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GLOBAL CONSERVATION SIGNIFICANCE OF CHOTIARI WETLANDS COMPLEX, SANGAHR, SINDH, PAKISTAN

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ABSTRACT

The global conservation significance of Chotiari Wetlands Complex (District Sanghar, Sindh, Pakistan) is reviewed with addition of some new field data on water birds. The complex provides refuge to at least 12 globally threatened (03 Critically Endangered; 01 Endangered; 08 Vulnerable) and eight near threatened species. The complex also hosts a variety of species and sub-species endemic to the country and South Asia, such as smooth-coated otter (*Lutrogale perspicillata sindica*), Sindh babbler (*Chrysomma altirostre scindicum*), Pakistan's brilliant agama (*Trapelus agilis pakistanensis*), Yellow-tailed sand gecko (*Crossobamon orientalis*), Kutch spotted ground gecko (*Cyrtopodion kachhense kachhense*), Sindh awl-headed sand snake (*Lytorhynchus paradoxus*) and bull frog (*Hoplobatrachus tigerinus*). Nara Canal Wetlands Area is an important wintering area for several species of Anatids, Ardeids, Rallids and shorebirds. The area fulfills certain criteria of Important Bird Area and wetland of international importance. The waterfowl count data collected during 1988-2009 showed fluctuation and great variation. We hypothesized that the complex hosts at least 20,000 waterfowls regularly and if uniform data collection methods are used then waterfowl counts taken during different times represent the same population with no difference in the medians and mean ranks. The Kruskal-Wallis test showed that the medians and mean ranks of waterfowl counts differ significantly (P<0.005) during 1988-2004 and whereas the difference was non-significant (P>0.005) for our data collected during 2006-2009. For effective management and better conservation, it is suggested that the complex be nominated for its inclusion in the list of wetlands of international importance.

Key words: Ramsar Site, Important Bird Area, Endemic Species, Restricted-range Species, Threatened Wildlife, Utilitarian Value, Indus Ecoregion.

INTRODUCTION

Wetland ecosystems account for 6% of the total land area of the world. An estimated area of the world under wetlands is about 63 million hectares and in Asia is about 10 million hectares (Schuyt and Brander, 2004). Despite its location in a xeric part of the world, Pakistan has substantial wetland area and diversity. The estimated area of inland waters in Pakistan is 7,603,590 ha. of which water-storage reservoirs comprise 195,670 ha. (2.57 %) (MINFAL, 2003). Scott (1989) identified 11 types of wetlands in Pakistan. At present, Pakistan has 19 wetlands of international importance but no new wetland has been nominated for the inclusion in this list since 2004.

The diversity and ecology of wetlands of Pakistan has been extensively studied (Rais, 2009, 2008 & 2007; Ali and Akhter, 2006; Sheikh and Kashif, 2006; Khan, 2005; Gachal and Slater, 2004; Amjad and Kidwai, 2003; Memon, 2002; Scott, 1989). Checklists and guides on the occurrence of waterfowl in the country are also available (Ghalib *et al.*, 2009; Ghalib and Hasnain, 1994; Ahmad, 1989; Ahmad and Ghalib, 1986; Koning and Koning-Raat, 1976, 1975; Koning and Dijksen, 1974, Koning and Walmsley, 1973; Koning and Dijksen 1972, 1971) including the data for mid-winter waterfowl counts conducted at different wetlands throughout the country by federal/provincial and territorial wildlife departments. Wetlands and wildlife of Sanghar district have also been thoroughly investigated (Rais *et al.*, 2011; Rais *et al.*, 2010; Qureshi *et al.*, 2009; Rais *et al.*, 2009; Rais *et al.*, 2008; WWF, 2008; Gachal *et al.*, 2007; Mahar *et al.*, 2007; Javed and Rehman, 2004; Azam *et al.*, 2002; Ghalib *et al.*, 1999; Leghari *et al.*, 1999).

