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Survey of avifauna of the Gharana wetland reserve: implications for conservation in a semi-arid agricultural setting on the Indo-Pakistan border

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The original version has been revised.

Abstract

Background: The Gharana wetland conservation reserve (GWCR) is a semi-arid wetland adjacent to agricultural areas on the Indo-Pakistani border. Despite being declared an Important Bird Area (IBA) by Birdlife International, the occurrence and distribution of birds has not been well-documented in this area. Our aims were to systematically document the composition, relative abundance and feeding guilds of all avian fauna in order to form a baseline to monitor changes from—and to underwrite—future conservation actions.

Results: From 24 surveys over 1 year, we recorded 151 species from 45 families and 15 orders. 41% of species were listed as 'rare' and only 22% were 'very common'. The largest number of families belonged to the order Passeriformes (40%), followed by Charadriiformes (14%) and Coraciiformes (11%). The most species (12%), were found in the family Anatidae (Anseriformes—widely recognized as bio-indicators), followed by Accipitridae (Falconiformes;12%) and Muscicapidae (Passeriformes; 6%). Carnivores and insectivores were the feeding guilds most frequently observed. Indeed, more than 50% of all species fed on the abundant fish, mollusks and insects and larvae. Bark-feeders and nectarivores were the least common.

Conclusions: Winter visitors were frequently found, while summer visitors were rare, reinforcing the importance of GWCR as a wintering site for high-altitude species. The conservation of this wetland is especially crucial for nine globally-threatened species. We have provided baseline documentation to help future monitoring efforts for this region, and a template to initiate the implementation of conservation plans for other remote IBAs.

Keywords: Biodiversity, Biological indicators, Feeding guilds, Relative abundance, Residential status, Wetland conservation

Background

Global avian diversity has been reviewed intermittently over the last 75 years [1–4], and is not complete, especially in Asia. This lack of documentation is especially prominent in India, which has one of the highest biodiversity indices in the world and includes 12% of the world's avifauna fauna. However, almost 25% of the bird species found in India (1224 species belonging to 78 families and 17 orders) are dependent on wetlands [5] at a time when wetland loss is considered the prime threat to waterfowl across the globe [6]. Eighty percent of the population decline in Asian flyways near wetlands are a result of human encroachment, increased agriculture and climate change, and militarization near borders [7, 8].

The Gharana wetland conservation reserve (GWCR) is recognized as an Important Bird Area (IBA) by Birdlife International [9]. IBAs ensue from a global network that identifies focal areas for conservation implementation [10].

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Criteria for inclusion into an IBA are based on the abundance of avian species, the presence of globally-threatened or restricted-range species, and/or their vulnerability to climate change [9] GWCR is especially important because it consists of a semi-arid wetland on the international border between the Indian states and the four provinces of Pakistan, and provides a unique habitat not only for birds, but also for many meso-predators and small carnivores, herbivores, primates and reptiles. The primary threats to this wetland are human encroachment and its corollaries such as cattle grazing, bathing, stray dogs and military shelling across the Indo-Pakistan border.

In order to draft conservation plans for the remaining avifauna in accordance with the IBA designation, it is essential that a number of criteria are documented: including the presence and abundance of bird species across all seasons, and their feeding guilds which relate to food abundance, quality, and availability of perching, roosting and nesting sites. These factors are important, not only because they influence the abundance and diversity of birds, but may have indirect effects on other animal and plant taxa throughout the ecosystem. For instance, granivorous birds can reduce seed survival of plant/crop species [11, 12], while insectivores can decrease the abundance of herbivorous arthropods [13, 14]. Frugivorous birds influence seed dispersal [15, 16] and the survival and reproduction of herbaceous and woody plants. They influence these processes directly through seed predation, and indirectly, by reducing the abundance of herbivorous insects and seed dispersal [17].

