



**Waterbirds
of Selected
Wetlands of
Uttarakhand**

Abstract

Although no comprehensive data are available, a number of wetlands of Uttarakhand are of great importance as staging and wintering areas for a wide variety of waterfowl. In this paper, an attempt has been made to compare and provide the current population status of migratory avifauna from some wetlands/reservoirs of Uttarakhand, viz., Asan Barrage, Bheemgoda Barrage (including Ganga Valley) and the Corbett Landscape. A review of literature indicates that the wetlands of Uttarakhand provide shelter to about 175 wetland avian species. Of these, 134 species are waterbirds, and the remaining 41 species are water-dependent birds. Nevertheless, the number of species and their abundance vary between habitats and years. The current counts of the migratory/water-dependent birds of the Corbett Landscape, Bheemgoda Barrage (including Ganga Valley) and Asan Barrage are 150, 70 and 91, respectively. In the Bheemgoda and Asan barrages, a declining trend in the number of migratory birds was observed. In Bheemgoda Barrage, the reason for the decline in the population of waterbirds may be the flood of 2010, which caused a heavy reduction in the area of green cover of the vegetated island. It has been realised that the ongoing conservation measures for migratory waterbirds are not adequate and that further efforts are needed for improving the protection.

Keywords : Asan Barrage (Asan Conservation Reserve), Bheemgoda Barrage, Corbett Landscape, Migratory waterbirds, Uttarakhand, wetlands

Introduction

Wetlands, both natural and artificial, support a high diversity of resident and migrant waterbirds (Cowardin et al. 1979, Amezaga et al. 2002). Waterbirds act as an important indicator of the health of wetland ecosystems as they form important links in the food web and nutrients cycles at the global level. It has been reported that the population of wetland birds has declined significantly (Saikia & Bhattacharjee 1993, Wetlands International 2006). Though the exact cause of the decline in the migratory population of birds is not known, yet it is an indication of environmental changes and possibly degradation of wetlands. However, long-term and systematic studies of the status of wetlands and abundance of migratory birds in the state of Uttarakhand are lacking.

There are reports indicating that Indian wetlands have been degraded due to rapid economic development, the increasing human population and the associated over-exploitation of resources (Islam & Rahmani 2004). Consequently, the populations of several duck species are declining in India (Islam & Rahmani 2004, Wetlands International 2006). Monitoring the species abundance, habitat preference and correlation between species abundance and habitat quality provides basic information for understanding factors causing fluctuations in the population of a bird species. In order to know the status of a particular species at the global level, monitoring of the population distribution of that species at the regional level is important. In this context, an attempt is being made in this article to understand the present status of the migratory waterbirds of Uttarakhand (28°43' to 31°28' N, 77°34' to 81°03' E) by compiling information from studies based on fieldwork conducted by the authors at various sites, the published literature and technical reports of other ornithologists about migratory birds.

Materials and Methods

A. Study Sites

1. Bheemgoda Barrage:

Bheemgoda reservoir (29°58' N, 78°13' E, 249.7 m asl), situated between the *Neeldhara* and tributaries of the Ganga, is a man-made wetland of area about 2.5 km², located in Haridwar.

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2. Asan Barrage/Asan Conservation Reserve (ACR)

ACR (30°25'60" N, 77°42'00"E, 389.4 m asl) is a wetland in the western part of Dehradun Valley, Uttarakhand, near the confluence of the rivers Asan and Yamuna. Its area is about 4.44 km². This wetland has been declared an Important Bird Area (IBA) (IBA Site code IN-UT-01) by BirdLife International (Islam & Rahmani 2004).

3. Corbett Landscape

Corbett Park (29°25' to 29°39' N, 78°44' to 79°07' E, 300–1040 m asl) is located at the Himalayan foothills. It has an area of about 1288 km². The Ramganga reservoir is the main reservoir in the Corbett area. The present study compiles the work carried out by Dhakate *et al.* (2008) in Corbett Tiger Reserve and by Bhattacharjee and Bargali (2012) in three wetlands, Baur, Haripura and Tumariya. Corbett Tiger Reserve is listed as an IBA by BirdLife International under criterion A1 (Islam & Rahmani 2004).

B. Methodology

During 1995–1997 and 2000–2013, we covered Bheemgoda Barrage and the adjacent Ganga Valley area, Haridwar. Data about the avian species in Missarpur Gangaghat, Haridwar and Asan Barrage, Dehradun were collected during 2010–2013. Field visits were made almost fortnightly to these sites, mainly during October–April, and the species and abundance of waterbirds and wetland-dependent birds at the study sites were noted. We used a pair of Nikon 10×50 prismatic field binoculars, a Nikon fieldscope ED 82 with a 72× zoom, a tally counter, a Nikon D 200 DSLR camera with a 80–400 mm Nikon lens and field guides such as *The Book of Indian Birds* (Ali 1996), *Birds of the Indian Subcontinent* (Grimmett *et al.* 1998) and *A Field Guide to the Birds of India* (Kazmierczak & Perlo 2006) for bird identification, counts and photography.

For a comparative study, we considered the data/checklists of migratory waterbirds compiled or generated by other workers in different wetlands/study areas of Uttarakhand at different points of time (Narang 1990, Tak *et al.* 1998, Kumar & Bhatt 2000, Sharma 2001, Tak & Sati 2003, Dhakate *et al.* 2008, Bhattacharjee & Bargali 2012, Kaushik & Gupta 2013, Mohan & Sondhi 2014). Satellite imagery was used to assess the changes in the area of the Bheemgoda Barrage under vegetation in different years during the study period (Figs. 1 & 2).

