



Distribution and Status of Vertebrate Fauna of Mahal Kohistan Wildlife Sanctuary, Khirthar Protected Area Complex, Sindh

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Abstract: Mahal Kohistan being a very significant habitat for wild fauna. The present study was undertaken during 2014 to 2017 to document the habitat use, distribution and status of vertebrate fauna (mammals, birds and reptiles) at Mahal Kohistan Wildlife Sanctuary. Point Count, Roadside Count, Line Transect and Pellet Count methods were used during the study to record the encountered species. A total of 29 species of Mammals, 78 species of Birds and 36 species of Reptiles were recorded from various habitats types in the area like Mountain Ridges, Ravines, Mountain Escarpment, Stony Ground/ Rocky Area, Sandy Plains, Wetlands, Riparian Areas, Villages/ Agriculture areas and Wasteland. 8 threatened species were recorded including critically endangered, Caracal and Striped Hyaena endangered, Indian Wolf, Sind Ibex, Urial, Chinkara, Egyptian Vulture and Imperial Eagle as Vulnerable. The area is protected but still it is facing certain severe threats especially due to the dependency of the local communities on the natural resources present within the study area in addition to developmental activities, exploration of minerals, and increased frequency and intensity of droughts due to changing climatic conditions. It is recommended that the Management Plan of the (KPAC) may be implemented in full at the earliest.

Keywords: Protected Area, Vertebrate Biodiversity, Mahal Kohistan, Mammalian Key species

1. INTRODUCTION

Wildlife Sanctuary is an area set aside as an undisturbed breeding ground, primarily for protection of all natural resources to which public access is restricted (IUCN, 1990). The University of Melbourne (2000), Mirza (2002), Khan (2006), Khan *et al.* (2012, 2012a), Environmental Management Consultants (2012), and Begum *et al.* (2013, 2013a) have studied the Wildlife of Khirthar Protected Area Complex (KPAC).

Recently, Khan *et al.* (2013) recorded a total of 33 species of mammals and 22 main habitats of mammals were identified in Khirthar Protected Area Complex (KPAC). Disturbance, human and wildlife conflicts, and degradation of habitats were found to be main threats to the wild animals particularly to Chinkara.

Khan *et al.* (2012) and Ghalib *et al.* (2013) reported a total of 207 species of birds belonging to 15 Orders and 38 families from seven different habitats of KPAC. They found 08 species as threatened and 06 species as near threatened (IUCN Red List, 2016). Wetland sites and at cropland/ villages were found to bear highest avian biodiversity and the lowest in mountainous areas. Highest number of threatened/ Near threatened species of birds was found at the Wetland Sites and next at Riparian/ Sandy/Plain areas. Another study Ghalib *et al.* (2015) reported 41 species of reptiles from Khirthar Protected Area Complex. They found twenty-two important habitats for reptiles in the area. Indian Fat – tail Gecko (*Eublepharis macularius*) was noted to have been almost disappeared from most of the area.

Pakistan has given serious attention to conservation of biodiversity and cultural assets in sustainable manner. For this purpose, Pakistan has made stern efforts to establish legislation, policies and institutions for environmental protection. However, implementation of these legislations and policies as a whole is not achievable due a number of factors. The gaps and needs associated with conservation of Protected Areas in Pakistan can be dealt effectively through extension of research, therefore, the present study was focused on determinate habitat, distribution and status of Vertebrate Fauna of Mahal Kohistan Wildlife Sanctuary, which will help the KPAC managers to effectively prepare micro level management plan for the Sanctuary.

2. MATERIALS AND METHODS

Study Area

Khirthar Protected Area Complex extends over 4,350 km² and comprises of the following components. Khirthar National Park (3,087 Km²), Mahal Kohistan Wildlife Sanctuary (705.7 km²) (Fig.1).

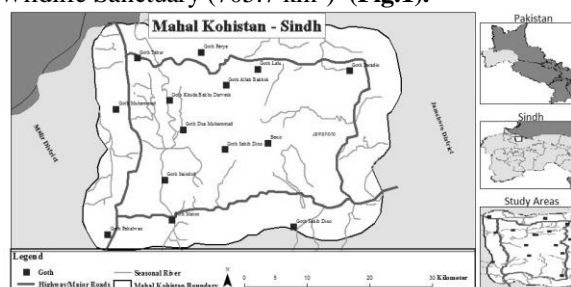


Fig.1. Map of study area.

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Based on baseline survey, Mahal Kohistan Wildlife Sanctuary was selected as study area. The Wildlife Sanctuary is situated in District Jamshoro between 67° 5' to 68.25° East latitude and 25° 5' to 26° 5' South to North longitude.

