoghar	14,92,073	7,75,022	7,17,051	2477.00	602
Godda	13,13,551	6,77,927	6,35,624	2266.00	580
Sahibganj	11,50,567	5,89,391	5,61,176	2063.00	558
Pakur	9,00,422	4,52,661	4,47,761	1811.00	497
Dhanbad	26,84,487	14,05,956	12,78,531	2040.00	1,316
Bokaro	20,62,330	10,72,807	9,89,523	2883.00	715
Lohardaga	4,61,790	2,32,629	2,29,161	1502.00	307
Purbi Singhbhum	22,93,919	11,76,902	11,17,017	3562.00	644
Palamu	19,39,869	10,06,302	9,33,567	4393.00	442
Latehar	7,26,978	3,69,666	3,57,312	4291.00	169
Hazaribagh	17,34,495	8,90,881	8,43,614	3555.00	488
Ramgarh	9,49,443	4,94,230	4,55,213	1341.00	708
Dumka	13,21,442	6,68,514	6,52,928	3761.00	351
Jamtara	7,91,042	4,04,830	3,86,212	1811.00	437
Ranchi	29,14,253	14,94,937	14,19,316	5097.00	572
Khunti	5,31,885	2,66,335	2,65,550	2535.00	210
Gumla	10,25,213	5,14,390	5,10,823	5360.00	191
Simdega	5,99,578	3,00,309	2,99,269	3774.00	159
Pashchimi Singhbhum	15,02,338	7,49,385	7,52,953	7224.00	208
Saraikela-Kharsawan	10,65,056	5,44,411	5,20,645	2657.00	401



1.3 Land Use Land Cover

Agricultural land (56.35%) and deciduous forest (27.04%) area dominant landscape of Jharkhand (Figure 1.2). Degraded and scrub forest and built up occupy 5.64% and 4.55% whereas wasteland occupies 4.1% and waterbodies occupies 2.32% of total geographic area (Table 1.1). Between 2008 and 2018, agriculture area increased by 2.99%, whereas wasteland reduced by 3.17%. A slight increase in built up (0.06%), deciduous forest (0.02%) and waterbodies (0.09%) was observed for the same time-period.



Table 1.1 Land use pattern in Jharkhand

S. No.	LULC Classes	Area (km^2) 2008-09	Area (%) 2008-09	Area (km^2) 2018-19	Area (%) 2018-19	Area change (%)
1	Built up	3580.75	4.49	3626.69	4.55	0.06
2	Agriculture	42532.36	53.36	44921.79	56.35	2.99
3	Deciduous forest	21541.17	27.02	21552.07	27.04	0.02
4	Degraded & Scrub Forest	4484.5	5.63	4493.09	5.64	0.01
5	Wasteland	5794.83	7.27	3268.42	4.1	-3.17
6	Waterbodies	1780.39	2.23	1851.94	2.32	0.09
	Total Area	79714	100	79714	100	

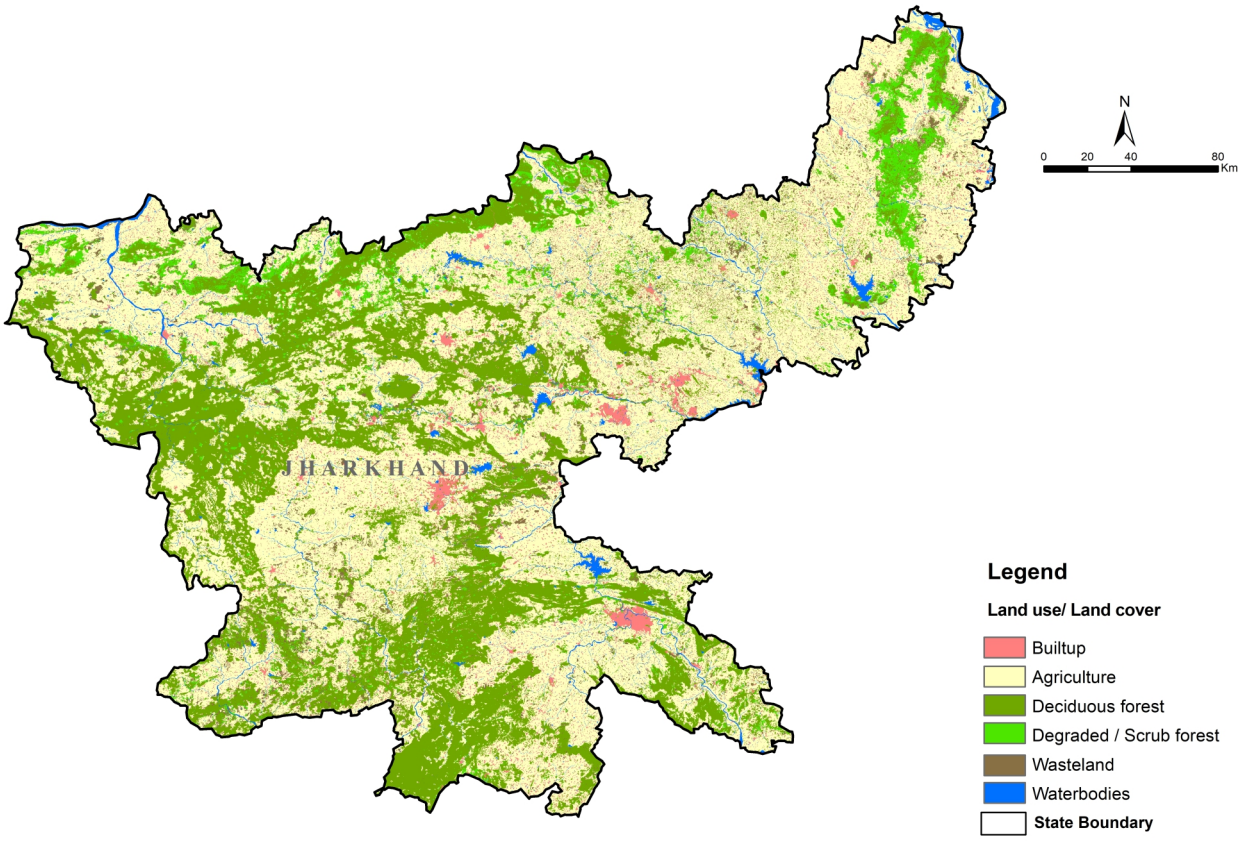


Figure 1.2 Land use Land cover of Jharkhand (Source: NRSC 2018-19)

1.4 Biogeography, Protected Areas, Flora and Fauna

Jharkhand falls under two biogeographic zones, Deccan peninsula (6B) and Gangetic plains (7B) (Rodgers & Pawar, 1988). The Recorded Forest Area (RAF) is 23,605 km^2 of the state's geographical area. Of the total forest area, 19,185 km^2 is under protected forests, 4,387 km^2 is reserved and 33 km^2 is unclassed forests (ISFR, 2019). According to Champion and Seth (1968) forest classification, forest types in Jharkhand may be divided into eight categories. Of which, Dry Peninsular Sal and Northern Dry Mixed Deciduous Forests cover almost 89% of the total forest area in the state (ISFR, 2019). The dominant floral species present in the state are *Tectona grandis*, *Terminalia* spp, *Shorea robusta, Anogeissus latifolia, Pterocarpus marsupium, Lagestroemia* spp., *Bauhinia racemosa, Buchanania lanzan, Cassia fistula* etc. (Champion & Seth, 1968).