Results

Different studies indicate that about 175 wetland birds (see Appendix 1), comprising 134 species of waterbird and 41

APPENDIX 1 : Checklist of water birds and wetland dependent birds of Uttarakhand State

S. No.	Family and Common name of the species	Scientific Name	Compiled checklist of birds of Uttarakhand*	Studied wetlands/ landscape sites			Conservation Status		
				Corbett landsc-ape**	Bhimgoda barrage, Haridwar ***	Asan barrage, Dehradun ***	Migration/ Residential Status	WPA, IUCN 1972	
1. ANATIDAE									
1.	Lesser Whistling duck	<i>Dendrocygna javanica</i> (Horsfield, 1821)	+	+	+	+	R/LM	Sch. IV	LC
2.	Greylag Goose	<i>Anser anser</i> (Linnaeus, 1758)	+	+		+	WM	Sch. IV	LC
3.	Greater White-fronted Goose	<i>Anser albifrons</i> (Scopoli, 1769)	+		+		WM	Sch. IV	LC
4.	Bean Goose	<i>Anser fabalis</i> (Latham, 1787)	+	+			WM	Sch. IV	LC
5.	Lesser White-fronted Goose	<i>Anser erythropus</i> (Linnaeus, 1758)	+				WM	Sch. IV	GT/V u
6.	Bar-headed Goose	<i>Anser indicus</i> (Latham, 1790)	+	+	+	+	R/WM	Sch. IV	LC
7.	Comb Duck	<i>Sarkidiornis melanotos</i> (Pennant, 1769)	+	+			R/LM	Sch. IV	LC
8.	Common Shelduck	<i>Tadorna tadorna</i> (Linnaeus, 1758)	+	+	+	+	WM	Sch. IV	LC
9.	Rudy Shelduck	<i>Tadorna ferruginea</i> (Pallas, 1764)	+	+	+	+	R/WM/PM	Sch. IV	LC
10.	Cotton Teal	<i>Nettapus ferruginea</i> (Pallas, 1764)	+	+	+	+	R/LM	Sch. IV	LC
11.	Gadwall	<i>Anas strepera</i> Linnaeus, 1758	+	+	+	+	WM	Sch. IV	LC
12.	Falcated Duck	<i>Anas falcata</i> Georgi, 1775	+			+	WM	Sch. IV	NT
13.	Eurasian Wigeon	<i>Anas penelope</i> Linnaeus, 1758	+	+	+	+	WM	Sch. IV	LC
14.	Mallard	<i>Anas platyrhynchos</i> Linnaeus, 1758	+	+	+	+	R/WM	Sch. IV	LC
15.	Spot-billed Duck	<i>Anas poecilorhyncha</i> J.R. Forester, 1781	+	+	+	+	R/LM	Sch. IV	LC
16.	Northern Shoveller	<i>Anas clypeata</i> Linnaeus, 1758	+	+	+	+	WM	Sch. IV	LC
17.	Northern Pintail	<i>Anas acuta</i> Linnaeus, 1758	+	+	+	+	WM	Sch. IV	LC
18.	Garganey	<i>Anas querquedula</i> Linnaeus, 1758	+	+	+	+	WM	Sch. IV	LC
19.	Common Teal	<i>Anas crecca</i> Linnaeus, 1758	+	+	+	+	WM	Sch. IV	LC
20.	Marbled Teal	<i>Marmaronett a angustirostris</i> (Ménétrières, 1832)	+				WM	Sch. IV	GT/V u
21.	Red-crested Pochard	<i>Rhodonessa rufina</i> (Pallas, 1773)	+	+	+	+	WM	Sch. IV	LC
22.	Common Pochard	<i>Aythya ferina</i> (Linnaeus, 1758)	+	+	+	+	WM	Sch. IV	LC

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23.	Baer's Pochard	<i>Aythya baeri</i> (Radde, 1863)	+				WM	Sch. IV	Cr
24.	Ferruginous Pochard	<i>Aythya nyroca</i> (Guldenstadt, 1770)	+	+	+	+	R/WM	Sch. IV	NT
25.	Tufted Pochard	<i>Aythya fuligula</i> (Linnaeus, 1758)	+	+	+	+	WM	Sch. IV	LC
26.	Greater Scaup	<i>Aythya marila</i> (Linnaeus, 1761)	+				WM	Sch. IV	LC
27.	Long-tailed Duck	<i>Clangula hyemalis</i> (Linnaeus, 1758)	+			+	WM	Sch. IV	GT/Vu
28.	Common Goldeneye	<i>Bucephala clangula</i> (Linnaeus, 1758)	+				WM	Sch. IV	LC
29.	Common Merganser	<i>Mergus merganser</i> (Linnaeus, 1758)	+	+	+		R/WM	Sch. IV	LC
2. PODICIPEDIDAE									
30.	Little Grebe	<i>Tachybaptus ruficollis</i> (Pallas, 1764)	+	+	+	+	R/LM	Sch. IV	LC
31.	Great Crested Grebe	<i>Podiceps cristatus</i> (Linnaeus, 1758)	+	+	+	+	R/WM	Sch. IV	LC
32.	Slavonian (Horned) Grebe	<i>Podiceps auritus</i> (Linnaeus, 1758)	+	+			WM	Sch. IV	LC
33.	Black-necked Grebe	<i>Podiceps nigricollis</i> Brehm, 1831	+			+	R/WM	Sch. IV	LC
3. PHOENICOPTERIDAE									
34.	Greater Flamingo	<i>Phoenicopterus ruber</i> Linnaeus, 1758	+	+			R/WM/LM	Sch. IV	LC
4. CICONIIDAE									
35.	Painted Stork	<i>Mycteria leucocephala</i> (Pennant, 1769)	+	+	+	+	R/LM	Sch. IV	NT
36.	Asian Openbill-Stork	<i>Anastomus oscitans</i> (Boddaert, 1783)	+	+		+	R/LM	Sch. IV	LC
37.	Black Stork	<i>Ciconia nigra</i> (Linnaeus, 1758)	+	+	+		WM/PM	Sch. IV	LC
38.	White-necked Stork	<i>Ciconiapiscopus</i> (Boddaert, 1783)	+	+		+	R	Sch. IV	LC
39.	European White Stork	<i>Ciconia ciconia</i> (Linnaeus, 1758)	+	+			WM	Sch. I	LC
40.	Black-necked Stork	<i>Ephippiorhynchus</i> (Latham, 1790)	+	+	+	+	R	Sch. IV	NT
41.	Lesser Adjutant-Stork	<i>Leptoptilos javanicus</i> (Horsfield, 1821)	+	+			R/LM	Sch. IV	GT/Vu
5. THRESKIORNITHIDAE									
42.	Black Ibis	<i>Pseudibis papillosa</i> (Temminck, 1824)	+	+	+	+	R	Sch. IV	LC