The avifauna has been minimally documented in Gharana. Sharma and Saini [18] recorded 21 waterfowl species in the region, while Pandotra and Sahi [19] reported the presence of 57 species of waterfowl and terrestrial birds. No complete documentation has been available, however, and no study has reported feeding guilds for either the resident or visiting species. Thus, it is unclear what resources from the wetland are attracting migrants.

Objectives

Our objectives were to comprehensively document the species composition, relative abundance and feeding guilds of all avian fauna over 1 year in GWCR, inclusive of the surrounding agricultural fields.

Results

The maximum number of families (Table 1) belonged to the order Passeriformes, 18 (40% of total) followed by Charadriiformes, 6 (14%). Most identified species belonged to Anatidae 19 (12%), followed by Accipitridae 18 (12%) and Muscicapidae 9 (6%). After ranking avifauna into three categories based on their cumulative abundance (Fig. 1), we learned that 62 (41% of total) species were rare, 56 species (37% of total) were common, and 33 (22% of total) species were very common. Nine globally-threatened species were identified: Painted Stork *Mycteria leucocephala*, Wooly-necked Stork *Ciconia episcopus*, Black-necked Stork *Ephippiorhynchus asiaticus*, Black-headed (White) Ibis *Threskiomis melanocephalus*, Ferruginous Duck *Aythya nyroca*, Greater Spotted Eagle *Aquila clanga*, Egyptian Vulture *Neophron percnopterus*, Pallid Harrier *Circus macrourus* and Indian River Tern *Sterna aurantia*. Among 151 total species (Table 1), 74 (49%) were winter visitors, 54 (36%) were resident, 11 (7%) were vagrant and 12 (8%) were summer visitors (Fig. 1).

Birds of GWCR primarily utilized eight feeding guilds: herbivores, bark feeders, carnivores, frugivores, granivores, insectivores, nectarivores and omnivores. Among these families, 19 (13%) were herbivores, bark feeders 2 (1%), carnivores 46 (36%), frugivores 6 (4%), graminivores 7 (5%), insectivores 40 (26%), nectarivore 1 (1%) and omnivores 30 (20%).

Discussion

We have provided baseline data for an under-reported, but vulnerable, wetland near a border in remote Asia. We recorded 151 species including 62 waterfowl and 89 terrestrial species. This provides a substantial update to the 21 and 57 species already documented [18, 19]. Most of the high-altitude bird species are known to migrate towards lower altitude sites such as GWCR during winter [20], and this was also observed in our study. In particular, the high number of winter visitors likely suggests that Gharana and its adjoining agricultural fields provide appropriate habitat for thousands of winter migratory birds as well as important wintering and stopover site for several other migratory species.

The high prevalence of the Anatidae affirms notions that this region provides particularly suitable habitat and abundant food for ducks, geese and swans. The Accipitridae are ideal indicators of ecosystem health because they are near the top of local trophic levels. As top-order predators, the Accipitridae are key bio-indicators to understanding the dynamics of local ecosystems. In GWCR, their presence likely reflects the greater availability of small mammals, birds, reptiles, amphibians and insects. Indeed, over 70% of the total feeding guilds were carnivorous (36%), insectivorous (26%) or omnivorous (20%).

The regional diversity of birds commonly varies with factors such as climate of the area (temperature, humidity and rainfall), altitude, food availability [21]. While some of these factors were beyond the remit of our study, and will be updated in furture reports, we were able to note the presence of a large number of species of fish, mollusks, amphibians and aquatic insects and their larvae, that these birds fed upon. These resources are important to document as thoroughly as possible because

Table 1 Comprehensive list of bird species recorded utilizing Gharana wetland conservation reserve and associated agricultural fields

