INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print) 2222-5234 (Online)
http://www.innspub.net
Vol. 3, No. 9, p. 44-54, 2013

RESEARCH PAPER OPEN ACCESS

Ecological status and threats of marsh crocodiles (C*rocodilus palustris)* in Manghopir Karachi

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Key words: Ecological, marsh crocodile, hunting, status, hazard, population.

doi: http://dx.doi.org/10.12692/ijb/3.9.44-54 Article published on September 10, 2013

Abstract

This study represents survey data and reviews the threats and ecological status of Marsh crocodiles (*Crocodylus palustris*) in the captive habitat of Manghopir Karachi. In Pakistan, only one crocodilian species of Marsh crocodile recorded. The present study on threats and ecological status of Marsh crocodiles was carried out from 2006 to 2009 during which 116 crocodiles were recorded from MP Karachi. The observation revealed that total number of crocodiles were 116 in the studied areas of MP Karachi among them 80 were adult crocodile, 20 were juveniles and 16 were hatchlings. The most people consider them as a serious and potentially dangerous pest and so do not regret their disappearance from their neighborhood. In Pakistan, the concept of utilization of wildlife is still anathema to a large segment of the crocodile population and they can be ranched. Currently the crocodile population is threatened by environmental deterioration, hazard chemicals in water resources, hunting pressure and loss of habitat.

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Introduction

The wildlife farming is a need for private individuals to complement such efforts for conservation of key stone species like as Marsh crocodiles. The government of Pakistan was signed the agreement on the Convention on International Trade of Endangered Species (CITES) of which crocodile population is encouraging by this agreement. However, illegal trade, killing and poaching still continues in several parts of the country with impunity which have been attributed to inadequate enforcement of wildlife legislation, irregular game patrol and lack of incentives to staff in the wildlife reserve areas. The wild animal species in Pakistan which was once abundant and now wild animal species is very low outside the protected conservation areas and also it was observed that even some species are endangered or even at the risk of extinction in some localities. To recover them it is necessary that urgent remedial actions are taken to improve their chances of survival and increase their numbers in native habitats. The best way of achieving this conservational goal is to increase wild population by encouraging and aware the local community and local organizations to participate in wildlife farming and captive management of wild animals like as crocodiles. The order *Crocodilidae* is represented by 23 living species (King, 1988), of which only one species of Marsh crocodile is found in Pakistan (Chang *et al.,* 2012, 2013). Three families of Crocodilian species are identified on the external morphological bases of: i) Shape of snout and ii) Scales/Scutes behind on the head region. However, Alligators have longer snout; the Marsh crocodile possess broad and blunt snout while the gavials have thinnest, elongated and beak likes jaws. On the presence of scales is concerned, the Alligators have small scales behind their heads, the Marsh crocodile possess large scales behind the head region while the gavials have the bunch of the smallest scales found with the skin away from the head region near its fore arms (Chang *et al.,* 2012).

Marsh crocodiles usually can be reached at the maximum length of 4-5 meters. The juvenile's body color is light tan and has a black cross banding on their body and on the tail region. When they become adult their body color is grey to brown and have a little banding on their body. The enlarged scutes are near the throats which are very helpful for their defense mechanism and also helpful at the time of swimming in water (Whitaker, 1989). They would like mostly prefer to live near the nest site which is near to pond. The females usually became sexually mature when they reached at the maximum length of 1.82 meters. The females near their hole nests they lay approximately 25-30 eggs annually. Mostly females dig their burrows for laying eggs which are over 2 feet deep into the sandy areas. It is also recorded that captive females lay two clutches in a year but there is no evidenced about the wild females (Whitaker, 1989). The incubation period in crocodiles were observed that they usually hatched within 55-75 (Whitaker, 1987). The total length of egg is observed 9×6 cm at both equal ends which is hard calcareous shell. The Juveniles would prefer to feed on crustaceans, insects and small fishes while the adults depend upon larger fish, amphibians, reptiles (snakes and turtles) and mammalian species. It is also evidenced that sometimes they take down the goat, cow, deer and buffalo (Groombridge *et al.,* 1982, Joshi *et al.,* 2011, Saberwal *et al.,* 1994). Marsh crocodile is listed in Appendix I of Convention on International Trade of Endangered Species (CITES) and IUCN listed it endangered (Baillie and Groombridge, 1996, Molur and Walker, 1998).