Asian elephant (*Elephas maximus indicus*) is the state animal and Asian koel (*Eudynamys scolopaceus*) is the state bird. Other significant mammals' species found in the state are - Bengal tiger (*Panthera tigris*), four-horned antelope (*Tetracerus quadricornis*), Indian giant squirrel (*Ratufa indica centralis*), Indian grey wolf (*Canis lupus pallipes*) (Prakash et al., 2011; Saren et al., 2019; Mallick, 2020). Jharkhand hosts 209 species of avifauna (eBird, 2024). Among these, tufted duck (*Aythya fuligula*), great crested grebe (*Podiceps cristatus*), lesser adjutant (*Leptoptilos javanicus*) and black-headed gull (*Chroicocephalus ridibundus*) are the waterbirds with the 'highest Conservation Priority' in the state, and need earnest conservation attention (SoIB, 2023).

There are 12 Protected Areas (PAs) in the state, which include 11 wildlife sanctuaries and Betla National Park as the only National Park (Table 1.2; Figure 1.3). Gautam Buddha Wildlife Sanctuary, Udhwa Lake Bird Sanctuary, Koderma Wildlife Sanctuary, Hazaribagh Wildlife Sanctuary, Lawalong Wildife Sanctuary, Palamu Wildlife Sanctuary, Dalma Wildlife Sanctuary and Betla National Park are situated in the Ganga River basin of the state. Five Important Bird Areas (IBAs) are within Ganga River basin of the state (Table 1.3; Figure 1.4). Udhwa Lake Bird Sanctuary is an important wetland in the state with an area of 5.65 km^2.



Palamu Tiger Reserve

Table 1.2 Protected Areas in Jharkhand

Protected Areas	Area (km²)	Protected Areas	Area (km²)
Betla National Park	226.33	Mahuadanr Wolf Wildlife Sanctuary	63.26
Dalma Wildlife Sanctuary	193.22	Palamu Wildlife Sanctuary	752.94
Gautam Buddha Wildlife Sanctuary	121.14	Palkot Wildlife Sanctaury	182.83
Hazaribagh Wildlife Sanctuary	186.25	Parasnath Wildlife Sanctuary	49.33
Kodarma Wildlife Sanctuary	177.35	Topchanchi Wildlife Sanctuary	12.82
Lawalong Wildlife Sanctuary	63.26	Udhwa Lake Bird Sanctuary	5.65

Table 1.3 Important Bird Areas in the Ganga River basin of Jharkhand

Important Bird Areas	Area (km²)
Hazaribagh Wildlife Sanctuary	186.25
Palamu Tiger Reserve	1306.78
Udhuwa Lake Wildlife Sanctuary	5.65
North Karanpura Valley	1230
Tilaiya Dam	59.21