Methodology

Field observations were made using spotting scope 60x60 and binocular 10 x 50 (Olympus). The animals were watched by walking along ridges and ravines in the early morning and late afternoon or sitting quietly on cliffs and watching the aspects facing the observer. On spotting an Urial and Ibex herd, the number of individuals was counted. Information recorded included number, sex, age, date, time, latitude and longitude and habitat type. The techniques used to record the observed fauna are Point Count Survey, Roadside Count, Line Transect and Pellet Count Methods.

During the present study, attempt was made to survey all the habitat types but the emphasis was on the principal bird habitat types such as the wetlands, foothills, stony ground, scrub forest and vicinity of villages. Transect method and point count methods were used during the study for observation of birds.

Reptiles seem to be very active after dusk during the summer season. Skinks and Lizards are diurnal in activity and seen most active during mid-morning. Certain geckos and snakes are active mostly at night. The one hour Plot Searching, night observations turning of stones and rocks techniques were employed for

collection of data regarding the occurrence and distribution of reptiles.

Different scales to record the population status of mammals, birds and reptiles each were framed indicating their status as Common, Less Common, Scarce and Rare, as given in (Table 1).

Table 1. Scale for determination of population status of mammals, birds and reptiles.

Mammal		Birds		Reptiles	
Common	Above - 16	Common	Above - 11	Common	Above - 10
Less Common	11 - 15	Less Common	7 - 10	Less Common	7 - 9
Scarce	6 - 10	Scarce	4 - 6	Scarce	4 - 6
Rare	1 - 5	Rare	1 - 3	Rare	1 - 3

3. RESULTS AND DISCUSSION

During the present work we observed *Zizyphus nummularia*, *Acacia nilotica*, *Acacia senegal*, *Acacia jacquemontii*, *Tecomella undulata*, *Tamarix* spp., *Salvadora oleoides*, *Commiphora wightii*, *Capparis decidua*, *Lycium ruthenicum*, *Euphorbia caducifolia*, *Prosopis cineraria*, *Veronica cinerascens* and *Grewia tenax* as dominate vegetation of the study area. Eight habitat types (Mountain Ridges and Ravines, Mountain Escarpment, Stony Ground/ Rocky Areas, Sandy Plains, Wetlands, Riparian Areas, Villages/ Agriculture areas and Wasteland) were scanned during the study to record the habitat use, distribution and status of fauna in the area. A total of 29 species of Mammals belonging to 6 Orders and 12 Families were recorded.

Table 2. Species of Mammals recorded from Mahal Kohistan Wildlife Sanctuary during 2014-2017

S. No.	Order	Family	Scientific Name	Common Name	Population Status
01	Insectivora	Erinaceidae	<i>Hemiechinus collaris</i>	Longeared Desert Hedgehog	Common
02	Insectivora	Erinaceidae	<i>Paraechinus micropus</i>	Indian Hedgehog	Less Common
03	Carnivora	Hyaenidae	<i>Hyaena Hyaena</i>	Striped Hyaena	Rare
04	Carnivora	Canidae	<i>Canis aureus</i>	Asiatic Jackal	Less Common
05	Carnivora	Canidae	<i>Canis lupus</i>	Wolf	Rare
06	Carnivora	Canidae	<i>Vulpes bengalensis</i>	Indian Fox	Less Common
07	Carnivora	Canidae	<i>Vulpes vulpes</i>	Red fox	Less Common
08	Carnivora	Mustellidae	<i>Mellivora capensis</i>	Honey Badger	Rare
09	Carnivora	Herpestidae	<i>Herpestes edwardsi</i>	Grey Mongoose	Less Common
10	Carnivora	Herpestidae	<i>Herpestes javanicus</i>	Small Indian Mongoose	Less Common
11	Carnivora	Felidae	<i>Felis silvestris</i>	Desert Cat	Scarce
12	Carnivora	Felidae	<i>Felis chaus</i>	Jungle Cat	Scarce
13	Carnivora	Felidae	<i>Felis caracal</i>	Caracal	Rare
14	Pholidota	Manidae	<i>Manis crassicaudata</i>	Indian Pangolin	Rare
15	Artiodactyla	Bovidae	<i>Capra aegagrus</i>	Sind Ibex	Common
16	Artiodactyla	Bovidae	<i>Ovis vignei</i>	Urial	Common
17	Artiodactyla	Bovidae	<i>Gazella bennettii</i>	Chinkara	Common
18	Lagomorpha	Leporidae	<i>Lepus nigricollis</i>	Indian Hare	Less Common
19	Rodentia	Sciuridae	<i>Funambulus pennantii</i>	Five Striped Palm Squirrel	Common
20	Rodentia	Hystriidae	<i>Hystrix indica</i>	Indian Porcupine	Less Common
21	Rodentia	Muridae	<i>Rattus rattus</i>	Roof Rat / House Rat	Less Common
22	Rodentia	Muridae	<i>Mus musculus</i>	House mouse	Common
23	Rodentia	Muridae	<i>Mus booduga</i>	Little Indian Field Mouse	Less Common
24	Rodentia	Muridae	<i>Mus saxicola</i>	Grey Spiny Mouse	Less Common
25	Rodentia	Muridae	<i>Golunda ellioti</i>	Indian Bush Rat	Less Common
26	Rodentia	Muridae	<i>Calomyscus bailwardi</i>	Mouse like Hamster	Less Common
27	Rodentia	Muridae	<i>Gerbillus nanus</i>	Balochistan Gerbil	Common
28	Rodentia	Muridae	<i>Tatera indica</i>	Indian Gerbil	Less Common
29	Rodentia	Muridae	<i>Meriones hurrianiae</i>	Indian Desert Jird	Common