It is key stone species which is help to maintain of ecosystem structure and function through predation on fish, recycling of nutrients and maintenance of water refugia during drought period (King, 1988). If illegal hunting is stop and their habitats are not destroyed, the crocodile population recovers (Webb and Smith, 1987). The impacts were often observed severe, as in habitat the conflicts between human and Crocodile population found (Karanth and Madhusudan, 2002). Previously, in Pakistan inadequate scientific research had been carried out on crocodiles. The aim of present study was to determine the historical perspective of crocodiles of Manghopir which are inhabitant in this site safely and also assess the their population status, geographical distribution,

ecological requirement, physicochemical parameters, environmental deterioration, threats, habitat degradation, impacts of insufficient amount of food and low quality of water. In order to determine the distribution and population status of Marsh crocodiles in Manghopir the some population surveys were conducted by Chang *et al.,* 2012, CSG, 2004, 2009, WWF-P, 2009. According to CSG, they surveyed and recorded 100 individuals in 2004 at Manghopir Karachi.

Materials and methods

The surveys were conducted in the area of MP Karachi during the year of 2006-2009. Surveys were undertaken to determine the threats and ecological status of Marsh crocodiles in MP Karachi.

Study area

Manghopir is located in Gadap town Karachi and positioned in the hilly areas in between Karachi district and Lasbela district of Balochistan-Pakistan. The area has the oldest Sufi shrine and known as Manghopir, the original name of this saint is Sufi Khawaja Sakhi Hassan Sultan. His history is about more than 700 years old. Mangho was formerly a Hindu dacoit, notorious for looting caravans which were mostly went to Makka for Hajj. At that time, a famous saint Baba Farid (1173-1266 AD) was also in caravans and Mangho was looting to caravans when Mangho met with Baba Farid; he was impressed by his righteous personality and teachings of Saint Baba Farid (Ganj-e-Shaakar, a renowned saint of Punjab). Then, he converted to Islam and turned to live a noble life. He also became one of the disciples of Baba Farid, who pleased with Mangho due to his devotion and meditation and he titled with "Pir". Manghopir became a famous saint equally respected by all communities both Hindus and Muslims. Urs of Manghopir is the most important event in the cultural calendar of the Sheedi community, a community of African-descended Pakistanis. It is held every year at the shrine of Manghopir, usually in summer season for four days, with the exact dates decided by the community leaders. The Urs of Manghopir is celebrated every year in the Islamic month of Zilhej. The sheedi mela/celebration is separate from the Manghopir Urs which marks the death anniversary of MP (CSG, Volume 23 Number 3, 2004, K.H. Katrak Sohrab, 2007).

Myth of crocodiles

The crocodiles are integral part of the shrine, chronicle of the saint and are so tightly interwoven that it is almost impossible to judge between the fact and fiction. According to Mr. Sajjad Baloach (a Gaddi nasheen/Caretaker), many traditions and facts are about the myth of crocodiles, (i). as it is believed that Baba Farid gifted these reptiles to MP (ii). Second myth is quite factual, during the visit of a famous world renowned saint Hazrat Lal Sakhi Shahbaz Qalandar (famous saint of Sindh), who in order to make the barren valley more inhabitable caused a hot spring to issue forth from the rock and grove of date palms to spring up from the ground, (iii). The crocodiles were originally lice of the saint, which was gifted to Manghopir, he was put them into the pond and then each louse turned into a crocodile! (iv). According to him another rational explanation the crocodiles were introduced in Manghopir by "Mor Mubarak" (also a saint/chief of crocodiles), who brought them from cave of korangi Karachi, as a result, after the name of saint, the chief of crocodiles (the eldest one) came to be known as "Mor Sahib". Mor Sahib, the chief of crocodiles is about more than 90 years old and over 12 feet (3.7 m) in length (K.H. Sohrab Katrak, 1963).

