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Status of water birds in Haripura-Baur Reservoir, western Terai-Arc landscape, Uttarakhand, India

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Abstract: We surveyed water birds in Haripura-Baur Reservoir using total count method between 2013 and 2015. A total of 65 species were recorded representing eight orders and 14 families. Numerically Anatidae was the dominant family followed by Ardeidae and Scolopacidae. Common Coot *Fulica atra*, Red-crested Pochard *Netta rufina*, Common Pochard *Aythya ferina*, Gadwall *Anas strepera*, and Tufted Pochard *Aythya fuligula* were dominant species in the reservoir. The Shannon diversity of water birds was more or less consistent over the years and ranged between 2.56 (2013–14) and 2.23 (2015–16). The reservoir supports water birds having declining population trends globally (41% of species), including three Vulnerable (Asian Woollyneck *Ciconia episcopus*, Lesser Adjutant *Leptoptilos javanicus*, and Sarus Crane *Grus antigone* and four Near Threatened species (Oriental Darter *Anhinga melanogaster*, Painted Stork *Mycteria leucocephala*, Black-necked Stork *Ephippiorhynchus asiaticus,* and River Lapwing *Vanellus duvaucelii*). Bird species belong to four feeding guilds with the domination of the carnivore group. The current information is expected to serve as preliminary database of water birds for further research and monitoring.

Keywords: Bird community, diversity, freshwater, guild, richness, wetland.

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Author details: Tanveer Ahmed is PhD student in Department of Wildlife Sciences, AMU. He has experience of working on birds and mammals of Ladakh and preparing management plans. Dr. Harendra Singh Bargali, Deputy Director at The Corbett Foundation (TCF), has been involved in conceptualising and supervising various conservation oriented research projects at grassroots level in Terai-Arc Landscape for more than 12 years. Dr. Deepa Bisht is currently working on validation and documentation of aromatic plants of Kumaon Himalaya. Her area of expertise encompasses antifungal efficacy of various essential oils isolated from aromatic plants of high altitude regions against grain storage fungi. Gajendra Singh Mehra holds a masters degree in Entomology from Kumaun University and a MPhil in herpetology. Dr. Afifullah Khan is chairman in the Department of Wildlife Sciences, AMU. He has served as member on several important committees constituted by the Ministry of Environment & Forests, Government of India and WWF-India.

Author contribution: TA analysed the data and wrote the manuscript. HSB conceptualized the study and was part of data collection process. DB and GSM were also involved in data collection. AK supervised the data collection and analysis.

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INTRODUCTION

Terai-Arc Landscape (henceforth TAL)—a green belt, runs along the foothills of the Himalaya from the river Bagmati in the east to the Yamuna in the west. It represents two distinct zones, i.e., Bhabar tract and the Terai plains of India (Rodgers & Panwar 1988). TAL is a mosaic of various habitats such as forests, grasslands, riverbeds, swamps, plantations, scrubland and wetlands that sustains birds representing Himalayan and Gangetic plain affinities (Rahmani et al. 1989; Pandey et al. 1994; Javed et al. 1999; Naoroji 1999; Dhakate et al. 2008).

The wetlands in the western part of TAL serve as an important habitat for resident and migratory birds (Dhakate et al. 2008; Bhattacharjee & Bargali 2013). Additionally, bird species categorized under the various categories of IUCN Red List of Threatened Species, viz., Darter *Anhinga melanogaster*, Painted Stork *Mycteria leucocephala*, Black-necked Stork *Ephippiorhynchus asiaticus*, Lesser Adjutant *Leptostilos javanicus*, Sarus Crane *Grus antigone*, and River Tern *Sterna aurantia* find home in these water bodies. Near Threatened migratory bird species such as Black-tailed Godwit *Limosa limosa* and Ferruginous Duck *Aythya nyroca* regularly winter in these wetlands (Bhattacharjee & Bargali 2013; Bhatt et al. 2014). Most importantly, the Bean Goose *Anser fabalis*, vagrant bird species which breed in the high Arctic and winter in temperate and sub-tropical regions (BirdLife International 2016) have been reported from these wetlands (Bhattacharjee 2013). The occurrence of these species highlight the significance of such wetlands for conservation of water birds, however, these water bodies do not have any legal conservation status and are basically managed for irrigation purposes. Furthermore, these wetlands are used for commercial fishing which not only reduces food availability to many native fish and bird species but is also a major cause of disturbance to the water birds.

