



DIVERSITY AND DISTRIBUTION OF AVIAN FAUNA AT BORITH LAKE, HUNZA, GILGIT BALTISTAN

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ABSTRACT

Borith Lake (36° 25' 52" N, 74° 51' 40" E), Hunza District, Gilgit Baltistan, was surveyed for avian diversity from 2021-2022, revealing 207 species across 18 orders and 45 families. The top 18 bird orders by species count were: Passeriformes 104, Charadriiformes 32, Accipitriformes 17, Anseriformes 16, Columbiformes 6, Pelecaniformes 6, Falconiformes 4, Gruiformes 4, Galliformes 3, Strigiformes 3, Podicipediformes 3, Coraciiformes 2, Piciformes 2, Suliformes 1, Bucerotiformes 1, Apodiformes 1, Cuculiformes 1 and Ciconiiformes 1 species. Notably, large numbers of migratory birds visited the lake and surrounding areas during spring (mid-February to mid-March) and summer (mid-August to mid-September). During the present study 01 bird species (Steppe Eagle) was recorded as Endangered, 02 species (Greater Spotted Eagle and Common Pochard) as Vulnerable and 07 bird species as Near-threatened in the study area. The lake's habitat appears to face no severe threats. This study establishes a baseline for understanding Borith Lake's avifaunal richness, population, and distribution, providing valuable insights for future research, conservation and management efforts.

Keywords: Gilgit Baltistan, birds biodiversity, high-altitude areas, eco-tourism.

INTRODUCTION

Freshwater ecosystems, comprising rivers, lakes, and wetlands, support a vast array of aquatic invertebrate and vertebrate biodiversity worldwide (World Resources, 2001). In Pakistan, 19 Ramsar Sites have been designated as wetlands of international importance, covering an area of 1,343,807 hectares (Ramsar, 2024). Pakistan is home to a diverse avifauna, with estimates varying across studies. Initially, Roberts (1991) documented a 660 species, Grimmett *et al.* (2008) updated the total to 670 species. More recently, Khan *et al.* (2010) reported 606 species, comprising 272 genera and 74 families.

Several ecologically important lakes and wetlands are situated at high-altitude, particularly in Gilgit Baltistan. There are following six lakes found in the district of Gilgit (Khurshid, 1997) and provide good habitat, breeding and feeding ground to residential and migratory birds:

1. Bario Darikush Lake, Bar Valley, Nogar I
2. Nalter Lake I, II, III, Nalter, Nomal
3. Borith Lake, Ghukin, Gojal

4. MourKhun Pond, MourKhun, Gojal
5. Shimshal Pamir Lake, Shimshal, Gojal
6. Kargah Nullah Lake, Nargah

Gilgit Baltistan (GB) is situated in the northern region of Pakistan, having an area about 72,500 km² bordering with India, China and Afghanistan. The region is an integral part of South Asia, covers the union zone of three grandiose ranges viz. Hindukush, Himalaya and Karakoram. Spectacular rivers, enormous glaciers distinctive ecological zones and magnificent valleys are present in the mountain ranges of GB.

The Hunza district, situated in the northernmost part of the Indian subcontinent, spans approximately 11,780 square kilometers. The region's diverse landscape features permanent snowfields, glaciers, alpine scrub, and dry alpine zones, characterized by an abundance of wildflowers, sedges, and grasses.

Borith Lake serves as a vital habitat for various bird species, including numerous raptors, Passeriformes, and seasonal visitors. The wetland study area is home to approximately 200 bird species, comprising: Raptors,

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Pipits, Waterfowl, Gulls, Finches, Warblers, Waders, Doves and Accentors. This study aimed to investigate the diversity and distribution of avifauna at Borith Lake, shedding light on the ecological significance of this vital habitat.

MATERIALS AND METHODS

Study Area

Borith Lake is a small saline lake in Gojal Hunza about 2km towards Husseini, a village in upper Hunza. The study was carried out during the period of 2021 to 2022.

Survey Methods

For field surveys Line Transect method (Sale and Berkmueller, 1998) and Point Transect method (Verner, 1985) were used. During the study, surveys were conducted early in the morning (5.00 – 7.00 am) and in the evening (4.00 – 6.00 pm). Several irregular visits were also made during different hours of the day. For species identification, Avian fauna books and field guides including Ali and Ripley (1987), Ali *et al.* (2001), Robert (1991, 1992), Grimmette and Inskipp (2001) and Grimmett *et al.* (2008) were used.

Birds Counting

Bird abundance was estimated using the technique described by Burnham *et al.* (1980). The methodology involved:

Daily Counts: Three daily surveys: 5:00-7:30 am, 10:30 am-12:00 pm and 4:30-6:00 pm.

Line Transect Count: 20-minutes lines transect counts.

Three observations per hour × 3 hours per day × 4 days per month

Six-minute settlement period between observation sessions.

During each transect count; birds were recorded as target objects while traversing a designated line.

RESULTS

Borith Lake serves as a vital sanctuary for migratory birds during spring and autumn, owing to its unique habitat featuring shrub lands, reeds, and cultivations. The lake also supports a diverse range of resident birds, including raptors, Passeriformes, and seasonal visitors. Previous studies Robert (1991) and Ponum *et al.* (2023) reported 230 bird species in Gilgit Baltistan and surrounding areas, underscoring the region's significance for avian biodiversity.

