



A REVIEW OF DISTRIBUTION, THREATS, CONSERVATION AND STATUS OF FRESHWATER TURTLES IN SINDH

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ABSTRACT

There are two families, six genera and eight species of freshwater turtles found in Pakistan, and the same species have also been recorded in Sindh province, six of which are threatened, and all species are listed in CITES Appendices I / II. Family Geoemydidae consists of Hard shelled turtles viz Spotted Pond turtle (*Geoclemys hamiltonii*), Crowned river turtle (*Hardella thurjii*), Brown roofed turtle (*Pangshura smithii*), and Indian roofed turtle (*Pangshura tectum*) and the second Family Trionychidae comprises of Soft shell turtles viz. Indian narrow-headed soft-shell turtle (*Chitra indica*), Indian soft-shell turtle (*Nilssonina gangeticus*), Indian peacock soft-shell turtle (*Nilssonina hurum*) and Indian flapshell turtle (*Lissemys punctata*). In Sindh province, Thatta, Sujawal, Badin, Dadu, Khairpur, Sanghar and Sukkur Districts have been identified as hotspots for freshwater turtle populations. Legally, all freshwater turtles in Sindh have been protected under the Sindh Wildlife Protection Ordinance 1972. Many efforts have been made by the Government, Non-governmental organizations and Academia for the protection and conservation of turtle population in Pakistan. The World Conservation Union for Nature - IUCN, WWF Pakistan, Sindh Wildlife Department, Zoological Survey of Pakistan and Department of Zoology (Wildlife Section), University of Karachi are contributing in efforts for the conservation of freshwater turtles in Sindh. But still, freshwater turtles are facing serious threats due to habitat destruction, urbanization, developmental projects and illegal trading.

Keywords: Sindh, population, distribution, freshwater turtles, threats.

INTRODUCTION

Freshwater turtles play a major role in maintaining balance in ecosystem of any wetland. They act as scavengers by decaying dead organic matter. They act as indicators of a healthy aquatic ecosystem. Some are carrion eating species that feed on aquatic weeds and reduce eutrophication. There are 313 species of Tortoises and Fresh water Turtles present worldwide, while 128 Freshwater Turtle species have been included in IUCN Red List of Threatened species (Fritz and Havas, 2007). Economically, freshwater turtles are considered as more valuable as compared to the fisheries because of the presence of good quality flesh and fats which are highly demanded by international markets for different purposes. Flesh of turtles is mostly used in different Continental and American cuisines, which serve as a luxurious dish in many restaurants. The calipee is the fatty gelatinous yellowish material present over the lower shell of a turtle, which is the symbol of delicacy in dishes of many

cuisines. Their fat is also used as a major component of cosmetic industry in USA and other countries.

Pharmaceutical industries are also utilizing plastron of Turtles for preparing specific medicines. In China and Taiwan, specialized medicinal compositions are prepared by using plastrons. China and Taiwan are considered as the major markets that are famous for plastron imports. According to a statistical review, annually hundreds of tons of plastron are imported by Taiwan.

Guilinggao jelly is the specialized medicinal composition that made up from boiling of plastron of turtles along with some herbs so it is also called as Turtle Herbal Jelly. It is also used for improvement of circulation in body, good muscle growth, resolving acne problems and for cure of many kidney diseases.

Pakistan has eight species of freshwater turtles. Based on absence or presence of horny scutes or scales on their carapace, freshwater turtles divide into two categories, Soft shell Turtles and Hard shell Turtles, respectively.

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Soft shell turtle species includes Indian softshell turtle, Peacock softshell turtle, Indian narrow-headed softshell turtle, and Indian flapshell turtle, while Spotted pond turtle, Indian roofed turtle, Brown roofed turtle and Crowned river turtle are Hard shell Turtles.

Freshwater turtles are residing in the whole Indus River system. This system is comprises of many canals, irrigation ditches, ponds, agricultural ponds and water reservoirs. All these tributaries of Indus River system are providing rich habitat for turtles. Major threats to the species are illegal hunting, poaching, and trading for export.

Pakistan is continuously struggling for conservation and protection of these threatened species and became the signatory of the Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES) and CITES appendix I contains the four species and appendix II contains three freshwater turtles from Pakistan.

