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DIVERSITY and ABUNDANCE OF WETLAND BIRDS IN TUMARIYA WETLAND, UTTARAKHAND, INDIA AND MANAGEMENT STRATEGIES FOR THEIR CONSERVATION

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ABSTRACT

Field survey was carried out during the winter migration season over three years (2009-2012) to monitor the avifaunal diversity in Tumariya Wetland, lying in the Corbett landscape. Sixty seven species of waterbirds belonging to 15 families were recorded. Common coot (*Fulica atra*) was the dominant species at Tumariya. The dominant family was Anatidae followed by Ardeidae and Scolopacidae. Mean species richness, diversity and mean abundance of wetland birds was found to have increased over the duration of the study. Seven species are categorized as "Globally Threatened" and are also listed under Schedule IV of the Wildlife (Protection) Act, 1972. Two species are listed under CITES. Interesting sightings included vagrant bean goose (*Anser fabalis*) and uncommon passage migrant Baillon's crake (*Porzana pusilla*). Major threats and conservation issues were also identified and possible measures to mitigate these problems are suggested.

Key words: Wetland birds, Tumariya, Corbett, Species richness, Threatened species, Habitat, Conservation Strategies.

Introduction

Birds which are ecologically dependant on wetlands are broadly defined as waterbirds (Kumar *et al.,* 2003). These include groups such as waterfowl, seabirds and waders.

There are several other birds such as kingfishers, raptors, and some passerines which are also dependant on wetlands. These are called wetland dependant birds (Kumar *et al.,* 2003). Many waterbirds are migratory, moving annually along various flyways to traverse between their breeding and non-breeding grounds. The concept of flyway is essentially an operational concept linked to waterfowl whose populations one wishes to manage over their entire migration space (Boere and Stroud, 2006). These flyways often span across considerable distances and cross several international boundaries. Thus, monitoring and conservation of such waterbirds and therefore the wetlands has to be a collective responsibility of all nations (Li *et al.,* 2009). India lies along the Central Asian Flyway (CAF) which is largely responsible for the significant number of migrant species to the Indian subcontinent.

Corbett Tiger Reserve (CTR), situated along the Himalayan foothills in the newly formed state of Uttarakhand is the first tiger reserve of the country and the launch pad of Project Tiger in 1973. CTR supports a sizeable variety of floral and faunal diversity (Bhartari, 1999). Corbett is a haven for bird-watchers. More than 40% of the approximate 1300 species of birds found in the Indian subcontinent (Kumar *et al.*, 2003), have been recorded in the Corbett landscape (Sharma *et al.,* 2003). Similarly, of the 310 wetland dependant bird species found in India (Kumar *et al.*, 2005), 49% (n = 149) are found in the CTR landscape (Dhakate *et al.*, 2008). Corbett Tiger Reserve is listed as an Important Bird Area (IBA) by BirdLife International in the A1 criteria (Islam and Rahmani, 2004), meaning the site has population of species listed in the IUCN Red List as Critically Endangered, Endangered or Vulnerable.

The Corbett Foundation (TCF) has been carrying out an annual waterbird census at Tumariya wetland (Fig. 1) located in the Corbett landscape since the winter migration season of 2009-10 on a fortnightly basis from the time migratory species start arriving till they start leaving the site (Bhattacharjee and Bargali, 2012). Tumariya wetland ($29^0$18' N $78^0$57' E), is a man-made reservoir located approximately 2 Km from Jaspur, the nearest town. The reservoir is fed by the rivers Dhela and Feeka. It lies across the Nainital and Udham Singh Nagar districts of Uttarakhand. Tumariya comes under the jurisdiction of the Terai West Forest Division, a territorial forest division adjacent to Corbett Tiger Reserve. Tumariya reservoir was established in the year 1962. With increasing demand, the Tumariya extension reservoir was completed in the year 1969. The two reservoirs are contiguous and are collectively referred to as Tumariya. The wetland spans over an area of 111 km^2.

