

A Qualitative Study on Wildlife of Chotiari Reservoir, Sanghar, Sindh, Pakistan

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Abstract.- In the present study, species richness of mammals, birds, reptiles and amphibians was studied from June, 2006 to June, 2009 at Chotiari Reservoir, Sanghar, Sindh Province. Data were collected through standard direct as well as indirect methods. A total of 203 species including 32 mammals, 136 birds, 32 reptiles and three amphibians belonging to 29 orders and 78 families were recorded during the study. Significant wildlife species included Red fox, Bengal fox, Indian desert cat, Caracal, Fishing cat, Smooth-coated Otter, Indian Civet, Pallas's fishing eagle, Houbara bustard, Cinereous Vulture, Great White-fronted Goose, Marsh Crocodile and Rock Python. Comparison with previous studies revealed that wildlife species composition in the study area had changed. It was found that Indian wolf, striped hyena and Hog deer have been disappeared from the area. Existence of Caracal and Sindh babbler was not ascertained despite of best efforts. Marbled teal was not found during the present study period. Changes in land use practices, habitat modification, hunting, unregulated fishing, overexploitation, community-wildlife conflict and trapping of wildlife species were major issues affecting wildlife composition and population of various species of the area.

Key words: Bakar Lake, Wildlife, Marsh Crocodile, Seepage, Nara Canal.

INTRODUCTION

Wetlands are amongst the most productive and dynamic ecosystems. Owing to their extensive and rich food webs, biological, ecological and cultural diversity, they are sometimes referred to as 'super-markets of biodiversity' (Mitsch and Gosselink, 1993). Wetlands (lakes, rivers, marshes; seas-shore up to six meters deep and man-made reservoirs and dams, etc) cover more than 1,280m. ha of earth surface, while lakes cover 204m.ha in Asia alone. During the last 50 years, number of dams in the world has increased from 5, 000 to 45, 000 (MEA, 2005).

Presence of a great diversity of ecological systems in Pakistan reflects its varied topography. Although predominantly arid and semi-arid, Pakistan possesses a great variety of wetlands distributed throughout the country. Ramsar Convention (1971) identified 18 different types of

wetlands in Pakistan whereas Scot (1989) identified 11 types of wetlands in Pakistan. Estimated area of inland waters in Pakistan is 780,000ha of which water-storage reservoirs comprise 92, 000 ha (12%) (Naik, 1986).

District Sanghar in Sindh Province is typified by numerous freshwater sources such as Sanghriaro Lake, Bakar Lake; temporary ponds, irrigation canals such as Nara and water storage reservoirs such as Chotiari (Rais *et al.*, 2008). Climate is hot/arid and maximum day temperature may exceed 40°C during May and June. December to February are the coolest months when maximum day temperatures range from 25 to 30°C. Rainfall is sparse and erratic mostly occurs between July and August with monthly average of 40mm and annual average of 125 mm. Floods are common in monsoon season creating numerous temporary water bodies (WWF, 2008).

Earlier researchers have made a significant contribution in documenting the wildlife associated with the wetlands of Sindh Province (Murray, 1884; Scot, 1989; Ahmed, 1954; Roberts, 1991, 1992; Amjad and Kidwai, 2000). Similarly, avifauna, Hog

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deer, smooth-coated otter and marsh crocodile in Sanghar District have also been studied (Roberts, 1991, 1992, 1997; Ghalib *et al.*, 1999; Azam *et al.*, 2002; Javed and Rehman, 2004; Gachal *et al.*, 2007; Rais *et al.*, 2008, 2009).

Present study was designed to investigate the species richness of mammals, birds, reptiles and amphibians of Chotiari Reservoir and to compare it with the earlier reported data for any change in species composition that might had occurred with the construction of Chotiari Reservoir.

MATERIALS AND METHODS

Study area

Chotiari Reservoir is located 30-35km in the east of the Sanghar Town, at 60m elevation. It is bounded by the Thar Desert sand hills on east, north, north-east and south-east and Nara Canal on the west and south. The reservoir comprises of many fresh and brackish water lakes (1-200ha) such as Gun, Wari, Jajur, Phuleil, Seriao Naro, Khor, Jadpur, Meena, Waguwala, Sanjaran and Bholo. The reservoir has a muddy bottom (WWF, 2008) and lies within a biogeographic province named Thar Desert of Indomalayan Realm (Code No.1.4.15) (Udvardy, 1975).

Chotiari Reservoir was constructed in 2003 in a natural depression along the left bank of Nara Canal. Its 58km long embankment can be divided into Northern Bund (19 km), Western Bund (14 km), Southern Bund (16km) and South Eastern Bund (9km). Chotiari Reservoir is provided with water through Ranto Canal. Water from the reservoir is being supplied to districts of Umer Kot, Mir Pur Khas, Khipro and Tando Mitha Khan (WWF, 2008). Water from the reservoir and Nara Canal is also used for human consumption, livestock and agriculture (Rais *et al.*, 2008). Seepage from Nara Canal and Chotiari Reservoir has created several small wetlands which are playing a common function of ground water recharge, flood water storage and wintering grounds for migratory birds, particularly ducks and shorebirds.

