Information Sheet on Ramsar Wetlands (RIS)

Categories approved by Recommendation 4.7 of the Conference of the Contracting Parties.

1. Date this sheet was completed/updated:
30th September, 2002

FOR OFFICE USE ONLY.
DD MM YY
Designation date | Site Reference Number

2. Country: PAKISTAN

3. Name of wetland: INDUS DELTA

4. Geographical coordinates: 67^0 12'15" to 68^0 13'00" E and 23^0 39'00" to 24^0 33'33" N

5. Elevation: Sea level **6. Area:** 472,800 **ha.**

7. Overview: Indus Delta is the fifth largest delta of the world, formed by the river Indus and tidal creeks at Turshian and Khobar near Keti Bunder and of the old delta near Karachi. The delta formed largely under arid climatic conditions and characterized by high river discharge, moderate tide and high wave energy conditions. It is considered unique, because of the fact that, it experiences the highest wave energy of any river in the World.

8. Wetland Type (please circle the applicable codes for wetland types; in the present document, the "Ramsar Classification System for Wetland Type" is found on page 9)

marine-coastal: ◯ ◯ **C D E** ◯ ◯ ◯ ◯ ◯ **K**
Zk(a)

inland: **L • M •** ◯ **O P •** ◯ ◯ ◯ ◯ **• Tp**

Ts • U • Va • Vt • W • Xf • Xp • Y • Zg • Zk(b)

human-made: 1 •2 • 3• 4 • 5• 6 • 7 •8 • 9 • Zk(c)

Please now rank these wetland types by listing them from the most to the least dominant:

I, J , A, B, F, G, H, N, Q, R, Sp, Ss,

9. Ramsar Criteria: (please circle the applicable Criteria; the *Criteria for Identifying Wetlands of International Importance* are reprinted beginning on page 11 of this document.)

① ② ③ ◯ ⑤ 6 7 ⑧

Please specify the most significant criterion applicable to the site: 3.

10. Map of site included? Please tick *yes* ☐ -or- *no* ☐
Yes.

11. Name and address of the compiler of this form:

Hussain Bux Bhaagat, Sindh Wildlife Department, M.D.Wafai Road, Karachi.
Pakistan. Phone and Fax: +9221 9260304

***Please provide additional information on each of the following categories by attaching extra pages* (please limit extra pages to no more than 10):**

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12. Justification of the criteria selected under point 9, on previous page. (Please refer to the *Criteria for Identifying Wetlands of International Importance* appended to this document)

Criteria 1: Indus delta is considered internationally important because it represent unique example of natural wetland type, found in the Arabian Coastal bio-geographic region. Indus delta consists of creeks, estuaries, mud, sand, salt flats, mangrove habitat, marshes, sea bays and straits and rocky shores. It is a typical fan shaped delta, built up by the discharge of large quantities of silt and sediments washed down the Indus river from the Karakoram and Himalaya mountain ranges.

Criteria 2: The delta area considered as very important due to the presence of arid mangrove ecosystem which is the 7th largest mangrove forest in the world. The area covered by the mangrove is about 129,000 ha, 97% of the total mangrove area in Pakistan. The major species in the delta is the *Avicennia marina* 95% of the total mangrove population it is the big stand of mangrove, other threatened species of mangroves in the area are *Rhizophora mucronata, Ceriops tagal, Aegiceras corniculata.*

Criteria 3: The delta area supports the large stand of mangrove forest in the Pakistan to maintain the delta habitat. These mangrove forest also support birds population which ultimately maintains the ecology of the area such as Dalmatian Pelican (*Pelecanus crispus*), Greater flamingo (*Phoenicopterus rubber*), Wigeon (*Anas phenelope)*, Black tailed Godwit (*limosa limosa)*, Pochard (*Aythya farina)* and Common coot (*Fluca atra*) etc. Beside three 3 spp. of marine dolphin which are Plumbeous dolphin, Finless porpoise, and bottle nose dolphin. It supports the humpback Whale and 4 spp. of reptiles (list attached).

Criteria 4: The estuarine creeks and mangrove area are the nursery ground for many species of fish and shrimps. They spend critical time of their life in these habitat till they reached at certain age. Mangroves also provide shelter to many aquatic as well as terrestrial species; they are also important staging ground for migratory birds. (List of species attached).