As regards their status, Sind Ibex, Urial, Chinkara were recorded as common. Indian Hedgehog, Asiatic Jackal, Indian Hare, House Rat, Indian Bush Rat recorded as Less Common, while Wolf and Striped Hyena recorded as Rare (Table 2).

Three species viz. Indian Wolf, Caracal and Indian Hare were not recorded in the previous study undertaken in the year 2000 (UoM, 2000 unpublished report), while in the present study, we recorded these species. Further, two species viz. Bengal Fox and Blacknaped Hare not recorded during the present study, while in the year 2000 these species were recorded. Eight Indicator species were recorded during the current study, Sind

Ibex, Urial, Chinkara, Honey Badger, Desert Cat, Caracal, Indian Pangolin and Indian Wolf.

There were 78 species of Birds belonging to 13 Orders and 30 Families recorded. Ring Dove, Sind Small Green Bee-eater, Crested Lark, King Crow, Bank Myna, Sind House Crow, White cheeked Bulbul, Common Babbler, House Sparrow were recorded as Common, Red Turtle Dove, Blue Jay, Indian Desert Finch – Lark, Red-vented Bulbul as Less Common. While, Shikra, Asiatic Sparrow- Hawk, Long Legged Buzzard, Tawny Eagle, Pallid Merlin and Common Kestrel recorded as Scarce. Booted Hawk Eagle, Imperial Eagle, Laggar Falcon, Peregrine Falcon recorded as Rare (Table 3).

Table 3. Species of Birds recorded from Mahal Kohistan Wildlife Sanctuary, during 2014 - 2017.