Dominant aquatic vegetation of the area included; *Typha latifolia*, *T. augustata*, *T. indica*, *T. pakistanika*, *T. aphylla*, *Phragmites karka*, *Arundo donax*, *Nelumbum nuliferum*, *Paspalum distichim*.

Major vegetation along the embankment of the reservoir include; *Demostachya bipinnata*, *Prosopis spicigera*, *Acacia nilotica*, *Eucalyptus spp.* and sand dunes have *Calligonurn polignoides*, *Capparis deciduas*, *C. aphylla*, *Calotropis procera*, *Salvadora persica*, *S. oleoides*, *Prosopis spicegerz* and *Euphorbia caducifolia* (Ghalib *et al.*, 1999; Azam *et al.*, 2002; Javed and Rehman, 2004).

Study design

The reservoir was regularly visited around the year from June 2006 to June 2009. Data on wildlife species were collected by using different direct and indirect methods depending upon the taxa (Schemnitz, 1980; Sale and Berkmuller, 1988; Heyer *et al.*, 1994; Sutherland, 1996). Birds were observed through binoculars and spotting scope. Wildlife species were identified by using field guides and books (Khan, 2006; Mirza, 2007; Roberts, 1997). A few species with doubtful presence such as Indian Krait, Caracal, Fishing Cat, etc were included in the list after confirmation by the local people. Data obtained were compared with the available literature about the reservoir (Ghalib *et al.*, 1999; WWF, 2008).

Similarity Index was calculated by using the following formula:

Sørensen similarity index (SI):

$$S = \frac{2C}{A+B}$$

where A and B are the species numbers in studies A and B, respectively and C is the number of species similar in two studies.

RESULTS

A total of 203 faunal species belonging to 29 orders and 78 families were recorded from the reservoir, including 32 (15.75%) species of mammals, 136 (66.99 %) birds, 32 (15.75 %) reptiles and three (1.47%) amphibians (Tables I-IV).

A total of 32 mammals belonging to 15 families and six orders were recorded from the study

area (Table I). Eighteen species of small mammals belonged to three orders (11 from Rodentia), 3 from Insectivora, and 4 from Chiroptera). Fourteen large and medium sized mammals belonging to three orders (11 from Carnivora, 1 each from Artiodactyla, Lagomorpha and Rodentia) were recorded. Indian Wolf and Striped Hyena could not be found and probably become locally extinct from the area. Based on our data Hog deer had no more wild population in the study area, while Chinkara were introduced here in late 1970s which inhabit an island within the reservoir. Significant mammals included Desert Fox, Bengal Fox, Indian Desert Cat, Caracal, Fishing Cat, Smooth-coated Otter and Indian Civet were recorded in the reservoir area.

As many as 136 bird species belonging to 19 orders and 48 families were recorded (Table II). Around 32.82 % birds were abundant, 52.20 % common, 8.08 % frequent and 2.94 % were scarce. Out of the total, summer and winter bird species constituted 69.11 % and 34.55%, respectively which included, 39% water birds, 9.5% birds of prey, 35% passerines and 16% forest/game birds. A few threatened bird *i.e.*, Pallas's Fishing Eagle, Houbara Bustard, Eurasian Black Vulture and Great White-fronted Goose were also recorded.

Based on data 32 species of reptiles were recorded (Table III), including three species of freshwater turtles, 15 snakes, 13 lizards and one crocodile. While Rock Python and Indian Marsh Crocodile were recorded as Threatened Species. A total of 3 amphibian species belonging to a single order and 3 families were recorded (Table IV).

DISCUSSION

During the present study, 32 species of mammals were recorded. Some Near Threatened mammals of Pakistan such as Asiatic jackal, Indian crested porcupine, Indian hairy-footed gerbil and Baluchistan gerbil (Sheikh and Molur, 2005) were observed quite frequently, while fox spp., Fishing cat and Indian civet were rarely seen. Caracal (Critically Endangered) was reported by the local people during the present study which was also recorded earlier from the area (Roberts, 1997).

Previous studies recorded 33 (SI=0.92) mammal species including Hog deer, Chinkara and

Feral donkey (WWF, 2008). However, wild populations of Hog Deer and Chinkara were not found during the present study, probably due to the reason that earlier was conducted over a larger area including vast area of Thar Desert. Least Pipistrelle and Indian Civet were recorded which were not reported earlier (WWF, 2008).