Field surveys conducted from 2021 to 2022 recorded 207 bird species, representing 45 families and 18 orders (Tables 1-18). There are 104 bird species of order Passeriformes, 32 Charadriiformes, 17 Accipitriformes, 16 Anseriformes, 6 Columbiformes, 6 Pelecaniformes, 4 Falconiformes, 4 Gruiformes, 3 Galliformes, 3 Strigiformes, 3 Podicipediformes, 2 Coraciiformes, 2 Piciformes, 1 Suliformes, 1 Bucerotiformes, 1 Caprimulgiformes, 1 Cuculiformes, and 1 species of order Ciconiiformes.

Migratory birds, including Flamingos, Falcons, Swans, Geese, Waders, Cranes, and Ducks, undertake long-distance journeys between breeding and wintering grounds. This phenomenon has driven evolutionary adaptations in certain traits of shorebirds (Piersma and Baker, 2000). Borith Lake is a critical habitat for numerous migratory and seasonal bird species. A recent study recorded 161 migratory bird species at the lake and its surrounding areas (Ponum *et al.*, 2023a,b), highlighting the lake's significance as a vital stopover for these birds.

During the present study 01 bird species (Steppe Eagle) was recorded as Endangered, 02 species (Greater Spotted Eagle and Common Pochard) as Vulnerable and 07 bird species as Near-threatened in the study area (Table 19).

Table 1. Birds Species of Order Passeriformes recorded in Borith Lake during 2021-2022.

S. No.	Scientific name	Common name
1	<i>Lanius collurio</i>	Red-backed Shrike
2	<i>Lanius phoenicuroides</i>	Red-tailed Shrike
3	<i>Lanius isabellinus</i>	Isabelline/Rufous-tailed Shrike
4	<i>Lanius schach</i>	Long-tailed Shrike
5	<i>Lanius excubitor</i>	Steppe Grey Shrike
6	<i>Oriolus oriolus</i>	Indian Golden Oriole
7	<i>Pica pica</i>	Eurasian Magpie
8	<i>Pyrrhocorax pyrrhocorax</i>	Red-billed Chough
9	<i>Pyrrhocorax graculus</i>	Yellow-billed Chough
10	<i>Corvus corone</i>	Carrion Crow
11	<i>Corvus macrorhynchos</i>	Large-billed Crow
12	<i>Corvus corax</i>	Common Raven
13	<i>Eremophila alpestris</i>	Horned Lark
14	<i>Calandrella brachydactyla</i>	Greater Short-toed Lark

15	<i>Alauda lacheleensis</i>	Asian Short-toed Lark
16	<i>Alauda arvensis</i>	Eurasian Skylark
17	<i>Alauda gulgula</i>	Oriental Skylark
18	<i>Hirundo rupestris</i>	Eurasian Crag-Martin
19	<i>Hirundo rustica</i>	Barn Swallow
20	<i>Delichon dasypus</i>	Asian House-Martin
21	<i>Parus rufonuchalis</i>	Rufous-naped Tit
22	<i>Parus cinereus</i>	Cinereous Tit
23	<i>Leptopoecile sophiae</i>	White-browed Tit-Warbler
24	<i>Tichodroma muraria</i>	Wallcreeper
25	<i>Troglodytes troglodytes</i>	Eurasian Wren
26	<i>Regulus regulus</i>	Goldcrest
27	<i>Phylloscopus collybita</i>	Common/Siberian Chiffchaff
28	<i>Phylloscopus sindianus</i>	Mountain Chiffchaff
29	<i>Phylloscopus griseolus</i>	Sulphur-bellied Warbler
30	<i>Phylloscopus humei</i>	Hume's Warbler
31	<i>Phylloscopus trochiloides</i>	Greenish Warbler
32	<i>Hippolais caligata</i>	Booted Warbler
33	<i>Iduna rama</i>	Sykes's Warbler
34	<i>Acrocephalus Agricola</i>	Paddyfield Warbler
35	<i>Acrocephalus dumetorum</i>	Blyth's Reed-Warbler
36	<i>Locustella naevia</i>	Common Grasshopper-Warbler
37	<i>Sylvia nana</i>	Asian Desert Warbler
38	<i>Sylvia nisoria</i>	Barred Warbler
39	<i>Sylvia althaea</i>	Hume's Whitethroat
40	<i>Sylvia curruca</i>	Lesser Whitethroat
41	<i>Sylvia communis</i>	Greater/Common Whitethroat
42	<i>Trochalopteron lineatum</i>	Streaked Laughing thrush
43	<i>Muscicapas triata</i>	Spotted Flycatcher
44	<i>Lusciniasvecica</i>	Bluethroat
45	<i>Myophonuscaeruleus</i>	Blue Whistling-Thrush
46	<i>Luscinia pectoralis</i>	White-tailed Rubythroat
47	<i>Ficedula parva</i>	Red-breasted Flycatcher
48	<i>Phoenicurus frontalis</i>	Blue-fronted Redstart
49	<i>Phoenicurus erythronotus</i>	Rufous-backed Redstart
50	<i>Phoenicurus coeruleocephala</i>	Blue-capped Redstart
51	<i>Phoenicurus erythrogastrus</i>	White-winged Redstart
52	<i>Phoenicurus ochruros</i>	Black Redstart
53	<i>Phoenicurus phoenicurus</i>	Common Redstart
54	<i>Monticola saxatilis</i>	Rufous-tailed Rock-Thrush
55	<i>Monticola solitaries</i>	Blue Rock-Thrush
56	<i>Saxicola maurus</i>	Siberian Stonechat
57	<i>Oenanthe oenanthe</i>	Northern Wheatear
58	<i>Oenanthe pleschanka</i>	Pied Wheatear
59	<i>Oenanthe isabellina</i>	Isabelline Wheatear
60	<i>Turdus maximus</i>	Tibetan Blackbird
61	<i>Turdus atrogularis</i>	Dark/Black-throated Thrush
62	<i>Turdus viscivorus</i>	Mistle Thrush
63	<i>Sturnus vulgaris</i>	Common/European Starling
64	<i>Pastor roseus</i>	Rosy Starling
65	<i>Prunella collaris</i>	Alpine Accentor
66	<i>Prunella himalayana</i>	Altai/Himalayan Accentor
67	<i>Prunella fulvescens</i>	Brown Accentor
68	<i>Prunella atrogularis</i>	Black-throated Accentor