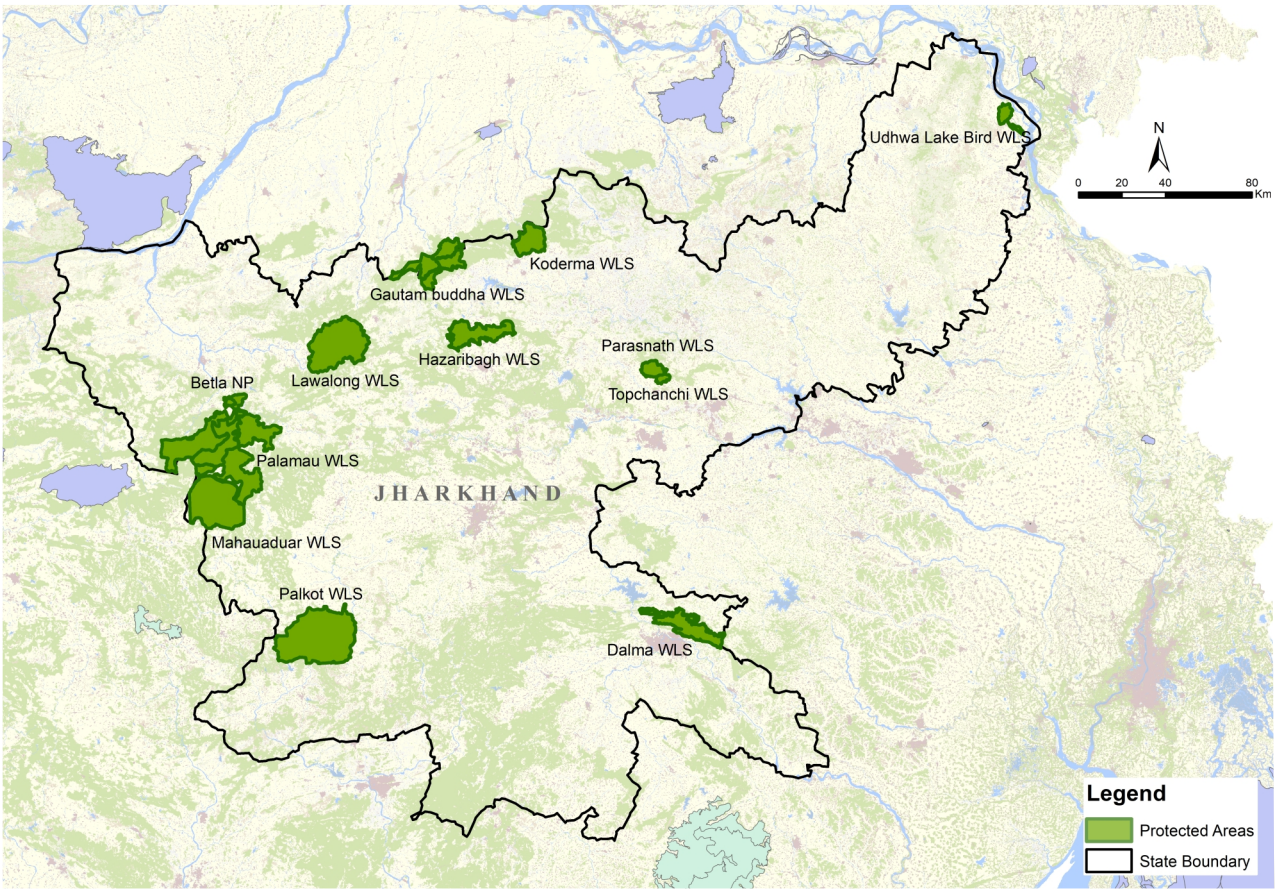


Figure 1.3 Protected Areas in Jharkhand

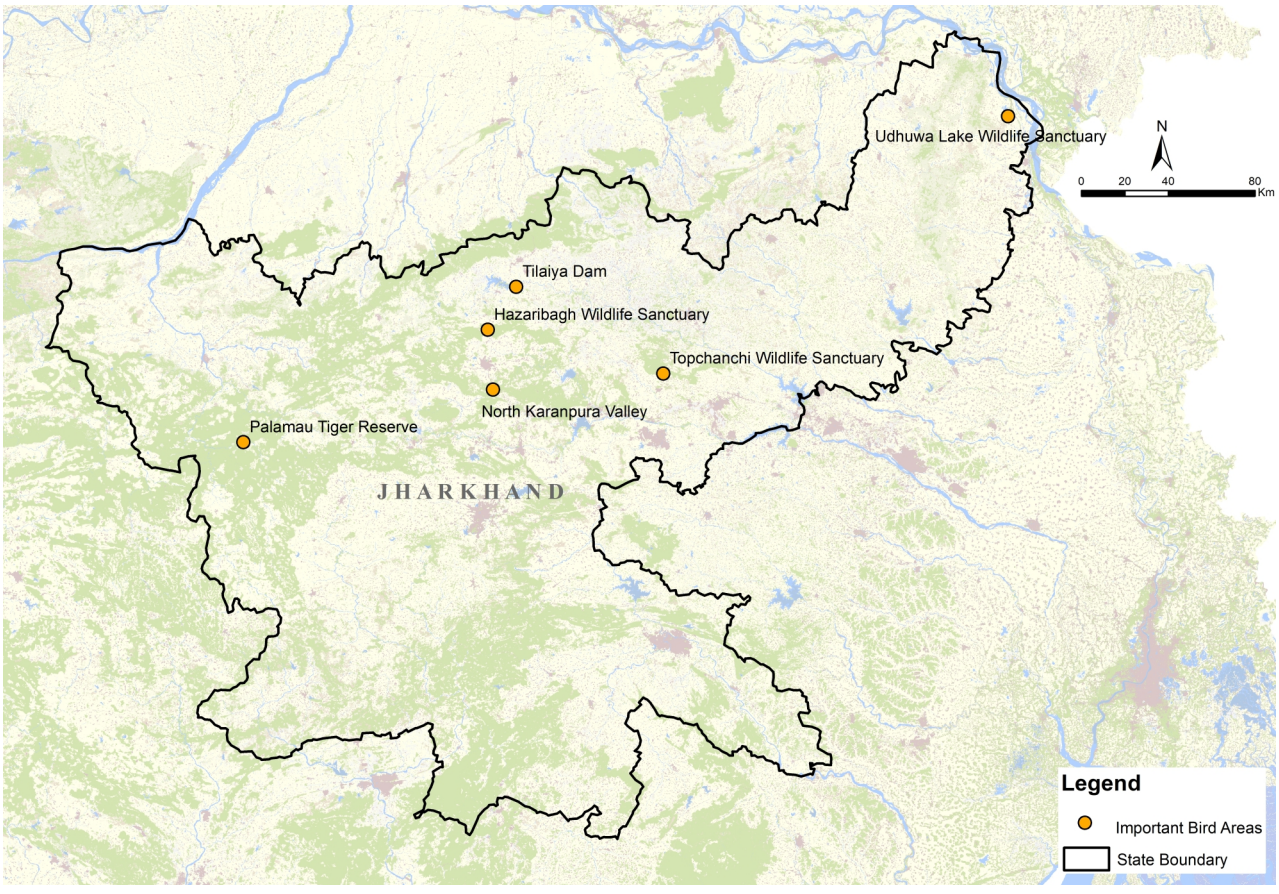


Figure 1.4 Important Bird Areas in the Ganga River Basin of Jharkhand

1.5 Status of Waterbodies in Jharkhand

The important rivers of the state are Ganga, Son, South Koel, Baitarni, Subarnarekha, Damodar, Ajay, Bagmari and Brahmani rivers. The total wetland area in the state is approximately 1700.51 km^2, which accounts for 2.1% of its geographical area. The Ganga River basin extends over 50389.14 km^2, which is 5.85% of basin's total area (India-WRIS, 2014). The major wetland types are river/stream, reservoir, and ponds. Most of the wetlands are rainfed in Jharkhand. According to project National Wetland Inventory Assessment (2011), nine categories of wetlands are identified in the state (Table 1.4). Within the Ganga River basin of the state, Sahibganj district has the 161.18 km^2 area of wetland. Within the district 113.78 km^2 area of wetland are river/stream type followed by 28.61 km^2 of lake, 12.04 km^2 riverine wetland and 7.3 km^2 of oxbow lake (NWIA, 2011). Udhwa lake Bird Sanctuary in Sahibganj district and Tilaiya dam in Koderma district are wetlands with Important Bird Areas (IBAs) designation (Table 1.3). Udhwa Lake Bird Sanctuary is recognized as a Wetland of International Importance (https://indianwetlands.in/). However, there are no Ramsar designated sites in Jharkhand.

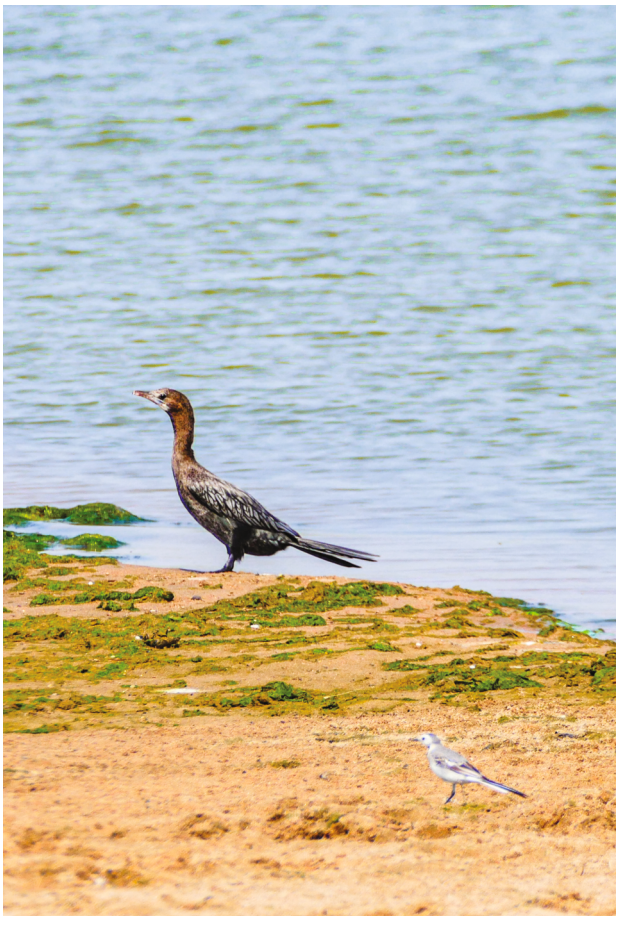
Table 1.4 Types of wetlands in Jharkhand (NWIA, 2011)

Wetland category	Total area (in ha)
Inland Wetlands- Natural	
Lakes/Ponds	3204
Ox-bow lakes/Cut-off meanders	83
Riverine wetlands	1629
Waterlogged	231
River/Stream	97743
Inland Wetlands- Man-made	
Reservoirs/Barrages	48177
Tanks/Ponds	5688
Waterlogged	61
Saltpans	8
Total Area	170051



2. METHODOLOGICAL FRAMEWORK FOR THE LITERATURE REVIEW

The review of literature was conducted following standard protocol of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Page et al. 2021). Extensive literature review was carried out to prepare the checklist of waterbirds from the rivers and wetlands of Jharkhand. Various online databases, web portals and websites such as Google scholar, Bibliography of South Asian Ornithology, Archive of Newsletter for Birdwatchers, ResearchGate (https://www.researchgate.net/) and Biodiversity Heritage Library for access of Journal of the Bombay Natural History & Society were used for the collection and compilation of information. Keywords related to the objective was used in various combinations to identify the related literature: "waterbirds + Jharkhand", "checklists + waterbirds + Jharkhand", "migratory birds + wetlands + Jharkhand", "Lake +birds + Jharkhand" "protected areas + important bird areas + bird + Jharkhand". To standardize the checklist, Indian Bird Checklist and Waterbirds of India (Gopi et al., 2018) was followed.



