



BREEDING AND POPULATION STATUS OF MARSH CROCODILE (*CROCODYLUS PALUSTRIS*) IN MANGHOPIR SHRINE AREA, KARACHI

M Zaheer Khan¹, *Tahira Abdul Latif¹, Syed Ali Ghalib¹, Iqbal Saeed Khan¹, Babar Hussain²,
Afsheen Zehra¹, Saima Siddiqui¹, Roohi Kanwal¹, Tanveer Jabeen¹ and Fozia Tabbassum¹

¹Wildlife Section, Department of Zoology, University of Karachi, Karachi-75270

²The World Conservation Union (IUCN), 1 Bath Island Road, Karachi, Pakistan

ABSTRACT

A study on breeding and population status of Marsh crocodile (*Crocodylus palustris*) in Manghopir Shrine Area was undertaken during the years 2010-2013. There is a 61 meters wide and 122 meters long water pond adjacent to the shrine. This pond is home to 144 Marsh crocodiles among them, there are 98 adults, 28 subadults, 15 juveniles and 3 hatchlings. In this area, the Sheedi Community (native peoples of the area) is providing shelter to the species. The pond and its adjacent area is small for such a large population. They cannot perform their communal activities such as basking, breeding as the habitable area of the Crocodiles is overpopulated. Though there is a large number of sexually mature Crocodiles, a few nest, but due to intraspecific competition, animals cannot breed. Only five successful nesting events were observed during the study period. Additionally, there are no adequate husbandry measures taken for the protection of eggs and hatchlings. According to the Community, these Marsh crocodiles are gifts from their Saint, Sheikh Sakhi Sultan. Shortage of food and lack of requisite territory for biological activities are major threats to the Marsh crocodiles in the Manghopir Shrine Area.

Keywords: Marsh crocodile, onsite breeding, population status, sheedi community.

INTRODUCTION

There are 23 species of crocodylians currently recognized (Eaton, 2010). Three families of the Order Crocodylia are known from Indian subcontinent, only one species, the Marsh crocodile (*Crocodylus palustris*) is known to occur in Pakistan (Table 1), where its status is classified as vulnerable (Ghalib *et al.*, 1981; Javed and Rehman, 2004). Crocodiles live in a variety of habitats and may persist in many different environments. Crocodiles are found in hot tropical areas of the world; globally they are found in many Asian countries, such as Bangladesh, Iran, India, Nepal, Sri Lanka, and Indo-China. This species has numerous common names in Pakistan, it is locally called Muggar Much, the name "Muggar" derives from the Indian 'Magar-Machh', that can also mean swamp crocodile (Ahmed, 1986). Marsh crocodile lives mostly in freshwater, rivers, lakes and swamps. Usually in case of water streams, it prefers stagnant and stumpy water. It shows great tolerance to aquatic environments with a greater saline concentration. A Marsh crocodile is regarded as "Keystone Species" that maintains ecosystem structure and function through selective predation on fish species, recycling of nutrients and conservation of

wetlands in droughts (King, 1988). This study was undertaken to determine the onsite breeding, and current population status of Marsh crocodile (*Crocodylus palustris*) in Manghopir Shrine Area Karachi.

MATERIALS AND METHODS

Karachi is located in the south of Pakistan on the coast of the Arabian Sea. Manghopir Mountain range lies in Northwest of Karachi between Hub River and Manghopir. The present study is based on secondary data and direct evidence during the survey of study area.

During the study, Marsh crocodile habitats were visited and data recorded, counting was done while Crocodiles were basking and swimming at the surface of water, and catching the reflection of eyes of Crocodiles during the night observation.

Crocodiles were categorized into four groups according to their sizes; (i) hatchlings with length of less than 0.5 meter (ii) juveniles with length of 0.5-1.0 meter, (iii) subadults with length of 1.1-2.0 meters (iv) adults with length of more than 2 meters. GPS was used for recording area coordinates. Standardized Digital camera was used for photography.

