The Journal of Threatened Taxa (JoTT) is dedicated to building evidence for conservation globally by publishing peer-reviewed articles online every month at a reasonably rapid rate at www.threatenedtaxa.org. All articles published in JoTT are registered under Creative Commons Attribution 4.0 International License unless otherwise mentioned. JoTT allows unrestricted use, reproduction, and distribution of articles in any medium by providing adequate credit to the author(s) and the source of publication.

Journal of Threatened Taxa
Building evidence for conservation globally
www.threatenedtaxa.org
ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

COMMUNICATION
STATUS OF WATER BIRDS IN HARIPURA-BAUR RESERVOIR, WESTERN TERAI-ARC LANDSCAPE, UTTARAKHAND, INDIA

Tanveer Ahmed, Harendra Singh Bargali, Deepa Bisht, Gajendra Singh Mehra & Afifullah Khan
26 July 2019 | Vol. 11 | No. 9 | Pages: 14158–14165
DOI: 10.11609/jott.3924.11.9.14158-14165

For Focus, Scope, Aims, Policies, and Guidelines visit https://threatenedtaxa.org/index.php/JoTT/about/editorialPolicies#custom-0
For Article Submission Guidelines, visit https://threatenedtaxa.org/index.php/JoTT/about/submissions#onlineSubmissions
For Policies against Scientific Misconduct, visit https://threatenedtaxa.org/index.php/JoTT/about/editorialPolicies#custom-2
For reprints, contact <ravi@threatenedtaxa.org>

Publisher & Host

The opinions expressed by the authors do not reflect the views of the Journal of Threatened Taxa, Wildlife Information Liaison Development Society, Zoo Outreach Organization, or any of the partners. The journal, the publisher, the host, and the partners are not responsible for the accuracy of the political boundaries shown in the maps by the authors.
STATUS OF WATER BIRDS IN HARIPURA-BAUR RESERVOIR, WESTERN TERAI-ARC LANDSCAPE, UTTARAKHAND, INDIA

Tanveer Ahmed 1,2, Harendra Singh Bargali 2, Deepa Bisht 3, Gajendra Singh Mehra 4, Afifullah Khan 5

1,2,3,4 The Corbett Foundation, Village & P.O. Dhikuli, Ramnagar, Uttarakhand 244715, India.
1,2 Department of Wildlife Sciences, Aligarh Muslim University, Aligarh, Uttar Pradesh 202002, India.
1 tanveerwildlife@gmail.com, 2 harendratcf@gmail.com (corresponding author), 3 deepa_ocean1981@yahoo.co.in,
4 gajendra.singh.skd@gmail.com, 5 afifullah.khan@gmail.com

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 a preliminary database of water birds for further research and monitoring.

Keywords: Bird community, diversity, freshwater, guild, richness, wetland.
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 Leptostilosis 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 Aytha 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 & Bargali 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°N & 79.294°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 Bhakhera River. Both reservoirs are adjacent to each other and spread over an area of 294.4km². 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 sp., Hygrophila polysperma, Sagittaria sagittifolia, Phragmites karka, Azolla pinetta, 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 mirigala (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).
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).
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).

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 et al. 2012).

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.
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 nigra | R      | UN                      | LC   | 236            | 359            | 224            | 3                   |
|                         | Indian Cormorant Phalacrocorax francolollis | R      | UN                      | LC   | 0              | 0              | 5              | 1                   |
|                         | Oriental Darter Anhinga melanogaster | R      | D                       | NT   | 1              | 1              | 1              | 1                   |
| Ardeidae                | Indian Pond Heron Ardea grayi     | R      | UN                      | LC   | 8              | 9              | 15             | 1                   |
|                         | Purple Heron Ardea purpurea       | R      | D                       | LC   | 5              | 7              | 3              | 1                   |
|                         | Grey Heron Ardea cinerea          | 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 Messophoy xintermedia | R      | D                       | LC   | 37             | 54             | 30             | 1                   |
|                         | Great Egret Casmerodius aibus     | R      | UN                      | LC   | 2              | 0              | 4              | 2                   |
|                         | Yellow Bitter Ixobrychus sinensis  | R      | UN                      | LC   | 0              | 0              | 1              | 1                   |
| Phalacrocoracidae       | 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 Leptatlos javanicus | R      | D                       | VU   | 0              | 1              | 0              | 1                   |
| Ciconiidae              | 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                   |
| Threskiornithidae       | Lesser-whistling Duck Dendrocygna javanica | 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                   |
| Anatidae                | Cotton Pygmy-goose Nettapus coromandelanus | 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 querquedula         | 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                   |
& 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

### 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 Amaronnis 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 Vanellus indicus | R | UN | LC | 22 | 0 | 0 | 1
| Northern Lapwing Vanellus venellus | WV | D | LC | 0 | 2 | 0 | 1
| River Lapwing Vanellus davacelli | WV | UN | NT | 4 | 22 | 6 | 1
| White-tailed Lapwing Vanellus 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 glareola | 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 Ichthyetaes ichthyetaes | WV | D | LC | 17 | 46 | 0 | 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 Hacyn smynensis | 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.
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. Prasad (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/

Bolund, 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: Sengupta, 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.