69	<i>Motacilla flava</i>	Western Yellow Wagtail
70	<i>Motacilla citreola</i>	Citrine Wagtail
71	<i>Motacilla alba</i>	White Wagtail
72	<i>Anthus campestris</i>	Tawny Pipit
73	<i>Anthus roseatus</i>	Rosy Pipit
74	<i>Anthus trivialis</i>	Tree Pipit
75	<i>Anthus cervinus</i>	Red-throated Pipit
76	<i>Anthus spinoletta</i>	Water Pipit
77	<i>Anthus rubescens</i>	Buff-bellied Pipit
78	<i>Emberiza leucocephalos</i>	Pine Bunting
79	<i>Emberiza cia</i>	Rock Bunting
80	<i>Emberiza buchanani</i>	Grey-hooded Bunting
81	<i>Emberiza hortulana</i>	Ortolan Bunting
82	<i>Emberiza citronella</i>	Yellowhammer
83	<i>Emberiza stewarti</i>	White capped/Chestnut-breasted Bunting
84	<i>Emberiza pusilla</i>	Little Bunting
85	<i>Emberiza rutile</i>	Chestnut Bunting
86	<i>Emberiza melanocephala</i>	Black-headed Bunting
87	<i>Emberiza bruniceps</i>	Red-headed Bunting
88	<i>Emberiza schoeniclus</i>	Reed Bunting
89	<i>Phylloscopus collybita</i>	Common Chaffinch
90	<i>Fringilla montifringilla</i>	Brambling
91	<i>Leucosticte nemoricola</i>	Plain Mountain-Finch
92	<i>Leucosticte brandti</i>	Brandt's/Black-headed Mountain-Finch
93	<i>Rhodopechys sanguineus</i>	Crimson-winged Finch
94	<i>Carpodacus erythrinus</i>	Common Rosefinch
95	<i>Carpodacus rhodochlamys</i>	Red-mantled Rosefinch
96	<i>Carpodacus puniceus</i>	Red-fronted Rosefinch
97	<i>Spinus spinus</i>	Eurasian Siskin
98	<i>Carduelis carduelis</i>	European Goldfinch
99	<i>Carduelis flavirostris</i>	Twite
100	<i>Serinus pusillus</i>	Fire-fronted Serin
101	<i>Mycerobas carripes</i>	White-winged Grosbeak
102	<i>Passer domesticus</i>	House Sparrow
103	<i>Passer hispaniolensis</i>	Spanish Sparrow
104	<i>Petronia petronia</i>	Rock Sparrow

Table 2. Species of Order Charadriiformes recorded in Borith Lake.

S. No.	Scientific name	Common name
1	<i>Himantopus himantopus</i>	Black-winged Stilt
2	<i>Vanellus vanellus</i>	Northern Lapwing
3	<i>Charadrius mongolus</i>	Lesser Sand-Plover
4	<i>Charadrius alexandrines</i>	Kentish Plover
5	<i>Charadrius sibiricus</i>	Little Ringed Plover
6	<i>Numenius arquata</i>	Eurasian Curlew
7	<i>Limosa limosa</i>	Black-tailed Godwit
8	<i>Philomachus pugnax</i>	Ruff Sand Plover
9	<i>Calidris ferruginea</i>	Curlew Sandpiper
10	<i>Calidris temminckii</i>	Temminck's Stint
11	<i>Calidris alpina</i>	Dunlin
12	<i>Calidris minuta</i>	Little Stint
13	<i>Gallinago gallinago</i>	Common Snipe
14	<i>Gallinago stenura</i>	Pin-tailed Snipe