Science cannot believe on the myths, it is assumed that in the ancient times the Indus River passed through this route where the shrine of MP exist and it was dropped into the Arabian Sea. The Marsh crocodiles were originally Indus River habitant. Due to environmental factors like as shortage of water, temperature and other anthropogenic activities they were dispersed and moved from their original habitat and migrate to canals, ponds, ditches and other waterways. According to Rao, 1994, Marsh crocodiles were originally inhabitant of freshwater rivers, lakes and marshy areas and they would like to prefer slow moving, shallower areas. They were occasionally

reported from the saltwater lagoons. The scientific history about the crocodiles states that during the ancient times these were carried out through result of heavy floods and later they were shifted in this pond. The archaeological evidence has also suggested that existence of a bronze age of settlement (2500-1700 BC) near to MP, who worshipped crocodiles and before the advent of Islam, these were thought sacred for Hindu community. Certain signs of crocodile's myth in the form of anima magic and witchcraft are also seen in the region of African countries such as Guinea and Zaire. The MP Urs is actually a garlanding ceremony, during which the Holy successor (Gaddi Nasheen) puts a garland around the neck of Chief of crocodiles known as Mor Sahib. According to Mr. Sohrab K.H. Katrak who was mayor of Karachi during the year of 1942-43, he writes about Manghopir in his essay about Karachi in following words: about twelve miles away from Karachi is place called Magarpeer. It is a well known swamp fed by a hot springs of reputed value. Adjoining of it the shrine of MP, an ancient Muslim Saint, this is visited by hundreds of pilgrims in every week. The swamp is filled with about forty numbers of huge alligators (known as muggers). The name was changed from Pir Mangho to MP during the British regime. About a mile away from this alligator's pond is a Lepers' Asylum, in the building of which a very prominent part was taken by Sadhu Navalrai and Sadhu Hiranand; the two celebrated saintly Sindhis of Hyderabad (K.H. Sohrab Katrak, 2007). Certainly, these trends are because of the unique nature of the reptile, which is always quick and ruthless and one who maintains a cool behavior at the surface of water while paddling like a devil underneath.

In the 1960s, the crocodile population in the pond had dropped to just in three numbers. Because the pond was silted to a shallow depth in 3 feet in pond where they lived and it was making crocodiles life in threatened. Due to taking strong recovery efforts of Wildlife Conservation Society of Pakistan, the crocodile's numbers increased and now their population is up to 116. Still the pool is too small for them and many times it was observed that mutual fight for space and grabbing for food.

Natural hot and cold water resort

Near the shrine of MP there are two springs hot and cold and the crocodile pond is filled by these springs. The temperature of these sulfur ponds recorded between the 43C (110F) to 54C (130F). Warm spring has some medicinal qualities because warm water of spring passing through the sulphur rocks and it is used for patients of skin diseased due to contains of some medicinal values so that many people come from long distances regularly and visit there to have a bath to cure the skin diseases. Nearby is a crocodile pond, measuring about 400 feet (120 m) long and 200 feet (61 m) wide, which nourished by an underground stream. Scientific analysis also shows that the warm water of MP is naturally saturated with carbon dioxide, besides containing some sulphur and other skin friendly nourishments, which are no doubt suitable for many skin diseased people (CSG, Volume 23 Number 3, 2004).

Sheedis and festival

The area of Manghopir is mostly inhabited by one of smallest ethnic communities of Pakistan, Makrani or sheedi. Sheedi are said to be the descendants of African slaves brought from Zanzibar and maintain their distinct African identity in the midst to the dominating South Asian countries. Currently, they are living in various parts of Karachi. Most of their population is living in Layari, but they are also found in Malir, Moaach Goth, MP and further areas of Sindh and Balochistan. Due to Layari's these ethnic population, it is often known as 'little Africa'. In Baghdadi, Layari (an abode of such ethnicity) vicinities have names such as Sheedi Village and Nairobi. Before the British rule or before, Baghdadi and many areas in layari functioned as a slave market where African Slaves were brought and sold. Later, these people amalgamated themselves with local Balochs and also adopted various Balochis and Islamic traditions, in addition maintaining their distinct African cultural heritage. For instance, some African touch festivals like as Gowaati, Layyaa

(dancing over the fire), dhammal, beating conga drums and many forms of witchcraft are still practiced. Now after centuries of amalgamation, these peoples proudly call themselves as Baloch or Makrani (K.H. Sohrab Katrak, 1963, 2007).

Crocodile pool

The flourishing breeding has made the pond too small for the expanding reptile population, which is naturally rough and tough and famous for its longevity. The crocodile population is under threat due to a water shortage in the pond, caused by established water pumping at the natural source of freshwater for the pond. The crocodile pond is not enough for the 116 crocodile population and they need a big pool for huge population. During our investigation the quality of water is not good for crocodile population.