S. No	Order	Family	Scientific Name	Common Name	Seasonal Status	Population Status
1	Accipitriformes	Accipitridae	<i>Milvus migrans</i>	Black Kite	R	Common
2	Accipitriformes	Accipitridae	<i>Accipiter badius</i>	Shikra	R	Scarce
3	Accipitriformes	Accipitridae	<i>Accipiter nisus</i>	Asiatic Sparrow-Hawk	WV	Scarce
4	Accipitriformes	Accipitridae	<i>Buteo rufinus</i>	Longlegged Buzzard	WV	Scarce
5	Accipitriformes	Accipitridae	<i>Buteo buteo</i>	Common Buzzard	WV	Scarce
6	Accipitriformes	Accipitridae	<i>Butastur teesa</i>	White-eyed Buzzard Eagle	R	Less Common
7	Accipitriformes	Accipitridae	<i>Hieraetus fasciatus</i>	Bonelli's / Slender Hawk Eagle	R	Scarce
8	Accipitriformes	Accipitridae	<i>Hieraetus pennatus</i>	Booted Hawk Eagle	WV	Rare
9	Accipitriformes	Accipitridae	<i>Aquila heliaca</i>	Imperial Eagle	WV	Rare
10	Accipitriformes	Accipitridae	<i>Aquila rapax</i>	Tawny Eagle	R	Scarce
11	Accipitriformes	Accipitridae	<i>Neophron percnopterus</i>	Egyptian Vulture	R	Less Common
12	Accipitriformes	Accipitridae	<i>Circus gallicus</i>	Short-toed Eagle	R	Scarce
13	Falconiformes	Falconidae	<i>Falco jugger</i>	Laggar Falcon	R	Rare
14	Falconiformes	Falconidae	<i>Falco peregrinus</i>	Peregrine Falcon	WV	Rare
15	Falconiformes	Falconidae	<i>Falco columbarius</i>	Pallid Merlin	WV	Scarce
16	Falconiformes	Falconidae	<i>Falco tinnunculus</i>	Common Kestrel	WV/r	Scarce
17	Galliformes	Phasianidae	<i>Ammoperdix griseogularis</i>	See-see Partridge	R	Less Common
18	Galliformes	Phasianidae	<i>Francolinus pondicerianus</i>	Grey Partridge	R	Less Common
19	Charadriiformes	Charadriidae	<i>Vanellus indicus</i>	Red Wattled Lapwing	R	Common
20	Columbiformes	Pteroclididae	<i>Pterocles exustus</i>	Chestnut-bellied / Common or Indian Sandgrouse	R	Scarce
21	Columbiformes	Columbidae	<i>Columba livia</i>	Blue Rock Pigeon	R	Common
22	Columbiformes	Columbidae	<i>Streptopelia decaocto</i>	Ring Dove	R	Common
23	Columbiformes	Columbidae	<i>Streptopelia tranquebarica</i>	Red Turtle Dove	R	Less Common
24	Columbiformes	Columbidae	<i>Streptopelia senegalensis</i>	Little Brown / Senegal Dove	R	Common
25	Psittaciiformes	Psittacidae	<i>Psittacula krameri</i>	Rose ringed Parakeet	R	Common
26	Cuculiformes	Cuculidae	<i>Centropus sinensis</i>	Common Crow-Pheasant or Coucal	R	Less Common
27	Strigiformes	Strigidae	<i>Athene brama</i>	Spotted Owlet	R	Scarce
28	Strigiformes	Strigidae	<i>Asio otus</i>	Longeared Owl	WV	Scarce
29	Caprimulgiformes	Caprimulgidae	<i>Caprimulgus mahrattensis</i>	Syke's or Sind Nightjar	R	Less Common
30	Apodiformes	Apodidae	<i>Apus affinis</i>	House Swift	R	Scarce
31	Coraciiformes	Alcedinidae	<i>Ceryle rudis</i>	Indian Pied Kingfisher	R	Less Common
32	Coraciiformes	Alcedinidae	<i>Halcyon smyrnensis</i>	White breasted Kingfisher	R	Less Common
33	Coraciiformes	Meropidae	<i>Merops superciliosus</i>	Blue cheeked Bee-eater	SBV/PM	Less Common
34	Coraciiformes	Meropidae	<i>Merops orientalis</i>	Sind Small Green Bee-eater	R	Common
35	Coraciiformes	Coraciidae	<i>Coracias benghalensis</i>	Roller or Blue Jay	R	Less Common
36	Coraciiformes	Upupidae	<i>Upupa epops</i>	Hoopoe	WV	Scarce
37	Piciformes	Picidae	<i>Picoides assimilis</i>	Sind Woodpecker	R	Scarce
38	Passeriformes	Alaudidae	<i>Eremopterix grisea</i>	Ashycrowned Finch-Lark	R	Less Common