Water birds assemblage in western TAL has been reported from Tumariya Reservoir (Bhattacharjee & Bargali 2013), Bheemgora barrage (Bhatt et al. 2014), Hathnikund barrage (Tak et al. 2010), and the water bodies of Corbett landscape (Dhakate et al. 2008). Information on the status of the water bird assemblage of Haripura-Baur Reservoir is not known and the present study is a pioneer attempt towards systematic data collection on water bird assemblage here. It is expected that the information will serve as a preliminary database of water birds for further research, monitoring and management.

MATERIALS AND METHODS

Study area

Haripura-Baur Reservoir (HBR) (29.135^{0}N & 79.294^{0}E) are earthen embankment dams located approximately 15km from Bazpur in Udham Singh Nagar District of Uttarakhand (Fig. 1; Image 1). HBR is a man-made wetland constructed in 1974 primarily for the purpose of storing water for irrigation purposes. Haripura having a maximum height of approximately 17m and length of 10km is built on Baur and Kakrala rivers, whereas, Baur with a maximum height of about 11m and length of 8km is built on Bhakhara River. Both reservoirs are adjacent to each other and spread over an area of 294.4km^2. Considering the limited height and primary role of providing water for irrigation these dams are rarely filled with water to the maximum capacity leaving shallow water areas towards the margins. Mostly the reservoir is devoid of any vegetation; however, the shallow water level at the eastern, western and northern periphery of HBR support aquatic free floating, submerged and semi-submerged plants such as *Ipomoea aquatica*, *Saccharum spontaneum*, *Typha* sp., *Polygonum barbatum*, *Vallisnaria* spp., *Hygrophila polysperma, Sagittaria sagittifolia, Phragmites karka*, *Azolla pinneta, Eichhornia crassipes, Nymphaea* spp., *Nymphoides cristata*, and *Stellaria media*. The southern edge of these dams is earthen embankment with a motorable road. Some introduced fish fauna in the reservoir includes *Catla catla* (Catla), *Labeo rohita* (Rohu), *Sperata seenghala, Hypophthalmichthys molitrix* (Silver Carp), *Cirrhinus mrigala* (Nain), *Channa marulius* (Saur), *C. striatus* (Shaul), and *Wallago attu* (Lachi).

Methods

Information on water birds was collected by visiting the wetland fortnightly during November–February (winter season) between 2013–14 and 2015–16. Birds were counted by applying total count method following Koskimies & Vaisanen (1991). Since it was not possible to cover the entire reservoir from a single point, water birds were counted by selecting more than one point. Species were recorded along with their numbers between 07.00h and 12.00h. Field observation were not carried out during adverse environment condition. Identification of species was based on Grimmett et al. (1998). Conservation status and global population trend of water birds in HBR was determined from IUCN (2016).