Conservation measures of all the species of wildlife are directly associated with legal decisions. In Pakistan, Provincial governments are responsible for adopting all conservational measures in their own provinces. Implementation of Wildlife Protection Ordinances is the major task for all provincial governments. In 1981, Federal Government passed a rule to ban the export of all wild mammals and reptiles. It also includes the restricted

export to all parts and products of wildlife.

Formerly in legal ordinances of provinces of Pakistan, no protection was given to the species of freshwater turtles and they were not considered as Protected in different wildlife protection acts of the provinces. However, present situation is different from past. Along with several other conservational measures, there are amended acts, which have declared the freshwater turtles as protected species. Appendices I and II of the CITES restricted the international trade, export and import of wildlife species including the freshwater turtles, their parts and their products as well. Section 12 of Sindh Wildlife Protection Ordinance, 1972 also banned the export of protected wildlife species including freshwater turtles. Pakistan has also been facing threats to freshwater turtles which include scarcity of water in rivers, and canals, water diversion and extraction projects for irrigation purposes, water pollution, habitat deterioration and fragmentation due to unsustainable development. In this paper we reviews the distribution, threats, conservation efforts and status of freshwater turtles in Sindh.

DISCUSSION

Sindh is the third largest province of Pakistan located in West of South Asia, having the area of about 140,915 square kilometers (Fig. 1). Sindh is having very strong belongings to Indus River and having a great variety of ecosystems. In east, desert ecosystem lies in the form of

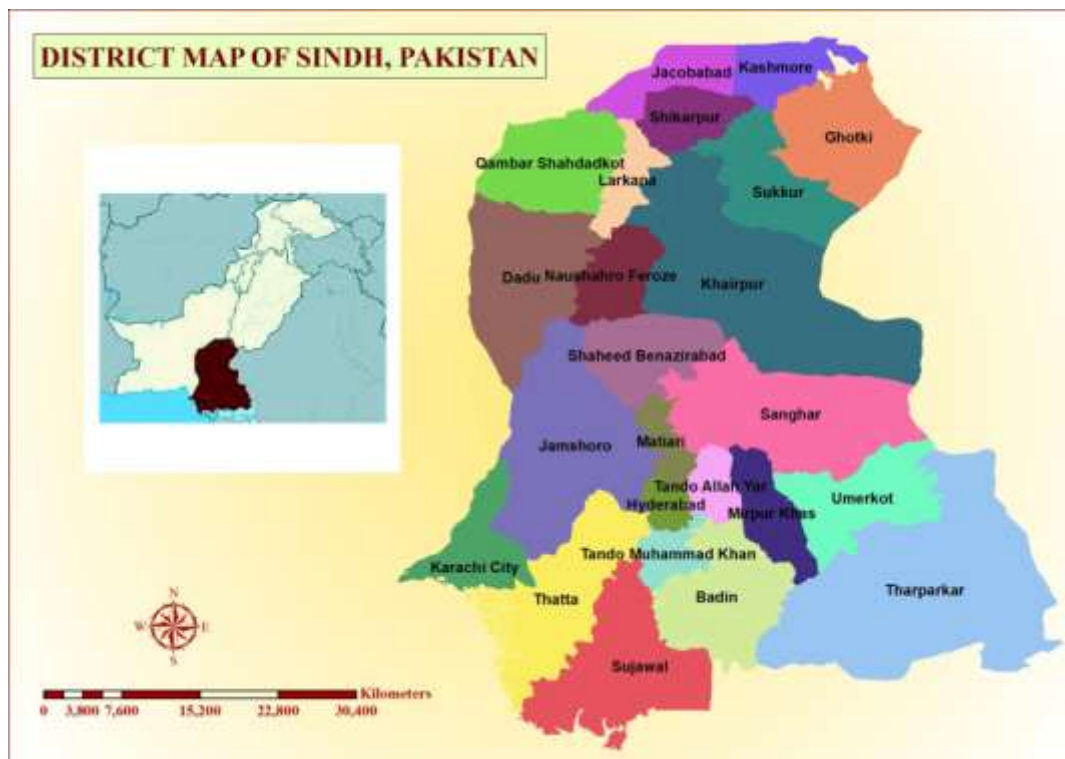


Fig. 1. Map of Sindh with Districts.

Table 1. Status of Freshwater Turtles in Sindh.