39	Passeriformes	Alaudidae	<i>Eremopterix nigriceps</i>	Blackcrowed Finch-Lark	R	Less Common
40	Passeriformes	Alaudidae	<i>Ammomanes deserti</i>	Indian Desert Finch-Lark	R	Less Common
41	Passeriformes	Alaudidae	<i>Galerida cristata</i>	Crested Lark	R	Common
42	Passeriformes	Hirundinidae	<i>Mirafra erythroptera</i>	Indian Bush Lark	R	Scarce
43	Passeriformes	Hirundinidae	<i>Riparia paludicola</i>	Grey throated Indian Sand Martin	R	Scarce
44	Passeriformes	Hirundinidae	<i>Hirundo rustica</i>	Common Swallow	WV	Scarce
45	Passeriformes	Hirundinidae	<i>Hirundo daurica</i>	Redrumped Swallow	WV	Rare
46	Passeriformes	Laniidae	<i>Lanius isabellinus</i>	Rufous-tailed or Isabelline Shrike	WV	Scarce
47	Passeriformes	Laniidae	<i>Lanius excubitor</i>	Grey Shrike	R	Scarce
48	Passeriformes	Laniidae	<i>Lanius vittatus</i>	Bay backed Shrike	R	Less Common
49	Passeriformes	Laniidae	<i>Lanius schach</i>	Rufous-backed Shrike	R	Scarce
50	Passeriformes	Dicruridae	<i>Dicrurus adsimilis</i>	Black Drongo or King Crow	R	Common
51	Passeriformes	Sturnidae	<i>Sturnus roseus</i>	Rosy Starling or Rosy Pastor	DPM	Scarce
52	Passeriformes	Sturnidae	<i>Acridotheres ginginianus</i>	Bank Myna	R	Common
53	Passeriformes	Sturnidae	<i>Acridotheres tristis</i>	Indian Myna	R	Common
54	Passeriformes	Corvidae	<i>Dendrocitta vagabunda</i>	Tree Pie	R	Less Common
55	Passeriformes	Corvidae	<i>Corvus splendens</i>	Sind House Crow	R	Common
56	Passeriformes	Corvidae	<i>Corvus corax</i>	Common Raven	R	Scarce
57	Passeriformes	Pyconotidae	<i>Pycnonotus leucogenys</i>	White-cheeked Bulbul	R	Common
58	Passeriformes	Pyconotidae	<i>Pycnonotus cafer</i>	Red-vented Bulbul	R	Less Common
59	Passeriformes	Timaliidae	<i>Turdoides caudatus</i>	Common Babbler	R	Common
60	Passeriformes	Timaliidae	<i>Turdoides striatus</i>	Sind Jungle Babbler	R	Common
61	Passeriformes	Sylviidae	<i>Prinia gracilis</i>	Indian Streaked Wren- Warbler / Long tailed Warbler	R	Less Common
62	Passeriformes	Sylviidae	<i>Prinia burnesii</i>	Long tailed Grass Warbler	R	Less Common
63	Passeriformes	Sylviidae	<i>Sylvia hortensis</i>	Orphean Warbler	PM/ WV	Rare
64	Passeriformes	Sylviidae	<i>Sylvia communis</i>	Common White throat	M	Rare
65	Passeriformes	Sylviidae	<i>Phylloscopus collybita</i>	Chiffchaff	WV	Rare
66	Passeriformes	Turdidae	<i>Cercotrichas galacototes</i>	Rufous Chat or Rufoustailed Scrub Robin	PM	Scarce
67	Passeriformes	Turdidae	<i>Phoenicurus ochruros</i>	Black Redstart	WV	Rare
68	Passeriformes	Turdidae	<i>Saxicola caprata</i>	Pied Bush Chat	R	Scarce
69	Passeriformes	Turdidae	<i>Saxicoloides fulicata</i>	Indian Robin	R	Common
70	Passeriformes	Turdidae	<i>Monticola olitarius</i>	Blue Rock Thrush	WV	Scarce
71	Passeriformes	Motacillidae	<i>Anthus similis</i>	Long billed Rock Pipit	R	Rare
72	Passeriformes	Motacillidae	<i>Motacilla flava</i>	Yellow or Citrine Wagtail	PM	Less Common
73	Passeriformes	Motacillidae	<i>Motacilla alba</i>	White or Pied Wagtail	WV	Less Common
74	Passeriformes	Nectariniidae	<i>Nectarinia asiatica</i>	Purple Sunbird	R	Less Common
75	Passeriformes	Passeridae	<i>Passer domesticus</i>	House Sparrow	R	Common
76	Passeriformes	Passeridae	<i>Passer pyrrhonotus</i>	Sind Jungle Sparrow	R	Rare
77	Passeriformes	Emberizidae	<i>Emberiza melanocephala</i>	Black headed Bunting	PM	Rare
78	Passeriformes	Emberizidae	<i>Emberiza striolata</i>	Striped or House Bunting	R	Scarce

Legend:

R = Resident

SV = Winter Visitor

SBV = Summer Breeding Visitor

M = Migrating / Year Round Visitor

SV = Summer Visitor

The Seasonal status of Birds recorded in Mahal Kohistan during the study, Resident Species 54, Winter visitors 15, Winter visitors/Resident 01, Summer Breeding Visitors/Passage Migrants 01, Double Passage Migrants 01, Passage Migrants / Winter visitors 01 and Passage Migrants 05.

Out of the 43 species of birds recorded earlier by the team of University of Melbourne (UoM, 2000 unpublished report), 18 species of birds were not

observed during the present study, viz. Common Quail, Houbara Bustard, Cream- coloured Courser, Whiskered Tern, Pallid Harrier, Variable Wheatear, Desert Wheatear, Grey Hypocolius, Rufous- fronted Prinia, Booted Warbler, Lesser Whitethroat, Greater short – toed Lark, Lesser short-toed Lark, Chestnut- shouldered Petronia, Red- throated Pipit, White – throated Munia, Trumpeter Finch and Grey- necked Bunting. In the present study, there are new records of occurrence of 54 species of birds in the Mahal Kohistan (Table 4).