Species (no.)	Order	Family	Common name	Scientific name	Residental status	Abundance	Feeding	IUCN status
1	Podicipediformes	Podicipedidae	Little Grebe	*Tachybaptus ruficollis*	R	VC	C	LC
2	Pelecaniformes	Phalacrocoracidae	Great Cormorant	*Phalacrocorax carbo*	WV	VC	C	LC
3			Little Cormorant	*Phalacrocorax niger*	WV	VC	C	LC
4	Ciconiiformes	Ardidae	Yellow Bittern	*Ixobrychus sinensis*	WV	R	C	LC
5			Black-crowned Night Heron	*Nycticorax nycticorax*	WV	C	C	LC
6			Indian Pond Heron	*Ardeola grayii*	R	VC	C	LC
7			Cattle Egret	*Bubulcus ibis*	R	VC	C	LC
8			Little Egret	*Egretta garzetta*	R	VC	C	LC
9			Intermediate Egret	*Mesophoyx intermedia*	R	C	C	LC
10			Great Egret	*Casmerodius albus*	WV	C	C	LC
11			Purple Heron	*Ardea purpurea*	R	VC	C	LC
12			Grey Heron	*Ardea cinerea*	R	VC	C	LC
13		Ciconiidae	Painted Stork	*Mycteria leucocephala*	WV	R	C	NT
14			Black Stork	*Ciconia nigra*	WV	R	C	LC
15			Wooly-necked Stork	*Ciconia episcopus*	WV	R	C	VU
16			Black-necked Stork	*Ephippiorhynchus asiaticus*	WV	R	C	NT
17		Threskiornithidae	Black-headed (White) Ibis	*Threskiomis melanocephalus*	WV	R	C	NT
18			Red-naped Ibis	*Pseudibis papillosa*	WV	R	C	LC
19			Glossy ibis	*Plegadis falcinellus*	WV	R	C	LC
20			Eurasian Spoonbill	*Platalea leucorodia*	WV	R	C	LC
21	Anseriformes	Anatidae	Lesser Whistling Duck	*Dendrocygna javanica*	WV	VC	H	LC
22			Greylag Goose	*Anser anser*	WV	R	H	LC
23			Greater White-fronted Goose	*Anser albifrons*	WV	R	H	LC
24			Indian Cotton Teal	*Nettapus coromandelianus*	WV	VC	H	LC
25			Bar-headed Goose	*Anser indicus*	WV	C	H	LC
26			Ruddy Shelduck	*Tadorna ferruginea*	WV	R	H	LC
27			Comb Duck	*Sarkidiornis melanotos*	WV	R	H	LC
28			Eurasian Wigeon	*Anas penelope*	WV	C	H	LC
29			Gadwall	*Anas strepera*	WV	VC	H	LC
30			Eurasian Teal	*Anas crecca*	WV	VC	H	LC
31			Mallard	*Anas platyrhynchos*	WV	R	H	LC
32			Indian Spot-billed Duck	*Anas poecilorhyncha*	WV	R	H	LC
33			Northern Pintail	*Anas acuta*	WV	C	H	LC
34			Garganey	*Anas querquedula*	SV	R	H	LC
35			Northern Shoveler	*Anas clypeata*	WV	VC	H	LC
36			Red-crested Pochard	*Netta rufina*	WV	R	H	LC
37			Common Pochard	*Aythya ferina*	WV	C	H	LC
38			Ferruginous Duck	*Aythya nyroca*	WV	R	H	NT
39			Tufted Duck	*Aythya fuligula*	WV	R	H	LC
40	Falconiformes	Accipitridae	Black-shouldered Kite	*Elanus caeruleus*	R	C	C	LC
41			Black Kite	*Milvus migrans*	R	C	C	LC
42			Steppe Eagle	*Aquila nipalensis*	WV	C	C	LC
43			Greater Spotted Eagle	*Aquila clanga*	WV	R	C	VU

Table 1 Comprehensive list of bird species recorded utilizing Gharana wetland conservation reserve and associated agricultural fields *(Continued)*