3. RESULTS

3.1 Trend in the Research on Waterbirds

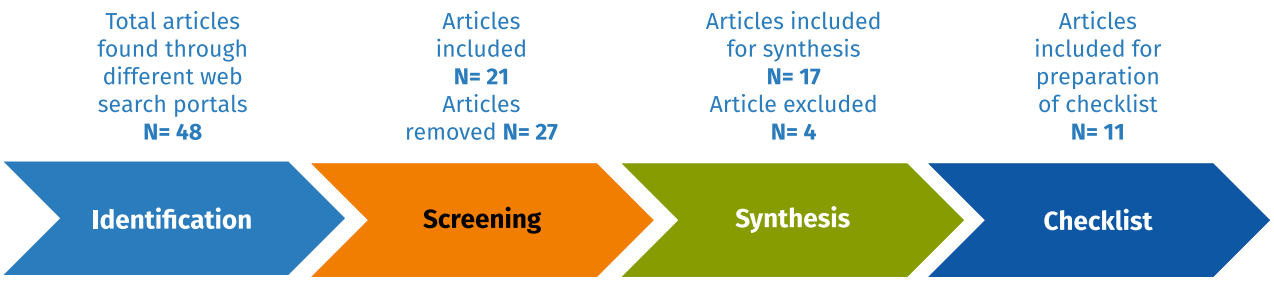


Figure 1.5 Systematic Literature Review following PRISMA protocol (Page et al., 2021)

Out of 48 outcomes, 21 studies were relevant to our objectives. From the available 21 relevant studies, 17 were used for the synthesis of the report and remaining four, were excluded as they were not part of the Ganga River basin (Figure 1.5). Out of these 17 studies, we used 11 studies for the checklist. The compiled list takes into account the conservation status of each waterbird according to the IUCN Red List and the IWPA (1972) Scheduled category (Annexure I). Only two studies were published during the colonial period, while 15 were published post-independence. Highest percent (31.25) of studies published between 1971-1980 primarily focused on terrestrial birds, with only a few records of waterbirds and water associated species (Figure 1.6). 88% of published studies documented the status and diversity of the terrestrial and waterbirds or water associated species in the state within the Ganga River basin of the state (Figure 1.7). The majority of studies were conducted in Ranchi (28.57%) and Hazaribagh (19.05%) districts (Figure 1.8).



Among the 17 studies, only six were indexed in National Academy of Agricultural Sciences (NAAS) rated journals, of which five were published in Journal of Bombay Natural History (JBNHS) and one in Journal of Threatened Taxa (JoTT). Three studies were published by Jharkhand Forest Department with collaboration of local non-government organisations, Indian Council of Forestry Research and education (ICFRE) and Kolhan Univeristy. One study was published by Wildlife Institute of India (WII). One study was conducted by Jharkhand Co-operative College. Only three studies conducted in the PAs of Jharkhand that is in Hazaribagh National Park and Udhwa Lake Bird Sanctuary.

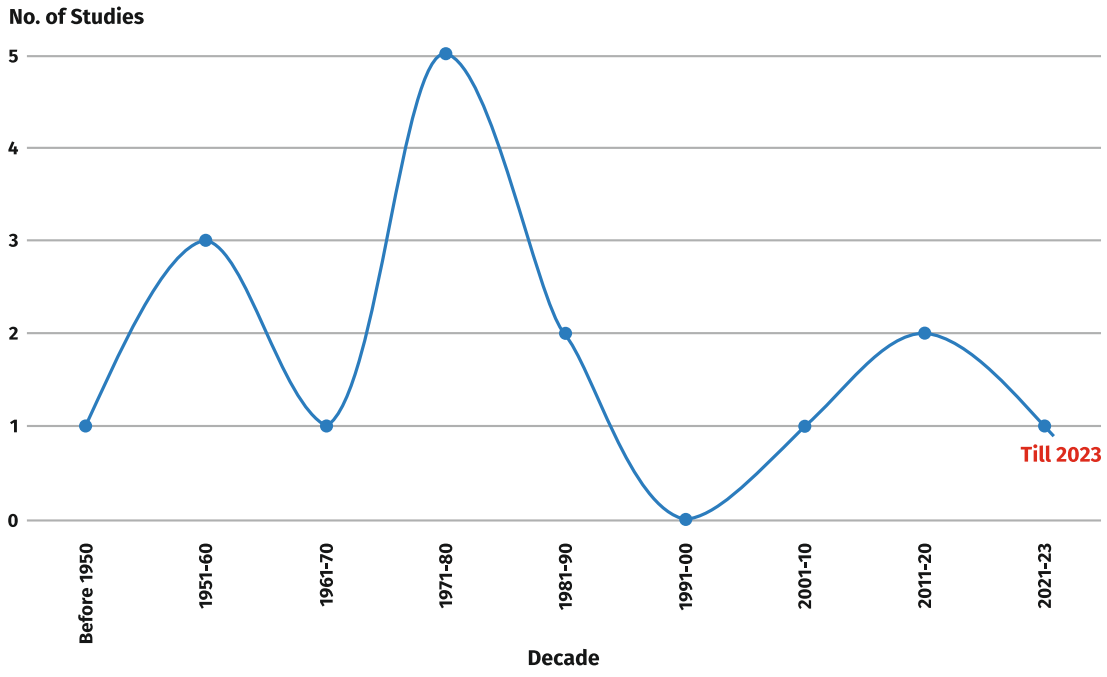


Figure 1.6 Decadal trends of published literature in Ganga River basin in Jharkhand state

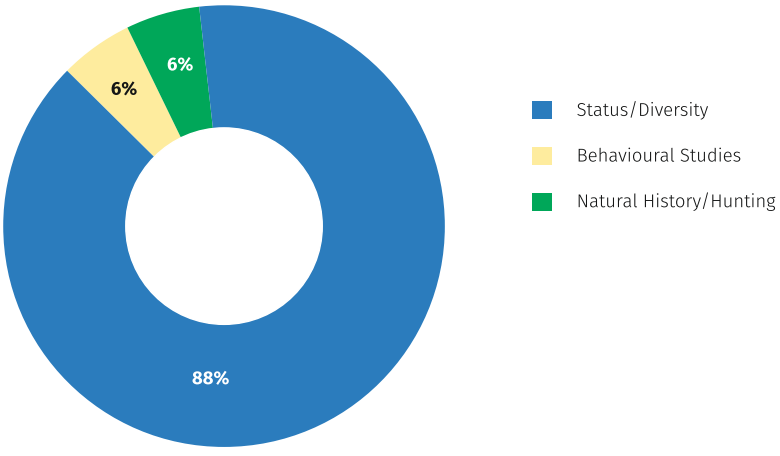


Figure 1.7 Type of studies published on waterbirds in the Ganga River basin of Jharkhand