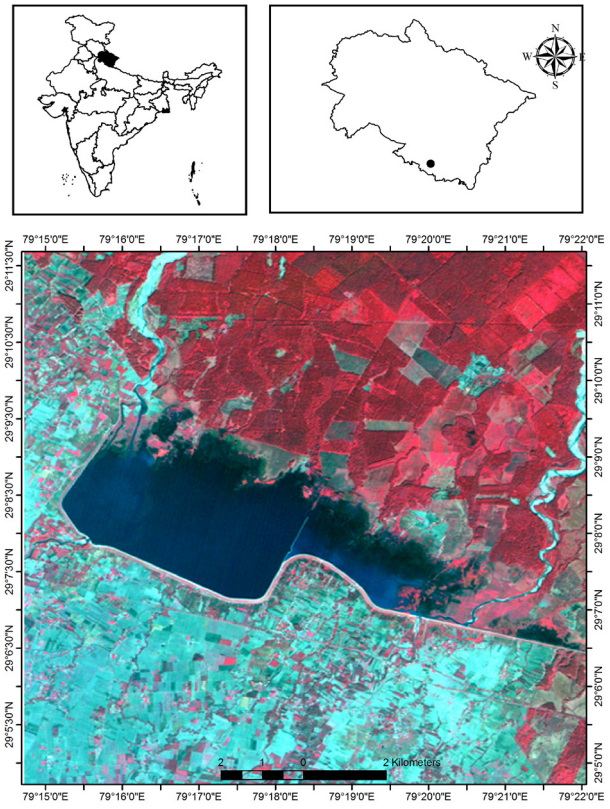

Figure 1. Haripura-Baur Reservoir in Uttarakhand, India.

Data analysis

Water bird community structure was determined through calculating various metrics such as Shannon's diversity (H), Margalef's richness (S), and evenness. Species richness represents totally unique species of water birds detected in all surveys. Shannon's diversity index describes diversity of species taking into account abundance of species. Evenness is an index of distribution of individuals among species. All the bird community indices were evaluated using Past 3.0 software (Hammer et al. 2017).

Maximum individuals of a bird species in a year were considered to determine the abundance of a species over a year. All the individuals of water birds sighted during various years were pooled to determine the abundance of bird species and birds were ranked into categories following Sultana & Khan (2000): Rare = 1–10 individuals; Common= 11–100 individuals; Abundant = 101–500 individuals; Very abundant = >500 individuals.

The mean rank abundance score for each species was calculated to assess the overall abundance in HBR. Birds were categorised into various feeding guilds following Ali (2002).

Image 1. Haripura-Baur Reservoir, Udham Singh Nagar District, Uttarakhand. © Harendra Singh Bargali.

RESULTS

A total of 65 species of water birds belonging to eight orders and 14 families were recorded in HBR. Of the recorded species, 36 species (55%) were resident, and 29 species (45%) were winter visitors. Among families, Anatidae was the dominant family with the maximum number of species (15 species) followed by Ardeidae (11 species), Scolopacidae and Ciconiidae (6 species each). Gruidae was the least represented family with only one species (Fig. 2). HBR support three Vulnerable species, viz., Woolly-necked Stork, Lesser Adjutant & Sarus Crane, and four Near Threatened species, viz., Darter, Painted Stork, Black-necked Stork & River Lapwing.

The Shannon diversity of water birds was more or less consistent over the years. It was 2.56, 2.45, and 2.23 during the year 2013–14, 2014–15, and 2015–16 respectively. Abundance of water birds was maximum (n=18,134 birds) during 2014–15 and minimum (n=8,452 birds) during 2013–14 (Table 1). Numerically, Common Coot (2,320–6,527 individuals), Red-crested Pochard (1,349–3,413 individuals), Common Pochard (937–2,692 individuals), Gadwall (942–1,099 individuals), and Tufted Pochard (527–1,191 individuals) were very abundant in the reservoir (Table 2). Species such as Oriental Darter (1–1), Painted Stork (9–10), Asian Woollyneck (5–11), Black-necked Stork (1–4), Lesser Adjutant (1), Sarus Crane (4–8), and River Lapwing (4–22) were rare in the reservoir. The reservoir supports a high proportion of water birds (41%) having a declining population trend globally (Fig. 3, Table 2).

Table 1. Status of birds in Haripura-Baur Reservoir, Uttarakhand, India.

Year	No. of species	Total individuals	Diversity	Richness	Evenness
2013–14	50	8452	2.52	5.41	0.24
2014–15	58	18134	2.45	5.71	0.20
2015–16	49	18098	2.23	4.89	0.19

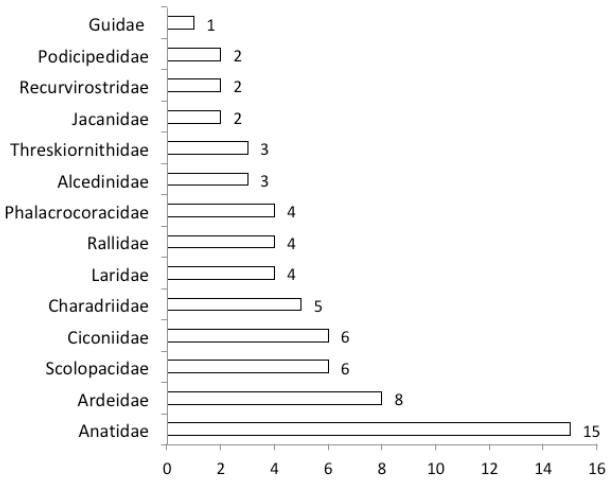

Figure 2. Species under various families in Haripura-Baur Reservoir, Uttarakhand, India.