Sixty seven (67) species of waterbirds belonging to 15 families were recorded with common coot (*Fulica atra*) as the dominant species in Tumaria wetland in Corbett landscape.

The average water level in the reservoir from the months of October to May is approximately 842.5 ft. There are approximately 22 villages located around the periphery of this reservoir. There are also two "Gujjar" settlements in the near proximity of the wetland. Although monitoring of bird diversity at Corbett Tiger Reserve in the past has included Tumariya Reservoir as part of the study area (Dhakate *et al.*, 2008), there has never been a systematic study of the wetland area. Hence, this was the first systematic study on the wetland bird diversity at Tumariya. The present paper analyzes the waterbird survey data of the three years, from 2009-10 to 2011-12, and notes the changing trend in the population of these waterbirds. The threats to the wetland are identified and possible recommendations suggested.

Methods

The survey was carried out over the winter migration seasons of 2009-10, 2010-11 and 2011-12. The standardized common and scientific names of the birds of the Indian subcontinent by Manakadan and Pittie (2001) were followed in the present study. The total count method was used for noting the species and number of birds observed. Large bird congregations were approached to the closest possible distance without causing disturbance for counting. Conspicuous species present in relatively small numbers or dispersed widely were counted singly. Observations were taken from 0600 hr to 1300 hr. Bushnell 8 x 42 and Olympus 10 x 50 binoculars were used for observations and the species were identified using recognized field guides such as Grimmett *et al.* (1999) and Kazmierczak (2000). The survey was conducted on a fortnightly basis from when migratory birds started arriving at the wetlands in October-November and was carried out till the last birds left in the months of March-April. Data analysis was done using SPSS and Microsoft Excel to obtain species richness, diversity, evenness, and mean abundance for the three winter migration seasons of the survey. Relative abundance of each species was also calculated for each. Both parametric as well as non-parametric tests have been used.

Results

Sixty seven species of waterbirds belonging to 15 families were recorded during entire study period (Table 1). Of these, two species are categorized as 'vulnerable' and five species are categorized as 'near threatened' in the IUCN red list of threatened species. All the above-mentioned seven species are listed under Schedule IV of the Wildlife (Protection) Act, 1972. One is listed under Schedule I of the Wildlife (Protection) Act, 1972. Eurasian spoonbill (*Platalea leucorodia)* and comb duck (Sarkidiornis melanotos) are listed under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 2011) in Appendix I and II respectively.

The maximum number of species (n =19) recorded from the study area belong to the family Anatidae comprising of ducks and geese. This was followed by the families Ardeidae (herons, egrets and bitterns) represented by eight species and Scolopacidae (godwit, snipes, shanks and sandpipers) represented by seven species respectively. Of the rest, six families were represented by one to two species only.

The recorded species were grouped into various residential status (Kumar *et al.*, 2003). Eight of the recorded species are residential species of birds, 23 are residents with local movements, one is a resident with local as well as summer movements, one a resident with altitudinal movements, 12 are residents with winter influx, one is a resident with winter influx as well as local movements, one is a resident with winter influx as well as passage movements, 17 are winter migrants, one is a largely winter migrant and partly resident, one is a restricted range species, and one is a vagrant with only two previous records from the country (Table 1).

Mean species richness, Shannon Wiener Diversity Index (H), Evenness (E) and Mean Abundance were calculated for the winter migration seasons of 2009-10, 2010-11, and 2011-12. The mean species richness at Tumariya wetland was observed to have increased over the years, from 28.83 ± 2.76 in 2009-10 to 31.89 ± 2.43 in 2010-11, and was recorded as highest during 2011-12 (38.38 ± 1.95). Diversity was also observed to have increased over the years from 2.02 in 2009-10, 2.05 in 2010-11, and 2011-12 recording the highest diversity of 2.19. Evenness was highest during 2009-10 (E = 0.524), and lowest during the subsequent year of 2010-11 (E = 0.505), before increasing to 0.517 during 2011-12. However, the value of E was approximately 0.5 across all three years, thus indicating that the distribution of species was never uniform in any of the years. The mean abundance at Tumariya wetland was observed to have increased over the years, and was recorded as highest during 2011-12 (3779.88).