15	<i>Scolopax rusticola</i>	Eurasian Woodcock
16	<i>Xenus cinereus</i>	Terek Sandpiper
17	<i>Phalaropus lobatus</i>	Red-necked Phalarope
18	<i>Actitis hypoleucos</i>	Common Sandpiper
19	<i>Tringa ochropus</i>	Green Sandpiper
20	<i>Tringa nebularia</i>	Common Greenshank
21	<i>Tringa stagnatilis</i>	Marsh Sandpiper
22	<i>Tringa glareola</i>	Wood Sandpiper
23	<i>Tringa tetanus</i>	Common Redshank
24	<i>Rissa tridactyla</i>	Black-legged Kittiwake
25	<i>Larus ridibundus</i>	Black-headed Gull
26	<i>Larus brunnicephalus</i>	Brown-headed Gull
27	<i>Larus ichthyaetus</i>	Pallas's Gull
28	<i>Sterna caspia</i>	Caspian Tern
29	<i>Larus fuscus</i>	Lesser Black-backed Gull
30	<i>Gelochelidon nilotica</i>	Gull-billed Tern
31	<i>Sterna hirundo</i>	Common Tern
32	<i>Chlidonias hybrid</i>	Whiskered Tern

Table 3. Species of Order Accipitriformes recorded in Borith Lake.

S. No.	Scientific name	Common name
1	<i>Gypaetus barbatus</i>	Lammergeier
2	<i>Butastur teesa</i>	White-eyed Buzzard
3	<i>Aegypius monachus</i>	Cinereous Vulture
4	<i>Gyps himalayensis</i>	Himalayan Griffon
5	<i>Gyps fulvus</i>	Griffon Vulture
6	<i>Clanga clanga</i>	Greater Spotted Eagle
7	<i>Hieraetus pennatus</i>	Booted Eagle
8	<i>Aquila nipalensis</i>	Steppe Eagle
9	<i>Aquila chrysaetos</i>	Golden Eagle
10	<i>Circus aeruginosus</i>	Eurasian Marsh-Harrier
11	<i>Circus cyaneus</i>	Northern/Hen Harrier
12	<i>Accipiter badius</i>	Shikra
13	<i>Accipiter nisus</i>	Eurasian Sparrowhawk
14	<i>Accipiter gentilis</i>	Northern Goshawk
15	<i>Milvus migrans</i>	Black Kite
16	<i>Buteo refectus</i>	Himalayan Buzzard
17	<i>Buteo rufinus</i>	Long-legged Buzzard

Table 4. Species of Order Anseriformes recorded in Borith Lake.

S. No.	Scientific name	Common name
1	<i>Anser anser</i>	Greylag Goose
2	<i>Anser indicus</i>	Bar-headed Goose
3	<i>Tadorna ferruginea</i>	Ruddy Shelduck
4	<i>Tadorna tadorna</i>	Common Shelduck
5	<i>Anas strepera</i>	Gadwall
6	<i>Anas Penelope</i>	Eurasian Wigeon
7	<i>Anas platyrhynchos</i>	Mallard
8	<i>Spatula clypeata</i>	Northern Shoveller
9	<i>Anas acuta</i>	Northern Pintail
10	<i>Anas querquedula</i>	Garganey
11	<i>Anas crecca</i>	Common Teal

12	<i>Netta rufina</i>	Red-crested Pochard
13	<i>Aythya ferina</i>	Common Pochard
14	<i>Aythya anyroca</i>	Ferruginous Pochard
15	<i>Aythya fuligula</i>	Tufted Duck
16	<i>Mergus merganser</i>	Common Merganser

Table 5. Species of Order Columbiformes recorded in Borith Lake.

S. No.	Scientific name	Common name
1	<i>Columba livia</i>	Rock Pigeon
2	<i>Columba rupestris</i>	Hill Pigeon
3	<i>Columba leuconota</i>	Snow Pigeon
4	<i>Columba eversmanni</i>	Yellow-eyed/Pale-backed Pigeon
5	<i>Streptopelia orientalis</i>	Oriental Turtle-Dove
6	<i>Streptopelia decaocto</i>	Eurasian Collared-Dove

Table 6. Species of Order Pelecaniformes recorded in Borith Lake.

S. No.	Scientific name	Common name
1	<i>Botaurus sstellaris</i>	Great Bittern
2	<i>Ixobrychus minutus</i>	Little Bittern
3	<i>Ardea cinerea</i>	Grey Heron
4	<i>Ardea alba</i>	Great Egret
5	<i>Nycticorax nycticorax</i>	Black-crowned Night-Heron
6	<i>Plegadis falcinellus</i>	Glossy Ibis

Table 7. Species of Order Falconiformes recorded in Borith Lake.

S. No.	Scientific name	Common name
1	<i>Falco tinnunculus</i>	Common Kestrel
2	<i>Falco subbuteo</i>	Eurasian Hobby
3	<i>Falco pegrinoides</i>	Barbary Falcon
4	<i>Falco peregrinus</i>	Peregrine Falcon

Table 8. Species of Order Gruiformes recorded in Borith Lake.

S. No.	Scientific name	Common name
1	<i>Rallus aquaticus</i>	Water Rail
2	<i>Porzana porzana</i>	Spotted Crake
3	<i>Gallinula chloropus</i>	Common/Eurasian Moorhen
4	<i>Fulica atra</i>	Eurasian Coot

Table 9. Species of Order Galliformes recorded in Borith Lake.