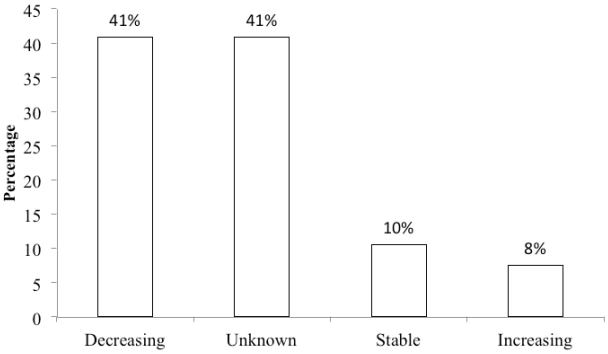

Figure 3. Global population trend of water bird species occurring in Haripura-Baur Reservoir, Uttarakhand, India.

Classification of observed species among feeding guilds revealed that the reservoirs support water birds belonging to four dietary guilds (Table 3). The carnivore guild was the dominant with maximum diversity (H=2.387) and richness (S=4.347). This guild was followed by omnivores (H=1.857, S=1.364). Insectivore birds were found least diverse and rich (H=0.928, S=0.73).

DISCUSSION

The wetlands in western TAL has been a regular winter abode for a large number of resident and migratory water birds (Dhakate et al. 2008; Bhattacharjee & Bargali 2013). HBR constructed primarily for the purpose of regulating water for irrigation purposes also supports water birds; however, there has been less focus on water birds visiting the reservoirs and on their conservation or management. The species recorded suggest that HBR support almost 50% of water birds species recorded from western TAL (Dhakate et al. 2008), and 23% of water bird species reported from India (Gopi et al. 2014). Almost half of the species recorded in HBR were migratory. Bhattacharjee & Bargali (2013) and Dhakate et al. (2008) found a similar proportion of migrant species in the wetlands of western TAL.

Family Anatidae was dominant in HBR. Studies conducted in wetland ecosystem in western TAL also advocated the dominancy of Anatidae (Dhakate et al. 2008; Kumar & Gupta 2009; Tak et al. 2010; Bhattacharjee

Table 2. Status and abundance of water birds in Haripura-Baur Reservoir, Uttarakhand, India.