*Corresponding author e-mail: tahiraa9@gmail.com

Table 1. List of living Species of Alligatoridae, Crocodylidae and Gavialidae in the world.

S. No.	Scientific Name	Common Name
Family : Alligatoridae		
1.	<i>Alligator mississippiensis</i>	American alligator
2.	<i>Alligator sinensis</i>	Chinese alligator
3.	<i>Caiman crocodilus</i>	Spectacled caiman
4.	<i>Caiman latirostris</i>	Broad-snouted caiman
5.	<i>Caiman yacare</i>	Jacare caiman
6.	<i>Melanosuchus niger</i>	Black caiman
7.	<i>Paleosuchus palpebrosus</i>	Cuvier's dwarf caiman
8.	<i>Paleosuchus trigonatus</i>	Schneider's dwarf caiman
Family : Crocodylidae		
9.	<i>Crocodylus acutus</i>	American crocodile
10.	<i>Crocodylus cataphractus</i>	Slender-snouted crocodile
11.	<i>Crocodylus intermedius</i>	Orinoco crocodile
12.	<i>Crocodylus johnstoni</i>	Australian freshwater crocodile
13.	<i>Crocodylus mindorensis</i>	Philippine crocodile
14.	<i>Crocodylus moreletii</i>	Morelet's crocodile
15.	<i>Crocodylus niloticus</i>	Nile crocodile
16.	<i>Crocodylus novaeguineae</i>	New guinea crocodile
17.	<i>Crocodylus palustris</i>	Marsh crocodile
18.	<i>Crocodylus porosus</i>	Estuarine crocodile
19.	<i>Crocodylus rhombifer</i>	Cuban crocodile
20.	<i>Crocodylus siamensis</i>	Siamese crocodile
21.	<i>Osteolaemus tetraspis</i>	African dwarf crocodile
22.	<i>Tomistoma schlegelii</i>	False gharial
Family : Gavialidae		
23.	<i>Gavialis gangeticus</i>	Indian gharial

Study Areas

Manghopir (24° 59' 08" N 67° 02' 29" E) is in the vicinities of Gadap Town in Karachi (Fig. 1). It is located in the mountainous areas in between Karachi District of Sindh and Lasbella District of Balochistan. Adjoining areas of Manghopir Shrine Area are ; Muhammad Khan Afridi Colony (N 24° 58' 38.8" E 67° 02' 09.7"), Allah Bachaya Goth (N 24° 58' 39.98" E 67° 02' 12.0"), Haji Hamza Goth (N 24° 58' 48.8" E 67° 02' 07.4") and Bilawal Deen Goth (N 24° 58' 47.5" E 67° 02' 02.7") .

Manghopir Shrine Area is a great attraction. This area is famous due to the following three main reasons.

i) Shrine of Saint Sheikh Sakhi Sultan

It is located on a hill at an altitude of approximately 600 feet. It is protected and managed by Department of Auqaf, Zakat and Ushr, Government of Sindh and the local Sheedi Community (Fig. 3).

ii) Hot Water Sulphur Spring

Many people regularly visit this area from long distances, to have a bath in the hot Sulphur Spring to get cure and remedy from skin diseases. There are separate swimming pools and shower rooms constructed for men and women for taking bath in this hot water sulphur spring.

iii) Marsh crocodile Pond

Adjacent to the shrine area, there is a major attraction for people in the form of Marsh crocodile pond (Fig. 2). For visitors, it is a great attraction and source of interest particularly for kids due to large numbers of Marsh crocodiles present in this pond area.

RESULTS AND DISCUSSION

Religious Background of Study Area

In Manghopir area the local community has firm religious belief about the origin of Marsh crocodiles. According to their belief, these crocodiles are the lice of their deceased Saint Sheikh Sakhi Sultan. In this regard, they esteem these crocodiles. This species has been existing in such large numbers at this locality due to care taken by locals. The community celebrates a yearly festival known as Sheedi Festival. It is also known as Crocodile Festival (Fig. 4). This festival is held in the Islamic month of Zil-Hijj. This festival shows their traditional and spiritual faiths about crocodiles. The devotees in this festival offer fresh meat to these Crocodiles, as they sacrifice goats or other animals for fulfillment of their wishes. According to their belief, acceptance of meat by crocodiles is a sign of good health and prosperity (Fig. 5). They also celebrate the garlanding ceremony of King Crocodile. It is known as "Mor Sahib" in the local language. It is the oldest animal in this population of Crocodiles. Rose garlands are placed on the "Mor Sahib" (Fig. 6).