One-way analysis of variance (ANOVA) was carried out between species richness at Tumariya in the winter migration seasons of 2009-10, 2010-11 and 2011-12. Post Hoc tests of Tukey HSD were carried out to further investigate differences between the same. The species richness in the three years was found to be significantly different (one-way ANOVA; $F_{2,20} = 3.96$, $P < 0.05$). However, the results from the Tukey test showed that only the mean species richness in 2009-10 and 2011-12 were significantly different ($P < 0.05$).

Table 1 : List of waterbirds and wetland dependant birds recorded at Tumariya wetland and their respective residential and conservation status

Sl. No.	Common Name	Scientific Name	Residential Status	IUCN Status	WL(P)A (1972)	CITES
1	Family: Podicipedidae					
1	Little Grebe	*Tachybaptus ruficollis*	R/ LM	LC	Sch. IV	-
2	Great Crested Grebe	*Podiceps cristatus*	R/ WM	LC	Sch. IV	-
2	Family: Phalacrocoracidae					
3	Great Cormorant	*Phalacrocorax carbo*	R/ WM	LC	Sch. IV	-
4	Indian Shag	*P. fuscicollis*	R/ LM	LC	Sch. IV	-
5	Little Cormorant	*P. niger*	R/ LM	LC	Sch. IV	-
3	Family: Anhingidae					
6	Darter	*Anhinga melanogaster*	R/ LM	NT	Sch. IV	-
4	Family: Ardeidae					
7	Indian Pond-Heron	*Ardeola grayii*	R/ LM	LC	Sch. IV	-
8	Purple Heron	*Ardea purpurea*	R/ LM	LC	Sch. IV	-
9	Grey Heron	*A. cinerea*	R/ WM	LC	Sch. IV	-
10	Cattle Egret	*Bubulcus ibis*	R/ AM	LC	Sch. IV	-
11	Little Egret	*Egretta garzetta*	R/ LM	LC	Sch. IV	-
12	Median Egret	*Mesophoyx intermedia*	R/ LM	LC	Sch. IV	-
13	Large Egret	*Casmerodius albus*	R/ LM	LC	Sch. IV	-
14	Yellow Bittern	*Ixobrychus sinensis*	R/ LM	LC	Sch. IV	-
5	Family: Ciconiidae					
15	Painted Stork	*Mycteria leucocephala*	R/ LM	NT	Sch. IV	-
16	Asian Openbill-Stork	*Anastomus oscitans*	R/ LM	LC	Sch. IV	-
17	White-necked Stork	*Ciconia episcopus*	R	LC	Sch. IV	-
18	Black-necked Stork	*Ephippiorhynchus asiaticus*	R	NT	Sch. IV	-
19	Lesser Adjutant-Stork	*Leptoptilos javanicus*	R/ LM	Vu	Sch. IV	-
6	Family:Threskiornithidae					
20	Black Ibis	*Pseudibis papillosa*	R	LC	Sch. IV	-
21	Glossy Ibis	*Plegadis falcinellus*	R/ WM/ LM	LC	Sch. IV	-
22	Eurasian Spoonbill	*Platalea leucorodia*	R	LC	Sch. I	Appendix I
7	Family: Anatidae					
23	Lesser Whistling-Duck	*Dendrocygna javanica*	R/ LM	LC	Sch. IV	-
24	Greylag Goose	*Anser anser*	WM	LC	Sch. IV	-
25	Bar-headed Goose	*A. indicus*	R/ WM	LC	Sch. IV	-
26	Bean Goose	*A. fabalis*	Va	LC	Sch. IV	-
27	Ruddy Shelduck	*Tadorna ferruginea*	R/ WM/ PM	LC	Sch. IV	-
28	Comb Duck	*Sarkidiornis melanotos*	R/ LM	LC	Sch. IV	Appendix II
29	Cotton Teal	*Nettapus coromandelianus*	R/ LM	LC	Sch. IV	-
30	Eurasian Wigeon	*Anas Penelope*	WM	LC	Sch. IV	-
31	Gadwall	*A. strepera*	WM	LC	Sch. IV	-
32	Common Teal	*A. crecca*	WM	LC	Sch. IV	-
33	Mallard	*A. platyrhynchos*	R/ WM	LC	Sch. IV	-
34	Spot-billed Duck	*A. poecilorhyncha*	R/ LM	LC	Sch. IV	-
35	Northern Pintail	*A. acuta*	WM	LC	Sch. IV	-
36	Garganey	*A. querquedula*	WM	LC	Sch. IV	-
37	Northern Shoveller	*A. clypeata*	WM	LC	Sch. IV	-
38	Red-crested Pochard	*Rhodonessa rufina*	WM	LC	Sch. IV	-
39	Common Pochard	*Aythya ferina*	WM	LC	Sch. IV	-
40	Ferruginous Pochard	*A. nyroca*	R/ WM	NT	Sch. IV	-
41	Tufted Pochard	*A. fuligula*	WM	LC	Sch. IV	-
8	Family: Gruidae					
42	Sarus Crane	*Grus antigone*	R/ LM	Vu	Sch. IV	-
9	Family: Rallidae					
43	Baillon's Crake	*Porzana pusilla*	R/ WM	LC	Sch. IV	-
44	White-breasted Waterhen	*Amaurornis phoenicurus*	R	LC	Sch. IV	-
45	Common Moorhen	*Gallinula chloropus*	R/ WM	LC	Sch. IV	-
46	Purple Moorhen	*Porphyrio porphyrio*	R/ LM	LC	Sch. IV	-
47	Common Coot	*Fulica atra*	R/ WM	LC	Sch. IV	-