44			Eurasian Marsh-Harrier	*Circus aeruginosus*	WV	R	C	LC
45			Eurasian Sparrowhawk	*Accipiter nisus*	V	R	C	LC
46			Himalyan buzzard	*Buteo buteo*	WV	R	C	LC
47			Long-legged Buzzard	*Buteo rufinus*	WV	R	C	LC
48			Besra	*Accipiter virgatus*	WV	R	C	LC
49			Northern Goshawk	*Accipiter gentilis*	WV	R	C	LC
50			Booted Eagle	Hieraaetus pennatus	WV	R	C	LC
51			Egyptian Vulture	*Neophron percnopterus*	SV	C	C	NT
52			Shikra	*Accipiter badius*	R	C	C	LC
53			Hen Harrier	*Circus cyaneus*	WV	C	C	LC
54			Eurasian Marsh-Harrier	*Circus aeruginosus*	WV	VC	C	LC
55			Pallid Harrier	*Circus macrourus*	WV	R	C	NT
56			Short-toed snake Eagle	*Circaetus gallicus*	WV	C	C	LC
57		Falconidae	Eurasian Hobby	*Falco subbuteo*	WV	R	C	LC
58	Galliformes	Phasianidae	Gray Francolin	*Francolinus pondicerianus*	R	VC	O	LC
59	Gruiformes	Rallidae	Water Rail	*Rallus aquaticus*	WV	C	O	LC
60			White-breasted Waterhen	*Amaurornis phoenicurus*	R	VC	O	LC
61			Common Moorhen	*Gallinula chloropus*	R	VC	O	LC
62			Purple Swamphen	*Porphyrio porphyrio*	R	VC	O	LC
63			Common Coot	*Fulica atra*	WV	C	O	LC
64	Charadriiformes	Jacanidae	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	SV	C	O	LC
65		Charadriidae	Red-wattled Lapwing	*Vanellus indicus*	R	VC	O	LC
66			Little Ringed Plover	*Charadrius dubius*	R	R	O	LC
67			White-tailed Plover	*Vanellus leucurus*	WV	R	O	LC
68		Scolopacidae	Greenshank	*Tringa nebularia*	WV	C	I	LC
69			Common Snipe	*Gallinago gallinago*	WV	R	I	LC
70			Common Redshank	*Tringa totanus*	V	R	I	LC
71			Common Sandpiper	*Actitis hypoleucos*	WV	C	I	LC
72			Green sandpiper	*Tringa ochropus*	WV	R	I	LC
73			Curlew Sandpiper	*Calidris ferruginea*	V	R	I	LC
74			Little Stint	*Calidris minuta*	V	R	I	LC
75			Ruff	*Philomachus pugnax*	WV	VC	I	LC
76		Recurvirostridae	Black-winged Stilt	*Himantopus himantopus*	WV	C	I	LC
77		Glareolidae	Oriental Pratincole	*Glareola maldivarum*	V	R	I	LC
78			Little Pratincole	*Glareola lactea*	R	C	I	LC
79		Laridae	Indian River Tern	*Sterna aurantia*	SV	C	C	NT
80			Common Tern	*Sterna hirundo*	V	R	C	LC
81			White-winged Black Tern	*Chlidonias leucopterus*	V	R	C	LC
82	Columbiformes	Columbidae	Eurasian Collared-Dove	*Streptopelia decaocto*	R	VC	O	LC
83			Spotted Dove	*Streptopelia chinensis*	WV	R	O	LC
84			Rock Pigeon	*Columba livia*	R	VC	O	LC
85	Psittaciformes	Psittacidae	Rose-ringed Parakeet	*Psittacula krameri*	R	C	F	LC
86			Plum-headed Parakeet	*Psittacula cyanocephala*	WV	R	F	LC
87	Cuculiformes	Cuculidae	Greater Coucal	*Centropus sinensis*	R	C	C	LC

Table 1 Comprehensive list of bird species recorded utilizing Gharana wetland conservation reserve and associated agricultural fields *(Continued)*