We hypothesized that the complex hosts at least 20,000 waterfowl regularly and if uniform data collection methods are used then waterfowl counts taken during different times represent the same population with no difference in the medians and mean ranks. In this paper, we have described the global conservation significance of Chotiari Wetlands Complex, particularly as water bird habitat and wetland of international importance, based on pertaining published literature review and field data analysis.

MATERIALS AND METHODS

Study Site: Chotiari Wetlands Complex (26.1° N latitude, 69.4 ° E longitude) is situated about 30-35 km northeast of Sanghar Town (District Sanghar, Province Sindh, Pakistan). It covers an area of about 18,000 ha., and is located at an elevation of 60 meters above sea level. The complex includes the Thar Desert sand hills on east, north, north-east and south-east and Nara Canal on the west and south. The reservoir comprises many fresh and brackish water bodies (1-200 ha.) such as Gun, Wari, Jajur, Phuleil, Seriao Naro, Khor, Jadpur, Meena, Waguwala, Sanjaran and Bholo (Rais *et al*., 2008). It lies in Thar Desert of Indomalayan Realm (Udvardy, 1975). Hot arid climate prevails in the area. The average maximum daily temperature may exceed 40°C during May and June. The coolest months are December to February, when the maximum daily temperatures range from 25 to 30°C. Rainfall mostly occurs between July and August and averages 40 mm monthly. Annual average rainfall is about 125 mm (Rais *et al*., 2008; WWF, 2008). The wetlands of the area include permanent freshwater lakes, seasonal/intermittent freshwater lakes, seasonal/ intermittent freshwater marshes/pools, Irrigated land including irrigation channels and rice fields and water storage areas. The reservoir is managed by Sindh Irrigation and Drainage Authority (SIDA).

Methodology for Waterfowl Count Data Collection: Waterfowl count data of 1988-2004 were obtained from the Sindh Wildlife Management Board, and data on waterfowl abundance from 2006-2009 were collected by the first author using the total count method at selected sampling units (Fig. 1.). The vantage point within a sampling unit was selected and with the help of a spotting scope (Yukon, 6-25X25 and 25-100X 100) direct counting of all the birds visible in the field of view was undertaken (Bibby *et al.*, 1998). The waterfowls were identified using a field guide (Mirza, 2007). The criteria set by Bird Life International to recognize Important Bird Area and by Ramsar Convention to identify wetland of international importance are listed in Table 1. The data were recorded on Wetlands International's Asian Waterfowl Census Form. The statistical analysis was performed using SPSS 17.0., and the map was prepared using ArcView 3.2.

RESULTS AND DISCUSSION

The Global 200 Analysis, developed by World Wide Fund for nature (WWF) scientists in collaboration with regional experts around the world, identified five ecoregions in Pakistan including Indus Ecoregion that lies fully within Pakistan. The Indus Ecoregion is also identified amongst world's 40 most biologically rich ecoregions. It covers approximately 65 % of Sindh Province (WWF, 2008). The Chotiari Wetlands Complex (Fig.1) covers the south-eastern portion of the Indus Ecoregion. The global conservation value of the complex is given and discussed in the following section as i) significance of the complex as a habitat for globally threatened species, ii) species endemism and iii) Important bird area and wetland of international importance.

Conservation value of Chotiari Wetlands Complex in terms of providing refuge to threatened wildlife species: The complex provides refuge to several threatened and near threatened species. These include Critically Endangered: caracal (*Felis caracal*) and white-backed vulture (*Gypus bengalensis*); Endangered: Indian wolf (*Canis lupus pallipes*); Vulnerbale: hog deer (*Axis porcinus*), marbled teal (*Marmaronetta angustirostris*), Pallas's fish eagle (*Haliaeetus leucoryphus*), imperial eagle (*Aquila heliacal*), saker falcon (*Falco cherrug*), houbara bustard (*Chlamydotis undulata*), Sindh babbler (*Chrysomma altirostre*) and Indian marsh crocodile (*Crocodylus palustris*) (Table 2).