Family	Species	Status	Global population trend	IUCN	Abundance 2013	Abundance 2014	Abundance 2015	Mean abundance Score
Podicipedidae	Little Grebe *Tachybaptus ruficollis*	R	D	LC	50	68	81	2
	Great Crested Grebe *Podiceps cristatus*	WV	UN	LC	143	542	466	3
Phalacrocoracidae	Great Cormorant *Phalacrocorax carbo*	R	IN	LC	12	74	56	2
	Little Cormorant *Phalacrocorax niger*	R	UN	LC	236	359	224	3
	Indian Cormorant *Phalacrocorax fuscicollis*	R	UN	LC	0	0	5	1
	Oriental Darter *Anhinga melanogaster*	R	D	NT	1	1	1	1
Ardeidae	Indian Pond Heron *Ardeola grayii*	R	UN	LC	8	9	15	1
	Purple Heron *Ardea purpurea*	R	D	LC	5	7	3	1
	Grey Heron *Ardea cinera*	R	UN	LC	8	14	7	1.
	Cattle Egret *Bubulcus ibis*	R	IN	LC	88	26	195	2
	Little Egret *Egretta garzetta*	R	IN	LC	54	83	69	2
	Intermediate Egret *Mesophoy xintermedia*	R	D	LC	37	54	30	1
	Great Egret *Casmerodius albus*	R	UN	LC	2	0	4	2
	Yellow Bittern *Ixobrychus sinensis*	R	UN	LC	0	0	1	1
Ciconiidae	Painted Stork *Mycteria leucocephala*	R	D	NT	0	10	9	1
	Asian Openbill *Anas oscitans*	R	UN	LC	94	53	169	2
	Black Stork *Ciconia nigra*	WV	UN	LC	0	5	2	1
	Asian Woollyneck *Ciconia episcopus*	R	D	VU	5	9	11	1
	Black-necked Stork *Ephippiorhynchus asiaticus*	R	D	NT	0	1	4	1
	Lesser Adjutant *Leptotilos javanicus*	R	D	VU	0	1	0	1
Threskiornithidae	Red-naped Ibis *Pseudibis papilosa*	R	D	LC	84	36	46	2
	Glossy Ibis *Plegadis falcinellus*	R	D	LC	20	12	0	2
	Eurasian Spoonbill *Platalea leucorodia*	R	UN	LC	2	0	0	1
Anatidae	Lesser-whistling Duck *Dendrocygna javanicus*	R	D	LC	0	12	0	1
	Graylag Goose *Anser anser*	WV	IN	LC	72	2	7	1
	Bar-headed Goose *Anser indicus*	WV	D	LC	28	12	34	2
	Ruddy Shelduck *Tadorna ferruginea*	WV	UN	LC	171	760	50	3
	Cotton Pygmy-goose *Nettapus coromandelianus*	R	ST	LC	62	137	1052	3
	Mallard *Anas platyrhynchos*	WV	D	LC	74	22	387	2
	Indian Spot-bill Duck *Anas poecilorhyncha*	R	D	LC	28	181	47	2
	Northern Pintail *Anas acuta*	WV	D	LC	355	380	1145	3
	Garganey *Anas querqueduedula*	WV	D	LC	5	0	0	1
	Northern Shoveler *Anas clypeata*	WV	D	LC	12	128	2	2
	Common Pochard *Aythya ferina*	WV	UN	LC	937	2692	1535	4
	Ferruginous Pochard *Aythya nyroca*	WV	D	LC	91	1021	103	3
	Red-crested Pochard *Netta rufina*	WV	UN	LC	1349	3011	3413	4
	Tufted Duck *Aythya fuligula*	WV	ST	LC	527	1191	661	4
	Gadwall *Anas strepera*	WV	UN	LC	969	942	1099	4
	Eurasian Wigeon *Mareca penelope*	WV	D	LC	95	46	97	2

Family	Species	Status	Global population trend	IUCN	Abundance 2013	Abundance 2014	Abundance 2015	Mean abundance Score
Gruidae	Sarus Crane *Grus antigone*	R	D	VU	4	8	0	1
Rallidae	White-breasted Waterhen *Amaurornis phoenicurus*	R	UN	LC	2	42	0	1
	Common Moorhen *Gallinula chloropus*	R	ST	LC	192	90	131	3
	Purple Swamphen *Porphyrio porphyrio*	R	UN	LC	29	96	66	3
	Common Coot *Fulica atra*	R	D	LC	2320	4782	6527	4
Jacanidae	Pheasant-tailed Jacana *Hydrophasianus chirurgus*	R	D	LC	27	40	48	2
	Bronze-winged Jacana *Metopidicus indicus*	R	UN	LC	15	27	27	2
Recurvirostridae	Black-winged Stilt *Himantopus himantopus*	R	IN	LC	0	9	9	1
	Pied Avocet *Recurvirostra avosetta*	WV	UN	LC	0	2	0	1
Charadriidae	Red-wattled Lapwing *Venellus indicus*	R	UN	LC	22	0	0	1
	Northern Lapwing *Venellus venellus*	WV	D	LC	0	2	0	1
	River Lapwing *Venellus duvacelii*	WV	UN	NT	4	22	6	1
	White-tailed Lapwing *Venellus leucurus*	WV	UN	LC	0	2	0	1
Scolopacidae	Common Redshank *Tringa totanus*	WV	UN	LC	6	20	0	1
	Common Greenshank *Tringa nebularia*	WV	ST	LC	0	5	0	1
	Wood Sandpiper *Tringa grareola*	WV	ST	LC	0	1	0	1
	Green Sandpiper *Tringa ochropus*	WV	ST	LC	0	2	9	1
	Common Sandpiper *Actitis hypoleucos*	WV	D	LC	2	7	0	1
	Pintail Snipe *Gallinago sternura*	WV	UN	LC	0	0	12	1
Laridae	Pallas' Gull *Ichthyaetus ichthyaetus*	WV	D	LC	17	46	2	2
	Brown-headed Gull *Chroicocephalus brunnicephalus*	WV	ST	LC	34	129	50	2
	Black-headed Gull *Chroicocephalus ridibundus*	WV	D	LC	140	58	164	3
Alcedinidae	Common Kingfisher *Alcedo atthis*	R	UN	LC	3	5	5	1
	White-breasted Kingfisher *Halcyon smyrnensis*	R	UN	LC	7	19	9	1
	Pied Kingfisher *Ceryle rudis*	R	UN	LC	3	9	3	1