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43.	Glossy Ibis	<i>Plegadis falcinellus</i> (Linnaeus, 1766)	+	+			R/WM/LM	Sch. IV	LC
44.	Eurasian Spoonbill	<i>Platalea leucorodia</i> Linnaeus, 1758	+	+		+	R	Sch. I	LC
45.	Oriental White Ibis	<i>Threskiornis melanocephalus</i> (Latham, 1790)	+	+		+	R/LM	Sch. IV	NT
6. ARDEIDAE									
46.	Great Bittern	<i>Botaurus stellaris</i> (Linnaeus, 1758)	+			+	WM	Sch. IV	LC
47.	Little Bittern	<i>Ixobrychus minutus</i> (Linnaeus, 1766)	+	+		+	R/LM	Sch. IV	LC
48.	Black Bittern	<i>Dupetor flavicollis</i> (Latham, 1790)	+				R/LM	Sch. IV	LC
49.	Yellow Bittern	<i>Ixobrychus sinensis</i> (Gmelin, 1789)	+	+			R/LM	Sch. IV	LC
50.	Chestnut Bittern	<i>Ixobrychus cinnamomeus</i> (Gmelin, 1789)	+	+		+	R/LM	Sch. IV	LC
51.	Black-crowned	<i>Nycticorax nycticorax</i> (Linnaeus, 1758)	+	+	+	+	R/LM	Sch. IV	LC
52.	Little Green Heron	<i>Butorides striatus</i> (Linnaeus, 1758)	+	+			R	Sch. IV	LC
53.	Indian Pond Heron	<i>Ardeola grayii</i> (Sykes, 1832)	+	+	+	+	R/LM	Sch. IV	LC
54.	Cattle Egret	<i>Bubulcus ibis</i> (Linnaeus, 1758)	+	+	+	+	R/AM	Sch. IV	LC
55.	Large Egret	<i>Casmerodius albus</i> (Linnaeus, 1758)	+	+	+	+	R/LM	Sch. IV	LC
56.	Grey Heron	<i>Ardea cinerea</i> Linnaeus, 1758	+	+	+	+	R/WM	Sch. IV	LC
57.	Purple Heron	<i>Ardea purpurea</i> Linnaeus, 1766	+	+		+	R/LM	Sch. IV	LC
58.	Median egret	<i>Mesophoyx intermedia</i> (Wagler, 1829)	+	+	+	+	R/LM	Sch. IV	LC
59.	Little Egret	<i>Egretta garzetta</i> (Linnaeus, 1766)	+	+	+	+	R/LM	Sch. IV	LC
60.	Western Reef-Egret	<i>Egretta gularis</i> (Bosc, 1792)	+	+			R/LM	Sch. IV	LC
7. PELICANIDAE									
61.	Great White Pelican	<i>Pelecanus onocrotalus</i> Linnaeus, 1758	+	+			R/WM	Sch. IV	LC
62.	Spot-billed Pelican	<i>Pelecanus philippensis</i> Gmelin, 1789	+	+			R/LM	GT/Vu	NT
8. PHALACROCORACIDAE									
63.	Little Cormorant	<i>Phalacrocorax niger</i> (Vieillot, 1817)	+	+	+	+	R/LM	Sch. IV	LC

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64.	Great Cormorant	<i>Phalacrocorax carbo</i> (Linnaeus, 1758)	+	+	+	+	R/WM	Sch. IV	LC
65.	Indian Shag	<i>Phalacrocorax fuscicollis</i> Stephens, 1826	+	+	+		R/LM	Sch. IV	LC
9. ANHINGIDAE									
66.	Darter	<i>Anhinga melanogaster</i> Pennant, 1769	+	+	+	+	R/LM	Sch. IV	NT
10. PANDIONIDAE									
67.	Osprey*	<i>Pandion haliaetus</i> (Linnaeus, 1758)	+	+	+	+	WM/R	Sch. I	LC
11. RALLIDAE									
68.	Common Coot	<i>Fulica atra</i> Linnaeus, Linnaeus, 1758	+	+	+	+	R/WM	Sch. IV	LC
69.	Brown Crake	<i>Amauornis akool</i> (Sykes, 1832)	+	+			R/LM	Sch. IV	LC
70.	Ruddy-breasted Crake	<i>Porzana fusca</i> , (Linnaeus, 1766)	+	+			R/WM	Sch. IV	LC
71.	Baillon's Crake	<i>Porzana pusilla</i> (Pallas, 1776)	+				R/WM	Sch. IV	LC
72.	Slaty-legged Crake	<i>Rallina eurizonoides</i> (Lafresnaye, 1845)	+				R/LM	Sch. IV	LC
73.	Water Rail	<i>Rallus aquaticus</i> (Linnaeus, 1758)	+				R/WM	Sch. IV	LC
74.	White-breasted Waterhen	<i>Amauornis phoenicurus</i> (Pennant, 1769)	+	+	+	+	R	Sch. IV	LC
75.	Common Moorhen	<i>Gallinula chloropus</i> (Linnaeus, 1758)	+	+	+	+	R/WM	Sch. IV	LC
76.	Purple Moorhen	<i>Porphyrio porphyrio</i> (Linnaeus, 1758)	+	+		+	R/LM	Sch. IV	LC
12. JACANIDAE									
77.	Bronze-winged Jacana	<i>Metopidius indicus</i> (Linnaeus, 1790)	+	+	+	+	R	Sch. IV	LC
13. HELIORNITHIDAE									
78.	Pheasant-tailed Jacana	<i>Hydrophasianus chir- urgus</i> (Scopoli, 1786)	+	+		+	R/LM/SM	Sch. IV	LC
14. SCOLOPACIDAE									
79.	Eurasian Curlew	<i>Numenius arquata</i> (Linnaeus, 1758)	+	+	+		WM	Sch. IV	NT
80.	Common Redshank	<i>Tringa totanus</i> (Linnaeus, 1758)	+	+	+	+	R/WM	Sch. IV	LC
81.	Marsh Sandpiper	<i>Tringa stagnatilis</i> (Bechstein, 1803)	+	+		+	WM	Sch. IV	LC
82.	Common Greenshank	<i>Tringa nebularia</i> (Gunner, 1767)	+	+	+	+	WM	Sch. IV	LC