Previous studies confirmed occurrence and rarity of caracal (*Felis caracal*) in the complex (Rais *et al.*, 2011; Roberts, 1997; Ahmed, 1954; Murray, 1884). Roberts (1997) reported Indian wolf (*Canis lupus*) from the complex. Hog Deer (*Axis porcinus*) was reported from riverine forest along Indus River, Keti Shah Reserves, Sukkar and swamps around Sandori Lake, Sanghr District (Roberts, 1997). Azam *et al*. (2002) concluded that the population of hog Deer in District Sanghar was restricted to three areas viz. Chotiari Reservoir (n=80-95), Pir Pagara Game Reserve (n=50-55) and Awadki Forest (n=6-7). Rais *et al*. (2010) reported that the species was confined to two nearby private game reserves. White-backed vulture (*Gypus bengalensis*) is reported from Chotiari Reservoir (Ghalib *et al.*, 1999; Roberts, 1991) but the species was not sighted during 2006-2010 (Rais *et al*., 2008) owing to a drastic decline in the population during the last decade in southeast Asia (Gilbert *et al*., 2002; Prakash, 1999) due to the wide use of diclofenac in livestock (Oaks *et al.*, 2004). Ghalib *et al*. (1999) counted 122 chicks/ juveniles along with 76 adults of marbled teal (*Marmaronetta angustirostre*) from the Chotiari Reservoir. Pallas's fish eagle (*Haliaeetus leucoryphus*) occurs in low numbers (Rais *et al*., 2008; Ghalib *et al*., 1999; Roberts, 1991). Imperial eagle (*Aquila heliaca*) is believed to be largely a winter migrant from Central Asia. Roberts (1991) reported imperial eagle as Scarce in Sindh. Houbara bustard (*Chlamydotis undulata*) is a winter visitor in the desert area of the complex (Rais *et al*., 2008; Ghalib *et al*., 1999; Roberts, 1991). The complex is one of the three core areas of the country from where Sindh babbler or

Jerdon's babbler (*Chrysomma altirostre*) is reported (Showler and Davidson, 1999).

Ahmed (1986) recorded 120 crocodiles from province of Sindh of which 17 (14 %) were directly sighted in Nara Canal, District Sangahr. Javed and Rehman (2004) sighted 69 crocodiles at different wetlands of Sindh province of which 20 (29%) were recorded from Chotiari Reservoir, District Sanghar. (Ahmad, 1986)

Species endemism at Chotiari Wetlands Complex: Two subspecies of smooth-coated otter (*Lutrogale perspicillata*) occur in South Asia of which one subspecies viz. *L. p. sindica* is confined to Indus Valley and adjacent river systems (Wayer, 1972). The species was reported from the complex in the past (Gachal, *et al.*, 2007; Roberts, 1997; Wayer, 1972) but the most recent sightings are by Rais *et al*. (2009). Although no endemic bird species is found in Pakistan, but Indus Plain has been identified as a Secondary Endemic Bird Area in Pakistan (Stattersfield *et al.*, 1998), for the area possesses a restricted range bird species viz. Sindh sparrow (*Passer pyrrhonotus*) and two passerine birds with a globally restricted ranges such as Rufous-vented prinia (*Prinia burnesii*) and Sindh babbler (*Chrysomma altirostre*). Sindh babbler is represented by three subspecies *Chrysomma altirostre altirostre, C. a. griseigulare,* and *C. a. scindicum* in the world (Showler and Davidson, 1999). Nara Canal Area is one of three localities of Pakistan from where the Sindh Babbler has been reported (Rais *et al*., 2008; Ghalib *et al*., 1999; Showler and Davidson, 1999; Roberts, 1992). The complex has abundant tall grassland of reedbeds (*Phragmites karka*) and reed grass (*Saccharum munja*) (Rais *et al*., 2008) which are used as habitat by the Sindh Babbler (Roberts, 1992).