10	Family: Jacanidae					
48	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	R/ LM/ SM	LC	Sch. IV	-
49	Bronze-winged Jacana	*Metopidius indicus*	R	LC	Sch. IV	-
11	Family: Rostratulidae					
50	Greater Painted-Snipe	*Rostratula benghalensis*	R/ LM	LC	Sch. IV	-
12	Family: Recurvirostridae					
51	Black-winged Stilt	*Himantopus himantopus*	R/ LM	LC	Sch. IV	-
13	Family: Charadriidae					
52	River Lapwing	*Vanellus duvaucelii*	R/ LM	LC	Sch. IV	-
53	White-tailed Lapwing	*V. leucurus*	WM	LC	Sch. IV	-
54	Red-wattled Lapwing	*V. indicus*	R/ LM	LC	Sch. IV	-
55	Little ringed plover	*Charadrius dubius*	R/ WM	LC	Sch. IV	-
14	Family: Scolopacidae					
56	Pintail Snipe	*Gallinago stenura*	WM	LC	Sch. IV	-
57	Common Redshank	*Tringa tetanus*	R/ WM	LC	Sch. IV	-
58	Marsh Sandpiper	*T. stagnatilis*	WM	LC	Sch. IV	-
59	Common Greenshank	*T. nebularia*	WM	LC	Sch. IV	-
60	Wood Sandpiper	*T. glareola*	WM	LC	Sch. IV	-
61	Green Sandpiper	*T. ochropus*	WM/ R	LC	Sch. IV	-
62	Common Sandpiper	*Actitis hypoleucos*	R/ WM	LC	Sch. IV	-
15	Family: Laridae					
63	Pallas's Gull	*Larus ichtyaetus*	R	LC	Sch. IV	-
64	Brown-headed Gull	*L. brunnicephalus*	RRS	LC	Sch. IV	-
65	Black-headed Gull	*L. ridibundus*	WM	LC	Sch. IV	-
66	River Tern	*Sterna aurantia*	WM	LC	Sch. IV	-
67	Black-bellied Tern	*S. acuticauda*	R	NT	Sch. IV	-