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83.	Wood Sandpiper	<i>Tringa glareola</i> Linnaeus, 1758	+	+		+	WM	Sch. IV	LC
84.	Green Sandpiper	<i>Tringa ochropus</i> Linnaeus, 1758	+	+		+	R/WM	Sch. IV	LC
85.	Common Sandpiper	<i>Actitis hypoleucos</i> Linnaeus, 1758	+	+	+	+	R/WM	Sch. IV	LC
86.	Spotted Redshank	<i>Tringa erythropus</i> (Pallas, 1764)	+			+	WM	Sch. IV	LC
87.	Jack Snipe	<i>Lymnocyptes minimus</i> (Brünnich, 1764)	+	+			WM	Sch. IV	LC
88.	Solitary Snipe	<i>Gallinago solitaria</i> Hodgson, 1831	+				R/AM/WM	Sch. IV	LC
89.	Wood Snipe	<i>Gallinago nemoricola</i> Hodgson, 1836	+	+			R/AM/WM	Sch. IV	GT/Vu
90.	Pintail Snipe	<i>Gallinago stenura</i> (Bonaparte, 1830)	+	+			WM	Sch. IV	LC
91.	Common Snipe	<i>Gallinago gallinago</i> (Linnaeus, 1758)	+	+			R/WM	Sch. IV	LC
92.	Eurasian Woodcock	<i>Scolopax rusticola</i> Linnaeus, 1758	+	+			R/AM/WM	Sch. IV	LC
93.	Temminck's Stint	<i>Calidris temminckii</i> (Leisler, 1812)	+	+		+	WM	Sch. IV	LC
94.	Little stint	<i>Calidris minuta</i> (Leisler, 1812)	+	+			WM	Sch. IV	LC
95.	Black-tailed Godwit	<i>Limosa limosa</i> (Linnaeus, 1758)	+	+			WM	Sch. IV	NT
96.	Long toed stint	<i>Calidris subminuta</i> (Middendorff, 1853)	+	+			WM	Sch. IV	LC
97.	Dunlin	<i>Calidris alpina</i> (Linnaeus, 1758)	+	+			WM		LC
15. LARIDAE									
98.	Pallas's Gull	<i>Larus ichthyaetus</i> J.E. Gray, 1831	+	+	+	+	WM	Sch. IV	LC
99.	Brown-headed Gull	<i>Larus brunnicephalus</i> Jerdon, 1840	+	+	+	+	R/WM	Sch. IV	LC
100.	Black-headed Gull	<i>Larus ridibundus</i> Linnaeus, 1766	+	+	+	+	WM/PM	Sch. IV	LC
101.	Yellow-legged gull	<i>Larus cachinnans</i> (Pallas, 1811)	+	+			WM	Sch. IV	LC
102.	Whiskered Tern	<i>Chlidonias hybridus</i> (Pallas, 1811)	+	+		+	R/WM/PM	Sch. IV	LC
103.	Gull-billed Tern	<i>Gelochelidon nilotica</i> (Gmelin, 1789)	+	+			R/WM	Sch. IV	LC
104.	River Tern	<i>Sterna aurantia</i> J.E. J.E. Gray, 1831	+	+	+	+	R	Sch. IV	NT
105.	Common Tern	<i>Sterna hirundo</i> Linnaeus, 1758	+				R/WM	Sch. IV	LC

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106.	Black-bellied Tern	<i>Sterna acuticauda</i> J.E. Gray, 1831	+	+		+	R	Sch. IV	EN
16. TURDINAE									
107.	White-capped Redstart	<i>Chaimarrornis leucocephalus</i> (Vigors, 1831)	+	+	+	+	R/AM/WM	Sch. IV	LC
108.	Plumbeous Redstart	<i>Rhyacornis fuliginosus</i> (Vigors, 1831)	+	+	+	+	R/AM	Sch. IV	LC
109.	Guldenstadt's Redstart	<i>Phoenicurus erythrogaster</i> (Guldenstadt, 1775)	+				R/AM/WM	Sch. IV	LC
110.	Little Forktail	<i>Enicurus scouleri</i> Vigors, 1832	+	+			R/AM	Sch. IV	LC
111.	Black-backed Forktail	<i>Enicurus immaculatus</i> (Hodgson, 1836)	+	+			R	Sch. IV	LC
112.	Slaty-backed Forktail	<i>Enicurus schistaceus</i> (Hodgson, 1836)	+	+			R/AM	Sch. IV	LC
113.	Spotted Forktail	<i>Enicurus maculatus</i> Vigors, 1831	+	+			R/AM	Sch. IV	LC
114.	White-tailed Stonechat	<i>Saxicola leucura</i> (Blyth, 1847)	+	+			R/LM		LC
17. SITTIDAE									
115.	Wallcreeper	<i>Tichodroma muraria</i> (Linnaeus, 1766)	+		+		R		LC
18. GRUIDAE									
116.	Sarus Crane	<i>Grus antigone</i> (Linnaeus, 1758)	+	+		+	R/LM	Sch. IV	GT/Vu
117.	Demoiselle Crane	<i>Grus virgo</i> (Linnaeus, 1758)	+	+			WM	Sch. IV	LC
118.	Common Crane	<i>Grus grus</i> (Linnaeus, 1758)	+	+			WM	Sch. IV	LC
19. ROSTRATULIDAE									
119.	Greater Painted Snipe	<i>Rostratula benghalensis</i> (Linnaeus, 1758)	+	+			R/LM		LC
20. RECURVIROSTRIDAE									
120.	Pied Avocet	<i>Recurvirostra avosetta</i> Linnaeus, 1758	+	+		+	R/WM	Sch. IV	LC
121.	Black-winged Stilt	<i>Himantopus himantopus</i> (Linnaeus, 1758)	+	+	+	+	R/LM	Sch. IV	LC
21. CHARADRIIDAE									
122.	Northern Lapwing	<i>Vanellus vanellus</i> (Linnaeus, 1758)	+	+		+	WM	Sch. IV	LC
123.	River Lapwing	<i>Vanellus duvaucelii</i> (Lesson, 1826)	+	+	+	+	R/LM	Sch. IV	LC
124.	White-tailed Lapwing	<i>Vanellus leucurus</i> (Lichtenstein, 1823)	+	+		+	WM	Sch. IV	LC
125.	Grey-headed Lapwing	<i>Vanellus cinereus</i> (Linnaeus, 1758)	+	+			WM	Sch. IV	LC