Criteria 5: The delta area regularly support more then 60,000 migratory waterfowl each year including some threatened species like Dalmatian pelican (*Pelecanus crispus*). (list of Species attached) . Ref. Sindh Wildlife waterfowl counts 1992-2000.

Criteria 8. The estuarine creeks, and mangrove area are the main nursery ground of fish and shrimps and all these species spent their early stages of their life and depend on these habitat. (list of species attached)

13. General location: (include the nearest large town and its administrative region).

Indus delta is located in Thatta Administrative District of Sindh Province. It is situated on the borders between Pakistan and India in the south-east of Karachi Metropolitan City. It is a typical fan shaped delta spread over an area of 472,800 ha from Pitiani creek in the west to Sir creek in the east. It comprises of seventeen major creeks.

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14. Physical features: (e.g., geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; catchment area; downstream area; climate)

It is characterized by various major creeks, innumerable minor creeks, mud, sand and salt flats, marshes, lagoons and fringing mangroves.

Geology:-

Indus delta is true representative of coastal wetland ecosystem. It is formed in the result of sediment trapping of river Indus in to Arabian Sea since millions of years. The geological history of the river Indus is associated with the rapid tectonic uplift in the region which has led to the formation of Himalayan mountains. The Arabian sea was formed during the late cretaceous as the Indus tectonic plate separated from Madagascar and moved northwards. The river Indus is a very large geographical phenomenon. The effects of its sediments and water discharge can be seen obviously in the coastal zone of the ocean as well as in the deltaic region in terms of water flow, sediment deposition and biological activity. But it can also be detected on the sea bed as the terrigenous sediments that form the Indus fan as for the south as latitude of 14^0 N of the equator. The fan and the Arabian Basin of which it forms the seabed are surrounded by the shallower seabed topography of the Owen fracture zone and the Murray Ridge on the west and north, the chagos laccadive Ridge in the east and the Carlsberg Ridge in the south. The lower deltaic plain (Indus delta), stretches inland from the coastline to the furthest point to which. Sea-water is driven by the very high tides during the south-west moonsoon winds in summer. This area, which is regularly covered by seawater during high tide period, consists of tidal creeks with raised edges that are covered with small mangrove trees growing on a sandy-silty sediment. There are also well-developed mangrove swamps and mud flats to the eastern sides. At the sea ward edge of the area, there are a string of coastal sand dunes and beaches between the mouths of tidal creeks.

Geomorphology:-

The entire Indus sediment cascade has its origin and evolution tied intimately to the Himalaya. The general geologic relationships between mountain uplift to erosion and sedimentation have long been of great interest to geologists because of new ideas about causes and effects of uplift and erosion in the Himalaya to understand the topographic evolution as well. Thus the role of erosional processes in the Himalya is not only vital to an understanding of its geomorphic history but perhaps even to understand some fundamental processes of the tectonic evolution of the mountain chain. Hewitt (1987) noted that the Indus river carried 390 tones of sediment annually out of the mountain front.

Origins:-

Indus Delta have many natural origins of creeks, estuaries, sediment mangrove beds and river mouth beds for supporting large variety of fauna, flora and marine ecosystem.

Hydrology:-

Riverine tract occupies a special significance in ecology of Sindh. In ancient times, River Indus used to flow at its own causing flooding of vast Indus plain extending as far as upto Thar desert in east. Realizing devastation and damage caused by floods, protective embankments were constructed on both sides of river during British regime, during 1900 to 1910 to regulate the flow of river.

After independence, much emphasis was given to agriculture sector development. With the expansion of agriculture more and more land was converted to agriculture use. In this process of transformation, natural vegetation, which originally occupied that land, was destroyed/grazed for cultivation of agriculture crops. Expansion of agriculture and subsequent industrial development led to the need for conserving water for agriculture purpose and power generation through construction of reservoir on Indus and its tributaries. The economic priorities over ruled ecological consequences that were bound to follow in years to come. An intricate system of canals, barrages and reservoirs was constructed to transfer supplies from Indus, Jhelum and Chenab rivers to the areas formerly fed by eastern rivers, to compensate for water supplies lost to India under the Indus Water Treaty signed between India and Pakistan in September 1960. Warsak dam was constructed in 1965 followed by Mangla dam in the year 1967 and by Tarbela dam in 1976. Following number of Dams, head works barrages and diversion canals have been constructed on Indus and its tributaries in Pakistan from 1886 to 1993.

These constructions have affected water flow reaching Sindh. The discharge volumes from 1940 to 2000-01 recorded at Kotri Barrage are given in the graph.