Note: LC = Least Concern; NT = Near Threatened; Vu = Vulnerable; Sch. = Schedule, R = Resident; R/LM = Resident with local movement; R/LM/SM = Resident with local as well as summer movement; R/AM = Resident with altitudinal movements; R/WM = Resident with winter influx; R/WM/LM = Resident with winter influx as well as local movements; R/WM/PM = Resident with winter influx as well as passage movements; WM = Winter Migrant; WM/R = Largely Winter Migrant and partly resident; RRS = Restricted Range Species; Va = Vagrant

Common coot (*Fulica atra*) was the dominant species recorded at Tumariya wetland in all three winter migration seasons. The relative abundance of all the species was calculated separately for 2009-10, 2010-11 and 2011-12. The top ten dominant species in each of the years was noted (Table 2). The relative abundance of common coot was the highest during the year 2010-11 (0.5384) and lowest during 2011-12 (0.4920).

Seven species of birds were seen only once during 2009-10. Of them, glossy ibis (*Plegadis falcinellus*), wood sandpiper (*Tringa glareola*) and western marsh-harrier (*Circus aeruginosus*) were considered as rare as only one bird of each species was recorded throughout the year. Ten species of birds were seen only once during 2010-11. Of them, baillon's crake (*Porzana pusilla*), western marsh-harrier (*Circus aeruginosus*) and small blue kingfisher (*Alcedo atthis*) were considered as rare as only one bird of each species was recorded throughout the year. Baillon's crake is an uncommon passage migrant from the area, which had no previous record in the Corbett checklist of birds (Bhattacharjee, 2012a). Fifteen species of birds were seen only once during 2011-12. Of them, yellow bittern (*Ixobrychus sinensis*), black-necked stork (*Anastomus oscitans*), lesser adjutant-stork (*Leptoptilos javanicus*), bean goose (*Anser fabalis*), white-tailed lapwing (*Vanellus leucurus*), western marsh-harrier (*Circus aeruginosus*), and small blue kingfisher (*Alcedo atthis*) were considered as rare, as only one bird of each species was recorded throughout the year. Bean goose is a vagrant species with no previous record from the State of Uttarakhand. In December 2011, a solitary bean goose was recorded among a mixed flock of bar-headed goose and ruddy shelducks (Bhattacharjee, 2012b). Previous to this sighting, there had been only two other individual records of this species from the entire country.

Tumariya wetland is under pressure from several threats. A brief discussion of the various threats may be categorized as follows:

Habitat Encroachment

The most important threat to the wetland is the loss of habitat due to human encroachment. The human population in the villages located around the wetland has increased over the years (pers. comm. BDO Ramnagar). This rapidly increasing human population is continuously encroaching into the wetland area for agricultural as well as developmental purposes. Extension of agricultural land into the wetland is reducing the permanent and seasonal extent of the wetland substantially (pers.

Table 2 : Relative abundance of top ten most abundant species at Tumariya in 2009-10, 2010-11 and 2011-12