S. No.	Family	Scientific Name	Common Name	IUCN Status	CITES Appendix	
					I	II
1	Geoemydidae	<i>Geoclemys hamiltoni</i>	Spotted Pond Turtle	Vulnerable	+	
2		<i>Pangshura smithii</i>	Brown Roofed Turtle	Near Threatened		+
3		<i>Pangshura tectum</i>	Indian Roofed Turtle	Vulnerable	+	
4		<i>Hardella thurjii</i>	Crowned River Turtle	Vulnerable		
5	Trionychidae	<i>Nilssonina gangeticus</i>	Indian Soft shell Turtle	Vulnerable	+	
6		<i>Nilssonina hurum</i>	Peacock Soft shell Turtle	Vulnerable	+	
7		<i>Lissemys punctata</i>	Indian Flapshell Turtle	Least Concern		+
8		<i>Chitra indica</i>	Indian narrow headed soft shell Turtle	Endangered		+

Fig. 2. *Geoclemys hamiltoni* (Spotted Pond Turtle).

vast Thar Desert commonly known as Tharparkar. In the west, mountainous ranges are existing known as Khirthar mountain range. In north, Punjab province is present while from southern side, Sindh is bordered by the Arabian Sea.

The climatic conditions are moderate, hot in summer, and mild in winter. In summer season, temperature varies from 35 to 48 degree Celsius, while during winter temperature ranges from 2 to 20 degree Celsius. Sindh is directly affected by two different monsoonal systems, one from southwest system that comes from Indian Ocean while other from northeast system coming from Himalayan Mountains. Annual average rainfall is about six to seven inches.

Distribution and Status of Freshwater Turtles

There are six genera and eight species of Freshwater Turtles recorded in Sindh (Fig. 2 - 9) (Khan *et al.*, 2012a ,

Khan, 2015), six of which are globally threatened. All species are listed in CITES Appendices I / II (Table 1) and their import and export is prohibited.

Distribution

Following areas of Sindh which are considered as hotspots for Freshwater Turtles, these includes Thatta District, Sujawal District, Badin District, Dadu District, Khairpur District, Sanghar District and Sukkur District.

1. Thatta District

Thatta is the historical district of Sindh Province. This district is having very strong bonding with Indus River. Thatta district is situated in southern portion of Sindh province. According to climatic distribution, this is included in lower region of Sindh. Major livelihood for the people of Thatta is dependent on the fishing practices. Thatta is distributed into four tehsils, Thatta, Mirpur Sakro, Ghora bari and Ketu Bander. The Ketu Bander is



Fig. 3. *Pangshura smithi* (Brown Roofed Turtle).



Fig. 4. *Pangshura tectum* (Indian Roofed Turtle).

the coastal area, while Ghora bari is very famous because of the presence of various fish farms there. Mir Pur Sakro contains a major canal named as Ghulamullah Canal (Fig. 10) or Mirpur Sakro Canal (Fig. 11). This canal and fish farms at Ghora bari (Fig. 12) serves as a very rich habitat for freshwater turtle populations. Major wetlands in Thatta district are Keenjhar, Haleji and Hadero Lakes.

Keenjhar Lake

Keenjhar Lake (Fig. 13) is a Ramsar site located in Thatta District of Sindh. It covers approximately 14,000 ha of area and having latitude and longitude of 68° 03' E and 24° 56' N. It is considered as one of largest freshwater lakes of Sindh and it is the major source of water supply to Karachi city, Thatta city and Ketibunder. The main



Fig. 5. *Hardella thurjii* (Crowned River Turtle).



Fig. 6. *Nilssonia gangeticus* (Indian soft shell Turtle or Ganges Soft shell Turtle).

water supply to Keenjhar Lake comes from River Indus. The location of Keenjhar Lake is about 19km North and North East to Thatta District, while it is situated 113km away from Karachi city. Many seepage lagoons and marshes are surrounding the Keenjhar Lake, which are connected with semi desert areas bearing limestone rock beds. This man made freshwater lake was formed in 1930 when two small lakes named Keenjhar and Kalri Lake

were merged together after development of a dam at Bangla (Khan and Abbas, 2011). This lake provides a rich habitat for Fresh water turtles survival.

Haleji Lake

Haleji Lake (Fig. 14) is an important wetland of Sindh located in Thatta district. Its total area is about 6.58km² along with the maximum depth of 5 to 6 m. This



Fig. 7. *Nilssonina hurum* (Indian Peacock soft shell Turtle).