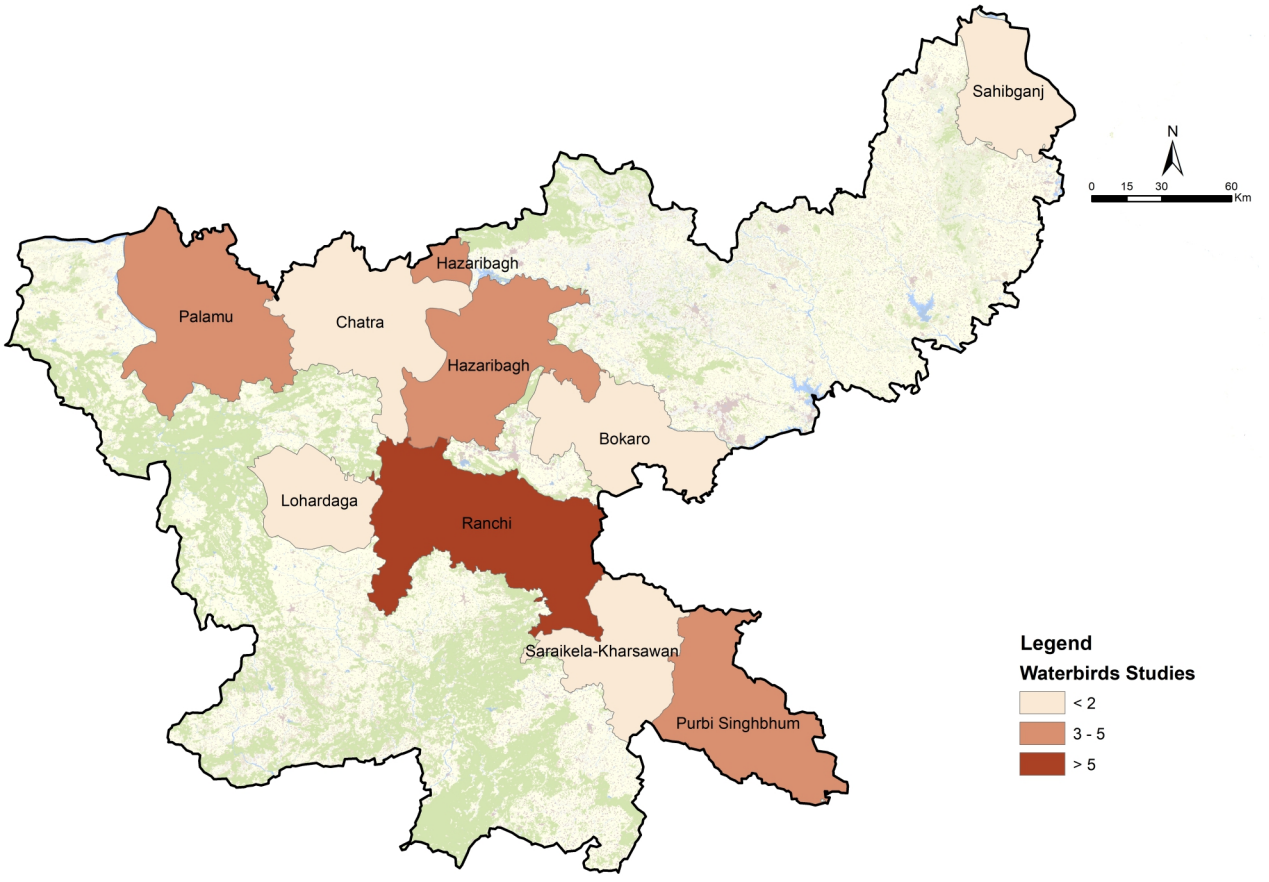


Figure 1.8 Waterbird studies conducted in the Ganga River Basin of the Jharkhand

3.2 Status of waterbirds in Ganga River basin of Jharkhand

Through the literature review, 95 waterbird species belonging to 10 orders and 20 families were recorded within the Ganga River basin of Jharkhand. Among these, the order Charadriiformes (29) has highest number of species followed by Anseriformes (16) and Pelecaniformes (13) (Figure 1.9). Anatidae (16) is the most dominant family followed by Scolopacidae (12) and Ardeidae (11) (Figure 1.10).

Among 17 studies, highest number of waterbird species were recorded from Udhwa Lake Bird Sanctuary, Sahibganj in the Ganga River basin of Jharkhand (Prakash et al. 2012), followed by 55 species in Lohardaga Forest Division (Xaxa et al., 2023) and 25 species in Dalma Wildlife Sanctuary (Verma, 2012). Of 95 species, three species were endangered (EN), four vulnerable (VU) and six were near threatened (NT) in the IUCN Red List Category. Pallas's fish eagle (*Haliaeetus leucoryphus*), greater adjutant (*Leptoptilos dubius*)



(Gmelin, 1789), black-bellied tern (*Sterna acuticauda*) are endangered species whereas sarus crane (*Antigone antigone*), woolly-necked stork (*Ciconia episcopus*), lesser adjutant (*Leptoptilos javanicus*) and river tern (*Sterna aurantia*) are vulnerable species found in the state (Table 1.6). Seven species were listed under Schedule-I and six were under Schedule-II of Indian Wild Life (Protection) Act, 1972.