Respect shown to dead crocodiles

According to Sajjad Baloch, Sheedis believe that the crocodiles of MP do not harm the saint's followers. Owing to this belief, when a crocodile dies, they buried with equal respect for burying with equal respect and formalities just as human being. There is also reserved place for burying such dead crocodiles.

Field equipments

During the collection of data, we have used the strong torch lights to watch their movements and other activities at night and also we have looked up the burrows of crocodiles and also their activities during the day. During our observation the fecal pellets of crocodiles were collected and saved in plastic bags and labeled it respectively. The Global Positioning System (GPS) was used which is very helpful for the location of areas where the crocodile population found. It was very helpful for the measuring, observing and mapping of observed areas. For the identification of different gut contents of crocodile the binocular was used and to focus it clearly to locate them. Different nets and strong ropes were used for the capturing of crocodiles and they were measured with measuring tape. Measuring tape was used for the measurement of eggs, fecal pellets, and crocodile individuals. For taking snaps, pictures and videos the digital camera was used to take the pictures of crocodiles and its tracks, signs, footprints, egg shell and other evidence of crocodile. We used maps which were helpful for the location of crocodile population and identification of studied areas.

Methods

The studies on the threats and conservational status of Marsh crocodiles in MP Karachi were carried out from 2006 to 2009 and it was based on (i). Already published data (ii). Direct evidence during the survey of study area and (iii). Indirect evidence obtained during interviewing of directors, game warden, game watcher and care taker of MP Karachi. During the direct method, we have counted and observed the sighting habitats, basking spots, swimming at surface water and catching the reflection of eyes of crocodiles during the night observation. Diurnal surveys were utilized to detect active crocodiles, tracks, trials and nest sites. Most population were visited at the time of emergence of crocodile and counting was done by snap shot method and recorded the time period required by the crocodiles for leaving the roosting site. When every sighting of crocodiles was observed than their number, location, nest sites and behavior were noted. Whenever possible, the crocodiles were identified based on their shape of snout, scales and abdomen. The length of individuals whenever possible was estimated visually and measured with measuring tape. Three categories were used to recognize the individuals; the hatchlings (<0.5 m), juveniles (0.5±1.0 m) and adults (>2 m). Marsh crocodiles were categorized based on their number: (i). Rare (< 10 individuals); (ii). Common (10±30 individuals); (iii). Abundant (>30 individuals) and probably extinct (there were no individuals available but crocodiles were known to occur in the past). Nocturnal spotlight surveys are the standard method of surveying of crocodiles and reflection of light from a 200,000 candle power spotlight/floodlight off the eyes allows for detection of the crocodiles (Webb and Smith, 1987). The water samples were then tested using a professional heavy metal kit for the presence and concentration of heavy metals in the water.

Results

The data shown in table 1 represent summary of the result which was collected from the field over three years of crocodile survey (Fig. 1).

During the study, in the areas of MP, the total number of counted crocodiles were one hundred sixteen (116), among them 80 were adult crocodiles, 20 were juveniles and 16 were hatchlings recorded (Table 1). During the study, it was recorded that the population of adult crocodiles were highest (80), Juveniles were (20) and the lowest (16) hatchlings were recorded in MP Karachi, (Table 1).

Table 1. Population Status of Marsh Crocodiles in Mp Karachi.

S. No.	Location	Adult	JuvenilE	Hatchling
1	Manghopir	80	20	16
Total		80	20	16

During the study, we used the measuring tape for the measurement of one selected hatchling (Table 2 and Fig. 3, 4 and 7), an adult crocodile (Table 3 and Fig. 5, 6 and 8), their body length and an egg sample (Table IV). It was observed that captive crocodiles took the food weekly according to their age group and their size (Table 6 and 7).

Table 2. Body measurement of one selected hatchling sample.

S. No.	Description	Hatchling(mm)
1.	Body condition	Alive and active
2.	Length (total)	279.4
3.	Width (at center)	76.2
4.	Head length	50.8
5.	Head width	25.4
6.	Tail length	152.4
7.	Tail width (at top)	20
8.	Tail width (at center)	15
9.	Tail width (at tip)	10
10.	Fore limb length	50.8
11.	Fore limb width	25.4
12.	Hind limb length	63.5
13.	Hind limb width (up)	25.4
14.	Hind limb width (down)	12.7
15.	Nails of fore limb	6
16.	Nails of hind limb	6
17.	Teeth of lower jaw	5
18.	Teeth of Upper jaw	5

The type of feed and their amount was rationed to Marsh crocodile in the captivity of MP Karachi. The type of feeding was mostly given to captive crocodiles included chicken, beef, fish, cartilaginous bones and also some time other animals meat was given to them. In MP Karachi, mostly chicken and beef were utilized than any other type of meat. They also utilized fresh fish as a source of protein to the crocodiles while cartilaginous bones were used depending upon the availability.