88			Asian Koel	*Eudynamys scolopaceus*	SV	C	O	LC
89			Pied Cuckoo	*Clamator jacobinus*	SV	R	O	LC
90			Eurasian Cuckoo	*Cuculus canorus*	SV	R	O	LC
91	Strigiformes	Strigidae	Spotted Owlet	*Athene brama*	R	C	C	LC
92	Coraciiformes	Alcedinidae	White throated Kingfisher	*Halcyon smyrnensis*	R	VC	C	LC
93			Common Kingfisher	*Alcedo atthis*	WV	C	C	LC
94			Crested Kingfisher	*Megaceryle lugubris*	R	VC	C	LC
95		Meropidae	Green Bee-eater	*Merops orientalis*	R	VC	I	LC
96			Blue-tailed Bee-eater	*Merops philippinus*	SV	C	I	LC
97		Coraciidae	Indian Roller	*Coracias benghalensis*	R	C	I	LC
98		Upupidae	Eurasian Hoopoe	*Upupa epops*	R	C	I	LC
99		Bucerotidae	Indian Grey Hornbill	*Ocyceros birostris*	R	R	F	LC
100	Piciformes	Picidae	Lesser goldenback	*Dinopium benghalense*	R	C	BF	LC
101			Yellow-crowned Woodpecker	*Dendrocopos mahrattensis*	R	R	BF	LC
102		Capitonidae	Coppersmith Barbet	*Megalaima haemacephala*	R	R	F	LC
103	Passeriformes	Alaudidae	Crested Lark	*Galerida cristata*	R	C	O	LC
104		Hirundinidae	Wire-tailed Swallow	*Hirundo smithii*	SV	C	I	LC
105			Barn Swallow	*Hirundo rustica*	WV	R	I	LC
106			Plain Martin	*Riparia paludicola*	R	R	I	LC
107		Motacillidae	Gray Wagtail	*Motacilla cinerea*	WV	C	I	LC
108			Paddyfield Pipit	*Anthus pratensis*	R	C	I	LC
109			Tree Pipit	*Anthus trivialis*	V	R	I	LC
110			Rosy Pipit	*Anthus roseatus*	WV	C	I	LC
111			White Wagtail	*Motacilla alba*	WV	C	I	LC
112			Citrine Wagtail	*Motacilla citreola*	WV	R	I	LC
113			White-browed Wagtail	*Motacilla madaraspatensis*	R	VC	I	LC
114		Campephagidae	Small Minivet	Pericrocotus cinnamomeus	R	R	I	LC
115		Pycnonotidae	Red-vented Bulbul	*Pycnonotus cafer*	R	VC	F	LC
116		Laniidae	Bay-backed Shrike	*Lanius vittatus*	R	C	O	LC
117			Long-tailed Shrike	*Lanius schach*	SV	C	O	LC
118		Muscicapidae	Pied Bushchat	*Saxicola caprata*	R	C	G	LC
119			Variable Wheatear	*Oenanthe picata*	WV	R	G	LC
120			Isabelline Wheatear	*Oenanthe isabellina*	V	R	G	LC
121			Black Redstart	*Phoenicurus ochruros*	WV	R	I	LC
122			Oriental Magpie-Robin	*Copsychus saularis*	R	VC	I	LC
123			Gray Bushchat	*Saxicola ferreus*	WV	C	I	LC
124			Indian Robin	*Copsychus fulicatus*	R	VC	I	LC
125			Bluethroat	*Luscinia svecica*	R	R	I	LC
126			White-tailed Stonechat	*Saxicola leucurus*	V	R	G	LC
127		Paridae	Great Tit	*Parus major*	WV	C	F	LC
128		Nectariniidae	Purple Sunbird	*Nectarinia asiatica*	SV	C	N	LC
129		Zosteropidae	Oriental White-eye	*Zosterops palpebrosus*	R	C	I	LC
130		Estrildidae	Scaly breasted munia	*Lonchura punctulata*	WV	VC	G	LC
131		Passeridae	House Sparrow	*Passer domesticus*	R	VC	G	LC

Table 1 Comprehensive list of bird species recorded utilizing Gharana wetland conservation reserve and associated agricultural fields *(Continued)*