The complex also hosts an endemic lizard of the country viz. Pakistan's brilliant agama (*Trapelus agilis pakistanensis*). Further, three reptiles viz. Yellow-tailed sand gecko (*Crossobamon orientalis*), Kachh spotted ground gecko (*Cyrtopodion kachhense kachhense*) and Sindh awl-headed sand snake (*Lytorhynchus paradoxus*) and one amphibian viz. bull frog (*Hoplobatrachus tigerinus*) which are endemic to South Asia also inhabit the complex (Molur, 2008; Khan, 2006).

The Chotiari Wetlands Complex as an Important Bird Area (IBA) and potential wetland of international importance: In Pakistan, 55 Important Bird Areas (IBA) have been identified by Bird Life International covering an area of 4,670,100 hectares (Crosby and Chan, 2005). Nara Canal Wetlands Area (IBA Number 43) includes Soonhari (now part of Chotiari Resevoir), Sadhori and Sanghriaro Lakes of the complex and spreads over 109,966 ha constituting around 2.35 % of the country's IBAs. At present, the number of designated wetlands of international importance in Pakistan is 19. Nara Canal Wetlands Area of the complex is among 18 potential wetlands of international importance identified by BirdLife International. Chotiari Wetlands Complex fulfills categories A1, A4i and A4iii for identifying Important Bird Areas (IBA), and criteria 2, 5 and 6 for identifying wetland of international importance.

Justification for IBA Criterion A1: The complex hosts globally vulnerable species such as Pallas's fish eagle (*Haliaeetus leucoryphus*), imperial eagle (*Aquila heliaca*), houbara bustard (*Chlamydotis undulata*) and marbled teal (*Marmaronetta angustirostris*). Indus basin is estimated to support 10–50% of global non-breeding population of marbled teal and <10% of global breeding population of Pallas's Fish Eagle (Rais *et al*., 2008; Crosby and Chan, 2005; Ghalib *et al*., 1999; Roberts, 1991).

Justification for Ramsar Convention's Criterion 2: As discussed in the preceding section, the complex provides refuge to a number of Threatened and Near Threatened species which includes nine species of mammals, eight of birds and three species of reptile (Table 2).

Justification for IBA Criterion A4I and Ramsar Convention's Criterion 6: The area regularly supports various congregatory water bird species such as black stork (*Ciconia nigra*), common pochard (*Aythya ferina*), ferruginous duck (*Aythya nyroca*) and common coot (*Fulica atra*) (Crosby and Chan, 2005) and Anatids such as common teal (*Anas crecca*), Eurasian wigeon (*A. penelope*), Northern pintail (*A. acuta*), Northern shoveler (*A. clypeata*) and tufted duck (*A. fuligula*) (Rais *et al*., 2008; Ghalib *et al*., 1999; Scott, 1989).

Justification for IBA Criterion A4III and Ramsar Convention's Criterion 5: An aerial survey of 21 lakes in Nara Canal Wetlands Area during February, 1988 yielded a total of 70,000 waterfowl count (Scott, 1989). We believe that the area still supports at least 20,000 waterfowls. To test this we hypothesized that the complex hosts at least 20,000 waterfowls regularly and if uniform data collection methods are used then waterfowl counts taken during different times represent the same population with no difference in the medians and mean ranks. The waterfowl count data during 1988-2009 showed great fluctuation with maximum count of 19,385 during the year 1988 despite the lowest number of species (07) while the minimum count of 4,539 was recorded during the year 2000 (Fig.2). The count for the same period showed large variation with all data bunched towards lower quartile and several outliers (Fig.3). However, our data displayed relatively less variation and more spread with few outliers (Fig. 4). The Kruskal-Wallis test showed that the medians and mean ranks of waterfowl counts during 1988-2009 were significantly

different (df = 12, P<0.005) with positive kurtosis in all instances. The

Table 1: Criteria formulated by Bird Life International to identify Important Bird Area and Ramsar Convention to identify wetland of international importance.