As the flows of freshwater down the Indus have decreased over the last one decade, so the water quality and stress upon the Indus delta have increased. Due to the decrease in the river water flow in to the delta creeks, salinity of the creek waters have increased and now salt tolerant vegetation species are sub-merged. The freshwater dilutes the salinity in the Indus delta and supports mangrove ecosystem and other freshwater ecological system. Indus Delta hydrological system form three major wetland ecosystem such as Estuaries, Creeks, Coastal Wetlands.

Soil type:-

Soils in the Indus delta are formed from parent material from high Himalaya. There are river sediment deposits, consists of generally fine to very fine sand in the delta reaches. Soil type of Indus delta includes mud, sand and salt flats, sub tidal, creeks, inter tidal creeks, sea bays and strails having less then 6 m water depth at low tide, and vegetated sediments. Estuarine delta system, inter tidal marshes, saline or alkaline lakebeds and marshes. The shallow and inter tidal areas of the estuarine and the margins of the land are typically marine environments.

Water quality:-

Water quality of the Indus Delta is generally brackish and saline. All coastal wetlands are seawater filled and have pH value 7 – 8. Only creeks, where river water mixes with seawater are considered freshwater habitats.

Water depth:-

Sea bays and strails have less than 6 m water depth at low tide, estuaries and creeks have less than 1-2 m water depth, while mud flats and marshes have no water or 0.5 m depth at low rains and low tides.

Fluctuations in water level:-

Water levels in creeks, estuaries, mudflats marshes, sea bays and strails fluctuates round the year during low tide and high tide and moonsoon season.

Tidal variations:

Tidal variations depends upon the moonsoon winds during winter and summer moonsoon seasons. River water flow into the sea also affects the tidal system. Same is the condition in catchment area.

Climate:

Climatic condition of the Indus delta is characterized as subtropical maritime desert with annual rainfall between 120 to 175 mm on the west, increasing to 240 mm towards east. Mean Maximum temperature rages from 32 to 48 ^{0}C during summer, while mean minimum temperature ranges from 14 to 18 ^{0}C during winter. Strong coastal winds are characteristic of the region, while humidity is high.

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15. Hydrological values: (groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.)

Ground water recharge:-

Ground water in the delta region is generally saline and brackish. No freshwater layers are present in this area. Only freshwater source is inflow of river water into the sea or seasonal rainfed areas have temporary sweet water layers in mud flats and marshy areas.

Flood control:

There is no freshwater flood control system. However delta has received serious ecological disaster during 1999 due to high tide of Arabian Sea during high moonsoon winds and cyclone 2 A. Since last few year a phenomena of seawater intrusion has started because of low water availability in the Indus River. But there is no sea flooding control system in the delta region. Mangroves serve an important function in protecting natural and man-made shorelines from erosive forces and storm damage. They reduces the energy of wind, waves and currents and hold

sediments in place by their roots, they can control the sea intrusion, if are properly managed.

Sediment trapping:-

The only sediment trapping in the delta ecosystem is through river Indus. But during last one decade water level in the river has decreased at such a level that down stream river water flow has reached to 0 level. Hence sediment trapping in the delta ecosystem is reduced, which has affected coastal and marine life, depending upon the vegetation of sediment entrapment areas.

Shoreline stabilization.

Being the coastal belt of the Arabian Sea, there is no shore line stabilization. Sea intrusion does not allow the shoreline stabilization system in this area. However, mangroves, with their expansive shallow root systems, have the capacity to trap and stabilize estuarine and coastal sediment and as primary colonizers play a significant role in natural reclamation of land from the sea, especially in delta formations.

16. Ecological features: (main habitats and vegetation types)

Indus delta is unique in its characteristic, because it supports unique vegetation types such as Sea weeds, Mangroves, different grasses etc:

Habitats:

Main Habitats and Vegetation of the Indus delta are:-

a) Freshwater lagoons a marshes.
b) Mangroves
c) Sea bays an straits
c) Estuaries
d) Creeks
e) Marshes
f) Mud, sand and salt flats

Sea weeds:

Old Indus delta at time, harbours a rich seaweeds including 45 species of green and 79 of red algae. The protected saltwater creeks of the present Indus Delta are however, not as rich in the seaweed species, probably because of the paucity of hard attachment sites in the silty, muddy and sandy environment of this area. On the mud, and sand flats in Bakran creek (near Gharo creek), the alga *Cladophora sp*. was found to be abundant. A few specimen of the bivalve molluscs (*Pandora flexuosa*) and the gastropod (*Natica sp*) were collected from the beneath the algal cover. The green algal (*E.intestinalis*) was also very much abundant on the mud sand flats. Algal mats formed by *Enteromorpha sp*., *Ulva sp* and *Cladophora sp.* have not been observed at Keti Bunder. The mudflats of the Keti Bunder are however covered by the grass (*Oryza coarctata*), which are food source of domestic cattle.