Table 4. New Record species of Birds from Mahal Kohistan Wildlife Sanctuary, during 2014 -2017.

S. No	Scientific Name	Common Name	Seasonal Status	Population Status
01	<i>Accipiter badius</i>	Shikra	R	Scarce
02	<i>Accipiter nisus</i>	Asiatic Sparrow-Hawk	WV	Scarce
03	<i>Buteo rufinus</i>	Longlegged Buzzard	WV	Scarce
04	<i>Buteo buteo</i>	Common Buzzard	WV	Scarce
05	<i>Butastur teesa</i>	White-eyed Buzzard Eagle	R	Less Common
06	<i>Hieraatus fasciatus</i>	Bonelli's or Slender Hawk Eagle	R	Scarce
07	<i>Hieraatus pennatus</i>	Booted Hawk Eagle	WV	Rare
08	<i>Aquila heliacal</i>	Imperial Eagle	WV	Rare
09	<i>Aquila rapax</i>	Tawny Eagle	R	Scarce
10	<i>Neophron percnopterus</i>	Egyptian Vulture	R	Less Common
11	<i>Falco jugger</i>	Laggar Falcon	R	Rare
12	<i>Falco peregrines</i>	Peregrine Falcon	WV	Rare
13	<i>Falco columbarius</i>	Pallid Merlin	WV	Scarce
14	<i>Falco tinnunculus</i>	Common Kestrel	WV/r	Scarce
15	<i>Ammoperdix griseularis</i>	See-see Partridge	R	Less Common
16	<i>Francolinus pondicerianus</i>	Grey Partridge	R	Less Common
17	<i>Streptopelia decaocto</i>	Ring Dove	R	Common
18	<i>Streptopelia tranquebarica</i>	Red Turtle Dove	R	Less Common
19	<i>Psittacula krameri</i>	Rose ringed Parakeet	R	Common
20	<i>Centropus sinensis</i>	Common Crow-Pheasant or Coucal	R	Less Common
21	<i>Athene brama</i>	Spotted Owllet	R	Scarce
22	<i>Asio otus</i>	Longeared Owl	WV	Scarce
23	<i>Caprimulgus mahrattensis</i>	Syke's or Sind Nightjar	R	Less Common
24	<i>Apus affinis</i>	House Swift	R	Scarce
25	<i>Ceryle rudis</i>	Indian Pied Kingfisher	R	Less Common
26	<i>Halcyon smyrnensis</i>	White breasted Kingfisher	R	Less Common
27	<i>Merops superciliosus</i>	Blue cheeked Bee-eater	SBV/PM	Less Common
28	<i>Coracias benghalensis</i>	Roller / Blue Jay	R	Less Common
29	<i>Eremopterix grisea</i>	Ashycrowned Finch-Lark	R	Less Common
30	<i>Eremopterix nigriceps</i>	Blackcrowned Finch-Lark	R	Less Common
31	<i>Mirafra erythroptera</i>	Indian Bush Lark	R	Scarce
32	<i>Riparia paludicola</i>	Grey throated Indian Sand Martin	R	Scarce
33	<i>Hirundo rustica</i>	Common Swallow	WV	Scarce
34	<i>Hirundo daurica</i>	Redrumped Swallow	WV	Rare
35	<i>Lanius excubitor</i>	Grey Shrike	R	Scarce
36	<i>Lanius schach</i>	Rufous-backed Shrike	R	Scarce
37	<i>Sturnus roseus</i>	Rosy Starling or Rosy Pastor	DPM	Scarce
38	<i>Acridotheres ginginianus</i>	Bank Myna	R	Common
39	<i>Acridotheres tristis</i>	Indian Myna	R	Common
40	<i>Dendrocitta vagabunda</i>	Tree Pie	R	Less Common
41	<i>Corvus corax</i>	Common Raven	R	Scarce
42	<i>Turdoides striatus</i>	Sind Jungle Babbler	R	Common
43	<i>Prinia gracilis</i>	Indian Streaked Wren- Warbler / Long tailed Warbler	R	Less Common
44	<i>Prinia burnesii</i>	Long tailed Grass Warbler	R	Less Common
45	<i>Sylvia communis</i>	Common White throat	M	Rare
46	<i>Phylloscopus collybita</i>	Chiffchaff	WV	Rare
47	<i>Cercotrichas galacototes</i>	Rufous Chat / Rufous tailed Scrub Robin	PM	Scarce
48	<i>Phoenicurus ochruros</i>	Black Redstart	WV	Rare
49	<i>Saxicola caprata</i>	Pied Bush Chat	R	Scarce
50	<i>Saxicoloides fulicata</i>	Indian Robin	R	Common
51	<i>Monticola olitarius</i>	Blue Rock Thrush	WV	Scarce
52	<i>Motacilla flava</i>	Yellow or Citrine Wagtail	PM	Less Common
53	<i>Motacilla alba</i>	White or Pied Wagtail	WV	Less Common
54	<i>Passer pyrrhonotus</i>	Sind Jungle Sparrow	R	Rare