Table 2. Population Status of Marsh Crocodiles at Manghopir Shrine Area.

S. No.	Class Size	Total	Male	Female
1	Adults	98	61	37
2	Sub- adults	28	19	9
3	Juveniles	15	13	2
4	Hatchlings	3	2	1
	Total	144	95	49

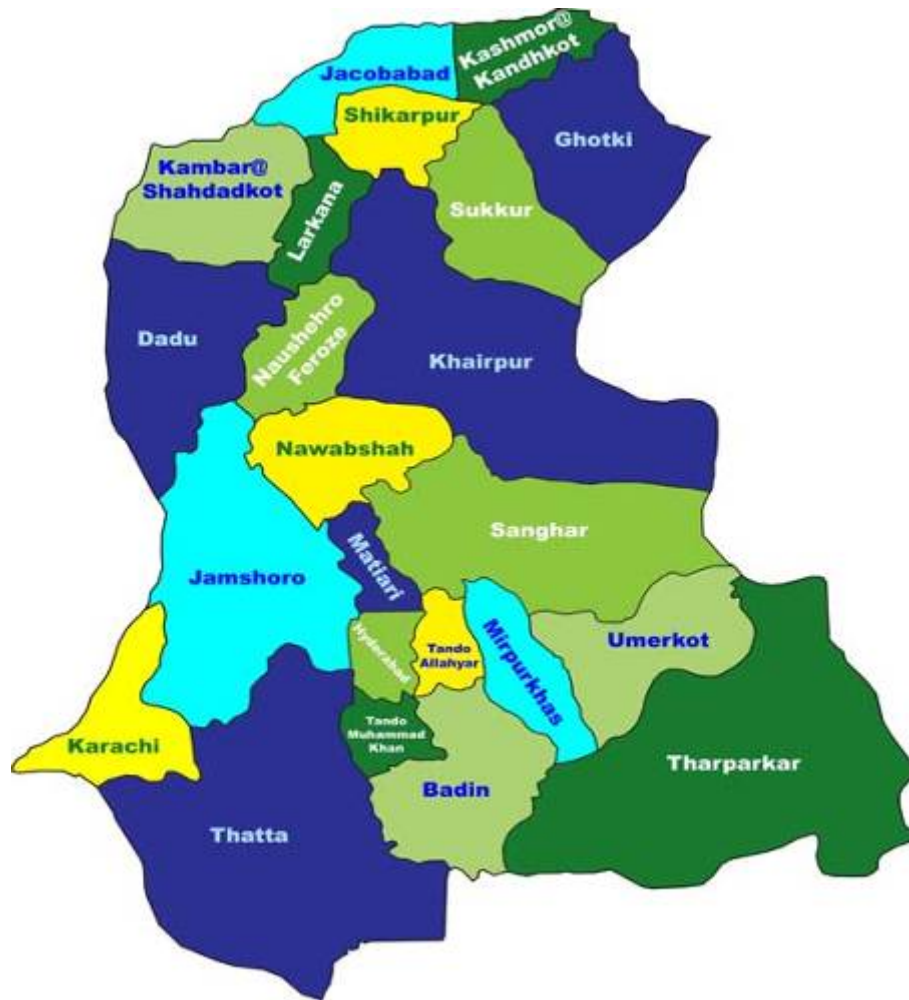


Fig. 1. Map of Sindh indicating study areas.