Mangroves:

Eight species of Mangroves occured in the Pakistan by only four are found now. The most abundant species in the Indus delta is *Avicennia marina*, which composes about 95% of the mangrove population of the delta. The other species occur mostly around the present Indus delta in small number and are absent from the Karachi region. The mangrove forests lining the banks of the farmer delta creeks near Karachi are relics of the estuarine conditions which once prevailed in this area. Since fresh water from the Indus is not reaching the creeks near Karachi or Keti Bunder, the mangroves living there may be experiencing some salt induced stress.

Zooplankton

Eggs and larvae of fish and shell fish are always abundant in Zooplankton samples collected from the creeks of Karachi. Zooplankton samples are always found to be dominated by *Copepods, Chaetognaths*, Crustacean eggs and larvae, and fish eggs and larvae. The larger forms, such as *Clanoid copepods, Lucifers* and *Chaetognaths* are typical upwelling area Zooplankton with short food chains. Zooplankton are found abundant in creeks when salinity is low and moonsoon runoff and nutrients from shelf upwelling are present.

Change of the food webs:

Estuarine food webs are based typically on detritus food supplied by the river and which is utilized by deposit feeders and suspension feeders (Polychaetes, bivalve, molluscs) and other groups. After the shifting of the Indus delta from near Karachi, benthic food webs in the creeks have changed, making deposit feeders and suspension feeders, scarcer and predators (Carnivorous gastropods, polyschaetes, crabs) more abundant.

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17. Noteworthy flora: (indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc.)

The Indus delta is Unique amongst the large world deltas, because it experiences the highest wave energy of any river in the world. Indus delta is predominant by mangrove vegetation, particularly *Avicennia marina,* with a few isolated patches of naturally accruing *Ceriops tagal, Aegeciras corniculatum* and *Rhizophora mucronata*. Apart from mangroves, other plant communities of the delta are, sea weeds and grasses. Other floral species of the Indus delta are, (Sea weeds) *Enteromorpha intestinalis, Enteromorpha compressa, Ulva reticulata, Cladophora sp. Polisiphonia platycarpa (Grasses)* and *Oryza coarctata.*

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18. Noteworthy fauna: (indicating, e.g., which species are unique, rare, endangered, abundant or biogeographically important; include count data, etc.).

The Indus delta occupies an area of about 600,000 ha consisting of creeks, mudflats, Estuaries, sea bays and trails, marshes and mangrove vegetation. Indus delta is rich in micro invertebrates, shrimp juveniles, finfishes, reptiles, birds and mammals and food

webs. Major animal, bird, fish, shellfish, oyster, snail, crab, coral and barnacle species, found in Indus delta are:-

Mammals:-

Humpback whale, Bottlenose Dolphin, Finless porpoise, Green Turtle, Olive ridley turtle, Indian python, Sea snakes, Saw-scaled viper. Finless porpoise is considered unique but population numbers of these animals are not constant round the year because of migration to the other coastal areas.

Birds:-

Indus delta is rich in bird fauna including aquatic birds, wadders, common birds, birds of prey etc:

Fishes:

Indus delta is also rich in fisheries diversity such as fishes, fin fishes, crustaceans, sharks-rays, crabs, shrimps, molluscs, oysters, snails, barnacles, polychaetes etc.

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19. Social and cultural values: (e.g., fisheries production, forestry, religious importance, archaeological site, etc.)