132		Sind Sparrow	*Passer pyrrhonotus*	WV	R	G	LC
133	Ploceidae	Baya Weaver	*Ploceus philippinus*	WV	C	O	LC
134		Black-breasted weaver	*Ploceus benghalensis*	WV	R	O	LC
135	Sturnidae	Brahminy Starling	*Temenuchus pagodarum*	WV	R	O	LC
136		Common Starling	*Sturnus vulgaris*	WV	C	O	LC
137		Bank Myna	*Acridotheres ginginianus*	R	VC	O	LC
138		Asian Pied Starling	*Gracupica contra*	V	C	O	LC
139		Common Myna	*Acridotheres tristis*	R	C	O	LC
140	Oriolidae	Eurasian Golden Oriole	*Oriolus oriolu*	WV	R	O	LC
141	Dicruridae	Black Drongo	*Dicrurus macrocercus*	R	C	I	LC
142		Ashy Drongo	*Dicrurus leucophaeus*	SV	C	I	LC
143	Corvidae	House Crow	*Corvus splendens*	R	VC	O	LC
144		Rufous Treepie	*Dendrocitta vagabunda*	R	C	O	LC
145		Large-billed Crow	*Corvus macrorhynchos*	WV	R	O	LC
146	Cisticolidae	Ashy Prinia	*Prinia socialis*	R	C	I	LC
147		Striated Prinia	*Prinia crinigera*	R	C	I	LC
148		Common Tailorbird	*Orthotomus sutorius*	R	C	I	LC
149		Plain Prinia	*Prinia inornata*	R	C	I	LC
150		Common Chiffchaff	*Phylloscopus collybita*	WV	C	I	LC
151		Zitting Cisticola	*Cisticola juncidis*	R	R	I	LC

Residential status: *WV* winter visitors, *R* resident, *V* vagrant and *SV* summer visitors. Abundance: *C* common, *VC* very common, *R* rare. Feeding: *BF* bark feeder, *C* carnivorous, *F* frugivorous, *G* granivorous, *H* herbivorous, *I* insectivorous, *N* nectarivorous, *O* omnivorous. IUCN Status (as of the time of manuscript preperation): *LC* least concern, *NT* near threatened, *VU* = vulnerable

they serve as attractive food sources for resident and migrants. In particular, wader species were found to regularly visits the agricultural fields surrounding GWCR, likely owing to the shallow water and presence of high numbers of aquatic insects.

Importantly, we have documented nine globally threatened species (5% of the total species). These species epitomize the need for further monitoring and conservation actions related to GWCR and its associated agricultural fields. The exceptional arthropod diversity provides abundant food for these guilds, and included a substantial number of unknown arachnids whose description warrants detailed scientific studies. Hence, the Gharana wetland is not only an ideal

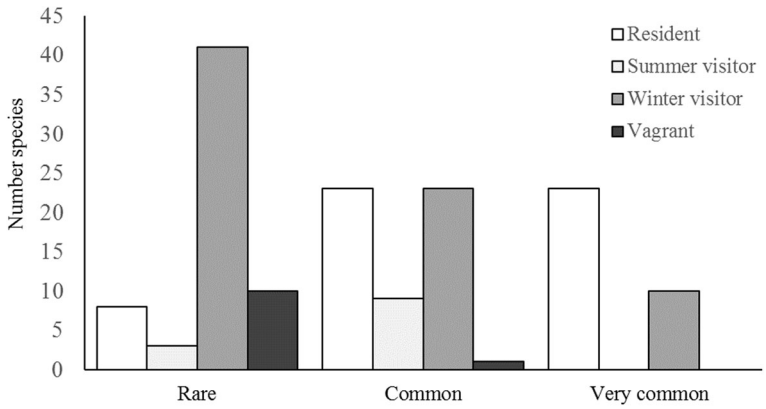

Fig. 1 Residential status and abundance of bird species observed in Gharana wetland conservation reserve and associated agricultural fields in Jammu and Kasmir, India from July 2012 to June 2013