Out of the recorded 136 bird species (SI=0.90), 24 were not recorded earlier by WWF (2008). Rais *et al.* (2008) concluded that composition of avifauna species of the study area had been changed due to alteration in the ecological conditions after the construction of Chotiari Reservoir. Present study recorded 44 new bird species (27 non-passerine and 17 passerine) whereas 34 species reported in previous studies (Ghalib *et al.*, 1999) were not recorded. Evidences concerning two globally vulnerable and rare bird species such as Marbled teal and Sindh babbler reported previously (Roberts, 1991, 1992; Ghalib *et al.*, 1999) were not found. Interviews with local people, especially hunters, revealed that Marbled teal had not been visiting the reservoir for at least the past three years mainly due to excessive hunting (Rais *et al.*, 2008).

The present study recorded 32 reptilian species, while WWF (2008) reported 28 (SI= 0.76) reptiles from the reservoir out of which five species were not found during the present study, while nine other reptiles were recorded (Table III). Three species of amphibians reported from the reservoir are quite common throughout the country and occur in a fair number at the reservoir as well.

Threats

Changes in land use practices, habitat modification, hunting, unregulated fishing, overexploitation, conflicts with Wild Boars, Jackals, Fox spp. and snakes with local community, and trapping of mongoose spp., Cobra, Dhaman and Monitor lizard, etc. were major threats to the wildlife of the reservoir and surroundings.

Across the world, habitat transformation had a rapid and high impact on wetlands and associated biodiversity over the last century while overexploitation had a moderate impact which is continuing (MEA, 2005). Impacts of these drivers were obvious in changing the fauna of Chotiari

Table I.- Mammalian fauna of Chotiari Reservoir, Sanghar, Sindh during 2006-2009

| Order Family | Scientific name (Common name) | Status ¹ |
|---|---|---------------------|
| 1. Insectivora | | |
| I. Erinaceidae* | 1. <i>Hemiechinus collaris</i> (Long-eared desert hedgehog) | LC |
| | 2. <i>Hemiechinus micropus</i> (Indian hedgehog) | LC |
| II. Soricidae* | 3. <i>Suncus murinus</i> (House shrew) | LC |
| 2. Chiroptera Sub-order Microchiroptera | | |
| I. Hipposideridae* | 4. <i>Asellia tridens</i> (Trident leaf-nosed Bat) | NE |
| II. Vespertilionidae* | 5. <i>Pipistrellus tenuis</i> × (Least pipistrelle) | LC |
| | 6. <i>Pipistrellus kuhlii</i> (Kuhl's pipistrelle) | LC |
| | 7. <i>Scotophilus heathii</i> (Common yellow-bellied bat) | LC |
| 3. Carnivora | | |
| I. Canidae | <i>Canis lupus pallipes</i> × (Indian wolf) | E |
| | 8. <i>Canis aureus</i> (Asiatic jackal) | NT |
| | 9. <i>Vulpes vulpes</i> (Red fox) | DD |
| | 10. <i>Vulpes bengalensis</i> (Bengal fox) | NT |
| II. Mustelidae Sub-family Lutrinae | 11. <i>Lutrogale perspicillata</i> (Smooth coated otter) | NT |
| | 12. <i>Viverricula indica</i> × (Indian civet) | NT |
| IV. Herpestidae | 13. <i>Herpestes javanicus</i> (Small Asiatic mongoose) | LC |
| V. Hyaenidae | 14. <i>Herpestes edwardsi</i> (Indian grey mongoose) | LC |
| | <i>Hyaena hyaena</i> × (Striped hyaena) | CR |
| VI. Felidae | 15. <i>Felis silvestris</i> (Indian desert cat) | DD |
| | 16. <i>Felis chaus</i> (Jungle cat) | LC |
| | 17. <i>Felis caracal</i> (Caracal) | CR |
| | 18. <i>Prionailurus viverrinus</i> (Fishing cat) | NT |
| 4. Artiodactyla | | |
| I. Suidae | 19. <i>Sus scrofa</i> (Indian wild boar) | LC |
| II. Cervidae | <i>Axis porcinus</i> (Hog deer) | VU |
| III. Bovidae | <i>Gazella bennettii</i> (Chinkara) | VU |
| 5. Lagomorpha | | |
| I. Leporidae | 20. <i>Lepus nigricollis</i> (Black-naped hare) | LC |
| 6. Rodentia | | |
| I. Sciuridae* | 21. <i>Funambulus pennantii</i> (Palm squirrel) | LC |
| II. Hystricidae | 22. <i>Hystrix indica</i> (Indian crested porcupine) | NT |
| III. Muridae* | 23. <i>Millardia meltada</i> (Soft-furred field rat) | LC |
| | 24. <i>Millardia gleadowi</i> (Sand colored rat) | LC |
| | 25. <i>Rattus rattus</i> (Roof rat) | LC |
| | 26. <i>Mus musculus</i> (House mouse) | LC |
| | 27. <i>Mus booduga</i> (Little Indian field mouse) | LC |
| | 28. <i>Bandicota bengalensis</i> (Sindh rice rat) | LC |
| | 29. <i>Nesokia indica</i> (Short-tailed mole rat) | LC |
| | 30. <i>Gerbillus nanus</i> (Balochistan gerbil) | NT |
| | 31. <i>Meriones hurrianae</i> (Indian desert jird) | LC |
| | 32. <i>Tatera indica</i> (Indian gerbil) | LC |