Fisheries production:-

Though the commercial fishing in relationship with Mangroves in Indus delta is not quantified, it is principal economic reason for maintaining the health and viability of the mangrove ecosystem. Due to the reduction in the mangrove cover, loss to the fishery production in Indus delta is significant. In Indus delta about five to six thousand families of fishermen are associated with fishing profession. According to Marine Fisheries Department source, annual fish catch in the Indus delta (project area) is about 99 Metric tons. Estuarine system of Indus delta (Coastal area), supports most important activity of commercial fishing. Artisanal fishing boats and gears are used for the exploitation of the fisheries resources of the area. Small pelagics (*Sardinellas, Anchovies and clupoeids*) demerso-pelagics (multets and shads) and demersal (Sea braeams, Barramundi and shrimp) dominate the commercial catches. Estuarine system is also used to be known for its shellfish, oysters, windospane oysters and shrimp production and commercial harvest. Fishing is carried out throughout the year except in the open ocean where fishing is reduced during the moonsoon season due to intensive wave action. Fishing activities in the creek areas intensify especially at the entrance of the creeks. Intertidal fisheries, Hella fisheries, Ice fisheries, Katra and fish meal fishing operations and crab and shrimp fisheries are the main types of commercial fishing in the Indus delta and its surrounding coastal areas.

Forestry:

Forestry cover in the Indus delta is dominated by Mangroves, which are reasonably diverse and are habitat for several animals, birds and fish species. They are physiologically unique in their ability to live in saline and brackish water. Due to fragile nature of Mangrove forests, their scientific management conservation have

always seen, viewed as delta ecosystem management. Since 1985, IUCN (Pakistan) and Sindh Forest Department have planted an area of 300 ha. Sindh Forest Department with the assistance of World Bank, planted 17100 ha blank and 8000 ha partially blank under the "Rehabilitation and Replanting of Indus Delta Mangroves Scheme". Success ratio was severally affected by cyclone 2-A, which hit the coastal belt in 1999. Mangroves in the Indus delta are declared as "protected forests" by the Sindh Forest Department, Government of Sindh.

Archaeological Sites:

Old Indus Delta is considered rich in archaeological heritage. Though the present Indus Delta itself does not have any significant archaeological sites, except Bhambore, Indus valley civilization is rich in Historical heritage. Many world famous grave yards, tombs, mosques, ports and ruined towns are still found in the surrounding areas of Indus Delta. Bhambore (A ruined town near gharo), Keti Bundar, Shah Bundar, (old ports of Sindh), Rehri, Makli grave yard and Shah Jahan Mosque at Thatta and Chowkhandi grave yard near Karachi are monuments of the Indus valley Civilization. As the present Indus Delta is the part of old Indus Delta, hence its archaeological significance can not be ruled out.

Religious Importance:-

There is significant religious impact or cultural values in the area. However shrines of saints are respected, and regularly visited by the Muslim communities, religious and cultural celebrations are arranged on these shrines every year.

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20. Land tenure/ownership of: (a) site (b) surrounding area

Site:-

There are about 40 small and large settlements in the area having about 1 million population and majority of the population is engaged in fishing activity. Since there is no restrictions on land use, people enjoy unrestricted land use and rights through centuries. No agricultural practices are noticed in the area because of having no freshwater system. Ownership rights are not settled because of un-surveyed land.

Surrounding area:- -- Same --

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21. Current land use: (a) site (b) surroundings/catchment

Site:

Since there is no restrictions on the land use in the area, hence current land use is open. Being coastal area of Arabian Sea, there is no land use for agriculture or other commercial purposes. Scattered human settlements are found along the outer ridge of the delta. Fishing is the only economic activity in the area. The literacy level is significantly low as compared to barrage areas. The health, education, infra structure

and other social activities are nearly non-existent consequently the quality of life is very poor.

Surroundings: same.

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22. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land use and development projects: (a) at the site (b) around the site

Site:-

Fresh water scarcity, long dry spell, Industrial pollution of adjacent Karachi Industrial area, left bank out fall drain right bank out fall drain tidal link canal grazing and fuel wood collection from mangroves, over exploitation of fishing,, hunting and trapping of Wildlife species, intrusion of Sea during high winds in summer moonsoon period.

Surrounding: -- Same --

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23. Conservation measures taken: (national category and legal status of protected areas - including any boundary changes which have been made: management practices; whether an officially approved management plan exists and whether it has been implemented)

Keti Bunder and Shah Bunder and Cut Manarki Chach are declared Wildlife Sanctuaries by Sindh Wildlife Department under section 14 of Sindh Wildlife Protection Ordinance 1972. Wildlife sanctuaries are under category IV of IUCN. Since there is no change in the boundaries of these protected areas. Restrictions are imposed on hunting, trapping, woodcutting, mining and distraction to the habitat under section 14 of Sindh Wildlife Protection Ordinance 1972. No management Plan (approved or unapproved). Sindh Forest Department, IUCN – Pakistan, Port Qasim Authority and Shirkat Gah (Local NGO) are also involved mangroves plantation and protection in Indus delta.