S. No.	Family and Common name of the species	Scientific Name	Compiled checklist of birds of Uttarakhand*	Studied wetlands/ landscape sites			Migration/ Residential Status	Conservation Status	
				Corbett landscape**	Bhimgoda barrage, Haridwar ***	Asan barrage, Dehradun ***		WPA, IUCN 1972	IUCN
126.	Red-wattled Lapwing	<i>Vanellus indicus</i> (Boddaert, 1783)	+	+	+	+	R/LM	Sch. IV	LC
127.	Yellow-wattled Lapwing	<i>Vanellus malabaricus</i> (Boddaert, 1783)	+	+	+	+	R/LM	Sch. IV	LC
128.	Sociable Lapwing	<i>Vanellus gregarius</i> (Pallas, 1771)	+	+			WM	Sch. IV	GT/Cr
129.	Lesser Sand Plover	<i>Charadrius mongolus</i> Pallas, 1776	+	+			R/WM	Sch. IV	LC
130.	Little Ringed Plover	<i>Charadrius dubius</i> Scopoli, 1786	+	+		+	R/WM	Sch. IV	LC
131.	Common Ringed Plover	<i>Charadrius hiaticula</i> Linnaeus, 1758	+	+			WM	Sch. IV	LC
132.	Long-billed Ringed Plover	<i>Charadrius placidus</i> J.E. Gray, 1863	+	+			WM	Sch. IV	LC
133.	Kentish Plover	<i>Charadrius alexandrinus</i> Linnaeus, 1758	+	+		+	R/WM	Sch. IV	LC
22. BURHINIDAE									
134.	Great Thick-Knee	<i>Esacus recurvirostris</i> (Cuvier 1829)	+	+		+	R/LM	Sch. IV	NT
135.	Eurasian Thick Knee*	<i>Burhinus oedicnemus</i> (Linnaeus 1758)	+	+			R/LM	Sch. IV	LC
23. GLAREOLIDAE									
136.	Small Pratincole*	<i>Glareola lactea</i> (Temminck, 1820)		+		+	R/LM		LC
23. ACCIPITRIDAE									
137.	Brahminy Kite *	<i>Haliastur indus</i> (Boddaert, 1783)	+	+	+	+	R/LM	Sch. I	LC
138.	Western Marsh-Harrier*	<i>Circus aeruginosus</i> (Linnaeus, 1758)	+	+			WM	Sch. I	LC
139.	Pallas's Fish Eagle*	<i>Haliaeetus leucoryphus</i> (Linnaeus, 1758)	+	+	+	+	R/WM	Sch. I	GT/Vu
140.	White-tailed Sea-Eagle*	<i>Haliaeetus albicilla</i> (Linnaeus, 1758)	+	+			WM	Sch. I	LC
141.	Lesser Grey-headed Fish-Eagle*	<i>Ichthyophaga humilis</i> (Muller, S & Schlegel, 1841)	+	+			R/AM	Sch. I	NT
142.	Greater Grey headed Fish-Eagle*	<i>Ichthyophaga ichthyaetus</i> (Horsfield, 1821)	+	+			R	Sch. I	NT
143.	Greater Spotted Eagle*	<i>Aquila clanga</i> Pallas, 1811	+	+			R/WM	Sch. I	GT/Vu
144.	Steppe Eagle*	<i>Aquila nipalensis</i> Hodgson, 1833	+	+	+		WM	Sch. I	LC
145.	Eastern Imperial Eagle*	<i>Aquila heliaca</i> , Savigny, 1809	+	+			WM	Sch. I	VU
24. ALCIDINIDAE									
146.	Small Blue Kingfisher *	<i>Alcedo atthis</i> (Linnaeus, 1758)	+	+	+	+	R/WM/SM	Sch. IV	LC

S. No.	Family and Common name of the species	Scientific Name	Compiled checklist of birds of Uttarakhand*	Studied wetlands/ landscape sites			Conservation Status		
				Corbett landsc-ape**	Bhimgoda barrage, Haridwar ***	Asan barrage, Dehradun ***	Migration/ Residential Status	WPA, IUCN 1972	
147.	White-breasted Kingfisher*	<i>Halcyon smyrnensis</i> (Linnaeus, 1758)	+	+	+	+	R/LM	Sch. IV	LC
148.	Blue-eared Kingfisher*	<i>Alcedo meninting</i> Horsfield, 1821	+				R	Sch. IV	LC
149.	Lesser Pied Kingfisher*	<i>Ceryle rudis</i> (Linnaeus, 1758)	+	+	+		R	Sch. IV	LC
150.	Stork-billed Kingfisher*	<i>Halcyon capensis</i> (Linnaeus, 1766)	+	+	+		R	Sch. IV	LC
151.	Greater Pied Kingfisher*	<i>Megaceryle lugubris</i> (Temminck, 1834)	+	+	+	+	R	Sch. IV	LC
25. CINCLIDAE									
152.	White-throated Dipper*	<i>Cinclus cinclus</i> (Linnaeus, 1758)	+				R/AM		LC
153.	Brown Dipper*	<i>Cinclus pallasii</i> Temminck, 1820	+	+			R/AM		LC
26. MOTACILLIDAE									
154.	Large pied Wagtail*	<i>Motacilla maderaspatensis</i> Gmelin, 1789	+	+	+	+	R	Sch. IV	LC
155.	Yellow Wagtail*	<i>Motacilla flava</i> Linnaeus, 1758	+	+			R/AM/WM/PM	Sch. IV	LC
156.	Citrine Wagtail*	<i>Motacilla citreola</i> Pallas, Pallas, 1776	+	+		+	R/AM/WM	Sch. IV	LC
157.	Grey Wagtail*	<i>Motacilla cinerea</i> Tunstall, 1771	+	+	+	+	R/AM/WM	Sch. IV	LC
158.	White Wagtail *	<i>Motacilla alba</i> Linnaeus, 1758	+	+	+	+	R/WM/PM	Sch. IV	LC
159.	Rosy Pipit*	<i>Anthus roseatus</i> Blyth, 1847	+	+			R/AM/WM	Sch. IV	LC
160.	Red-throated Pipit*	<i>Anthus cervinus</i> (Pallas, 1811)	+				PM	Sch. IV	LC
161.	Water Pipit*	<i>Anthus spinoletta</i> (Linnaeus, 1758)	+	+		+	WM	Sch. IV	LC
27. HIRUNDINIDAE									
162.	Sand Martin*	<i>Riparia riparia</i> (Linnaeus, 1758)	+	+			R/WM		LC
163.	Pale Martin*	<i>Riparia diluta</i> (Sharpe & Wyatt, 1893)	+				R/WM		NR
164.	Plain Martin*	<i>Riparia paludicola</i> , Vieillot, 1817	+	+			R/LM		LC
165.	Common Swallow *	<i>Hirundo rustica</i> Linnaeus, 1758	+	+	+	+	R/WM		LC
166.	Wire-tailed Swallow*	<i>Hirundo smithii</i> Leach, 1818	+	+	+	+	R/SM		LC
167.	Red-rumped Swallow*	<i>Hirundo daurica</i> Linnaeus, 1771	+	+			R/SM		LC