Criteria	Description
Bird Life International criteria to identify Important Bird Areas	
Criterion A1: Globally threatened bird species	The site regularly holds significant numbers of a globally threatened species, or other species of global conservation concern.
Criterion A4I :Globally important congregations	The site is known or thought to hold, on a regular basis, 1% or more of a biogeographic population of a congregatory water bird species
Criterion A4III: Globally important congregations	The site is known or thought to hold, on a regular basis, for identifying Important Bird Area at least 20,000 water birds, or at least 10,000 pairs of seabird, of one or more species.
Ramsar Convention criteria to identify wetland of international importance	
Criterion 2	A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities
Criterion 6	A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of water birds
Criterion 5	A wetland should be considered internationally important if it regularly supports 20,000 or more water birds.

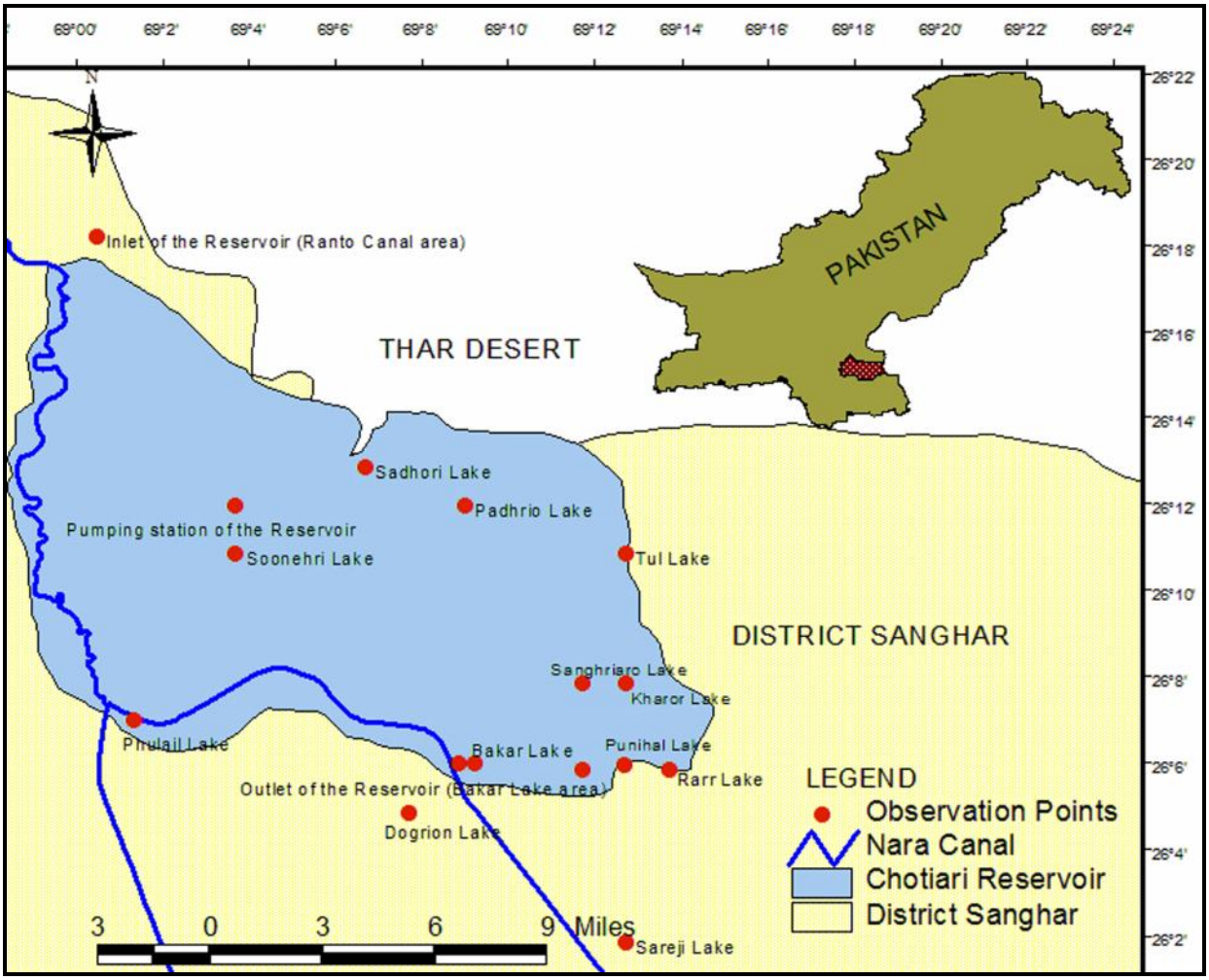
Table 2: Threatened and Near Threatened wildlife species of the Chotiari Wetlands Complex, Sanghar, Sindh, Pakistan.