Status: R—Resident, WV—Winter visitor; **Population trend:** D—Declining, IN—Increasing, ST—Stable, UN—Unknown; **Mean abundance score:** 1—Rare, 2—Common, 3—Abundant, 4—Very abundant; **IUCN:** LC—Least Concern | NT—Near Threatened | VU—Vulnerable.

& Bargali 2013). The occurrence of winter migrants and birds categorized under the IUCN Red List of Threatened Species signifies the importance of HBR as a foraging and resting habitat for migratory and resident water birds.

HBR supported a consistent diversity of water birds over the study period. The diversity of water birds recorded during the present study might be due to availability of a wide spectrum of feeding resources in the study area in the form of crustaceans, invertebrates, emergent vegetation and plankton. Moreover, occurrence of fish species like *Catla catla, Labeo rohita, Sperata seenghala*, and *Wallago attu* in the reservoir also serve as important dietary resources for water birds, as also the surrounding agriculture fields that provide foraging grounds. Kloskokowski et al. (2010) suggested fish age and biomass, amphibian abundance, water transparency and emergent vegetation govern the richness of water birds. The domination of carnivore guild in the reservoir could be due to the high availability of fish fauna. The low abundance of water birds during 2014–15 could be related to low water levels and subsequent agriculture-based activities in non-submerged areas. This also supports the results of Bolduc & Aftan (2008), who has highlighted that the water bird abundance is controlled by water depth.

Since the reservoir is managed by the irrigation

Image 2a–d. a—Great-crested Grebe | b—Common Coot | c—Brown-headed Gull; d—Red-crested Pochard. © Harendra Singh Bargali.

Table 3. Richness and diversity of birds under various feeding guild in Haripura-Baur Reservoir, Uttarakhand, India.

Index	Carnivore	Herbivore	Insectivore	Omnivore
Total species	37	10	4	14
Shannon diversity (H)	2.387	1.31	0.928	1.857
Margalef richness (S)	4.347	0.8822	0.7388	1.364
Evenness	0.2941	0.3707	0.6324	0.4574

department, there is a regular practice of commercial fishing to private parties for a stipulated time period. Fishing in the reservoir post monsoon causes lots of disturbance to the water birds. Hence, we strongly recommend to allow only traditional fishing activities through proper inter-departmental cooperation and for developing a sound policy to regulate water for irrigation purposes, commercial fishing with an emphasis on the conservation of water birds. Aarif et al. (2017) highlighted that traditional fishing activities enhance water bird abundance and diversity. Considering the limited water bodies in western TAL, HBR plays a considerable role in providing the required habitat to migratory as well as resident water birds. It provides home to a high proportion of water birds having declining population trends. If managed properly it will not only provide crucial habitat to water birds but an opportunity for promoting eco-tourism by developing the site as a bird tourism destination.

REFERENCES

Aarif, K.M., A. Nefa, S.B. Muzafar, K.K. Musammilu & P.K. Prasadan (2017). Traditional fishing activities enhance the abundance of selected waterbird species in a wetland in India. *Avian Research* 8(16): 1–10.