S. No.	Family and Common name of the species	Scientific Name	Compiled checklist of birds of Uttarakhand*	Studied wetlands/ landscape sites			Conservation Status		
				Corbett landscape**	Bhimgoda barrage, Haridwar ***	Asan barrage, Dehradun ***	Migration/ Residential Status	WPA, IUCN 1972	
168.	Streak-throated Swallow*	<i>Hirundo fluvicola</i> Blyth, 1855	+	+			R/SM	LC	
28. RYNCHOPIDAE									
169.	Indian Skimmer	<i>Rynchops albicollis</i> Swainson, 1838	+				R/LM	GT/Vu	
29. MEROPIDAE									
170.	Blue-cheeked Bee-eater*	<i>Merops persicus</i> Pallas, 1773	+				SM/PM	LC	
171.	Blue-tailed Bee-eater*	<i>Merops philippinus</i> , Linnaeus, 1766	+	+			R/WM	LC	
172.	Chestnut-headed Bee-eater*	<i>Merops leschenaulti</i> Vieillot, 1817	+	+			R	LC	
30. FALCONIDAE									
173.	Peregrine Falcon*	<i>Falco peregrinus</i> Tunstall, 1771	+	+	+		R/WM	Sch. I LC	
31. STRIGIDAE									
174.	Brown Fish-Owl *	<i>Ketupa zeylonensis</i> (Gmelin, 1788)	+	+			R	Sch. IV LC	
175.	Tawny Fish-Owl	<i>Ketupa flavipes</i> (Hodgson, 1836)	+	+			R	Sch. IV LC	

Sources used for the studies conducted in different wetlands of Uttarakhand :

* Mohan, D. & Sondhi, S. 2014

** Dhakate *et al.* 2008; Bhattacharjee, A. & Bargali, H. S. 2012

*** Kumar, A. & Bhatt D. 2000; Data generated by Avian Biodiversity & Bioacoustics Lab. G. K. V., Haridwar; Joshi *et al.* 2010

**** Tak, P. C. & Sati, J. P. 2003; Kaushik, T. K. & Gupta, R. C. 2013

Other sources used: Kumar *et al.* 2005; Grimmett *et al.* 1998; Kazmierczak & Perlo 2006

* An asterisk after the common name indicates the category of water dependent birds

Abbreviations used :

WM- winter migrant; **R/WM-** resident and winter migrant; **R/AM/WM-** resident with altitudinal and winter movements; **WM/PM-** winter migrant as well as passage migrant; **R/WM/PM-** resident with winter influx as well as passage movement; **R/AM/WM/PM-** resident with altitudinal, winter and passage movements; **R/LM-** resident with local movements; **R/LM/SM-** resident local as well as summer movements; **R/WM/LM-** resident with winter arrival and local movements; **R-** resident; **R/AM-** resident with altitudinal movements; **R/SM-** resident with summer influx; **SM/PM-** summer visitor and passage migrant; **R/SM/WM-** resident with summer and winter movements, **GT-** globally threatened; **CR-** critically endangered; **EN-** endangered; **VU-** vulnerable; **NT-** near threatened; **LC-** least concern; **NR-** not recognised

Threatened category status as per BirdLife International 2012. IUCN Red List of Threatened Species. Version 2012.2

Satellite imagery indicates that the green cover of Bheemgoda Barrage decreased from 1,68,467 m² (2003) to 1,17,300 m² (2007) (Fig. 1a & 1b). The green area reduced further from 1,15,028 m² to 62,323 m² between 2010 and 2012 (Fig. 2a & 2b).

Figures 1 (a) : Bheemgoda barrage wetland (28.10.2003)



Figures 1 (b) : Bheemgoda barrage wetland (27.05.2007)

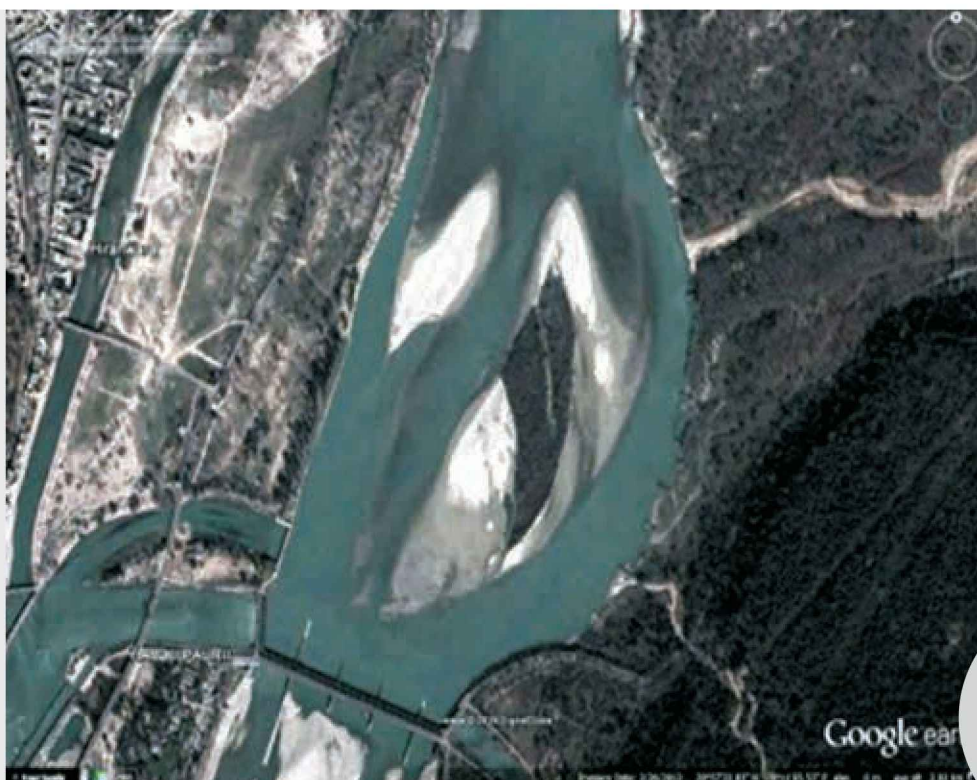




Figures 2 (a) : Bheemgoda barrage wetland (27.3.2010)