	Family	Species	Common Name	IUCN Category
Mammals				
	Canidae	**Canis lupus pallipes*	Indian wolf	Endangered [a]
		Vulpes bengalensis	Bengal fox	Near Threatened [a]
	Mustelidae			
		Lutrogale perspicillata sindica	Smooth-coated otter	Near Threatened [a]
	Hyaenidae	*Viverricula indica*	Indian civet	Near Threatened [a]
		**Hyaena hyaena*	Striped hyaena	Critically Endangered [a]
	Felidae			
		**Felis caracal*	Caracal	Critically Endangered [a]
		**Prionailurus viverrinus*	Fishing cat	Near Threatened [a]
	Cervidae			
		Axis porcinus	Hog deer	Vulnerable [a]
	Muridae			
		Gerbillus nanus	Balochistan gerbil	Near Threatened [a]
Birds				
	Anatidae			
		†*Marmaronetta angustirostris*	Marbled teal	Vulnerable [b]
	Accipitridae	*Haliaeetus leucoryphus*	Pallas's fish eagle	Vulnerable [b]
		†*Gypus bengalensis*	White-backed vulture	Critically Endangered [b]
		†*Aegypius monachus*	Cinereous vulture	Near Threatened [b]
	Falconidae			
		Falco cherrug	Saker falcon	Vulnerable [b]
		†*Aquila heliacal*	Imperial eagle	Vulnerable [b]
	Otididae			
		Chlamydotis undulate	Houbara bustard	Vulnerable [b]
	Sylvidae			
		††*Chrysomma altirostre*	Sindh babbler	Vulnerable [b]
Reptiles				
	Emydidae			
		Pangshura smithii	Brown river turtle	Near Threatened [b]
	Crocodylidae			
		Crocodylus palustris	Indian marsh crocodile	Vulnerable [b]
	Boidae			
		Python molurus	Rock python	Near Threatened [b]