Crocodiles were internationally categorized according to their estimated weight and their size (Table 5). The result indicating that there is increasing interest rate in keeping the Marsh crocodiles in the study area but several constraints may be the limiting factor.

Table 3. Measurement of one selected adult crocodile sample.

S. No.	Description	Adult (mm)
1.	Body condition	Active and alive
2.	Length (total)	2895.8
3.	Width (at center)	457.2
4.	Head length	457.2
5.	Head width	254
6.	Tail length	1676.4
7.	Tail width (at top)	254
8.	Tail width (at center)	196.8
9.	Tail width (at tip)	37.8
10.	Fore limb length	457.2
11.	Fore limb width	114.3
12.	Hind limb length	609.6
13.	Hind limb width (up)	203.2
14.	Hind limb width (down)	88.9
15.	Nails of fore limb	40
16.	Nails of hind limb	40
17.	Teeth of lower jaw	40-50
18.	Teeth of upper jaw	40-50
19.	Segments in tail	33
20.	Teeth upper and lower jaw	30-30

Table 4. Measurement and weight of marsh crocodile's egg.

S. No.	Location	Length of Egg (mm)	Width of Egg (mm)	Weight of Egg (Grms)
1.	Manghopir	65	40	160

Table 5. Inteernationally catogorized size-classes of marsh crocodiles.

S. No.	Crocodile	Size (m)
1.	Adult	≥ 1.5
2.	Sub-Adult	1 – 1.5
3.	Juvenile	0.5 – 1
4.	Hatchling	≤ 0.5

Table 6. International parameters for the identification of marsh crocodiles.

S. No.	Body length (m)	Body weight (kg)
1.	0.5	0.3
2.	1.0	3
3.	2.0	30
4.	3.0	100
5.	4.0	300
6.	5.0	700

Table 7. Food intake by captive farmed marsh crocodiles.

S. No:	Crocodile Length (m)	% of Body Weight Eaten Per Week	Food Eaten Per Week (g)
1.	≤ 0.5	25	150
2.	1	15	500
3.	> 2	10	3,000

Discussion

The aim of this study was to determine the threats, ecological impacts and conservational status of crocodile population. Previously there is insufficient data available about the crocodiles of MP Karachi.

Fig. 1. Map of Manghopir Karachi.

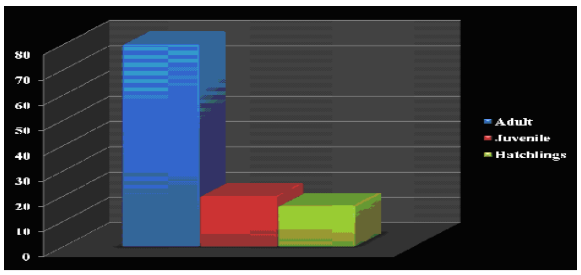

Fig. 2. Mean graph showing the population status of Marsh Crocodiles in MP Karachi.

Fig. 3. A hatchling in MP Karachi.