Figures 2 (b) : Bheemgoda barrage wetland (26.2.2012)



There were a large number of individuals of migratory species between 1995 and 1997 and between 2000 and 2003, but during and after 2004, there was a significant decline in the number of various migratory species. Examples of the declining trend of some species (5) have been given in Table 1.

Asan Barrage/Asan Conservation Reserve (ACR):

We observed 60–64 waterbirds and 10–14 water-dependent birds during our study period. The average abundance of all species during the study period was 3560. Narang (1990) reported only 12 species of waterbird. Thereafter, Tak and Sati (2003) observed 66 waterbirds and 14 water-dependent birds in 2003. Recently Kaushik and Gupta (2013) reported 60 waterbirds. These authors did not observe the total abundance of the avifauna of Asan Barrage. Taking all studies into account, it can be said that the ACR provide shelter to about 91 species (76 waterbirds and 15 water-dependent birds) (see Appendix 1).

Checklist of all the birds of Uttarakhand

According to the updated checklist of the birds of Uttarakhand compiled by Mohan and Sondhi (2014), 868 avian species are found in Uttarakhand. From the checklist, 175 species can be categorised as waterbirds/wetland-dependent birds (Appendix 1). There is no indication about the migratory or conservation status of the listed species.

Discussion

Studies have shown that Asan reservoir, in Dehradun, Bheemgoda reservoir and Ganga Valley, in Haridwar, Ramganga, reservoirs in the Corbett Landscape, and several other wetlands across the state of Uttarakhand are a major site/passage for migratory waterbirds. Out of the 310 Indian wetland bird species, 175 (~56%) are found in Uttarakhand.

As indicated in the checklist of birds, the largest number (150) of migratory species was observed in the Corbett Landscape as compared with Asan Barrage (91) and Bheemgoda Barrage (70). This variation could be due to habitat heterogeneity, the larger area and greater extent of submerged and emergent vegetation, grasses, shrubs and trees in the Corbett Landscape as compared with Asan or Bheemgoda Barrage. The difference in the number of species may also be due to variations in the microclimatic conditions between the wetlands. Thus it appears that the Corbett Landscape is an ideal place for most of the migratory and wetland-dependent waterbirds, but this habitat is currently being degraded due to habitat change, illicit felling, encroachment, grazing and fire.

In the Asan wetland, a positive correlation was found between the vegetation cover and waterfowl populations (Kumar *et al.* 2005), indicating the importance of the vegetation cover for the migratory birds. Narang (1990) appears to be the first researcher to have reported the presence of eight species of migratory duck (Brahminy Duck *Tadorna ferruginea* (Pallas, 1764), Northern Pintail *Anas acuta* (Linnaeus, 1758), Common Teal *Anas crecca* (Linnaeus, 1758), Mallard *Anas poecilorhyncha* (J. R. Forester, 1781), Red Crested Pochard *Rhodonessa rufina* (Pallas, 1773), Common Pochard *Aythya ferina* (Linnaeus, 1758), Tufted Duck *Aythya fuligula* (Linnaeus, 1758), Common Teal *Anas crecca* Linnaeus, 1758), two species of grebe (Great Crested Grebe *Podiceps cristatus* (Linnaeus, 1758) and Dabchick *Tachybaptus ruficollis* (Pallas, 1764)) and two species of rail (Indian Moorhen *Gallinula chloropus* (Linnaeus, 1758) and Coot *Fulica atra* Linnaeus, 1758), having found these species during 1983–1986 at ACR, Dehradun. Thereafter a number of ornithologists have studied the migratory avifauna at ACR from time to time (Gandhi & Singh 1995, Tak *et al.* 1998, Tak & Sati 2003).

According to Tak *et al.* (1998), Tak and Sati (2003) and Kumar *et al.* (2005),

Table 1 : Abundance of some migratory species at Bheemgoda barrage and shifting of some species to a nearby Missarpur ghat in Ganga valley during 1995-2013

S.No.	Common name of the species	Mean abundance of individuals between 1995-1997	Mean abundance of individuals between 2000-2003	Dr o u g t (2)	Mean abundance of individuals between (2004-2009) before flood	F l o o (4)	Mean abundance of individuals between 2010-2013 after flood	Mean abundance of individuals at Missarpur Ganga ghat Site between 2010-2013
1	Ruddy shelduck	42.55	264.25		60.50	(2)	12.05	60.18
2	Pintail	505.27	334.00	(2)	14.63	0	10.00	35.73
3	Mallard	947.50	152.50	0	07.87	0	7.39	13.69
4	Red crested pochard	08.47	182.50	0	13.50	4)	6.70	14.97
5	Common teal	00.00	254.00	4)	22.97		13.33	17.23

during 1996–1998 about 90% of the population of migratory waterbirds in Asan Barrage were *Tadorna ferruginea* (Pallas, 1764), *Anas acuta* (Linnaeus 1758), *Rhodonessa rufina* (Pallas, 1773), *Aythya ferina* (Linnaeus, 1758), *Anas penelope* (Linnaeus, 1758), *Anas poecilorhyncha* (J.R. Forester, 1781), *Anas strepera* (Linnaeus, 1758), *Anas crecca* (Linnaeus, 1758), *Aythya fuligula* (Linnaeus, 1758), *Anas clypeata* (Linnaeus, 1758) and *Fulica atra* (Linnaeus, 1758). The average total waterfowl count in 1998 was 3,741; however, a number of species and the total number of waterfowl have varied from year to year. For example, Tak and Sati (2003) reported 66 waterbirds, while Kaushik and Gupta (2013) reported only 60 waterbirds. Kaushik and Gupta (2013) also reported a decline in the population of *Anas clypeata*, *Anas acuta*, *Anas crecca*, *Anas querquedula* (Linnaeus, 1758), Spot-billed Duck *Anas poecilorhyncha* (J. R. Forester 1781) and *Anas strepera* during 2005–2012. This decline in the populations of the migratory species may be due to climate change, anthropogenic activities or degradation of the wetland.