Klooskowski, 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. I & II. FAQ, Dehradun, 608pp.

Tak, P.C., J.P. Satl & 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
Species richness and abundance of monogonont rotifers in relation to environmental factors in the UNESCO Sakaerat Biosphere Reserve, Thailand — Nattaporn Plangklung, Chaichat Boonyanusith & Sujeephon Athibai, Pp. 14087–14100

Distribution and habitats of Phiphiopodilium Pfizer (Orchidaceae) known to occur in Bhutan — Dhan Bahadur Gurung, Nima Gyeltshen, Kezang Tobgay, Stig Dalstrøm, Jangchu Wangdi, Bhakta Bahadur Ghalley, Lekey Chaida, Phuntsho, Ngawang Gyeltshen, Kelzang Dawa, Tandin Wangchuk, Rebecca Pradhan, Thomas Hoijer & Choki Gyeltshen, Pp. 14101–14111

Observations on nesting activity, life cycle, and brood ball morphometry of the Bordered Dung Beetle Oniticellus cinctus (Fabricius, 1775) (Coleoptera: Scarabaeidae) under laboratory conditions — Amar Paul Singh, Kritish De, Shagun Mahajan, Ritwik Mondal & Virendra Prasad Uniyal, Pp. 14128–14136

Status of water birds in Haripura-Baur Reservoir, western Terai-Arc landscape, Uttarakhand, India — Tanveer Ahmad, Harendra Singh Bargali, Deepa Bisht, Gajendra Singh Mehra & Uttarakhand Kailash, Pp. 14166–14186

Bird diversity in the coastal talukas of Sindhudurg District, Maharashtra, India — Golu Babu Rao, Santhanakrishnan Babu, Goldin Quadros & Vijaykumar Amonoop, Pp. 14166–14186

Greater One-horned Rhinoceros Rhinoceros unicornis (Mammalia: Perissodactyla: Rhinocerotidae) population census in the Rajiv Gandhi Orange National Park, Assam, India — Deba Kumar Dutta & Parikshit Kakati, Pp. 14158–14165

Crowding, group size and population structure of the Blackbuck Antilope cervicapra (Linnaeus, 1758) (Mammalia: Cetartiodactyla: Bovidae) in the semi-arid habitat of Haryana, India — Deepak Rai & Jyoti, Pp. 14194–14203

Notes

Extended distribution of the vulnerable Cooper’s Stone Flower Corallodiscus cooperi (Gesneriaceae) in India — Vikas Kumar, Samiran Panday, Sudhansu Sekhar Dash, Bipin Kumar Sinha & Paramjit Singh, Pp. 14224–14227

First record of the Blue-and-white Flycatcher Cyanoptila cyanomelana (Tommick, 1829) (Aves: Muscicapidae) from Bhutan — Kado Rinchen, Kinley Kinley, Chhim Delto & Dorji Wangmo, Pp. 14232–14234

Butterflies collected using malaise traps as useful bycatches for ecology and conservation — Augusto Henrique Battista Rosa, Lucas Neves Perillo, Frederico Siqueira Neves, Danilo Bandini Ribeiro & André Victor Lucci Freitas, Pp. 14235–14237

Notes on the hairstreak butterflies Eupsa Moore, 1884 (Lepidoptera: Lycaenidae) with new distribution records to the Indian eastern Himalaya — Gaurab Nandi Das, Subrata Gayen, Motoki Saito & Kailash Chandra Neves, Pp. 14238–14241

First record of the Australian gall midge Actilasioptera tumidifolium Gagné, 1999 (Diptera: Cecidomyiidae) from Andaman Islands, India — Duraikannu Vasanthakumar & Radheshyam Murirdhar Sharma, Pp. 14242–14243

New record of Blanford's Fox Vulpes cana (Mammalia: Carnivora: Canidae) in central Oman: a connection between the northern and southern populations — Taimur Alsaid, Abdulrahman Aluwaisi, Sultan Albalushi, Zahrain Alabdulsalam, Said Alharsusi & Steven Ross, Pp. 14244–14246