2009-10		2010-11		2011-12	
Common Name	Relative Abundance	Common Name	Relative Abundance	Common Name	Relative Abundance
Common Coot	0.5264	Common Coot	0.5384	Common Coot	0.4920
Gadwall	0.0589	Tufted Pochard	0.0715	Little Cormorant	0.0865
Tufted Pochard	0.0551	Great Crested Grebe	0.0475	Tufted Pochard	0.0760
Common Pochard	0.0515	Gadwall	0.0439	Common Pochard	0.0715
Great Crested Grebe	0.0510	Common Pochard	0.0407	Gadwall	0.0374
Ruddy Shelduck	0.0396	Ruddy Shelduck	0.0326	Northern Pintail	0.0239
Bar-headed Goose	0.0383	Red-crested Pochard	0.0284	Great Crested Grebe	0.0235
Common Moorhen	0.0282	Common Moorhen	0.0269	Common Moorhen	0.0217
Red-crested Pochard	0.0273	Bar-headed Goose	0.0260	Red-crested Pochard	0.0187
Little Cormorant	0.0253	Eurasian Wigeon	0.0224	Eurasian Wigeon	0.0117

comm. DFO Terai West and JE Kashipur).

Excessive Livestock Grazing

Majority of the villagers own livestock. Additionally, there are two 'Gujjar' settlements near Tumariya wetland. These 'Gujjars' own large herds of livestock. Livestock grazing pressure on Tumariya wetland is very high. It has been found that increased grazing pressure leads to soil erosion and degradation of watershed, thereby causing siltation of wetlands. Excessive cattle grazing is destroying the emergent vegetation, thus causing loss of nesting material of wetland birds, especially those belonging to the wader group. During summer, when the water level in the wetland decreases, large herds of cattle are let loose into the wetland. This excessive livestock grazing pressure is degrading the wetland.

Solid Waste Pollution

Solid waste from the local villages is also being dumped into the wetlands. This is polluting the water of the wetland.

Hunting and Direct Physical Damage

A key threat to waterbirds is hunting and direct physical damage to eggs and chicks. Although most waterbirds at Tumariya are winter migrants, there are a few, especially belonging to the wader groups that breed in the area. Local hunting of waterbirds is quite rampant at Tumariya. There is also the problem of feral dogs running rampant in the area and disturbing the birds. Local children residing in the nearby villages sometimes destroy eggs and chicks, as witnessed by our team.

Commercial Fishery

Commercial fishing is carried out at Tumariya wetland under the jurisdiction of the Fisheries Department. Often the boats of the fishermen disturb the large congregations of waterbirds. Some of the fishermen also practice illegal hunting of the birds.

Spread of Invasive Vegetation

Another major threat to the wetland is the spread of algae and other invasive species such as *Ipomoea* and *Salvinia* spp. These invasive species have been taking over the wetland, and slowly choking the native plant species found at the site. If not controlled in the coming years, these could cause major degradation of the wetland area as an important habitat for waterbirds.

Discussion

Waterbirds are valuable indicators for the ecological health and productivity of wetlands (Li *et al.,* 2009). They play significant roles in the lives of humans culturally, socially, scientifically and as a food resource (Kumar *et al.,* 2003). They also attract tourists to wetlands and may hold the key to generating awareness among people regarding the importance of wetland conservation. A major threat towards the viability of all wildlife populations is the fragmentation of their habitats (Wiens, 1995), and the same is true of waterbirds and their habitats, the wetlands. Baseline information is prerequisite for planning and monitoring management actions for waterbirds as well as their habitats (Kumar *et al.,* 2003, Kumar *et al.,* 2005).

A total of 67 species of wetland birds were recorded from Tumariya wetland. Mean species richness, diversity, as well as mean abundance of wetland birds were found to have increasing over the study period. Thus, Tumariya wetland appears to be a good habitat for wetland birds. However, the wetland is under various threats and pressure, and these threats need to be addressed if the wetland is to continue as a prospective habitat for wetland birds.

None of the Vulnerable and Near Threatened

species, including globally threatened species such as the lesser adjutant-stork (Leptoptilos javanicus) and sarus crane (Grus antigone), are listed under CITES, and thus there are no restriction on their trade. Greater painted snipe (Rostratula benghalensis) is not listed under the Wildlife (Protection) Act, 1972 at all (MoEF, 2006). Thus, analysis of the conservation status of the recorded waterbirds at the study area revealed a lacuna in the protection afforded at present to these species. This lacuna needs to be addressed immediately and the protection status of the waterbirds enhanced accordingly.