24. Conservation measures proposed but not yet implemented: (e.g., management plan in preparation; officially proposed as a protected area, etc.)

As such no Management Plan is under preparation, however Sindh Wildlife Department intends to prepare it on priority basis with the active participation of WWF Pakistan. Indus delta, as a whole is not declared as a protected area, but three Wildlife Sanctuaries, Keti Bundar (south and north), and Cut Monarki Chhach are located within the boundary limits of the delta. Indus Delta has been declared a Global 200 ecoregion by WWF and WWF-Pakistan has plans to develop a vision for this area on a long term basis and for this purpose they have started their initial activities. In addition, IUCN-Pakistan has also prepared year to document to be submitted in coming year to declare this area as the World Heritage Site.

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25. Current scientific research and facilities: (e.g., details of current projects; existence of field station, etc.)

Currently no research project or scheme is under implementation by Sindh Wildlife Department. But Sindh Forest Department, IUCN (Pakistan) and Port Qasim Authority (Federal Agency) are engaged in mangrove forestation in the Indus delta. No field station as such exists in Indus delta, but Sindh Wildlife Department Karachi office and its district office at Thatta are regularly monitoring the activities of hunting, protection and management of Wildlife and its habitat.

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26. Current conservation education: (e.g., visitors centre, hides, info booklet, facilities for school visits, etc.)

There is no visitor centre, hide or info booklet, school childrens visit facilities in the area, owned by Sindh Wildlife Department. But Sindh Forest Department have some facility centres at Keti Bunder, Shah Bunder and Karachi and have good information on mangrove ecosystem of the Indus delta.

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27. Current recreation and tourism: (state if wetland is used for recreation/tourism; indicate type and frequency/intensity)

There is no managed tourism or recreation in the delta wetlands. However individual boat safaris are arranged by influential and business community of the Karachi city in the nearby creeks and bays. Sindh Tourism or Pakistan tourism departments do not have such facilities or infra structure in delta region. In many situations, un-planned and uncontrolled recreation and tourism have been viewed as a threat to the coastal ecosystem. However recreation and tourism promotes an economic benefits for the local people. Local fishermen and boat operators can act as guide to take visitors in to the narrow mangrove creeks to view the Wildlife. This is a unique environment that can be further improved through planned eco-tourism.

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28. Jurisdiction: (territorial, e.g. state/region, and functional, e.g. Dept of Agriculture/Dept. of Environment, etc.)

Government of Sindh.

a) Sindh Wildlife Department.
b) Sindh Forest Department.
c) Sindh Environment Protection Agency.
d) Thatta District Government.

Government of Pakistan

e) Port Qasim Authority
f) National Institute of Oceanography
g) Marine Fisheries Department.

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29. Management authority: (name and address of local body directly responsible for managing the wetland)

1. Sindh Wildlife Department, Government of Sindh, M. D. Wafai Road, Saddar Karachi Tel: 92-021-9204951-2 Fax – 9204959. Karachi.

2. Sindh Forest Department, Model Colony Karachi 021-4503022.

3. Port Qasim Authority, Government of Pakistan.

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30. Bibliographical references: (scientific/technical only)

Please return to: **Ramsar Convention Bureau, Rue Mauverney 28, CH-1196 Gland, Switzerland**
Telephone: **+41 22 999 0170** • Fax: **+41 22 999 0169** • e-mail: **ramsar@ramsar.org**

1. Pakistan Wetland Action Plan (August 2000).
2. A directory of Asian Wetlands.
3. Root Causes of Bio-diversity Loss- Case study by WWF-Int, By Alexander Wood, Palmela Stedman, Edwards & Johanna Mang. 2000.
4. The Indus River (Biodiversity, Resources, Humankind) - By Azra and Peter Meadows.
5. Sustainability of the Indus delta Mangrove Forests – By Mohammed Tahir Qureshi.
6. Neglected Coastal Eco-system – By Mohammed Tahir Qureshi (IUCN).
7. Role of Mangrove forestry in new millennium – By Hyder Raza Khan, DFO, (SFD), Karachi.
8. Changing Ecology of River Indus System in Sindh – By Ghulam Qadir Shah, DFO, (SFD), Hyderabad.
9. Waterfowl Surveys in Pakistan (Sindh) 1987 to 1990 – By Fred. J. Koning and others.
10. IUCN Red Data Book 2000
11. Sindh Wildlife Department Waterfowl count data 1992-2000.