During the Festival, local community devotees seek blessings for their children by holding them over a Marsh crocodile. The community also pays respect to the dead crocodiles. They bury dead Crocodiles with an equal respect and formalities just as for a human being. They have space in this area for the purpose. They do not allow sale or trade in Marsh crocodiles.

Marsh Crocodile Pond

There is a synthetic artificial pond in Manghopir Shrine Area. In this pond, water is supplied from a sulphur spring which originates in this area. There are another 61 meters (wide) and 122 meters (long) and 20 meters deep water pond. It is adjacent to the shrine, and there is a supply of water to this pond also from Sulphur Water Spring.

The main pond is home to 144 Marsh crocodiles, among them, there are 98 adults, 28 subadults, 15 juveniles and 3 are hatchlings (Table 2). Here large number of Marsh crocodiles recorded in captivity even though the pond area is insufficient for such a population of crocodiles as

restricts their biological, physical and social activities. Limited space is a major threat to this species in this area. There Crocodiles cannot move for a long distance, even larger animals move from land area to pond water and again towards land area. This area is not appropriate for their onsite breeding. In a year hardly two pairs were recorded to be doing nesting activities.

Color of Crocodile pond water is leaf green, but there is no odour in this stagnant water. Water quantity and quality is not suitable as compared to number of crocodiles living in this pond. Manghopir Shrine Area could be managed as a model protected area for the conservation of crocodiles. Local community is protecting this species because of their religious point of view regarding crocodiles as gift from their Saint Sheikh Sakhi Sultan.

Considering the developmental trends in Manghopir Shrine Area, there is no serious destruction, modification or degradation of habitat. There is no impact from tourism activities that may negatively influence the Crocodiles



Fig. 2. An over view of Marsh crocodile pond at Manghopir Shrine Area in Karachi.



Fig. 3. An over view of Shrine of Sheik Sakhi Sultan at Manghopir Shrine Area.

population. The pond area is insufficient for different activities such as basking, breeding, and moving as the main strong hold of the Crocodiles is over populated (Fig. 7). Food availability is also a severe limiting factor for them in this study area.

There are some plantations inside and outside the pond area. Inside the pond area, Palm Tree and Indian Badam are present, whereas outside the pond area numerous plant species were recorded (Table 3). Filamentous algae were abundant and are disreputable for forming of large, pillow-like mats of algae that float on the surface area of pond, whereas other floating aquatic plants were not present. In pond, submerged plants were not studied. Elephant grass was recorded in good number which provides a shelter to hatchlings and juveniles it also

provides the animals with shadow and lodging.

Fauna of Manghopir Shrine Area

During the field study, the vertebrate fauna of the main site and adjacent areas was also recorded and 20 species of mammals, 17 species of birds, 12 species of reptiles and one species of amphibians recorded (Tables 4-7).

Breeding

During breeding period, the female Marsh crocodiles preferred to stay near the nesting area. There is high parental care observed in this species. The female Crocodiles guard their nests very carefully. Hatchlings stay with their pods for longer time period. Hatchlings have instinct ability to identify their pods and mother. Female Crocodile builds nests near water habitat, where it



Fig. 4. Women celebrate the Sheedi Festival.



Fig. 5. A Sheedi devotee is providing meat pieces to a crocodile, as acceptance of meat by crocodile is taken to be a sign of health and prosperity.

usually lays approximately 35-70 eggs in a hole nest (Whitaker and Whitaker, 1989).

In captivity the females start laying eggs when they are 1.7-2.0 m long, and of 6 years of age. Males are sexually mature at 2.6 m and 10 years of age. The known incubation period is approximately 55-75 days

(Thorbjarnarson, 1992; Webb *et al.*, 1987). The eggs are hard with calcareous shell. The diameter of shell has total length of 9 cm, its width is 6 cm. Eggs are generally laid in late February to March. Nests, which are 30 to 45 cm deep, are made by scooping out mud of earth, in which 48 to 56 eggs are usually laid in a clutch, during the study total 236 eggs recorded (Table 8). The nest is made inside



Fig. 6. During “Sheedi Festival” Khalifa Sajjad Baloch is providing meat to King Crocodile.