Only recorded species are numbered; *small mammals; ×not listed in WWF (2008); status¹ as per Sheikh and Molur (2005)

Reservoir. The construction of Chotiari Reservoir has greatly altered the habitat, occurrence and distribution pattern of various wildlife species as number of sand dunes came under water. It is

inferred that earlier a few species were more abundant and wide spread including: *Pipistrellus kuhlii* (Kuhl's pipistrelle), Red fox, Caracal, *Millardia gleadowi* (sand colored rat), Houbara

Table II.- Avifauna of Chotiari Reservoir, Sanghar, Sindh during 2006-2009.

| Order / Sub-order / Family | Scientific name (Common name) | Occurrence | Status ² |
|----------------------------|---|------------|---------------------|
| 1. Podicipediformes | | | |
| I. Podicipedidae* | 1. <i>Tachybaptus ruficollis</i> (Little grebe) | R | C |
| 2. Pelecaniformes | | | |
| I. Phalacrocoracidae* | 2. <i>Phalacrocorax carbo</i> (Great cormorant) | WV | A |
| | 3. <i>Phalacrocorax niger</i> (Little cormorant) | R | A |
| II. Pelecanidae* | 4. <i>Pelecanus onocrotalus</i> × (Great white pelican) | WV | C |
| 3. Ciconiiformes | | | |
| I. Ardeidae* | 5. <i>Ixobrychus sinensis</i> (Yellow bittern) | SV | F |
| | 6. <i>Ixobrychus cinnamomeus</i> (Chestnut bittern) | SV | F |
| | 7. <i>Ixobrychus flavicollis</i> (Black bittern) | SV | C |
| | 8. <i>Nycticorax nycticorax</i> (Black-crowned night heron) | SV | C |
| | 9. <i>Ardeola grayii</i> (Indian pond heron) | R | A |
| | 10. <i>Bubulcus ibis</i> (Cattle egret) | R | C |
| | 11. <i>Egretta garzetta</i> (Little egret) | R | C |
| | 12. <i>Mesophoyx intermedia</i> (Intermediate egret) | R | F |
| | 13. <i>Casmerodius albus</i> (Great egret) | WV | C |
| | 14. <i>Ardea cinerea</i> (Grey heron) | WV/R | C |
| | 15. <i>Ardea purpurea</i> (Purple heron) | R | C |
| II. Threskiornithidae* | 16. <i>Plegadis falcinellus</i> (Glossy ibis) | WV/R | C |
| 4. Anseriformes | | | |
| I. Anatidae* | 17. <i>Anser albifrons</i> (Greater white fronted goose) | WV | Rr |
| | 18. <i>Anas penelope</i> × (European wigeon) | WV | A |
| | 19. <i>Anas strepera</i> (Gadwal) | WV | C |
| | 20. <i>Anas crecca</i> (Common teal) | WV | A |
| | 21. <i>Anas platyrhynchos</i> (Mallard) | WV | A |
| | 22. <i>Anas acuta</i> (Northern pintail) | WV | A |
| | 23. <i>Anas clypeata</i> (Northern Shoveler) | WV | A |
| | 24. <i>Netta rufina</i> (Red-crested pochard) | WV | S |
| | 25. <i>Aythya ferina</i> (Common pochard) | WV | A |
| | 26. <i>Aythya fuligula</i> (Tufted duck) | WV | S |
| 5. Accipitriformes | 27. <i>Elanus caeruleus</i> (Black-winged kite) | R | C |
| I. Accipitridae | 28. <i>Milvus migrans</i> × (Black kite) | R | C |
| | 29. <i>Haliaeetus leucoryphus</i> (Pallas's fish eagle) | R | VU |
| | 30. <i>Aegypius monachus</i> × (Cinereous vulture) | R | NT |
| | 31. <i>Circus aeruginosus</i> (Western marsh harrier) | R | C |
| | 32. <i>Accipiter nisus</i> × (Eurasian Sparrow hawk) | R | F |
| | 33. <i>Accipiter badius</i> (Shikra) | R | C |
| | 34. <i>Butastur teesa</i> (White-eyed buzzard) | R | A |
| | 35. <i>Buteo buteo</i> (Common buzzard) | SV | F |
| | 36. <i>Buteo rufinus</i> (Long-legged buzzard) | WV | C |
| | 37. <i>Aquila rapax</i> × (Tawny eagle) | R | C |
| II. Pandionidae | 38. <i>Pandion haliaetus</i> (Osprey) | SV | C |
| 6. Falconiformes | | | |
| I. Falconidae | 39. <i>Falco tinnunculus</i> × (Common kestrel) | WV/R | C |