Based on our study, Indian Garden Lizard was recorded as Common, Indian Fat – tailed Gecko as Less Common and Keeled Rock Gecko, Sindh Ribbon Snake, Saw

scaled Viper as Rare, during the whole study period (Table 5). While 36 species of Reptiles belonging to one Order and 12 Families were recorded.

Table 5 Species of Reptiles recorded from Mahal Kohistan Wildlife Sanctuary, during 2014 - 2017.

S. No	Order	Family	Scientific Name	Common Name	Population Status
1	Squamata	Agamidae	<i>Calotes versicolor</i>	Indian Garden Lizard/ common Tree Lizard	Common
2	Squamata	Agamidae	<i>Laudakia lirata</i>	Yellow-headed Spotted Rock Agama	Less Common
3	Squamata	Agamidae	<i>Laudakia melanura</i>	Black Rock Agama	Common
4	Squamata	Agamidae	<i>Laudakia nupta</i>	Rock Agama	Less Common
5	Squamata	Agamidae	<i>Trapelus agilis</i>	Brilliant Agama / Common Field Agama	Common
6	Squamata	Agamidae	<i>Trapelus megalonyx</i>	Afghan Agama/ Ocellate Ground Agama	Common
7	Squamata	Agamidae	<i>Trapelus rubrigularis</i>	Red- throated Agama	Rare
8	Squamata	Eublepharidae	<i>Eublepharis macularius</i>	Indian Fat-tailed Gecko	Less Common
9	Squamata	Gekkonidae	<i>Agamura persica</i>	Persian Spider Gecko	Scarce
10	Squamata	Gekkonidae	<i>Cyrtopodion kachhensis</i>	Warty Rock Gecko / Kutch Spotted Ground Gecko	Rare
11	Squamata	Gekkonidae	<i>Cyrtopodion scabrum</i>	Keeled Rock Gecko/ Common Tuberculate Ground Gecko	Rare
12	Squamata	Gekkonidae	<i>Crossobamon orientalis</i>	Sind or Yellow tailed Sand Gecko	Less Common
13	Squamata	Gekkonidae	<i>Hemidactylus brookii</i>	Spotted Indian House Gecko / Spotted Barn Gecko	Less Common
14	Squamata	Gekkonidae	<i>Hemidactylus laviviridis</i>	Yellow bellied House Gecko	Common
15	Squamata	Gekkonidae	<i>Hemidactylus persicus</i>	Persian House Gecko	Less Common
16	Squamata	Gekkonidae	<i>Hemidactylus triedrus</i>	Blotched House Gecko	Rare
17	Squamata	Gekkonidae	<i>Teratolepis faciata</i>	Indian Flat-tail Gecko	Less Common
18	Squamata	Gekkonidae	<i>Tropicolotes persicus</i>	Persian Banded or Sind Dwarf Gecko	Scarce
19	Squamata	Lacertidae	<i>Acanthodactylus antoris</i>	Indian Fringe-toed Lizard or Bartailed Sand Lizard	Less Common
20	Squamata	Lacertidae	<i>Mesalina watsonana</i>	Long tailed Desert Lacerta / Spotted Lacerta	Scarce
21	Squamata	Lacertidae	<i>Ophisops jerdoni</i>	Punjab Snake – eyed Lizard / Rogose Spectacled Lacerta	Less Common
22	Squamata	Scincidae	<i>Novoeumeces blythianus</i>	Orange tail Skink	Scarce
23	Squamata	Scincidae	<i>Ophiomorus tridactylus</i>	Indian Sand Swimmer	Less Common
24	Squamata	Uromastycidae	<i>Saara hardwickii</i>	Indian Spiny tailed Lizard	Common
25	Squamata	Varanidae	<i>Varanus griseus</i>	Desert Monitor	Common
26	Squamata	Typhlopidae	<i>Ramphotyphlops braminus</i>	Brahminy Blind Snake	Less Common
27	Squamata	Typhlopidae	<i>Typhlops ductuliformes</i>	Slender Blind Snake	Scarce
28	Squamata	Boidae	<i>Eryx johnii</i>	Common Sand Boa	Scarce
29	Squamata	Colubridae	<i>Platyceph rhodorachis</i>	Cliff Racer	Scarce
30	Squamata	Colubridae	<i>Platyceph ventromaculatus</i>	Glossy bellied Racer/ Plains Racer	Scarce
31	Squamata	Colubridae	<i>Psammophis candanura</i>	Indian Sand Snake	Scarce
32	Squamata	Colubridae	<i>Psammophis leithii</i>	Sindh Ribbon Snake	Rare
33	Squamata	Colubridae	<i>Spalerosophis diadema</i>	Blotched Diadem Snake / Royal Snake	Scarce
34	Squamata	Elapidae	<i>Bungarus caeruleus</i>	Common Krait	Scarce
35	Squamata	Elapidae	<i>Naja naja</i>	Black Cobra	Scarce
36	Squamata	Viperidae	<i>Echis carinatus</i>	Saw scaled Viper	Rare