S. No.	Scientific name	Common name
1	<i>Coturnix coturnix</i>	Common Quail
2	<i>Alectoris chukar</i>	Chukar
3	<i>Tetraogallus himalayensis</i>	Himalayan Snowcock

Table 10. Species of Order Strigiformes recorded in Borith Lake.

S. No.	Scientific name	Common name
1	<i>Bubo bubo</i>	Eurasian Eagle-Owl
2	<i>Athene noctua</i>	Little Owl
3	<i>Asio flammeus</i>	Short-eared Owl

Table 11. Species of Order Podicipediformes recorded.

S. No.	Scientific name	Common name
1	<i>Podiceps auritus</i>	Horned Grebe
2	<i>Podiceps cristatus</i>	Great Crested Grebe
3	<i>Podiceps nigricollis</i>	Black-necked/Eared Grebe

Table 12. Species of Order Coraciiformes recorded in Borith Lake.

S. No.	Scientific name	Common name
1	<i>Merops persicus</i>	Blue-cheeked Bee-eater
2	<i>Coracias garrulous</i>	European Roller

Table 13. Species of Order Piciformes recorded in Borith Lake.

S. No.	Scientific name	Common name
1	<i>Jynx torquilla</i>	Eurasian Wryneck
2	<i>Picus squamatus</i>	Scaly-bellied Woodpecker

Table 14. Species of Order Suliformes recorded in Borith Lake.

S. No.	Scientific name	Common name
1	<i>Phalacrocorax carbo</i>	Great Cormorant

Table 15. Species of Order Bucerotiformes recorded in Borith Lake.

S. No.	Scientific name	Common name
1	<i>Upupa epops</i>	Eurasian Hoopoe

Table 16. Species of Order Apodiformes recorded in Borith Lake.

S. No.	Scientific name	Common name
1	<i>Apus apus</i>	Common Swift

Table 17. Species of Order Cuculiformes recorded in Borith Lake.

S. No.	Scientific name	Common name
1	<i>Hierococcyx varius</i>	Common Cuckoo

Table 18. Species of Order Ciconiiformes recorded in Borith Lake.

S. No.	Scientific name	Common name
01	<i>Ciconia nigra</i>	Black Stork

Table 19. List of Threatened and Near Threatened bird species recorded in the study area.

S. No.	Scientific name	Common name	IUCN Status
1	<i>Aquila nipalensis</i>	Steppe Eagle	Endangered
2	<i>Clanga clanga</i>	Greater Spotted Eagle	Vulnerable
3	<i>Aythya ferina</i>	Common Pochard	Vulnerable
4	<i>Vanellus vanellus</i>	Northern Lapwing	Near threatened
5	<i>Limosa limosa</i>	Black-tailed Godwit	Near threatened
6	<i>Gypaetus barbatus</i>	Lammergeier	Near threatened
7	<i>Gyps himalayensis</i>	Himalayan Griffon	Near threatened
8	<i>Aegypius monachus</i>	Cinereous Vulture	Near threatened
9	<i>Aythya anyroca</i>	Ferruginous Pochard	Near threatened
10	<i>Numenius arquata</i>	Eurasian Curlew	Near threatened

DISCUSSION

A total of 207 bird species representing 18 orders and 45 families were documented during the Borith Lake avifaunal survey, underscoring the site's exceptional biodiversity. Notably, the study revealed the presence of threatened species, including the Endangered Steppe Eagle, and the Vulnerable Greater Spotted Eagle and Common Pochard. Furthermore, seven additional bird species were classified as Near-threatened within the study area.

Order Passeriformes

Family Laniidae includes Red-backed shrike (*Lanius collurio*), Red-tailed shrike (*Lanius phoenicuroides*), Isabelline/Rufous-tailed shrike (*Lanius isabellinus*) and Long-tailed shrike (*Lanius schach*).

Single species of family Oriolidae was recorded namely Indian golden oriole (*Oriolus kundoo*).

Species of family Corvidae are Eurasian magpie (*Pica pica*), Red-bellied chough (*pyrrhocorax pyrrhocorax*), Yellow-bellied chough (*pyrrhocorax graculus*), Carrion crow (*Corvus corone*), Large-billed crow (*Corvus macrorhynchos*) and Common raven (*Corvus corax*).

Family Alaudidae consists of Horned lark (*Eremophila alpestris*), Great short toed lark (*Calandrella brachydactyla*), Asian short toed lark (*Alauda lacheleensis*), Eurasian sky lark (*Alauda arvensis*) and Oriental sky lark (*Alauda gulgula*).

Family Hirundinidae consists of swallows which are Eurasian crag martin (*Ptyonoprogne rupestris*), Barn swallow (*Hirundo rustica*) and Asian house martin (*Delichon dasypus*). Family Paridae contains Rufous-naped tit (*Periparus rufonuchalis*) and Cenerous tit (*Parus cinereous*).

Family Aegithalidae including White-browed tit warbler (*Leptopoeile sophiae*) and Tichodromidae included Wall creeper (*Tichodroma muraria*). Eurasian wren (*Troglodytes troglodytes*) belonging to family Troglodytidae was observed in study area, while Golden crest of family Regulidae also recorded.