Continued

| Order / Sub-order / Family | Scientific name (Common name) | Occurrence | Status ² |
|----------------------------|--|------------|---------------------|
| 7. Galliformes | | | |
| I. Phasianidae | 40. <i>Francolinus francolinus</i> (Black francolin) | R | C |
| | 41. <i>Francolinus pondicerianus</i> (Greyfrancolin) | R | C |
| 8. Gruiformes | | | |
| I. Rallidae* | 42. <i>Amaurornis phoenicurus</i> (White breasted water-hen) | R | C |
| | 43. <i>Gallinula chloropus</i> (Common moorhen) | R | A |
| | 44. <i>Porphyrio porphyrio</i> (Purple swampen) | R | C |
| | 45. <i>Gallicrex cinerea</i> (Water cock) | R | C |
| | 46. <i>Fulica atra</i> (Black coot) | WV | A |
| II. Otididae | 47. <i>Chlamydotis undulata</i> × (Houbara bustard) | WV | VU |
| 9. Charadriiformes | | | |
| I. Jacanidae* | 48. <i>Hydrophasianus chirurgus</i> (Pheasant tailed jacana) | R | C |
| II. Rostratulidae* | 49. <i>Himantopus himantopus</i> (Black-winged stilt) | R | A |
| III. Glareolidae* | 50. <i>Glareola lactea</i> × (Small pratincole) | SV | C |
| IV. Charadriidae* | 51. <i>Charadrius alexandrinus</i> × (Kentish plover) | R | C |
| | 52. <i>Vanellus indicus</i> (Red-wattled lapwing) | R | A |
| | 53. <i>Vanellus leucura</i> (White-tailed lapwing) | R | C |
| V. Scolopacidae* | 54. <i>Calidris alba</i> × (Sanderling) | WV | C |
| | 55. <i>Calidris minuta</i> (Little stint) | WV | A |
| | 56. <i>Tringa tetanus</i> (Common redshank) | WV | A |
| | 57. <i>Tringa nebularia</i> (Greenshank) | WV | C |
| | 58. <i>Actitis hypoleucos</i> × (Common sandpiper) | WV | C |
| VI. Laridae* | 59. <i>Larus marinus</i> (Great black-headed gull) | WV | F |
| | 60. <i>Larus ridibundus</i> (Black-headed gull) | WV | C |
| | 61. <i>Larus brunnicephalus</i> × (Brown-headed gull) | WV | A |
| | 62. <i>Larus argentatus</i> (Herring gull) | WV | A |
| VII. Sternidae* | 63. <i>Sterna nilotica</i> (Gull-billed tern) | WV | C |
| | 64. <i>Sterna aurantia</i> (Indian river tern) | WV | C |
| | 65. <i>Sterna albifrons</i> (Little tern) | WV | F |
| | 66. <i>Chlidonias hybridus</i> (Whiskered tern) | YRV | A |
| 10. Pteroclidiformes | | | |
| 1. Pteroclididae | 67. <i>Pterocles exustus</i> (Chestnut-bellied sandgrouse) | R | C |
| 11. Columbiformes | | | |
| I. Columbidae | 68. <i>Columba livia</i> (Rock Pigeon) | R | A |
| | 69. <i>Streptopelia decaocto</i> (Eurasian collared dove) | R | A |
| | 70. <i>Streptopelia tranquebarica</i> (Red-collared dove) | SV | A |
| | 71. <i>Stigmatopelia senegalensis</i> (Laughing dove) | R | A |
| 12. Psittaciformes | | | |
| 1. Psittacidae | 72. <i>Psittacula krameri</i> (Rose-ringed Parakeet) | R | A |
| 13. Cuculiformes | | | |
| I. Cuculidae | 73. <i>Clamator jacobinus</i> (Pied-crested cuckoo) | SV | C |
| | 74. <i>Eudynamys scolopacea</i> (Asian koel) | R | C |