Earlier, 39 species of Reptiles were recorded (UoM, 2000 unpublished report), while in the present study, three species viz. Tree Bark Gecko, Yellow – bellied Mole Skink / Common Mole Skink and Indian Monitor were not recorded. Indian Fat-tail Gecko (*Eublepharis macularius*) is economically important in this area as it has been illegally captured on a large scale for commercial purposes due to the value of its skin.

Threatened Species of Mammals

In the Mahal Kohistan area, there were 6 species of Threatened Mammals viz. Caracal, Striped Hyaena, Wolf, Sind Ibex, Chinkara, and Uril, reported as Threatened (IUCN, 2016). This includes two species as Critically Endangered, one species as Endangered, three species as Vulnerable, as given in (Table 6).

Table 6. Threatened Species of mammals recorded from Mahal Kohistan

S. No.	Common Name	Scientific Name	IUCN Red List Status
1	Caracal	<i>Felis caracal</i>	CE
2	Striped Hyaena	<i>Hyaena hyaena</i>	CE
3	Wolf	<i>Canis lupus</i>	E
4	Sind Ibex	<i>Capra aegagrus</i>	V
5	Chinkara	<i>Gazella bennettii</i>	V
6	Uril	<i>Ovis vignei</i>	V

Among Birds, three species were recorded out of which, one is endangered, the other is Vulnerable and the third one is Near Threatened, as given in (Table 7).

Table 7. Threatened / Near threatened species of Birds recorded from Mahal Kohistan .

S. No	Common Name	Scientific Name	IUCN Red List Status
1	Egyptian Vulture	<i>Neophron percnopterus</i>	E
2	Imperial Eagle	<i>Aquila heliaca</i>	V
3	Laggar Falcon	<i>Falco jugger</i>	NT

The area has been facing a lot of threats as it is already under pressure due to developmental activities, such as Gas Exploration, Mineral Exploration, Wind Power Plants, M-9 Karachi Hyderabad Motorway. We also noted competition for grazing between domestic livestock and the wild animals. Local people use the same water points for the collection of drinking water for their livestock and for their own use, scarcity of water in the area due to drought.

Due to anthropogenic actions, degradation of vegetation and wildlife habitats was also noted. There is also loss of wildlife habitats due to the increasing human population having about 1 lac people in the area and also from agriculture activities in the area.

4. CONCLUSION

Mahal Kohistan Wildlife Sanctuary is an important biodiversity hotspot as it is home to some threatened species. The habitat is under serious threats due to the exploration of minerals, developmental projects, anthropogenic pressure and climate change especially after 2010 with increased intensity and frequency of droughts. The management needs to be further improved and regular monitoring is required for the safeguard of the threatened species.

Some Photograph of species and habitats recorded from Mahal Kohistan Wildlife Sanctuary (KPAC) Sindh (Figs. 2-15).

**Fig 2. Entrance to Khirthar National Park via Super Highway, Karachi****Fig 3. Inside KPAC – showing the starting limits of Khirthar National Park****Fig 4. Habitat of Sind Ibex****Fig 5. Habitat of Chinkara****Fig 6. Habitat of Urial****Fig. 7. *Gazella bennettii* (Chinkara)****Fig 8. *Ovis vignei* (Urial)****Fig 9. *Capra aegagrus* (Sind Ibex)****Fig 10. *Galerida cristata* (Crested Lark)**

Fig 11. *Buteo buteo* (Common Buzzard)Fig 12. *Lanius excubitor* (Grey Shrike)Fig 13. *Lanius vittatus* (Bay backed Shrike)Fig 14. *Laudakia melanura* (Black Rock Agama)Fig 15. *Echis carinatus* (Saw scaled Viper)

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