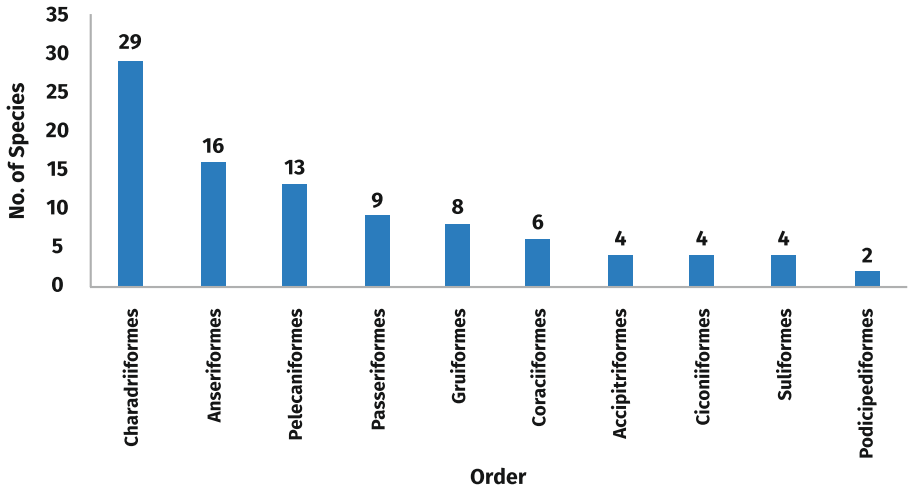


Figure 1.9 Order wise composition of waterbirds in Jharkhand

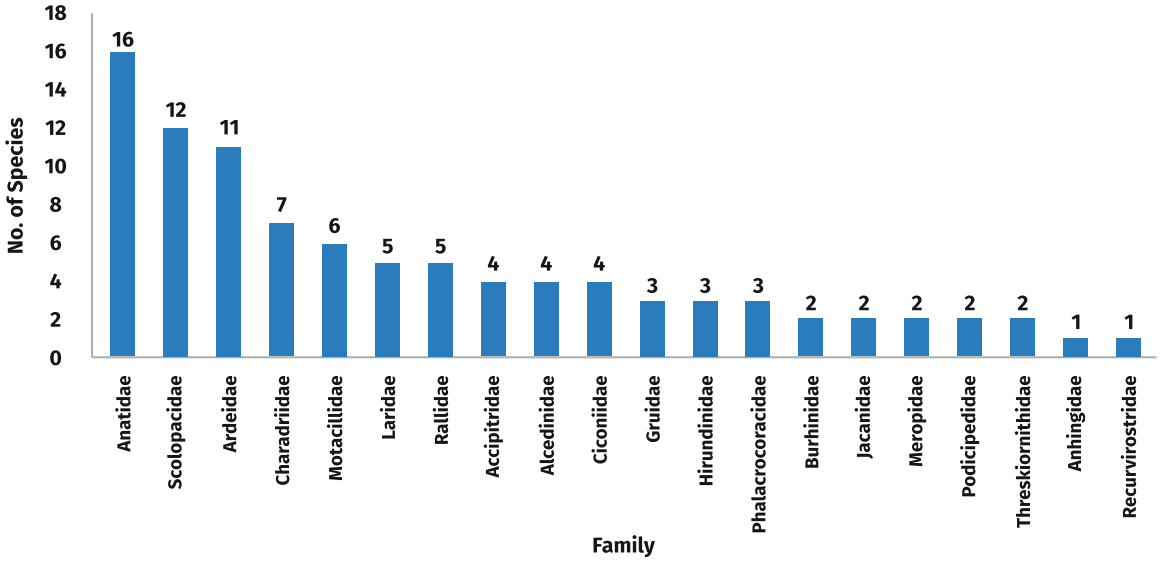


Figure 1.10 Family wise species composition of waterbirds in the Ganga River basin of Jharkhand

Table 1.6 List of Threatened Species in the Ganga River basin of Jharkhand

Common Name	Scientific Name	IUCN Status	IWPA (1972) Schedule
Pallas's fish eagle	*Haliaeetus leucoryphus* (Pallas, 1771)	EN	Sch I
Greater adjutant	*Leptoptilos dubius* (Gmelin, 1789)	EN	Sch I
Black-bellied tern	*Sterna acuticauda* (Gray, 1831)	EN	Sch I
Sarus crane	*Antigone antigone* (Linnaeus, 1758)	VU	Sch I
Woolly-necked stork	*Ciconia episcopus* (Boddaert, 1783)	VU	Sch II
Lesser adjutant	*Leptoptilos javanicus* (Horsfield, 1821)	VU	Sch I
River tern	*Sterna aurantia* (Gray, 1831)	VU	Sch I
Oriental darter	*Anhinga melanogaster* (Pennant, 1769)	NT	Sch II

Common Name	Scientific Name	IUCN Status	IWPA (1972) Schedule
Great-thick knee	*Esacus recurvirostris* (Cuvier, 1829)	NT	Sch II
Grey-headed fishing eagle	*Haliaeetus ichthyaetus* (Horsfield, 1821)	NT	Sch I
Eurasian curlew	*Numenius arquata* (Linnaeus, 1758)	NT	Sch II
Black-headed ibis	*Threskiornis melanocephalus* (Latham, 1790)	NT	Sch II
River lapwing	*Vanellus duvaucelii* (Lesson, 1826)	NT	Sch II

*EN – Endangered; VU – Vulnerable; NT - Near Threatened

3.3 Tools and Techniques

Most of the studies used direct field observation and nest count for recording species (Ball, 1875; Ara, 1951; 1953; 1960; 1966; 1971; 1974; 1976; Swami, 1971; Futehally, 1977; Ajana, 1981; Abdulali, 1983; Gupta, 2004; Verma, 2011; Prakash, 2012; Xaxa, 2023). Four studies used point count and transect for bird sampling (Verma, 2011; Prakash, 2012; Xaxa, 2023; Umar et al., 2023). However, only two studies included diversity indices and majority of the studies were confined to checklist.



4. CONSERVATION THREATS

The reported studies identified threats related to habitat such as noise pollution, human disturbances grazing pressure, agriculture expansion, riverbed sand mining (Ara, 1966; Gupta, 2004; Verma, 2012; Umar et al., 2023) and siltation of waterbodies (Futehally, 1977). Hunting and poaching of the waterbird species have been reported in the published studies (Ara, 1960; 1971; Gupta, 2004).



5. LIMITATIONS AND WAY FORWARD

The majority of the studies included for the synthesis of report were limited to checklists or the status and diversity of avifauna species, only one study reported the diversity indices and abundance status (Saeed el al., 2023). Out of 17 studies, only five were on water dependent and water associated species (Ara, 1951; Ara, 1974; Ajana, 1981; Abdulali, 1983; Gupta, 2004) whereas others primarily focused on forest/terrestrial birds. Most studies lacked proper ecological sampling techniques. No studies have been reported from any IBAs within the Ganga River basin in the state, except for Udhwa Lake. None of the studies were published in peer-reviewed journals listed in Science Citation Index (SCI). The state is abundant in minerals and has numerous mining sites, none of the studies reported mineral mining as a threat to waterbirds or their habitats, only one study reported riverbed sand mining as a threat to waterbird habitat in the Dalma Wildlife Sanctuary. Most of the studies have been conducted in forested areas having small natural or man-made waterbodies. Despite the presence of numerous dams, reservoirs, and a river network within the Ganga River basin of the state, there is a lack of systematic scientific studies on waterbirds and associated habitats.

Robust ecological studies are needed to understand the diversity, behaviour and population trend of waterbirds in the state. There is a need of studies focusing on threats and issues of habitat of waterbirds. The wetlands and small rivers in Jharkhand, particularly those in the Ganga River basin, supports numerous resident and migratory waterbird species. Despite of their significance, many of these habitats are not thoroughly studied. Given the presence of important wetlands and rivers that provides suitable habitat for waterbirds such as Udhwa lake Bird Sanctuary and their global importance, there is a need for Ramsar site. This requires thorough evaluation of the wetlands and their species based on ecological and scientific standards. Understanding the habitats, species distribution, the interaction between species and their habitats and the threats they face is crucial for effective conservation management.