Ali, S. (2002). *The Book of Indian Birds. 13th Edition.* Oxford University Press, New Delhi, 326pp.

Bhatt, D., V.K. Sethi, S. Santosh, A. Kumar, V. Saini & A. Singh (2014).

Water birds of selected wetlands of Uttarakhand, pp140–159. In: Gopi G.V. & S.A. Hussain (eds.). *Water Birds of India*. ENVIS Bulletin: Wildlife and Protected Areas, Vol. 16, Wildlife Institute of India, Dehradun, 368pp.

Bhattacharjee, A. (2013). First record of Bean Goose *Anser fabalis* from Uttarakhand, India. *Indian Birds* 8(2): 46–47.

Bhattacharjee, A. & H.S. Bargali (2013). Diversity and abundance of wetland birds in Tumariya Wetland, Uttarakhand, India and management strategies for their conservation. *Indian Forester* 139(10): 899–905.

BirdLife International (2016). *Species factsheet: Anser fabalis*. Downloaded on 25 November 2016. http://www.birdlife.org/

Bolduc, F. & A.D. Afton (2008). Monitoring waterbirds abundance in wetland: the importance of controlling results for variation in water depth. *Ecological Modelling* 216: 402–408.

Dhakate, P.M., T.A. Patil & R. Bhartari (2008). Wetland birds of Corbett Tiger Reserve Landscape, pp1974–1982. In: Sengupata, M. & R. Dalwani (eds.). Proceeding of Taal 2007: The 12th World Lake Conference, Jaipur, India.

Gopi, G.V., S. Arya & S.A. Hussain (2014). Waterbirds of India: An Introduction, pp10–23. In: Gopi G.V. & S.A. Hussain (eds.). *Water Birds of India*. ENVIS Bulletin: Wildlife and Protected Areas, Vol. 16, Wildlife Institute of India, Dehradun, 368pp.

Grimmett, R., C. Inskipp & T. Inskipp (1998). *Birds of the Indian Subcontinent.* Oxford University Press, Delhi, 889pp.

Hammer, O., D.A.T. Harper & P.D. Ryan (2017). *PAST*< http://folk.uio.no/ohammer/past/>. Accessed on 29 September 2017.

IUCN (2016). *The IUCN Red List of Threatened Species.*<http://www.iucnredlist.org/> Downloaded on 29 August 2016.

Javed, S., Q. Qureshi & A.R. Rahmani (1999). Conservation status and distribution of swamp francolin in India. *Journal of the Bombay Natural History Society* 96: 16–23.

Kloskowski, J., M. Nieoczym, M. Polak & P. Pitucha (2010). Habitat selection by breeding waterbirds at ponds with size-structured fish populations. *Naturwissenschaften* 97(7): 673–682.

Kumar, P. & S.K. Gupta (2009). Diversity and abundance of wetland birds around Kurukshetra, India. *Our Nature* 7: 212–217.

Naoroji, R. (1999). Status of diurnal raptors of Corbett National Park with notes on their ecology and conservation. *Journal of the Bombay Natural History Society* 96: 387–398.

Pandey, S., J. Joshua, N.D. Rai, D. Mohan, G.S. Rawat, K. Sankar, M.V. Katti, D.V.S. Khati & A.J.T. Johnsingh (1994). Birds of Rajaji National Park, India. *Forktail* 10: 105–114.

Rahmani, A.R., G. Narayan, L. Rosalind, R. Sankaran & U. Ganguli (1989). Status of the Bengal Florican (*Houbaropsis bengalensis*) in India. *Journal of the Bombay Natural History Society* 88: 349–375.

Rodgers, W.A. & H.S. Panwar (1988). Planning a wildlife protected area network in India. Vol. 1 & II. FAO, Dehradun, 608pp.

Tak, P.C., J.P. Sati & A.N. Rizvi (2010). Status of waterbirds at Hathnikund Barrage wetland, Yamunanagar District, Haryana, India. *Journal of Threatened Taxa* 2(4): 841–844. https://doi.org/10.11609/JoTT.o2200.841-4

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