Apart from the above factors, natural disasters such as droughts, floods, extreme rainfall events, flash floods and fires can have a significant effect on the avian migratory species diversity and flock size by having significant effects on the habitat, as has been shown in the case of Bheemgoda Barrage.

It is interesting to note that despite the smaller area of Bheemgoda Barrage in comparison with ACR, it held about 3000–4000 individuals of 70 species of water-/wetland-dependent bird. This clearly reflects the high capacity of Bheemgoda Barrage to provide nourishment and shelter to wetland species. But due to the drought in 2004 (one of the five drought years in India in the past 20 years, Reddy 2014) and other anthropogenic disturbances, there was a drastic decline in the area of the green cover of the island (Figure 1a & 1b), consequently reducing the number of species and the number of individuals that used to arrive at Bheemgoda (Table 1). The bird species that declined significantly were *Tadorna ferruginea* Pallas, 1764, *Anas acuta* Linnaeus, 1758, *Anas platyrhynchos* Linnaeus, 1758, *Rhodonessa rufina* Pallas, 1773 and *Anas crecca* Linnaeus, 1758.

Similarly, in 2010 and thereafter, there was a further decline in the number of migratory species and their abundance. During this period, only 28 species arrived at the wetland. This decline appears to have been caused by the heavy flood that occurred in August 2010 in Haridwar, which further damaged the green island of the barrage, greatly reducing the vegetation cover available for the migratory avifauna. Apart from the flood, there were a number of construction activities going on the river bank and near Bheemgoda Barrage in preparation for the Kumbh Mela (2010), causing a high level of human disturbance in the area. A significant decrease in the abundance of a number of species such as *Ephippiorhynchus asiaticus* Latham, 1790 (76%), *Podiceps cristatus* (Linnaeus, 1758) (5%) and *Larus ichthyætus* (Pallas 1773) (47%) was noted at Bheemgoda Barrage, while some species such as *Anser indicus* Latham, 1790 and *Aythya ferina* (Linnaeus, 1758) did not arrive at this wetland. Joshi *et al.* (2010) also reported declines in the populations and alterations in the arrival and departure timings of migratory species in and around Bheemgoda Barrage.

Issues of conservation and management

The survival of a seasonal breeding species depends upon its ability to breed at a propitious time of the year (Chandola *et al.* 1982). In order to breed at the right time of the year, migratory birds should reach their breeding ground when food resources are abundant. There are reports that long-distance migratory birds do not appear to be responding to climate change as rapidly as short-distance migrants (Crick 2004, Mills 2005, Tryjanowski *et al.* 2002). This suggests that long-distance migrants are more likely to suffer from climate change-induced changes in their environment and migratory routes (Coppack & Both 2002, Visser *et al.* 2004). Therefore it can be assumed that climate change will also affect the number, abundance and arrival and departure dates of the migratory avifauna of Uttarakhand as most of the birds are long-distance migrants from the Palearctic zone. Though there are numerous wetland habitats for birds across the state of Uttarakhand, only a few habitats and their migratory waterbirds have been systematically surveyed. Hence, comprehensive information on the abundance, distribution and effects of climate change is lacking, which makes it difficult to suggest/implement conservation plans effectively for long-distance migrants. Currently, a habitat conservation approach is only one side of conservation efforts. However, without studying the effects of climate change on migratory waterbirds, it will be difficult at this point of time to devise adequate conservation measures. Improved and up-to-date status and trend information is vital in the light of the major development pressures on the natural and man-made wetlands in the state of Uttarakhand.

Since the wetlands of Uttarakhand provide safe nutrition and shelter sites for about 26 threatened species (Appendix 1), the restoration and conservation of these wetlands becomes most important for safe and regular arrival of these migratory birds. Also, there is a need to improve our understanding of the migration patterns and conservation requirements of the waterbirds through continuous research and sharing of knowledge and skills.

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Waterbirds
of Selected
Wetlands of
Uttarakhand

- 1 - Photo Plate 1-4 :** *Waterbirds observed in Bheemgoda barrage*
2 - Photo Plate 5-8 : *Waterbirds observed in Asan barrage*



Photo Plate 1 : A Flock of Painted stork
(*Mycteria leucocephala*)



Photo Plate 2 : Black-crowned night-heron
(*Nycticorax nycticorax*)



Photo Plate 3 : River lapwing
(*Vanellus duvaucelii*)



Photo Plate 4 : Pallas's gull
(*Ichthyophaga ichthyophaga*)



Waterbirds
of Selected
Wetlands of
Uttarakhand

Photo Plate 5 : Black-headed ibis
(*Threskiornis melanocephalus*)

Photo Plate 6 : Black-winged stilt
(*Himantopus himantopus*)

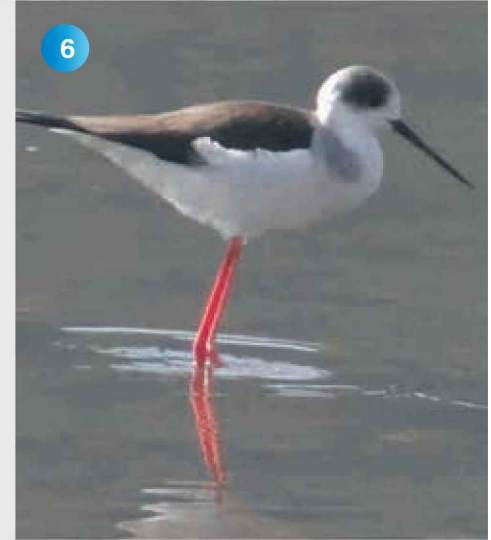


Photo Plate 7 : A flock of Ruddy shelduck
(*Tadorna ferruginea*); Little egret (*Egretta
garzetta*) & Little cormorant (*Microcarbo niger*)



Photo Plate 8 : Spot-billed duck
(*Anas poecilorhyncha*)



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