Fig. 8. *Lissemys punctata* (Indian Flap shell Turtle).

important Ramsar site is situated at $67^{\circ} 46'38''\text{E}$ and $24^{\circ} 48'\text{N}$ having an altitude of 4 m. This lake is located 88km away from Karachi (Khan *et al.*, 2012a,b; Khan *et al.*, 2014). It is very rich in Biodiversity and a variety of species of fauna and flora are inhabitant of this lake. Haleji Lake is surrounded by lagoons which serves as a natural habitat for fresh water turtles.

Hadero Lake

Hadero Lake is a saline water lake which is located at longitude of $24^{\circ} 49'\text{N}$ and latitude of $67^{\circ} 52'\text{E}$ in Thatta district of Sindh province. Primarily it affirmed as Game Sanctuary in 1971 but later on it was declared as Wildlife Sanctuary in 1977. Hadero Lake is natural lake that is located at the periphery of the stony desert. Its covered area is 1321 hectares. Livelihood of the local population



Fig. 9. *Chitra indica* (Indian narrow headed soft shell Turtle).



Fig. 10. Ghulamullah Canal.

is dependent on fishing from the lake. In past a number of fresh water turtles had been observed in the vicinity of this lake.

2. Badin District

Badin District is located in the lower portion of Sindh called as Lar, It is having a critical geographical location that lies in between Tharparkar Desert and Arabian Sea.



Fig. 11. In Mirpur Sakro Canal, Brown Roofed Turtle (*Pangshura smithii*) is ready for jumping.



Fig. 12. Fish farms at Ghora Bari.

The geographical coordinates are 24°-5' to 25°-25' north and 68°21' to 69° 20' east. Badin District is distributed in five tehsils which includes Matli, Talhar, Tando Bago, Badin and Golarchi.

There are 24 important lakes and wetlands present in Badin District which serve as key potential areas for distribution of freshwater turtle populations. Major canal running through Thatta and Badin District is LBOD (Left



Fig. 13. A view of Keenjhar Lake.



Fig. 14. A view of Haleji Lake.

Bank Outfall Drain). Fish farming is the major profession of the local population of Badin district. There are about 370 Fish farms developed by local people that also have freshwater turtle population.

3. Sujawal District

Sujawal is a newly formed district of Sindh Province. Its Latitude is 24°36'23" of North and longitude is 68°4'19" of East. Indus River is the main demarcation line between



Fig. 15. Nara Canal.



Fig. 16. A view of Sukkur Barrage.

Thatta District and Sujawal District. Administratively, it is subdivided into five tehsils named as Jaati, MirPur Bathoro, Shah Bandar, Kharochan and Sujawal. The total area covered by this district is about 7335 km². The major livelihood for local people is cultivation of agricultural

crops. Fish farming is also common. Important fish of this district is Palla that has been cultured in fish farms. Freshwater turtles have been mostly recorded from the near Sujawal.

4. Dadu District

Dadu District is an important district of Sindh Province. It comprises of Mehar, Khairpur Nathan Shah, Dadu, Johi and Sehwan tehsils. Its total area is about 190704 square km. Geography of Dadu district is unique. It contains three different types of ecosystems, Kohistan or Hilly areas, Barrage area, and Lower lands river area. In east Indus River is existing. There are many waterways which are flowing in this district locally called as Nais. The major wetland in Dadu District is Manchhar Lake. Other important lakes are Sanjri Dhand and Unheri Dhand.

Manchar Lake

Manchar Lake is a natural freshwater shallow lake that created by a vast depression formed in between hilly ranges. Khirthar Hills are present in the west, while Laki hills are present in the south and Indus River flows in the east. The deepness of this lake is 10km. This big water reservoir is sufficient to supply water for drinking purposes to whole district as well as it is also a major supplier of water to irrigation canals and agricultural croplands. This is also an important source of livelihood for local communities in the form of fishing practices. Local anglers called as Mohanas or Meerbahar used to live in boats inside the lake. In past it was considered as major roosting area for migratory birds but because of construction of MVND (Main Nara Valley Drain), most of saline water drains out into Manchar Lake that result in loss of natural fauna and flora from the lake. Drainage of Chemical effluents and other pollutants in lake also result in serious contaminations in water that leads to biodiversity loss including that of turtles.