Fig. 7. A large number of Crocodile basking on sandy area.

a burrow. The nest chamber is a wide-mouthed pitcher shaped structure, dug away from the water body. Mother Crocodile guards nests by lying to protect the eggs, and control the humidity and heat. The incubation period varies from 75 to 90 days. Hatchlings, when ready to merge from eggs produce short feeble grunts significant to the mother who excavates the hatchlings and transfers them to the nearby bodies by jaws (Fig. 8). Crocodilians are the most social reptiles and show universal parental care. Parental care behaviour is observed in Crocodilians

including nesting site selection, nest construction and defense, nest and egg opening, transport of hatchlings to the water, burrow construction, defense and vigilance of hatchlings, creche formation, response to distress calls of young individuals, moving hatchling groups to better nursery areas, and possible hatchling feeding.

In addition to Manghopir Shrine Area study, the population status of Crocodiles was also studied in wild and captivity in Karachi, Malir, Sanghar, Khairpur,



Fig. 8. Hatchlings of Marsh crocodile hatching out from egg shells.

Shaheed Benazirabad and Thatta Districts. During the present study, it was significant that the largest population of Marsh crocodile was recorded in Deh Akro II Wetland Complex in Wild, there were 544 animals. In Nara Canal, 238 Marsh crocodile were recorded. In Chotiari Reservoir, population of Marsh crocodile was counted as 237. In the Haleji Lake Wildlife Sanctuary, there were 205 Crocodiles in wild and 13 were in captivity. In Hub Dam Reservoir, only one Marsh crocodile was recorded. In Kirthar National Park (Khar Center), 36 crocodiles were recorded in captivity. The population of crocodile was recorded about more than one thousand in the areas of Makhi and Bakar Lake (Javed and Rehman, 2004). In the Punjab region, due to environmental deterioration crocodile has become extirpated (Chaudhury, 1993; Khan, 2008). Whereas in Balochistan province, it has been recorded from Nari, Hub, Hingol, Dasht, Nahang and Kuch Kuar in small numbers (Ahmed, 1986; Ghalib *et al.*, 1981; Khan, 1989).

Table 3. List of Flora recorded at Manghopir Shrine and adjacent areas.

S. No.	Scientific Name
1.	<i>Acacia nilotica</i>
2.	<i>Aerva javanica</i>
3.	<i>Inula grantoides</i>
4.	<i>Prosopis cineraria</i>
5.	<i>Rhazia stricta,</i>
6.	<i>Salvadora oleoides</i>

S. No.	Scientific Name
7.	<i>Sueda fruticosa</i>
8.	<i>Tamarix aphylla</i>
9.	<i>Zizyphus nummularia</i>
10.	<i>Phoenix dactylifera</i>
11.	<i>Phragmites karka</i>
12.	<i>Ficus bengalensis</i>
13.	<i>Prosopis juliflora</i>
14.	<i>Terminalia catapa</i>

Another study by Chang *et al.* (2012a,b, and 2013a,b) in Manghopir Karachi from 2006 to 2009, showed that there were 116 Crocodiles, among them 80 adults, 20 juveniles and 16 were hatchlings.

CONCLUSION

On the basis of present study, it is concluded that in Manghopir Shrine Area, there are 144 Marsh crocodiles which is the highest recorded population in captivity in Sindh province.

ACKNOWLEDGEMENT

We are thankful to the Department of Auqaf, Government of Sindh and all the leaders of local community, particularly Holy Successor Kahlifa Sajjad Baloch Sheedi, for their valuable information and support during the study period.

Table 4. List of Mammals recorded from Manghopir Shrine and adjacent areas.