Continued

| Order / Sub-order / Family | Scientific name (Common name) | Occurrence | Status ² |
|----------------------------|---|------------|---------------------|
| | 75. <i>Centropus sinensis</i> (Greater coucal) | R | C |
| 14. Strigiformes | | | |
| I. Tytonidae | 76. <i>Tyto alba</i> (Barn owl) | R | S |
| II. Strigidae | 77. <i>Athene brama</i> (Spotted owlet) | R | C |
| 15. Caprimulgiformes | | | |
| I. Caprimulgidae | 78. <i>Caprimulgus mahrattensis</i> (Syke's night jar) | R | C |
| 16. Apodiformes | | | |
| I. Apodidae | 79. <i>Apus apus</i> × (Eastern swift) | R | C |
| | 80. <i>Apus affinis</i> × (House swift) | R | C |
| 17. Coraciformes | | | |
| I. Alcedinidae* | 81. <i>Halcyon smyrnensis</i> (White-throated kingfisher) | R | C |
| | 82. <i>Alcedo atthis</i> (Common king fisher) | R | F |
| | 83. <i>Ceryle rudis</i> (Pied kingfisher) | R | A |
| II. Meropidae | 84. <i>Merops orientalis</i> (Little green bee-eater) | R | A |
| | 85. <i>Merops superciliosus</i> (Madagascar bee-eater) | SV | A |
| III. Coraciidae | 86. <i>Coracias benghalensis</i> (Indian Roller) | R | C |
| IV. Upupidae | 87. <i>Upupa epops</i> (Eurasian hoopoe) | WV/R | C |
| 18. Piciformes | | | |
| I. Picidae | 88. <i>Dinopium benghalense</i> (Black-rumped flameback) | R | C |
| 19. Passeriformes | | | |
| I. Alaudidae | 89. <i>Eremopterix grisea</i> (Ashy-crowned sparrow lark) | R | C |
| | 90. <i>Ammomanes deserti</i> × (Desert lark) | R | C |
| | 91. <i>Galerida cristata</i> (Crested lark) | R | A |
| | 92. <i>Alauda gulgula</i> (Oriental sky lark) | WV | A |
| II. Hirundinidae | 93. <i>Riparia paludicola</i> (Plain martin) | R | A |
| | 94. <i>Hirundo rustica</i> (Barn swallow) | R | A |
| | 95. <i>Hirundo smithii</i> (Wire-tailed swallow) | R | C |
| | 96. <i>Hirundo fluviicola</i> × (Streak-throated swallow) | R | C |
| III. Motacillidae | 97. <i>Anthus novaeseelandiae</i> (Australasian pipit) | R | C |
| | 98. <i>Anthus campestris</i> × (Tawny pipit) | WV | C |
| | 99. <i>Motacilla flava thunbergi</i> (Grey-headed yellow wagtail) | WV | C |
| | 100. <i>Motacilla alba dukhunensis</i> × (Siberian pied wagtail) | WV | A |
| | 101. <i>Motacilla maderaspatensis</i> (White-browed wagtail) | R | C |
| IV. Pycnonotidae | 102. <i>Pycnonotus leucogenys</i> (Himalyan bulbul) | R | A |
| | 103. <i>Pycnonotus cafer</i> (Red-vented bulbul) | R | A |
| V. Turdidae | 104. <i>Luscinia svecica</i> (Bluethroat) | WV | C |
| | 105. <i>Phoenicurus ochruros</i> (Black redstart) | WV | C |
| | 106. <i>Saxicola torquata</i> × (Common stonechat) | WV | C |
| | 107. <i>Saxicola caprata</i> (Pied bushchat) | R | A |
| | 108. <i>Oenanthe deserti</i> (Desert wheatear) | WV | C |
| | 109. <i>Saxicoloides fulicata</i> (Indian robin) | R | C |
| VI. Sylviidae | 110. <i>Cettia cetti</i> (Cetti's warbler) | WV | S |
| | 111. <i>Prinia gracilis</i> (Graceful warbler) | R | C |

Continued

| Order / Sub-order / Family | Scientific name (Common name) | Occurrence | Status ² |
|----------------------------|--|------------|---------------------|
| | 112. <i>Prinia buchanani</i> (Rufous -fronted prinia) | R | A |
| | 113. <i>Prinia inornata</i> (Plain prinia) | R | C |
| | 114. <i>Sylvia curruca</i> (Lesser white throat) | WV | F |
| | 115. <i>Phylloscopus sindianus</i> (Mountain chiffchaff) | WV | F |
| | 116. <i>Phylloscopus collybita</i> (Common chiffchaff) | WV | A |
| VII. Rhipiduridae | 117. <i>Rhipidura aureola</i> × (White-browed fantail) | R | C |
| VIII. Timaliidae | 118. <i>Turdoides caudatus</i> (Common babbler) | R | A |
| | 119. <i>Turdoides earlei</i> (Striated babbler) | R | A |
| | 120. <i>Turdoides striatus</i> (Jungle babbler) | R | C |
| IX. Nectarinidae | 121. <i>Nectarinia asiatica</i> (Purple sunbird) | R | A |
| X. Laniidae | 122. <i>Lanius vittatus</i> (Bay backed shrike) | R | C |
| | 123. <i>Lanius schach</i> (Rufous- backed shrike) | R | C |
| | 124. <i>Lanius excubitor</i> (Great-grey shrike) | R | C |
| XI. Dicruridae | 125. <i>Dicrurus macrocercus</i> (Black drongo) | R | A |
| XII. Corvidae | 126. <i>Dendrocitta vagabunda</i> (Rufous tree pie) | R | A |
| | 127. <i>Corvus splendens</i> (House crow) | R | C |
| XIII. Sturnidae | 128. <i>Sturnus vulgaris</i> (Common starling) | WV | A |
| | 129. <i>Sturnus roseus</i> × (Rosy starling) | SV | C |
| | 130. <i>Acridotheres tristis</i> (Common myna) | R | A |
| | 131. <i>Acridotheres ginginianus</i> (Bank myna) | R | A |
| XIV. Passeridae | 132. <i>Passer domesticus</i> (House sparrow) | R | A |
| | 133. <i>Petronia xanthocollis</i> (Chestnut-shouldered petronia) | WV | C |
| | 134. <i>Passer pyrrhonotus</i> (Sindh sparrow) | R | F |
| XV. Ploceidae | 135. <i>Ploceus manyar</i> ×(Streaked weaver) | R | C |
| XVI. Estrildidae | 136. <i>Lonchura malabarica</i> × (White-throated munia) | R | C |