Species of family Phylloscopidae include Common siberian chiffchaff (*Phylloscopus collybita*), Mountain chiffchaff (*Phylloscopus sindianus*), Sulfur-bellied warbler (*Phylloscopus griseous*), Hume's warbler (*Phylloscopus humei*) and Greenish warbler (*Phylloscopus trochiloides*). Group of Reed warblers and Allies contain species of family Acrocephalidae including Booted warbler (*Iduna caligata*), Skye's warbler (*Iduna rama*), Paddyfield

warbler (*Acrocephalus agricola*) and Blyth's reed warbler (*Acrocephalus dumetorem*).

Family Locustellidae contains only Common grasshopper (*Locustella naevia*).

Group of Sylviid warblers consists of species of family Sylviidae such as Asian desert warbler (*Sylvia nana*), Barred warbler (*Sylvia nisoria*), Hume's whitethroat (*Sylvia althaea*), Lesser whitethroat (*Sylvia curruca*) and Great/ Common whitethroat (*Sylvia communis*).

Old World flycatchers include members of family Muscicapidae, which are Blue fronted redstart (*Phoenicurus frontalis*), Rufous backed redstart (*Phoenicurus erythronota*), Blue-capped redstart (*Phoenicurus coeruleocephala*), White winged redstart (*Phoenicurus erythrogastrus*), Black redstart (*Phoenicurus sochruros*), Common redstart (*Phoenicurus phoenicurus*), Rufous tailed rock thrush (*Monticola saxatilis*), Blue rock thrush (*Monticola solitarius*), Siberian stone chat (*Saxicola maurus*), Northern wheatear (*Oenanthe oenanthe*), Pied wheat eater (*Oenanthe pleschanka*), Desert wheatear (*Oenanthe deserti*) and Isabelline wheateater (*Oenanthe isabellina*).

Family Turdidae comprises of Tibetan blackbird (*Turdus maximus*), Dark/Black-throated thrush (*Turdus ruficollis*) and Mistle thrush (*Turdus viscivorus*). Sturnidae includes Common/ European starling (*Sturnus vulgaris*) and Rosy starling (*Paster roseus*).

Prunellidae encompasses Alpine accentor (*Prunella collaris*), Altai/ Himalayan accentor (*Prunella himalayana*), Brown accentor (*Prunella fulvescens*) and Black-throated accentor (*Prunella atrogularis*).

Motacillidae incorporates Western yellow wagtail (*Motacilla flava*), Citrine wagtail (*Motacilla citreola*), Grey wagtail (*Motacilla cinerea*), White wagtail (*Motacilla alba*), Tawny pipit (*Anthus campestris*), Rosy pipit (*Anthus roseatus*), Tree pipit (*Anthus trivalis*), Red throated pipit (*Anthus cervinus*), Water pipit (*Anthus spinoletta*) and Buff-bellied pipit (*Anthus rubescens*).

Family Emberizidae involves Buntings such as Pine bunting (*Emberiza leucocephalos*), Rock bunting (*Emberiza cia*), Grey hooded bunting (*Emberiza buchanani*), Ortolan bunting (*Emberiza hortulana*), Yellow hammer (*Emberiza citrinella*), White-capped/ Chestnut breasted bunting (*Emberiza stewarti*), Little bunting (*Emberiza pusilla*), Chestnut bunting (*Emberiza rutile*), Black headed bunting (*Emberiza melanocephala*), Red headed bunting (*Emberiza bruniceps*) and Reed bunting (*Emberiza schoeniclus*).

Family Fringillidae consists of Finches and Euphonias. The species are Common chaffinch (*Fringilla coelebs*), Brambling (*Fringilla montifringilla*), Plain mountain finch (*Leucosticte brandti*), Crimson's winged finch (*Rhodopechys sanguineus*), Mongolian finch (*Bucanetes mongolicus*), Desert finch (*Rhodospiza obsoleta*), Common rose finch (*Carpodacus erythrinus*), Red mantled rose finch (*Carpodacus rhodochlamys*), Great rose finch (*Carpodacus rubicilla*), Red fronted rosefinch (*Carpodacus puniceus*), Eurasian siskin (*Spinus spinus*), European goldfinch (*Carduelis flavirostris*), Fire fronted serin (*Serinus pusillus*) and White winged grosbeak (*Mycerobas carnipes*). Old World Sparrow incorporates the family Passeridae which consists of House sparrow (*Passer domesticus*), Spanish sparrow (*Passer hispaniolensis*) and Rock sparrow (*Petronia petronia*).

Order Charadriiformes

Order Charadriiformes has 32 species incorporate Shorebirds mainly migratory and globally, morphologically divergent (Seebohm, 1887). Charadriiformes exhibit the main factors of global diversity of water birds (Dehorter and Guillemain, 2007; Joseph *et al.*, 1999). Some Shorebirds are also noticed which appertains to three families; Charadriidae, Scolopacidae, and Laridae. Family Recurvirostridae include Black winged stilt (*Himantopus himantopus*) and Pied avocet (*Recurvirostra avosetta*).