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APPENDIX 1

Comprehensive Checklist of Waterbird species in the Ganga River Basin of Jharkhand state

S.No.	Order	Family	Common Name
1	Anseriformes	Anatidae	Northern shoveler
2	Anseriformes	Anatidae	Mallard
3	Anseriformes	Anatidae	Cotton pygmy-goose
4	Anseriformes	Anatidae	Tufted duck
5	Anseriformes	Anatidae	Ruddy shelduck
6	Anseriformes	Anatidae	Common teal
7	Anseriformes	Anatidae	Lesser-whistling duck
8	Anseriformes	Anatidae	African comb duck
9	Anseriformes	Anatidae	Gadwall
10	Anseriformes	Anatidae	Garganey
11	Anseriformes	Anatidae	Greylag goose
12	Anseriformes	Anatidae	Bar-headed goose
13	Anseriformes	Anatidae	Eurasian wigeon
14	Anseriformes	Anatidae	Northern pintail
15	Anseriformes	Anatidae	Red-crested pochard
16	Anseriformes	Anatidae	Fulvous whistling-duck
17	Podicipediformes	Podicipedidae	Little grebe
18	Podicipediformes	Podicipedidae	Great crested grebe
19	Gruiformes	Rallidae	Common moorhen
20	Gruiformes	Rallidae	White-breasted waterhen
21	Gruiformes	Rallidae	Common coot
22	Gruiformes	Rallidae	Grey-headed swamphen
23	Gruiformes	Rallidae	Little Crake
24	Gruiformes	Gruidae	Sarus crane
25	Gruiformes	Gruidae	Common crane
26	Gruiformes	Gruidae	Demoiselle Crane
27	Charadriiformes	Burhinidae	Great-thick knee
28	Charadriiformes	Burhinidae	Indian thick-knee
29	Charadriiformes	Recurvirostridae	Black-winged stilt
30	Charadriiformes	Charadriidae	Red-wattled lapwing
31	Charadriiformes	Charadriidae	Yellow-wattled lapwing
32	Charadriiformes	Charadriidae	River lapwing
33	Charadriiformes	Charadriidae	Little ringed plover
34	Charadriiformes	Charadriidae	Grey-headed lapwing
35	Charadriiformes	Charadriidae	Kentish plover
36	Charadriiformes	Charadriidae	Pacific golden plover
37	Charadriiformes	Jacanidae	Bronze-winged jacana
38	Charadriiformes	Jacanidae	Pheasant-tailed jacana

Scientific name	IUCN Status*	IWPA Status	References**
Spatula clypeata (Linnaeus, 1758)	LC	Sch II	a
Anas platyrhynchos (Linnaeus, 1758)	LC	Sch II	a
Nettapus coromandelianus (Gmelin, JF, 1789)	LC	Sch I	a, h
Aythya fuligula (Linnaeus, 1758)	LC	Sch II	g, k
Tadorna ferruginea (Pallas, 1764)	LC	Sch II	d, g, k
Anas crecca (Linnaeus, 1758)	LC	Sch II	d, g, k
Dendrocygna javanica (Horsfield, 1821)	LC	Sch II	g, h, j, k
Sarkidiornis melanotos (Pennant, 1769)	LC	Sch II	g, h, j
Mareca strepera (Linnaeus, 1758)	LC	Sch II	g, h, j, k
Spatula querquedula (Linnaeus, 1758)	LC	Sch II	g, h
Anser anser (Linnaeus, 1758)	LC	Sch II	g
Anser indicus (Latham, 1790)	LC	Sch II	g, k
Mareca penelope (Linnaeus, 1758)	LC	Sch II	h, k
Anas acuta (Linnaeus, 1758)	LC	Sch II	h, j, k
Netta rufina (Pallas, 1773)	LC	Sch II	h, k
Dendrocygna bicolor (Vieillot, 1816)	LC	Sch I	h
Tachybaptus ruficollis (Pallas, 1764)	LC	Sch II	a, g, h, I, j, k
Podiceps cristatus (Linnaeus, 1758)	LC	Sch II	k
Gallinula chloropus (Linnaeus, 1758)	LC	Sch II	b, h, j, k
Amaurornis phoenicurus (Pennant, 1769)	LC	Sch II	a, I, j, k
Fulica atra (Linnaeus, 1758)	LC	Sch II	a, h, k
Porphyrio poliocephalus (Latham, 1801)	LC	Sch II	h, k
Zapornia parva (Scopoli, 1769)	LC	Sch II	h
Antigone antigone (Linnaeus, 1758)	VU	Sch I	b
Grus grus (Linnaeus, 1758)	LC	Sch I	g
Grus virgo (Linnaeus, 1758)	LC	Sch I	g
Esacus recurvirostris (Cuvier, 1829)	NT	Sch II	e
Burhinus indicus (Salvadori, 1865)	LC	Sch II	k
Himantopus himantopus (Linnaeus, 1758)	LC	Sch II	i
Vanellus indicus (Boddaert, 1783)	LC	Sch II	a, b, c, f, h, I, j, k
Vanellus malabaricus (Boddaert, 1783)	LC	Sch II	b, c, I, k
Vanellus duvaucelii (Lesson, 1826)	NT	Sch II	a, e
Charadrius dubius (Scopoli, 1786)	LC	Sch II	c, d, h, I, k
Vanellus cinereus (Blyth, 1842)	LC	Sch II	h, j, k
Charadrius alexandrinus (Linnaeus, 1758)	LC	Sch II	k
Pluvialis fulva (Gmelin, 1789)	LC	Sch I	h
Metopidius indicus (Latham, 1790)	LC	Sch II	f, h, j, k
Hydrophasianus chirurgus (Scopoli, 1786)	LC	Sch II	h, j, k

S.No.	Order	Family	Common Name
39	Charadriiformes	Scolopacidae	Green sandpiper
40	Charadriiformes	Scolopacidae	Wood sandpiper
41	Charadriiformes	Scolopacidae	Common sandpiper
42	Charadriiformes	Scolopacidae	Little stint
43	Charadriiformes	Scolopacidae	Common snipe
44	Charadriiformes	Scolopacidae	Temminck's stint
45	Charadriiformes	Scolopacidae	Common snipe
46	Charadriiformes	Scolopacidae	Wood sandpiper
47	Charadriiformes	Scolopacidae	Common greenshank
48	Charadriiformes	Scolopacidae	Pintail snipe
49	Charadriiformes	Scolopacidae	Eurasian curlew
50	Charadriiformes	Scolopacidae	Marsh sandpiper
51	Charadriiformes	Laridae	River tern
52	Charadriiformes	Laridae	Whiskered tern
53	Charadriiformes	Laridae	Black-bellied tern
54	Charadriiformes	Laridae	Black-headed gull
55	Charadriiformes	Laridae	Brown-headed gull
56	Ciconiiformes	Ciconiidae	Woolly-necked stork
57	Ciconiiformes	Ciconiidae	Greater adjutant
58	Ciconiiformes	Ciconiidae	Asian openbill
59	Ciconiiformes	Ciconiidae	Lesser adjutant
60	Suliformes	Anhingidae	Oriental darter
61	Suliformes	Phalacrocoracidae	Great cormorant
62	Suliformes	Phalacrocoracidae	Indian cormorant
63	Suliformes	Phalacrocoracidae	Little cormorant
64	Pelecaniformes	Ardeidae	Indian pond heron
65	Pelecaniformes	Ardeidae	Cattle egret
66	Pelecaniformes	Ardeidae	Black-crowned night heron
67	Pelecaniformes	Ardeidae	Little egret
68	Pelecaniformes	Ardeidae	Striated heron
69	Pelecaniformes	Ardeidae	Great bittern
70	Pelecaniformes	Ardeidae	Cinnamon bittern
71	Pelecaniformes	Ardeidae	Great egret
72	Pelecaniformes	Ardeidae	Grey heron
73	Pelecaniformes	Ardeidae	Intermediate egret
74	Pelecaniformes	Ardeidae	Purple heron
75	Pelecaniformes	Threskiornithidae	Black-headed ibis
76	Pelecaniformes	Threskiornithidae	Red-naped ibis
77	Accipitriformes	Accipitridae	Pallas's fish eagle
78	Accipitriformes	Accipitridae	Grey-headed fishing eagle
79	Accipitriformes	Accipitridae	Brahminey kite
80	Accipitriformes	Accipitridae	Western marsh harrier