5. Khairpur District

Its total covered area is 15910 km². There is complete network of canals present to irrigate the whole area, that is the reason Khairpur is a very fertile area for cultivation of all types of crops.

Nara Canal

It a major canal emerging from Nara Tehsil of Khairpur district. It considered as largest canal of Sindh that originates from Sukkur Barrage, extends from Nara Tehsil of Khairpur District to Sanghar, and finally drains off in Runn of Kutch Area. Nara wetland complex is very famous and ecologically important combination of approximately 200 wetlands of different sizes, which are present on both sides of Nara Canal (Fig. 15). These serve as important habitats for freshwater turtles.

6. Sanghar District

Sanghar District situated in the middle area of Sindh Province. It comprises of six tehsils named as Jam Nawaz Ali, Khipro, Sanghar, Shadad Pur, Sinjoro and Tando Adam. Total covered area of Sanghar District is 9874km². It is famous because of the presence of a wetland complex called as Chotiari wetland complex. Bakar Lake and

Sanghriaro Lake are the important lakes of Sanghar District.

Chotiari Wetland Complex

Chotiari Wetland Complex is the combination of many freshwater and Saline wetlands that covers an area of about 18000 hectares. This complex has the major water reservoir named as Chotiari Dam. The geographical coordinates of Chotiari wetlands complex are 26°1' N latitude and 69°4' E longitude. It is bounded by Thar desert from East and North while in southern portion Nara canal is present. The major wetlands in Chotiari wetland complex are Naro, Khor, Meena, Sajaran, Phuleil, Gun, Wari, Jajur, Bholo and Jadpur (Rais *et al.*, 2008).

7. Sukkur District

Sukkur District comprises of four tehsils includes Sukkur, Rohri, Saleh Pat and Pano Aqil. Climatic condition of Sukkur is very harsh and intense. Sukkur is famous for Sukkur Barrage. Thick and dense Riverine forest is also a unique ecological characteristic of Sukkur. It grows along with the bank of Indus River.

Sukkur Barrage

Sukkur Barrage (Fig. 16) was constructed in 1932 over River Indus to control the flow of water in River Indus. In past it was also called as Lloyd Barrage. It has 66 gates. It irrigates about 7.63 million acres of area. The land of Sukkur is very fertile and productive due to presence of this major irrigation canal system. Sukkur barrage is not only responsible to fertile lands of Sukkur district but it also supply water through its canal system to Khairpur district, Mirpurkhas district, Sanghar district, Tharparkar district and Hyderabad district. Sukkur Barrage is also responsible for drinking water supply, irrigation and flood control in Sukkur district. There is a very well developed canal system that form unique networking and irrigation system. There are seven canals that emerge out from Sukkur Barrage. Four canals originate from left bank while three canals originate from right bank. Nara Canal is the major canal which is largest canal in Sindh. After Nara Canal, Rohri Canal exist and the third canal is Mir Wah Canal, while forth is Abul Wah Canal. Three canals originate from Right bank named as Dadu Canal, Rice Canal and Khirthar Canal. All other canals are permanent, while Rice Canal is a seasonal canal for cultivation of Rice fields.

Threats

Sindh is the highly populated province of Pakistan. Most of the districts are under-developed and poverty is one of the main reasons for their interest in trade of turtles. River Indus, Indus basin and the tributaries of River Indus includes canals, lakes, waterways, streams, swamps, marshes and ponds, all provides feeding and breeding grounds for freshwater turtles.

Another threat for freshwater turtles in Sindh is the profession of the local communities residing near wetlands, and people depend on fishing for their survival. Most of those areas in interior Sindh are rural areas and local tribal communities like Mohana communities or Kail communities are involved in trade of turtles along with fishing.

Sand mining also has very disastrous effects on ecology and habitat of freshwater turtles. Commercial sand mining from the rivers not only cause erosion but also destruct the nesting areas of the turtles. It also modifies the direction of flow of water, configuration of riverbanks and makes water more turbid. All these factors directly influence on the growth of waterweeds, on under water activities of turtles and it also has hazardous effects on health of that aquatic ecosystem. Another important factor which is influenced by sand mining in rivers is reduction in dissolved oxygen in water which ultimately results in disturbance of aquatic life.