Family Charadriidae include Northern lapwing (*Vanellus vanellus*), Lesser sand plover (*Charadrius mongulus*), Kentish plover (*Charadrius alexandrinus*), Little ringed plover (*Charadrius dubius*) and the species of Family Scolopacidae viz. Eurasian curlew (*Numenius arquata*), Black tailed godwit (*Limosa limosa*), Ruff (*Philomachus pugnax*), Curlew sand piper (*Calidris ferruginea*), Temminck's stint (*Calidris temminckii*), Dunlin (*Calidris alpina*), Little stint (*Calidris minuta*), Common Snipe (*Gallinago gallinago*), Pin tailed snipe (*Gallinago stenura*), Eurasian Woodcock (*Scolopax rusticola*), Terek sand piper (*Xenus cinereus*), Red necked Phalarope (*Phalaropus lobatus*), Common sand piper (*Actitis hypoleucos*), Green sand piper (*Tringa ochropus*), Common Greenshank (*Tringane bularia*), Marsh sandpiper (*Tringa stagnatilis*), Wood sand piper (*Tringa glareola*) and Common redshank (*Tringa totanus*).

Order Accipitriformes

Species of only one family Acciptridae of order Accipitriformes found at Borith Lake including Lammergeier (*Gypaetus barbatus*), Himalayan Griffon (*Gyps himalayensis*), White-eyed Buzzard (*Butastur teesa*), Cinereous vulture (*Aegypius monachus*), Griffon vulture (*Gyps fulvus*), Greater spotted eagle (*Aquila clanga*), Booted eagle (*Hieraetus pennatus*), Steppe eagle (*Aquila nepalensis*), Golden eagle (*Aquila chrysaetos*), Eurasian marsh harrier (*Circus aeruginosus*), Northern /

Hen harrier (*Circus cyaneus*), Shikra (*Accipiter badius*), Eurasian sparrow hawk (*Accipiter nisus*), Northern goshawk (*Accipiter gentilis*), Black kite (*Milvus migrans*), Himalayan buzzard (*Buteo refectus*) and Long-legged buzzard (*Buteo rufinus*).

Order Anseriformes

The species of order Anseriformes have been observed at Borith Lake including Greylag goose (*Anser anser*), Bar headed goose (*Anser indicus*), Gadwall (*Anas strepera*), Ruddy shelduck (*Tadorna ferruginea*), Common shelduck (*Tadorna tadorna*), Eurasian wigeon (*Anas penelope*), Mallard (*Anas platyrhynchos*), Northern shoveller (*Anas clypeata*), Northern pintail (*Anas acuta*), Garganey (*Anas querquedula*), Common teal (*Anas crecca*), Red-crested pochard (*Netta ruffina*), Common pochard (*Aythya ferina*), Ferruginous pochard (*Aythya nyroca*), Tufted duck (*Aythya fuligula*) and Common merganser (*Mergus merganser*).

Order Columbiformes

Columbiformes, a readily identifiable order, is divided into two families: Columbidae and Raphidae. The Columbidae family is particularly diverse, with more than 300 species of doves and pigeons documented globally (Gibbs *et al.*, 2001). Five species were also spotted in the study area viz. Rock pigeon (*Columba livia*), Hill pigeon (*Columba rupestris*), Snow pigeon (*Columba leuconota*), Oriental turtle dove (*Streptopelia orientalis*) and Eurasian collared-dove (*Streptopeliadecaocto*). In Caprimugliformes, members of family Apodidae were noticed, consisting of Common swift (*Apus apus*).

Order Pelecaniformes

Six Species of order Pelecaniformes include Great bittern (*Botaurus stellaris*), little bittern (*Ixobrychus minutus*), Grey heron (*Ardea cinerea*), Black crowned night heron (*Nycticorax nycticorax*) and Glossy Ibis (*Plegadis falcinellus*) observed at our study areas.

Order Falconiformes

Falconiformes contain birds of prey. Four species belonging to family Falconidae including Eurasian/Common kestrel (*Falco tinnunculus*), Eurasian hobby (*Falco subbuteo*), Barbary Falcon (*Falco pelegrinoides*) and Peregrine falcon (*Falco peregrinus*) were observed at Borith Lake area.

Order Gruiformes

Four species of order Gruiformes including *Rallus aquaticus* (Water Rail), *Porzana porzana* (Spotted Crake), *Gallinula chloropus* (Common/Eurasian Moorhen), and *Fulica atra* (Eurasian Coot) have been recorded at Borith Lake.

Order Galliformes

The order Galliformes is also a significant division of birds in the world (del Hoyo *et al.*, 1992; Zhang *et al.*, 2003) and

for the human being, they are advantageous because they are also tamed, harvested for their meat and feathers, and used in trade (Fuller and Garson, 2000). In prehistoric arts and literature, Galliformes cultural impotence is also observed. For example, in Shang Dynasty of China, the role of pheasants and chicken was found in oracle inscription (Peters *et al.*, 2016). Additionally, Galliformes have taken an unusual position to enhance animal studies and protection (McGowan and Gasrson 1995; McGowan *et al.*, 2012), owing to their closed connection with humans and in studies of birds; few are used as model animals (del Hoyo *et al.*, 1992; Fuller and Garson, 2000). Three species of order Galliformes were recorded in surrounding area of Borith Lake which belongs to family Phasianidae. They include Common quail (*Coturnix coturnix*), Chukar (*Alectoris chukar*) and Himalayan snow cock (*Tetragallus himalayensis*).