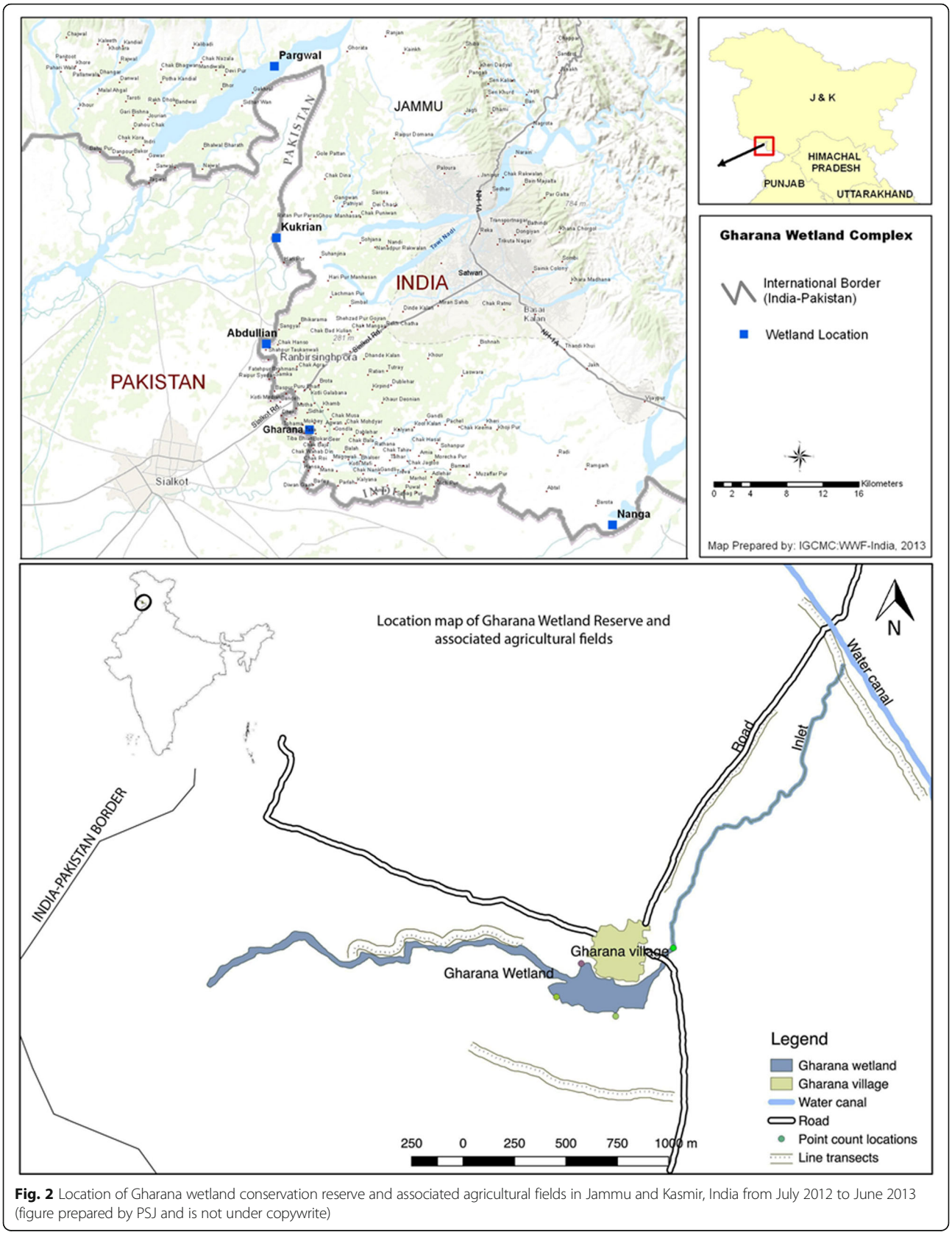

Fig. 2 Location of Gharana wetland conservation reserve and associated agricultural fields in Jammu and Kasmir, India from July 2012 to June 2013 (figure prepared by PSJ and is not under copywrite)

place for the conservation of endemic and globally threatened birds, but also for a complex array of flora and fauna that attract such a broad range of bird species.