Trade of Calipee

Calipee is the soft cartilaginous part of plastron of Soft shell Turtles. It is considered as most valuable part of turtle's body. It can use in soups and other dishes. It is very interesting fact that being a Muslim country, Pakistan is not utilizing these parts of turtle for edible purposes but most of these used to export to neighboring countries like China.

People from rural areas utilize this resource of nature to earn their riches. Mostly middlemen play an important role by connecting the link between local fishermen and foreign traders. It recorded that many consignments seized by custom in Pakistan, which supplied to China. The shipment contains tons of calipee, and tagged as dried fish.

Turtle habitats are being extensively degraded, destroyed and fragmented because of anthropogenic activities (Klemens, 2000). Some time natural habitat of freshwater turtles destructed because of developmental activities and urbanization. In Sindh, several developmental projects are under progress like Wind Mill projects Jhimpir (Thatta), Thar Coal project (Tharparkar), Double carriageway project (Thatta to Karachi), Solar power project (Khairpur) and Thermal power projects. All these sort of developmental activities although are beneficial for mankind but also hazardous to natural habitat of wild fauna.

All crop growing activities and major deforestation also responsible for water seepage problems, modification of waterways and canal blockage. Agricultural wastewater and pesticides usage is also disastrous to population of fresh water turtles, Khan and Law (2005) also reported pesticides threats to turtles.

Industrial waste material is an important cause of reduced population of freshwater turtles. It results in disturbed breeding biology, infertility, eggs shell thinning and physiological disorders in freshwater turtles.

Most of the soft shell turtles in Sindh are struggling for their existence and continuously fighting with high level of illegal killing for trade and export. The people kill them and cut their parts to sell them to local consumers. Alternate livelihood opportunities should be provided to them for enhancing their financial resources.

China is the major market for Freshwater turtles. Being a neighboring country, it is very easy for traders to export whole turtles or their parts to China.

Environmental and climate changes and natural disasters are also major threats for turtle survival. Pollution, contamination of water with industrial, agricultural, or domestic waste, pesticides sprays, fertilizers, global warming, and pathogens, all serve as threat for existence of Freshwater turtles. Habitat modification, habitat degradation, and destruction are also important factors for their loss.

Urbanization, developmental projects, construction of dams, barrages and roads are also important reason for their decreased populations. Globally, turtle habitats are being extensively degraded, destroyed and fragmented, and where they still exist in reasonable populations turtles are being subjected to subsistence hunting as well as for collection for regional and international consumption markets, in addition to the growing international pet trade (Klemens, 2000).

Conservation Efforts

In Pakistan, many efforts have been made by the different governmental and nongovernmental organizations for the conservation of turtles. IUCN Pakistan, WWF Pakistan, Sindh Wildlife Department, Zoological Survey of Pakistan and Department of Zoology, University of Karachi are actively working and contributing for making studies regarding the protection and conservation of freshwater turtles in Sindh. The Scientific and Cultural Society of Pakistan (SCSP) provided capacity development through training workshops to university students for conservation and management of freshwater turtles. The IUCN Commission on Ecosystem Management (CEM), West Asia also conducted several training programs for conservation and management of ecosystem at University of Karachi during 2013-2016.

Many researchers have worked on the distribution and conservation of freshwater turtles particularly in different locations in Sindh. Noureen (2009) reported eight species of freshwater turtles in Indus River system. Arshad and

Noureen (2010) conducted a survey to identify the causes of mass scale mortality of freshwater turtles downstream Sukkur Barrage. Regarding illegal trading, Noureen *et al.* (2012) investigated the consequences and status of freshwater turtles in Pakistan. Recently, Khan (2015) reported the distribution of freshwater turtles in Indus Valley with morphology, natural history, and threats. Habitat loss was found to be the major threat for all species. Another study, Khan *et al.* (2015) described the distribution and status of freshwater turtles in Sindh and Khyber Pakhtun Khuwa (KPK). In this study, eight species of freshwater turtles were recorded in Sindh and population of turtles was estimated to be higher in Sindh as compared to that in KPK.

Recommendations

The legislation for conservation of turtles should be properly implemented. Distribution areas and hotspots should be highlighted. Community based awareness should be utilized. Alternate livelihood opportunities should be provided to local people to avoid fresh water turtle trade. Major threats should be detected and resolved. Habitat destruction should be discouraged. Export of parts of turtles should be checked, and local markets should be monitored to minimize the use of turtles in as pet trade.

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