Table 1. Vegetation species of Indus Delta.

S.NO	SCIENTIFIC NAME
MANGROVES:	
1	*Avicennia marina*
2	*Rhizophora mucronata*
3	*Ceriops tagal*
4	*Aegiceras corniculata*
SEA WEEDS:	
5	*Enteromarpha intestinalis*
6	*Enteromarpha compressa*
7	*Ulva reticulata*
8	*Cladophora sp.*
9	*Policyphonia platycarpa*
GARASSES:	
10	*Oryza coarctata*

Table 2. Animal communities of Indus Delta..

S.NO	COMMON NAME	SCIENTIFIC NAME
MAMMALS:		
1	Humpback Whale	*Megaptera movaenglus*
2	Plumbeaus Whale	*Sousa chinensis*
3	Bottlenose Dolphin	*Tursiops truncatus*
4	Finless porpoises	*Neophocaena phocaenoids*
REPTILES:		
5	Green turtle	*Chelonia mydas*
6	Olive Ridley Turtle	*Lepidochelys*
7	Indian Python	*Python molurus*
SNAKES:		
8	Sea snake	*Enhydra sehistosa*
9	Sea snake	*Hydrophlus cyanocinctus*
10	Sea snake	*Microphalophus gracius*
11	Saw scaled viper	*Echis carinatus*

Table 3. Birds of Indus Delta.

S.NO	COMMON NAME	SCIENTIFIC NAME
1	Greater Flamingo	*Phoenicopterus ruber*
2	Lesser Flamingo	*Phoeniconaias minor*
3	Dalmatian Pelican	*Pelecanus crispus*
4	Great white Pelican	*Palicanus orocrotalus*
5	Little Ringed Plover	*Charadrius dubuis*
6	Ringed Plover	*Charadrius hiaticula*
7	Pariah Kite	*Haliastur indus*
8	Black Kite	*Milvus migrans*
9	Marsh Harrier	*Circus aeruginosus*
10	Osprey	*Pandion haliaetus*
11	White Eyed Buzzard	*Butastur teesa*
12	Pallas Fishing Eagle	*Haliaeetus leuaory ptus*
13	White Toed Sea Eagle	*Haliaeetus albicilla*
14	Sparrow Hawk	*Accipiter nisus*
15	Shikra	*Accipiter badius*
16	Tawny Eagle	*Aquila rapax vindhiana*
17	Peregrine Falcon	*Falco peregrinus*
18	Little Carmorant	*Phalacrocorax niger*
19	Grey Heron	*Ardea cinerea*
20	Great Indian Cormorant	*Phalacrocorax carbo*
21	Little Egret	*Egretta garzetta*
22	Purple Heron	*Ardea purpurea*
23	Black Winged Stilt	*Himantopus himintopus*
24	Ruff	*Philomachus pugnax*
25	Little stint	*Calidris minuta*
26	Common Snipe	*Gallinago gallinago*
27	Curlew	*Numenius arguata*
28	Red Shank	*Tringa totanus*
29	Intermediate Egret	*Egretta intermedia*
30	Great Egret	*Egretta alba*
31	Common shelduck	*Tadorna tadorna*
32	Wigeon	*Anas penelope*
33	Gadwall	*Anas strepera*
34	Common Teal	*Anas crecca*
35	Pin Tail	*Anas ocuta*