The survey results are described in the table I, which shows the total crocodile population in MP Karachi. The history of crocodiles of Manghopir is very old and they are inhabitant of more than 700 years ago. According to Mr. Sohrab K.H. Katrak who was mayor of Karachi during the year of 1942-43, in the pond the total numbers of crocodiles were 40 at that time. In the 1960s, the crocodile population in the pond had dropped to just in three numbers due to silted pond (K.H. Sohrab Katrak, 1963). Recent survey on Manghopir' crocodiles were carried out by the Crocodile Specialist Group (CSG) and they were recorded about 100 crocodiles (CSG. Volume 23, No. 3. July, 2004-September 2004). In Pakistan, some previous studies on Marsh crocodiles were carried out by (de Silva *et al.,* 2009, de Silva and Lenin 2010, Groombridge, 1982, Whitaker, 1993). In Punjab province reported that the crocodile population became extinct due to habitat degradation (Chaudhury *et al.,* 1993, Chang *et al.,* 2012, 2013). In Balochistan province it is reported that small numbers of crocodiles were recorded in the rivers of Nari, Hab, Fitiani, Hingol, Dasht, Nahang and Kuch kuar (Ahmed, 1986, Ghalib *et al.,* 1981, Khan, 1988). During the drought period, in the Hingol River when the water level decreased many crocodiles were killed in the years of 1999-2004 (Javed *et al.,* 2005, Khan, 1988). However, in the province of Sindh small numbers of Marsh crocodiles were recorded in Manghopir, Karachi Zoological Garden, Samzu Park and Khar Center Karachi (Captivity), Haljei Lake Thatta (Captivity and Wild), Chotiari Wetland Complex Sanghar (Wild), Deh Akro II Nawabshah (Wild), Nara Desert Wildlife Sanctuary Khairpur (Wild) and New Jatoi Farm Naushehroferoze in Captivity (Ahmed, 1990, Chang *et al.,* 2012, 2013, Javed *et al.,* 2004). The crocodile population were recorded about five hundred only in the areas of Chotiari Wetland Complex (Makhi/Bakar Lake) by Pakistan Zoological Survey of Pakistan during the year of 1997. About more than one thousand crocodile population in Chotiari Wetland Complex and its associated areas were recorded by Sindh Wildlife Department in 1999-2000 (Javed *et al.,* 2004). Two recent surveys were carried out on Marsh crocodiles by the Zoological Survey of Pakistan in the years of 2004 and 2005 respectively.

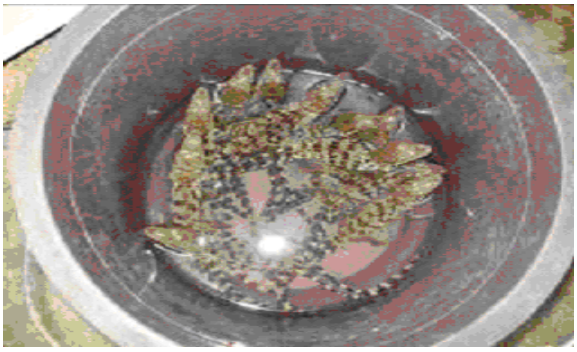

Fig. 4. Hatchlings in MP Karachi.

Fig. 5. Marsh crocodiles in MP Karachi.

WWF-Pakistan was carried out the survey on Marsh crocodiles in Nara Canal and Chotiari Wetland Complex during the year of 2008-2009. Crocodile Specialist Group was carried out the most recent survey in different areas of Sindh in January 2009 (CSG, March 2009, Volume 28. Number 1). In last decades, the crocodile population in Chotiari Wetland Complex, Deh Akro II and Nara Desert Wildlife Sanctuary was in thousand numbers but unfortunately now-a-days their numbers are very few due to hunting practices, fishing practices, habitat degradation, environmental pollution, construction of dam, land used for agriculture, increase human population, shortage of water and low quality of water. During our observation, the crocodile population was recorded 116 in MP Karachi (Table 1). Hatching success rate of the eggs was found to be site specific in captivity and was observed below 40 % (Data not shown).

Fig. 6. Marsh crocodiles in MP Karachi.

Fig. 7. Hatchling in MP Karachi. chi

Today, captive breeding is the major sort of production for skins in different countries (Ross, 2001). Crocodiles serve as a source of raw materials where their skin are exported and used for the shoes, belts, handbags, medicines, ornamental production due to its high demand for skin trade (Young, 1981). The crocodiles are bio indicator, which really focused attention on the major issues of the pollution, which are directly concerned with the human health and other life used polluted water (Chang *et al.,* 2012, 2013, Grizmeks *et al.,* 1975). The shortage of water and quality of water was also serious effect on crocodile's health (Abtin, 2012, Chang *et al.,* 2012, 2013). For the survival of wildlife it is very important that the wildlife sanctuaries, game reserve and conservational strategies and strict law should be enforced.

Fig. 8. Adult Marsh crocodile in MP Kara.

Acknowledgement

This research study on Marsh crocodiles (*Crocodylus palustris*) in Manghopir Karachi was carried out by the financial sponsorship of WWF-Pakistan. We also tank to Mr. Sajjad Baloch (Care taker of Manghopir)

for his fieldwork assistance and the hospitality during our stay in the Manghpir Karachi Sindh, Pakistan.

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