*water birds

×not listed in WWF (2008)

Status² as per Roberts (1991) and Roberts (1992)

Bustard, *Pterocles exustus* (chestnut-bellied sandgrouse), *Trapelus agilis* (common field agama), *Crossobamon orientalis* (yellow tailed sand gecko) and *Eryx johnii* (common sand boa). Further, it is believed that species such as Indian grey mongoose, desert cat, *Caprimulgus mahrattensis* (Syke's night jar) and *Ophiomorus tridactylus* (three-toad sand swimmer) are more abundant than recorded. It is feared that Red fox, Caracal, Desert cat, Houbara Bustard and Common Sand Boa may suffer further reduction in distribution range and population.

Merging the smaller lakes into a single large reservoir has changed microhabitat requirements for fishing cat, smooth-coated otter, marbled teal,

Indian marsh crocodile and Rock Python), therefore, a further decline in distribution range and population of these species is expected in future.

After the construction of reservoir, a vast area of rangelands has been inundated, eliminating scrub and thorny vegetations, thereby affecting Indian civet, Bengal fox, Little Indian field mouse, Black francolin, *Cyrtopodion scabrum* (common tuberculate ground gecko), *Psammophis condanarus* (Indo-Burmese sand snake) and *Daboia russelii* (Russel's chain viper). Nonetheless, a few species still occur in fair number in the remaining rangelands, and may not be affected in future, including Least Pipistrelle, *Scotophilus heathii*

Table III.- Reptilian fauna of Chotiari Reservoir, Sanghar, Sindh during 2006-2009

| Order/ Sub-order/ Family | Scientific name (Common name) | Status ¹ |
|--------------------------|--|---------------------|
| 1. Testudines | | |
| I. Emydidae | 1. <i>Kachuga smithii</i> (Brown river turtle) | NT |
| | 2. <i>Kachuga tecta</i> (Saw back turtle) | LC |
| II. Trionychidae | 3. <i>Lissemys punctata</i> (Indian flapshell) | LR |
| 2. Crocodylia | | |
| I. Crocodylidae | 4. <i>Crocodylus palustris</i> (Indian marsh crocodile) | VU |
| 3. Squamata | | |
| A. Sauria | | |
| I. Agamidae | 5. <i>Calotes versicolor</i> (Common tree lizard) | NE |
| | 6. <i>Trapelus agilis</i> (Common field agama) | NE |
| | 7. <i>Trapelus megalonyx</i> (Ocellate ground agama) | NE |
| II. Eublepharidae | 8. <i>Eublepharis macularius</i> (Fat-tail gecko) | NE |
| III. Geckonidae | 9. <i>Crossobamon orientalis</i> (Yellow tailed sand gecko) | NE |
| | 10. <i>Cyrtopodion kachhense</i> × (Kachh spotted ground- gecko) | NE |
| | 11. <i>Cyrtopodion scabrum</i> (Common tuberculate ground gecko) | NE |
| | 12. <i>Hemidactylus brookii</i> × (Spotted barn gecko) | NE |
| | 13. <i>Hemidactylus flaviviridis</i> (Yellow-bellied house gecko) | NE |
| IV. Lacertidae | 14. <i>Acanthodactylus cantoris</i> (Blue-tail sand lizard) | NE |
| V. Scincidae | 15. <i>Ophiomorus tridactylus</i> (Three-toad sand swimmer) | NE |
| VI. Uromastycidae | 16. <i>Uromastyx hardwickii</i> (Indus valley spiny-tailed lizard) | NE |
| VII. Varanidae | 17. <i>Varanus bengalensis</i> (Bengal monitor lizard) | NE |
| B. Serpentens | | |
| I. Boidae | 18. <i>Eryx johnii</i> (Common sand boa) | NE |
| | 19. <i>Eryx conicus</i> (Chain sand boa) | NE |
| | 20. <i>Python molurus</i> (Rock python) | NT |
| II. Colubridae | 21. <i>Lycodon striatus</i> × (White-spotted wolf snake) | NE |
| | 22. <i>Lytrohynchus paradoxus</i> × (Sindh awl-headed sand snake) | NE |
| | 23. <i>Platyceps ventromaculatus</i> (Plains racer) | NE |
| | 24. <i>Psammophis condanarus</i> × (Indo-Burmese sand snake) | NE |
| | 25. <i>Psammophis leithii</i> × (Sindhi ribbon snake) | NE |
| | 26. <i>Psammophis schokari</i> × (Saharo-Sindhian sand snake) | NE |
| | 27. <i>Ptyas mucosus</i> (Dahman) | NE |
| | 28. <i>Spalerosophis diadema</i> × (Blotched diadem snake) | NE |
| III. Elapidae | 29. <i>Bungarus caeruleus</i> (Sindhi krait) | NE |
| | 30. <i>Naja naja</i> (Black cobra) | NE |
| IV. Viperidae | 31. <i>Daboia russelii</i> (Russel's chain viper) | NE |
| | 32. <i>Echis carinatus sochureki</i> (Saw-scale viper) | NE |