[a] Sheikh and Molur (2005); [b] IUCNredlist.org

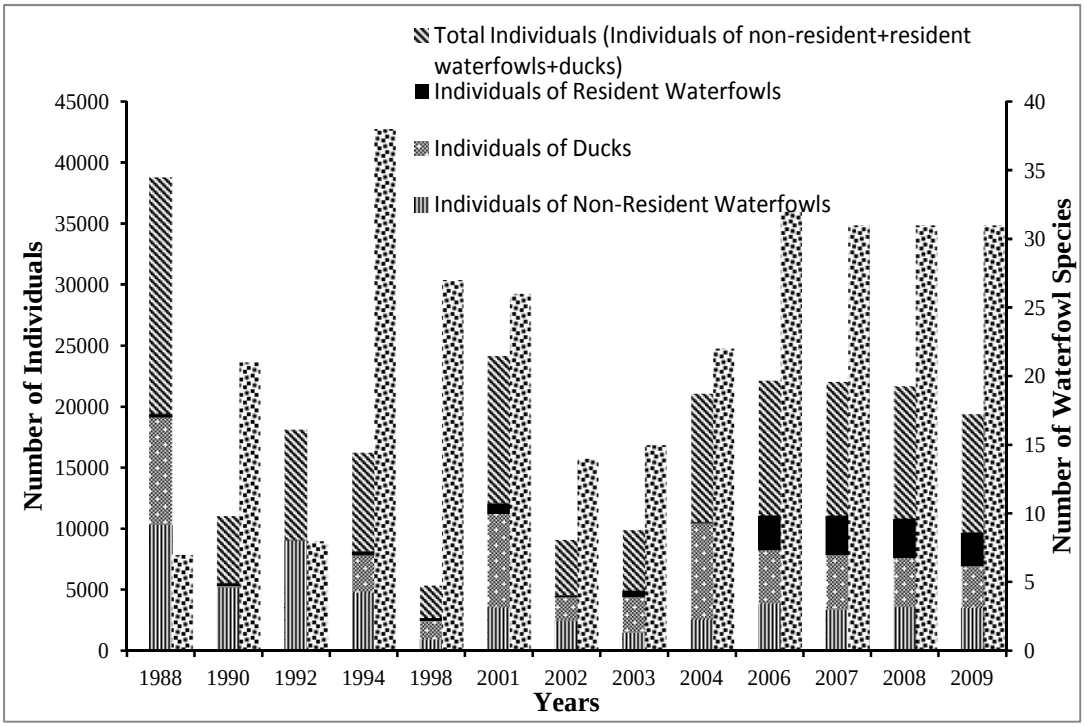
test also yielded significant difference (df = 8, P<0.005) between the medians and mean ranks of waterfowl counts during 1988-2004 whereas the difference was non-significant (df = 3, P>0.005) for our count data of 2006-2009 period. Our counts may underestimate waterfowl abundance, because our sampling was limited to a few wetlands of the complex. Therefore, we conclude that the observed difference was not because of the fact that the complex had birds below 20,000 throughout 1988-2009 rather it was due to differences in the observers, timings during which the counts were undertaken, sampling effort, use of equipments such as spotting scope and selection of vantage points for the count.

Sodhi and Ehrlich (2010) have summarized the nine major patterns which had been recognized during the last two decades for global conservation priorities. These include Crisis Ecoregions, Biodiversity Hotspots, Endemic Bird Areas, Centers of Plant Diversity, Mega diversity Countries, Global 200 Ecoregions, High-biodiversity Wilderness Areas, Frontier Forests and Last of the Wild. It is concluded that Chotiari Wetlands Complex holds significant position amongst world's sites for global conservation priorities due to its pivotal role in maintaining habitat and wildlife species diversity within the Indus Ecoregion. The survival of many threatened, near threatened and endemic species is also intricately linked with the conservation of the complex. The harvesting of species with utilitarian value on sustainable basis can yield benefits to the community of the area. For effective management and better conservation, it is suggested that the complex be nominated for its inclusion in the list of wetlands of international importance. Initiation of regular water bird population monitoring programs, research and conservation programs for threatened and endemic species are also recommended.



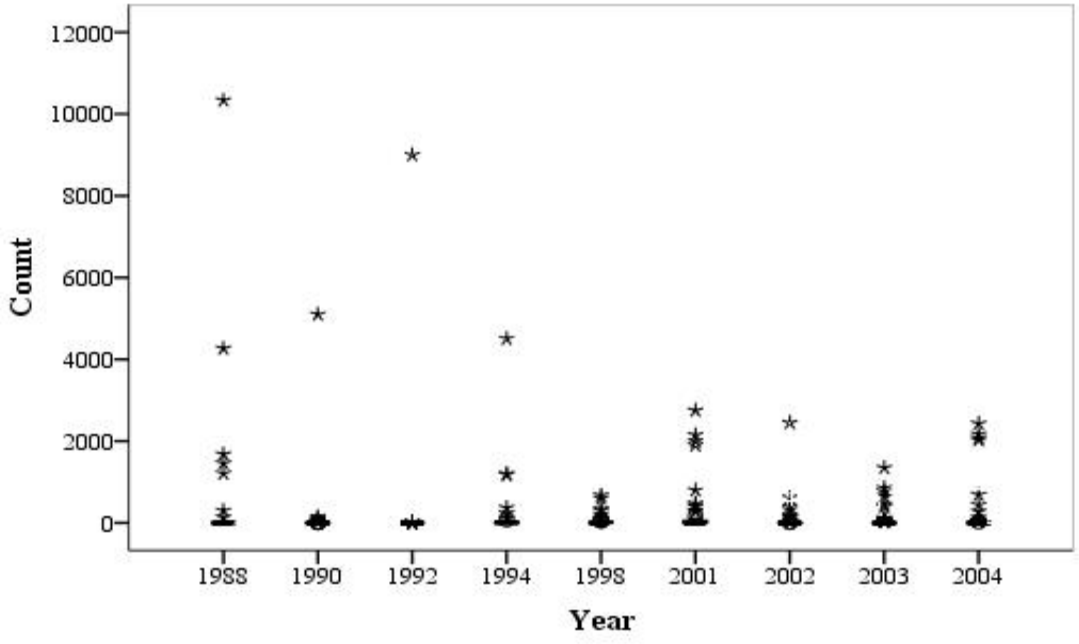
(Vantage Points: Bakar Lake, Padhrio Lake, Tul Lake, Dogrion Lake, Noonghno Lake and Punihal Lake)