S. No.	Order	Family	Common Name	Scientific Name
1.	Carnivora	Canidae	Asiatic Jackal	<i>Canis aureus</i>
			Red Fox	<i>Vulpes vulpes</i>
		Felidae	Desert Cat	<i>Felis silvestris</i>
		Herpestidae	Small Indian Mongoose	<i>Herpestes javanicus</i>
			Grey Mongoose	<i>Herpestes edwardsi</i>
2.	Artiodactyla	Suidae	Indian Wild Boar	<i>Sus scrofa</i>
3.	Rodentia	Muridae	Common House Rat	<i>Ratus ratus</i>
			House Mouse	<i>Mus musculus</i>
			Indian Mole Rat	<i>Bandicota bengalensis</i>
			Indian Desert Jird	<i>Meriones hurrianae</i>
			Balochistan Gerbil	<i>Gerbillus nanus</i>
		Hystriidae	Indian Crested Porcupine	<i>Hystrix indica</i>
	Sciuridae	Palm Squirrel	<i>Funambulus pennantii</i>	
	Insectivora	Erinaceidae	Indian Hedgehog	<i>Paraechinus micropus</i>
Long Eared Hedgehog			<i>Hemiechinus collaris</i>	
4.	Pholidota	Manidae	Indian Pangolin	<i>Manis crassicaudata</i>
5.	Lagomorpha	Leporidae	Indian Hare or desert Hare	<i>Lepus nigricollis</i>

Table 5. List of Birds recorded from Manghopir Shrine and adjacent areas.

S. No.	Order	Family	Common Name	Scientific Name
1.	Falconiformes	Accipitridae	Common Kite	<i>Milvus migrans</i>
			Central Asian Shikra	<i>Accipiter badius</i>
		Falconidae	Common Kestrel	<i>Falco tinnunculus</i>
		Pandionidae	Osprey	<i>Pandion haliaetus</i>
2.	Columbiformes	Columbidae	Blue Rock Pigeon	<i>Columba livia</i>
			Little Brown Dove	<i>Streptopelia senegalensis</i>
3.	Coraciiformes	Meropidae	Blue-cheeked Bee-eater	<i>Merops persicus</i>
	Passeriformes	Alaudidae	Desert Lark	<i>Amomanes deserti</i>
		Sturnidae	Indian Myna	<i>Acridotheres adsimilis</i>
		Pycnonotidae	White-cheeked Bulbul	<i>Pycnonotus leucogenys</i>
		Timaliidae	Jungle Babbler	<i>Turdoides striata</i>
		Sylviidae	Common Chiffchaff	<i>Phylloscopus collybita</i>
		Nectaraniidae	Purple Sunbird	<i>Nectarinia asiatica</i>
		Passeridae	Sind Jungle Sparrow	<i>Passer pyrrhonotus</i>
			House Sparrow	<i>Passer domesticus</i>
Corvidae	House Crow	<i>Corvus splendens</i>		

Table 6. List of Reptiles recorded from Manghopir Shrine and adjacent areas.

S. No.	Order	Family	Common Name	Scientific Name
1.	Crocodylia	Crocodylidae	Marsh crocodile	<i>Crocodylus palustris</i>
2.	Squamata	Elapidae	Indian Cobra	<i>Naja naja</i>
		Boidae	Indian Sand Boa	<i>Eryx johnii</i>
		Colubridae	Glossy-bellied Racer	<i>Platyceps ventromaculatus</i>
		Agamidae	Common Tree Lizard	<i>Calotes versicolor</i>
		Gekkonidae	Yellow-bellied House Gecko	<i>Hemidactylus flaviviridis</i>
			Common House Gecko	<i>Hemidactylus frenatus</i>
			Spotted Indian House Gecko	<i>Hemidactylus brookii</i>
		Scincidae	Three-fingered Sand-fish	<i>Ophiomorus raithmai</i>
		Varanidae	Bengal Monitor	<i>Varanus bengalensis</i>
			Desert Monitor	<i>Varanus griseus</i>
Lacertidae	Blue tail Sand Lizard	<i>Acanthodactylus cantoris</i>		

Table 7. List of Amphibians recorded from Manghopir Shrine and adjacent areas.

S. No.	Order	Family	Common Name	Scientific Name
1.	Anura	Ranidae	Tiger or Bull Frog	<i>Hoplobatrachus tigerinus</i>

Table 8. Eggs laying record of Marsh Crocodile at Manghopir Shire Area.