×not listed in WWF (2008)

Status as per IUCN redlist.org

Table IV.- Amphibian fauna of Chotiari Reservoir, Sanghar, Sindh during 2006-2009

| Order / Family | Scientific name (Common name) | Status ¹ |
|----------------|--|---------------------|
| I. Anura | | |
| I. Bufonidae | 1. <i>Bufo stomaticus</i> (Indus valley toad) | NE |
| II. Ranidae | 2. <i>Euphlyctis cyanophlyctis</i> (Skittering frog) | NE |
| | 3. <i>Hoplobatrachus tigerinus</i> (Bull frog) | NE |

Status as per IUCN redlist.org

(common yellow-bellied bat), *Funambulus pennantii* (palm squirrel), grey francolin, *Streptopelia decaocto* (Eurasian collared dove), *Streptopelia tranquebarica* (red-collared dove), *Stigmatopelia senegalensis* (laughing dove), *Centropus sinensis* (greater coucal), *Merops orientalis* (little green bee-eater), *Merops superciliosus* (Madagascar bee-eater), *Coracias benghalensis* (Indian Roller), *Pycnonotus leucogenys* (Himalyan bulbul), *Pycnonotus cafer* (red-vented bulbul), *Turdoides caudatus* (common babbler), *Lanius vittatus* (bay backed shrike), *Lanius schach* (rufous-backed shrike), *Dicrurus macrocercus* (black drongo), *Calotes versicolor* (common tree lizard) and *Acanthodactylus cantoris* (blue-tail sand lizard).

Seepage from the reservoir has encouraged the formation of several small *dhundhs* (water body). These are rich in organic nutrients, with extensive hydrophytes e.g. *Typha*, *Saccharum* and *Phragmites* favoring the distribution range of certain wildlife species such as *Prinia inornata* (plain prinia), *Porphyrio porphyrio* (purple swamphen), *Gallinula chloropus* (common moorhen), *Amaurornis phoenicurus* (white breasted water-hen) and *Himantopus himantopus* (black-winged stilt). Extension of irrigated canal system and converting surrounding lands into croplands has favored species such as Indian wild boar, Black-naped hare, Porcupine, *Millardia meltdada* (Soft-furred field rat), *Mus booduga* (Little Indian field mouse), *Bandicota bengalensis* (Sindh rice rat), *Nesokia indica* (Short-tailed mole rat), *Bubulcus ibis* (Cattle egret), *Ardeola grayii* (Indian pond heron), black francolin, grey francolin, *Acridotheres tristis* (Common myna) and *Passer domesticus* (House sparrow). Abundance and distribution range of these species are likely to increase in future.

Recommendations

1. If notable wetlands of district Sanghar such as Sanghriaro Lake and Sadhori Lake, and portion of Thar Desert along Chotiari Reservoir are considered as Chotiari Wetlands Complex, it fulfills Ramsar Criteria number 1, 2, 3 and 7 for the consideration of Wetland of international importance- Ramsar Site. Declaring Chotiari Wetlands Complex as a Ramsar Site would inevitably result in better management and conservation of biodiversity resources of the complex.

2. The Sindh Wildlife Protection Ordinance (1972) should be implemented in letter and spirit. Non-protected species such as mongoose, Black francolin, Black cobra, Dhaman snake and freshwater turtles are trapped and sold in Sindh and other parts of the Pakistan. Few protected species such as Houbara Bustard, Smooth-coated otter, Marsh crocodile and Varanus are also hunted and trapped. The Ordinance allows 25 ducks and 20 francolins (species unspecified) per hunting license per season, while bag limit of coot and black-naped hare are not specified. It is suggested that bag limits for wildlife species, especially ducks and francolins should be revised based on their current population status.

3. There is a dire need for the development of management plan for the conservation and sustainable use of reservoir's resources.

4. Water logging and salinity caused by seepage from reservoir are damaging the surrounding agriculture lands. Immediate steps such as installation of piezometer nests to observe vertical and horizontal movements of seepage water must be taken to contain the problem.

5. Ban on cutting of trees and other vegetation should be imposed. Community living near the reservoir must be provided with alternative source

of livelihood so as to reduce their dependence on natural resources.

6. Local people should be provided with the opportunities for the bee-farming, fish farming, cattle farming, agriculture, lily farming, etc. to increase their income.

7. *Typha*, *Phragmites* and *Sacharum* are abundant in the surrounding of reservoir that can provide opportunities to the locals for utilization of these plants for the making of rugs and mats, etc.

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