Migratory waterbirds pass through several wetlands en route to their breeding and wintering grounds. Therefore, even though the number of birds present at any one time may never exceed 20,000 birds (Criterion 5 of Ramsar Convention for identifying Wetlands of International Importance) or 1% of a population (Criterion 6 of Ramsar Convention for identifying Wetlands of International Importance), the wetland may still be supporting internationally important numbers of birds. Criterion 2 of the Ramsar Convention for identifying Wetlands of International Importance states "A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities" (Wetland International, 2002). Tumariya wetland harbours a number of threatened bird species and must be afforded a better protection status.

Management Options

In order to save the wetland birds and their habitat from declining some immediate management options have been recommended.

- The concerned Irrigation Department, Forest Department and Fisheries Department need to work together to ensure that the waterbirds at the wetland are not harmed by the commercial fishing being carried out at the sites.
- The concerned irrigation departments should consult the forest department and scientific experts regarding management of the water levels in the reservoirs.
- The concerned irrigation department and forest departments need to work together in controlling the encroachment of wetland areas, intensive grazing pressures, and other illegal activities rampant at the sites. The cooperation of the local police department should be sought for ensuring preventive action in the area.
- All development work around the wetland should be monitored and should have to obtain permission from the forest department. An advisory committee comprising of representatives from all concerned government departments, scientific experts, and local community members could be constituted.
- The Irrigation Department should seek the support of the forest department and scientific experts to remove the various invasive species taking over the wetlands.
- Regular awareness programmes should be organized for the local villagers, 'Gujjars' and other stakeholders. Special awareness camps should be organized for the local children. Local NGOs such as The Corbett Foundation could play a role in designing the modules.
- Intensive studies should be carried out on the vegetation, water quality, and land use changes at the sites. Regular and sustained monitoring of waterbirds at the sites need to be ensured.

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ट्यूमारिया तरभूमि, उत्तराखंड, भारत में तरभूमि पक्षियों का वैविध्य तथा प्रचुरता तथा उनके संरक्षण के लिए प्रबंधन रणनीतियां

अनुश्री भट्टाचार्यजी तथा हरेन्द्र सिंह बरगाली

सारांश

कार्बेट भू-दृश्य में ट्यूमारिया तरभूमि में पक्षियों के वैविध्य को मॉनीटर करने के लिए सर्दियों के मौसम में 2009-2012 तक पक्षियों के विस्थापन पर कार्यक्षेत्रीय सर्वेक्षण किये गये। 15 कुलों के 67 जलपक्षियों की प्रजातियों को रिकार्ड किया गया। ट्यूमारिया में कॉमन कूट (*फ्यूलिका आट्रा*) मुख्य प्रजाति थी। मुख्य कुल एनाटीडाई थी जिसके बाद अर्डीडाइ तथा स्कोलोपेसीडाई का स्थान था। अधययन के दौरान माधय प्रजाति वृद्धि, वैविध्य तथा जलपक्षियों की प्रचुरता में वृद्धि दर्ज की गई। सात प्रजातियों को ''वैश्विक संकटापन्न'' प्रजातियों में श्रेणीवद्ध किया गया तथा वन्यजीव

(रक्षण) अधिनियम 1972 की चौथी सूची में दर्ज किया गया। दो प्रजातियों को साईट्स के तहत सूची बद्ध किया गया है। प्रत्यक्ष दर्शन का मुख्य आकर्षण वेग्रेन्ट बीन गूज (*अनसर फेबालिस*) तथा असामान्य स्थलों में माइग्रेन्ट बेलियोन क्रेक (*पोरजाना प्यूसीला*) रहे। मुख्य खतरों तथा संरक्षण समस्याओं को चिन्हित किया गया और समस्याओं से निपटने के उपाय सुझाये गये हैं।

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