Length of female Crocodiles (m)	No. of eggs in each clutch	Average weight of eggs in each cluster (gm)	Average length of eggs in each cluster (gm)	Average diameter of eggs in each cluster (cm)
2.65	48	98	7.45	4.60
2.38	50	96	7.88	4.75
2.45	40	114	8.52	4.90
2.89	56	92	7.68	4.46
2.36	42	93	7.90	4.76

REFERENCES

- Ahmed, A. 1986. The Distribution and Population of Crocodiles in the Province of Sindh and Baluchistan (Pakistan). *Bombay Nat. Hist. Soc.* 83:220-223.
- Chang, MS., Gachal, GS., Qadri, AH. and Sheikh, MY. 2012^a. Bio-ecological status, Management and Conservation of Marsh crocodiles (*Crocodylus palustris*) in Deh Akro 2, Sindh, Pakistan. *Sindh University Research Journal (Science Series)*. 44(2):209-214.
- Chang, MS., Gachal, GS., Qadri, AH., Jabeen, T., Baloch, and Sheikh, MY. 2012^b. Distribution and Population Status of Marsh crocodiles (*Crocodylus palustris*) in Nara Desert Wildlife Sanctuary (NDWS) Sindh, Pakistan. *Sindh University Research Journal (Science Series)*. 44(3):453-456.
- Chang, MS., Gachal, GS., Qadri, AH. and Sheikh, MY. 2013^a. Ecological Impacts on the Status of Marsh crocodiles in Manghopir Karachi. *International Journal of Advanced Research*. 1:42-46.
- Chang, MS., Gachal, GS., Qadri, KZ. and Sheikh, MY. 2013^b. Population and Conservation Status of Marsh crocodiles, *Crocodylus palustris* in Karachi Zoological Garden, Samzu Park and Khar Center Karachi, Sindh, Pakistan. *Sindh University Research Journal (Science Series)*. 45(3):534-541.
- Chaudhry, AA. 1993. Status of Crocodiles in Pakistan. *Crocodile Specialist Group Newsletter*. 12(1):19-20.
- Eaton, MJ. 2010. Dwarf Crocodile *Osteolaemus tetraspis*. In: *Crocodiles. Status Survey and Conservation Action Plan*. (3rd edi.). IUCN Crocodile Specialist Group, Darwin. 127-132.
- Ghalib, SA, Rehman, H, Iffat, F. and Hasnain, SA. 1981. A Checklist of the Reptiles of Pakistan. *Record Zoological Survey Pakistan*. 8:37-59.
- Javed, HI. and Rehman, H. 2004. Status of Marsh crocodile (*Crocodylus palustris*) in Sindh. *Record Zoological Survey Pakistan*. 15:2-30.
- Khan, MS. 2008. *Reptiles and Amphibians of Pakistan*. Kreiger Publishing Company, Malabar, Florida, USA.
- Khan, AA. 1989. *Crocodile Specialist Group Newsletter*. 8:5-6.
- King, FW. 1988. Crocodiles: Keystone wetland species. In: *Wildlife in the Everglades and Latin American Wetlands. Abstracts of the Proceedings of the 1st Everglades National Park Symposium*, Miami, USA. 18-19.
- Thorbjarnarson, J. 1992. *Crocodiles An Action Plan for their Conservation*. IUCN, Gland, Switzerland.
- Webb, GJC, Manolis, PJ. and Whitehead. 1987. *Wildlife Management: Crocodiles and Alligators*. Surrey Beatty and Sons Pty Limited, Chipping Norton.
- Whitaker, R. and Whitaker, Z. 1989. Ecology of the Mugger Crocodile. In: *Crocodiles. Their Ecology, Management and Conservation. A Special Publication J. Bio. and Env. Sci.* 2013-72.

Received: Dec 29, 2014; Revised: Feb 20, 2015; Accepted: Feb 28, 2015