Scientific name	IUCN Status*	IWPA Status	References**
Tringa ochropus (Linnaeus, 1758)	LC	Sch II	b, h, j
Tringa glareola (Linnaeus, 1758)	LC	Sch II	b
Actitis hypoleucos (Linnaeus, 1758)	LC	Sch II	b, c, h, j, k
Calidris minuta (Leisler, 1812)	LC	Sch II	b, h
Gallinago gallinago (Linnaeus, 1758)	LC	Sch II	a, d
Calidris temminckii (Leisler, 1812)	LC	Sch II	d, h
Gallinago gallinago (Linnaeus, 1758)	LC	Sch II	h, k
Tringa glareola (Linnaeus, 1758)	LC	Sch II	h, k
Tringa nebularia (Gunnerus, 1767)	LC	Sch I	k
Gallinago stenura (Bonaparte, 1831)	LC	Sch II	h
Numenius arquata (Linnaeus, 1758)	NT	Sch II	h
Tringa stagnatilis (Bechstein, 1803)	LC	Sch II	h
Sterna aurantia (Gray, 1831)	VU	Sch I	a, d, k
Chlidonias hybridus (Pallas, 1811)	LC	Sch II	e
Sterna acuticauda (Gray, 1831)	EN	Sch I	d
Larus ridibundus (Linnaeus, 1766)	LC	Sch II	h, k
Larus brunnicephalus (Jerdon, 1840)	LC	Sch II	h
Ciconia episcopus (Boddaert, 1783)	VU	Sch II	a, b, c, d, h, k
Leptoptilos dubius (Gmelin, 1789)	EN	Sch I	d
Anastomus oscitans (Boddaert, 1783)	LC	Sch II	h, k
Leptoptilos javanicus (Horsfield, 1821)	VU	Sch I	h, k
Anhinga melanogaster (Pennant, 1769)	NT	Sch II	a
Phalacrocorax carbo (Linnaeus, 1758)	LC	Sch II	a, f, k
Phalacrocorax fuscicollis (Stephens, 1826)	LC	Sch II	a, h
Microcarbo niger (Vieillot, 1817)	LC	Sch II	a, d, h, j, k
Ardeola grayii (Sykes, 1832)	LC	Sch II	a, b, c, f, h, I, j, k
Bubulcus ibis (Linnaeus, 1758)	LC	Sch II	a, b, c, f, h, I, j, k
Nycticorax nycticorax (Linnaeus, 1758)	LC	Sch II	a, b, c, j, k
Egretta garzetta (Linnaeus, 1766)	LC	Sch II	a, c, I, k
Butorides striata (Linnaeus, 1758)	LC	Sch II	a
Botaurus stellaris (Linnaeus, 1758)	LC	Sch II	a
Ixobrychus cinnamomeus (Gmelin, 1789)	LC	Sch I	f
Ardea alba (Linnaeus, 1758)	LC	Sch II	h, I, k
Ardea cinerea (Linnaeus, 1758)	LC	Sch II	h, k
Ardea intermedia (Wagler, 1829)	LC	Sch II	h, j, k
Ardea purpurea (Linnaeus, 1766)	LC	Sch II	h, k
Threskiornis melanocephalus (Latham, 1790)	NT	Sch II	h, k
Pseudibis papillosa (Temminck, 1824)	LC	Sch II	h, I, k
Haliaeetus leucoryphus (Pallas, 1771)	EN	Sch I	a, d, g, h
Haliaeetus ichthyaetus (Horsfield, 1821)	NT	Sch I	a
Haliastur indus (Boddaert, 1783)	LC	Sch I	a, d, f, k
Circus aeruginosus (Linnaeus, 1758)	LC	Sch I	a, h, k

S.No.	Order	Family	Common Name
81	Coraciiformes	Alcedinidae	Pied kingfisher
82	Coraciiformes	Alcedinidae	Common kingfisher
83	Coraciiformes	Alcedinidae	White-breasted kingfisher
84	Coraciiformes	Alcedinidae	Blue-eared kingfisher
85	Coraciiformes	Meropidae	Chestnut-headed bee-eater
86	Coraciiformes	Meropidae	Blue-tailed bee-eater
87	Passeriformes	Hirundinidae	Barn swallow
88	Passeriformes	Hirundinidae	Red-rumped swallow
89	Passeriformes	Hirundinidae	Wire-tailed swallow
90	Passeriformes	Motacillidae	Western yellow wagtail
91	Passeriformes	Motacillidae	Grey wagtail
92	Passeriformes	Motacillidae	White wagtail
93	Passeriformes	Motacillidae	White-browed wagtail
94	Passeriformes	Motacillidae	Citrine wagtail
95	Passeriformes	Motacillidae	Water pipit

***CR:** Critically Endangered; **EN:** Endangered; **VU:** Vulnerable; **NT:** Near Threatened; **LC:** Least Concern

** [a] Ara, J. (1953); [b] Ara, J. (1966); [c] Ara, J. (1971); [d] Ara, J. (1976); [e] Ball, V. (1875); [f] Futehally, Z. (1977); [g] Gupta, H. S. (2004); [h] Prakash, S. et al. (2012); [i] Saeed, U. et al. (2023); [j] Verma, S. K. (2011); [k] Xaxa, S. et al. (2023)

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c. Ara, J. (1971). The avifauna of Harhap - a small isolated reserved forest in Bihar. Newsletter for Birdwatchers 11(11): 6-10.

d. Ara, J. (1976). A comparison of the birdlife of Kechki and Horhap in Bihar. Newsletter for Birdwatchers 16(4): 5-8.

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Scientific name	IUCN Status*	IWPA Status	References**
Ceryle rudis (Linnaeus, 1758)	LC	Sch II	b, c, h, k
Alcedo atthis (Linnaeus, 1758)	LC	Sch II	a, b, c, h, j, k
Halcyon smyrnensis (Linnaeus, 1758)	LC	Sch II	a, b, c, h, j, k
Alcedo meninting (Horsfield, 1821)	LC	Sch II	e
Merops leschenaulti (Vieillot, 1817)	LC	Sch II	c
Nyctyornis athertoni (Jardine & Selby, 1828)	LC	Sch II	e
Hirundo rustica (Linnaeus, 1758)	LC	Sch II	c, f, h, j, k
Cecropis daurica (Linnaeus, 1771)	LC	Sch II	c
Hirundo smithii (Leach, 1818)	LC	Sch II	d, k
Motacilla flava (Linnaeus, 1758)	LC	Sch II	a, b, h, j, k
Motacilla cinerea (Tunstall, 1771)	LC	Sch II	a, b, h, i
Motacilla alba (Linnaeus, 1758)	LC	Sch II	a, b, c, h, I, j, k
Motacilla maderaspatensis (Gmelin, 1789)	LC	Sch II	a, d, h, j, k
Motacilla citreola (Pallas, 1776)	LC	Sch II	e, h
Anthus spinoletta (Linnaeus, 1758)	LC	Sch II	h



NOTE



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