Conclusions

Winter visitors were frequently found in GWCR, while summer visitors were rare, reinforcing the importance of this region as a wintering site for high-altitude species. The conservation of this wetland is especially crucial for nine globally-threatened species. We have provided baseline documentation to help future monitoring efforts for this region, and a template to initiate the implementation of conservation plans for other remote IBAs.

Methods

Study site

Gharana 32°32'28" N; 74°41'27" E; 281 m asl (Fig. 2) is located on the international India-Pakistan border in the south-western part of Jammu province in the Indian state of Jammu and Kashmir. It is a naturally maintained, rain-fed swamp with a bottom surface of loamy clay with decaying vegetation. Surrounding plants include macrophytes such as *Eicchornia spp*. and *Hydrilla spp*. [22] and the Common reed (*Typha spp*.). Additional sources of water are spillover from a nearby canal (the Ranbir Canal) and surface runoff from agricultural areas [19].

This wetland and its adjacent agricultural fields are in the subtropical climatic zone where summer temperatures may reach 46 °C maximum and winter minima decrease to as low as 2 °C. Annual rainfall is around 1331 mm, with most precipitation occurring when the south-western monsoon winds arrive from July-September. The agricultural fields adjacent to Gharana village also provides both suitable habitat, and concomitant threats, for a diverse group of bird taxa. Owing to the wide diversity of avifauna, and also being a wintering ground for many threatened and migratory waterfowl, GWCR was also declared as Important Bird Area (IBA) by the Bombay Natural History Society and BirdLife International [23].

Data collection

We conducted twenty-four surveys from July 2012 to June 2013, covering all seasons; summer (April–June), monsoon (July–Sept), autumn (Oct–Novem) and winter (Dec–March). Our surveys (Fig. 2) followed well established methods including line transects and point count methods, as per [24]. Bird counts were direct visual sightings only. Counts were performed twice per month at all sites by a team of ten individuals in the early morning (07:00–10:00) during the time of highest bird activity [25] and lowest human disturbance. Experts with over 200 h of wetland bird identification and post-doctoral training were consulted throughout the period.

We classified all species as common/rare, resident/migratory status of the birds as per [26] For instance, VC = very common species encountered during 80% of all surveys); C = common species encountered frequently (50–70%) and R = rare species which are encountered less frequently (10–20%). Likewise, if we only documented a particular species between December and March, then we considered it as a winter visitor. Whereas, presence between April and June was documented as a summer visitation. If we documented a bird throughout a year in and around GWCR, then it was considered as a resident. Feeding guilds were identified from the literature, rather than what birds were seen feeding on at the time. Nikon Monarch 10 × 42 binoculars were used during surveys for taking observations and on-the-spot identification. We used photographs and/or video to validate any unidentified species. The checklist was prepared using the standardized common and scientific names assigned in [27]. All data collected were observational and did not involve any manipulation or alteration of any animals, plants or humans.

Limitations

The limitations of our study are due to the lack of hypotheses testing, and is purely descriptive. Post-hoc analyses may be performed using our data set which has been submitted to a public repository (details in the declarative statement).

Abbreviations

GWCR: Gharana wetland conservation reserve; IBA: Important Bird Area

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Availability of data and materials

The datasets generated during and/or analyzed during the current study has been made available in a public digital data repository available at https://doi.pangaea.de/10.1594/PANGAEA.874857.

Authors' contributions

PSJ, PC, RR and AA designed the study and collected all data. PSJ and MHP analyzed and presented the data and drafted the manuscript. PMK assisted the analysis and all drafts of the manuscript. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

Consent for publication

Not applicable.

Ethics approval and consent to participate
These data are observational only and do not require ethics approval or consent to participate.

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