Order Strigiformes

Order Strigiformes has three species including *Bubo bubo* (Eurasian Eagle-Owl), *Athene noctua* (Little Owl) and *Asio flammeus* (Short-eared Owl) observed in our study areas.

Order Podicipediformes

The order Podicipediformes is regarded as the earliest and unique lineage of Aves having no close relatives but the closest taxonomic level might be with Phoenicopteres (Padilla, 2015). Podicipediformes is restricted to family Podicipedidae involves all Grebes. Worldwide nearly 22 Grebe species are identified and divided into six genera. They have heavy bodies and long necks ranging from small to medium size. They live in fresh water and inland wetlands; some species inhabited in saltwater during winters (Padilla, 2015). Few Grebes also found in the study area named Horned grebe (*Podiceps auritus*), Great crested grebe (*Podiceps cristatus*), Black-necked/eared grebe (*Podiceps nigricollis*).

Order Coraciiformes

In Coraciformes, two species from family Meropidae were recognized including Blue cheeked bee-eater (*Merops persicus*) and Coraciidae contains European roller (*Coracias garrulous*).

Order Piciformes

During the study in order Piciformes two species *Jynx torquilla* (Eurasian Wryneck) and *Picus squamatus* (Scaly-bellied Woodpecker) recorded at the Borith Lake. Mostly Piciformes are arboreal. They eat termites, ants and insects (Grimmet *et al.*, 2008).

Order Suliformes

Order Suliformes include cormorants, frigate birds and allies. Great cormorant (*Phalacrocorax carbo*) belongs to order Suliformes and family Phalacrocoracidae. Cormorants are aquatic birds having elongated necks, mostly eat fish (Grimmett *et al.*, 2008).

Order Bucerotiformes

One species from Bucerotiformes of Upupidae is noted which is Eurasian hoopoe (*Upupa epops*). Hoopoes have unique morphology with elongated downward curve bill, short legs and rounded wings. They feed on insects (Grimmet *et al.*, 2008).

Order Apodiformes

During the two years only one species *Apus apus* (Common Swift) of order Apodiformes was recorded at our study areas.

Order Cuculiformes

During the field surveys of this study only one species *Hierococcyx varius* (Common Cuckoo) has been recorded from order Cuculiformes at Borith Lake.

Order Ciconiiformes

In order Ciconiiformes, species of family Ciconiidae multiracial in classification present in warmer regions except for cooler areas such as northern North America, Oceania and New Zealand (Austin, 1965). Black stork (*Ciconia nigra*) belonging to order Ciconiiformes, family Ciconiidae has been recorded in the study area.

CONCLUSION

Borith Lake's exceptional avifaunal diversity, with 207 recorded bird species, underscores its significance for protecting and conserving both invertebrate and vertebrate biodiversity. Earlier study by Robert (1991) documented 230 bird species in Gilgit Baltistan, including migratory species such as migrants, vagrants, residents, breeding, and irregular visitors. The present study confirms Borith Lake as a vital habitat, with 207 species recorded. Currently, no severe threats to the bird population or habitat are evident. However, future research should focus on:

1. Investigating climate change impacts on the lake and
2. Conducting annual bird censuses and population monitoring.

These initiatives will ensure the long-term conservation of Borith Lake's unique biodiversity.

Some Selected Bird Species (from Order Passeriformes, Charadriiformes, Acciptriformes, Anseriformes, Columbiformes, Pelecaniformes, Falconiformes and Gruiformes) of Borith Lake Recorded During 2021-2022 Study (Figs. 1 to 21). (Photography credits: Imran Shah and Zahid Khan).

Order Passeriformes



Fig. 1. *Pyrrhonorax graculus* (Yellow Bellied Cough).



Fig. 2. *Lanius collurio* (Red backed Shrike).



Fig. 3. *Leptopoeile sophiae* (White-browed Tit-Warbler).



Fig. 4. *Hirundo rustica* (Barn Swallow).



Fig. 5. *Eremophila alpestris* (Horned Lark).

Order Charadriiformes



Fig. 6. *Vanellus vanellus* (Northern Lapwing).



Fig. 7. *Xenus cinereus* (Terek Snadpiper).



Fig. 8. *Calidrius ferruginea* (Curlew Snadpiper).



Fig. 9. *Numenius arquata* (Eurasian Curlew).

Order Acciptriformes



Fig. 10. *Gyps Himalayensis* (Himlayan Griffon).



Fig. 11. *Milvus migrans* (Black Kite).



Fig. 12. *Accipiter badius* (Shikra).



Fig. 13. *Circus aeruginosus* (Eurasian Marsh Harrier).

Order Anseriformes



Fig. 14. *Anas acuta* (Northern Pintail).



Fig. 15. *Tadorna tadorna* (Common Shelduck).

Order Columbiformes



Fig. 16. *Streptopelia orientalis* (Oriental Turtle Dove).



Fig. 17. *Columba rupestris* (Rock Dove).

Order Pelecaniformes



Fig. 18. *Casmerodius albus* (Great Egret).



Fig. 19. *Plegadis falcinellus* (Glossy Ibis).

Order Falconiformes



Fig. 20. *Falco pelegrinoides* (Barbary Falcon).

Order Gruiformes



Fig. 21. *Fulica atra* (Eurasian Coot).

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