Fig.1. Map showing the extent of Chotiar Reservoir, location of different wetlands and Nara Canal within Chotiari Wetlands Complex, Sanghar, Sindh, Pakistan.



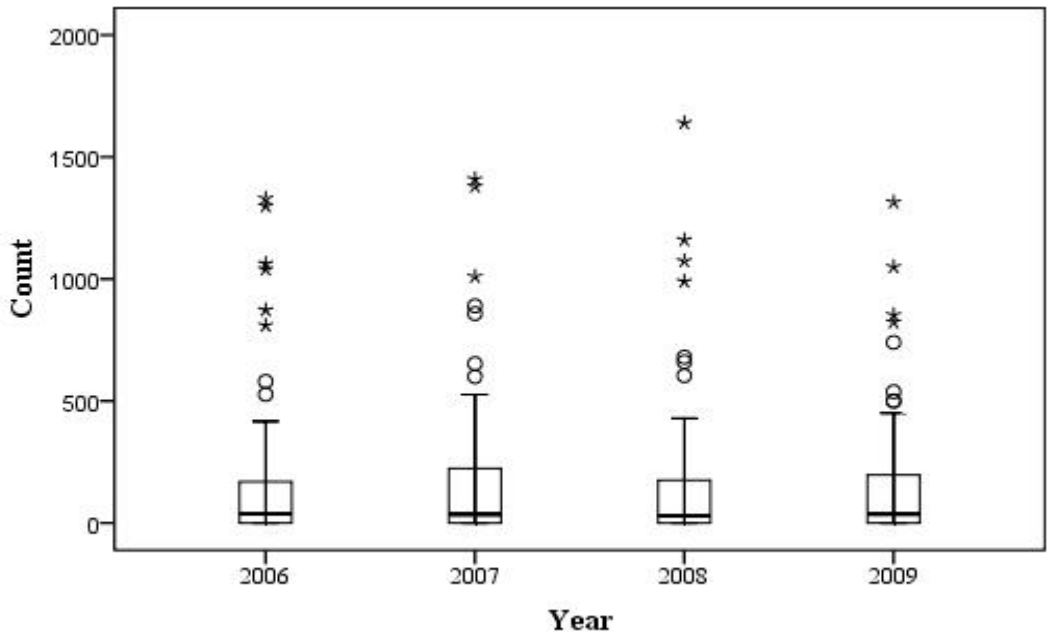
Data during 1988-2004 by Sindh Wildlife Management Board and during 2006-2009 by first author

Fig.2. A comparison of waterfowl species richness and count of Chotiari Wetlands Complex (Sanghar, Sindh, Pakistan) during different years.



*=Extreme outliers

Fig.3. Box plots of waterfowl count conducted by Sindh Wildlife Management Board during 1988-2004.



*=extreme outliers; o=mild outliers

Fig.4. Box plots of waterfowl count conducted during present study from 2006 to 2009.

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