36	Garganey	*Anas querquedula*
37	Shoveler	*Anas clypeats*
38	Common Poachard	*Aythya ferina*
39	Cotton Teal	*Neltapus coromandelianus*
40	White Brested Waterhen	*Amauronics phoenicurus*
41	Moorhen	*Gallinula chloropus*
42	Coot	*Fulica atra*
43	Pheasant Tailed Jacana	*Hydrophasianus chiruigus*
44	Avocet	*Recurvirostra avocetta*
45	Oystercatcher	*Haematopus ostralegus*
46	Shorttoed Eagle	*Circeatus galliccus*
47	Ruddy shell duck	*Tadorna ferruginea*
48	Reef Heron	*Egretta gularis*
49	Little Grebe	*Tachifabtus ruficollis*
50	Kentisch plover	*Charadtrius alexandrinus*
51	Lesser Sand Plover	*Charadrius leschenaultii*
52	Red Wattled Lapwing	*Vanellus vanellus*
53	Yellow Wattled Lapwing	*Malabaricus indicus*
54	Dunlin	*Calidris alpina*
55	Aqarsh Sand Piper	*Tringa ochropus*
56	Terek Sand Piper	*Yenus cinereus*
57	Common Sand Piper	*Actitus hypoleucos*
58	Sooty Gull	*Larus hemprichi*
59	Great Black headed Gull	*Larus inchthyaetus*
60	Black headed Gull	*Larus ridibundus*
61	Slender Billed Gull	*Larus genei*
62	Caspian Tern	*Sterna caspia*
63	Common Tern	*Sterna hirundo*
64	Swift Tern	*Sterna begii*
65	Sandwich Tern	*Sterna sandircensis*
66	Little Tern	*Sterna albifrons*
67	White Breasted King fisher	*Halcyon smyrnensis*
68	Pied Kingfisher	*Cerylo rudis*
69	Common King Fisher	*Alcedo atthis*
70	Little Green Bee eater	*Merops orientalis*
71	Indian Roller	*Corocias benghalensis*
72	White checked Bulbul	*Pycnonotus leucogenys*
73	Indian Robin	*Saxicola fulicata*
74	Common babbler	*Turoides caudatus*
75	Grey Shrike	*Lanius excubitor*
76	Black Drongo	*Dicrurus marco cercus*
77	Indian Tree pie	*Dendrocitta vagabunda*
78	Common Myna	*Acridotheres ginginianus*
79	House sparrow	*Passer domesticus*
80	Crested Lark	*Galarida cristata*

81	Indian Sand Lark	*Calendrella raytal*
82	Hoopoe Lark	*Alaemon alavdipus*
83	Collard dove	*Streptopelia deccaocto*
84	Little Brown Dove	*Streptopelia senegalensis*
85	Rose Ringed Paraket	*Psittacula krameri*
86	Koel	*Eudynamys scolpacea*
87	House swift	*Apus affinus*

Table 4. Fishes, Shrimps, Molluscs, Crabs, Crustaceans, Sharks-Rays & Oysters of Indus Delta.

S.NO	TAXA
FISH:	
1	*Liza subviridis*
2	*Baleophthalmus dentatus*
3	*Baleophthalmus dussumieri*
4	*Boleophthalmus sp.*
5	*Periophthalmus waltoni*
6	*Periophthalimus sp*
7	*Periophthalmus koelreuteri*
8	*Therapon jarbua*
9	*Epinephalus diacanthus*
10	*Paracheturichthys ocellatus*
11	*Thryssa mystax*
12	*Dussumieria aculta*
13	*Solea sp.*
14	*Saurida tumbil*
15	*Pomacentrus maculatus*
16	*Thryssa purava*
17	*Arius sp.*
18	*Johinus sp*
19	*Sciaena sina*
20	*Polynemus tetradactylus*
21	*Gabius sp.*
22	*Tetraodon sp.*
23	*Acanthopagrus berda*
24	*Chupeoids*
25	*Eel*
FIN FISHES:	
26	*Tenualosa ilisha*
27	*Tenualosa toli*
28	*Chirocentrus dorab*
29	*Plotosus canius*
30	*Arius sp*
31	*Harpodon neherus*

32	*Lates calcarifer*
33	*Polynemus tetradactylus*
34	*Pangasius rangasius*
35	*Silnonia silnonia*
36	*Megalops cyrinoides*
37	*Elops machnata*
38	*Nematalosa nabus*
39	*Opisthopterus tardoore*
40	*Pellona ditchela*
41	*Coilia dussumieri*
42	*Coilia neglecta*
43	*Thryssa hamiltoni*
44	*Thryssa malabarica*
45	*Thryssa mystax*
46	*Thryssa setirostis*
47	*Thryssa vitrirostris*
48	*Congressox talabanoides*
49	*Aruis sp.*
50	*Chanos chanos*
51	*Epinephalus malabricus*
52	*Sillago sihama*
53	*Therapon jarbua*
54	*Rachycentron conadum*
55	*Lutjanus johnii*
56	*Acanthopagrus berda*
57	*Argyrops spinifer*
58	*Crenidens crenidens*
59	*Proteonibea diacanthus*
60	*Drepane punctata*
61	*Liza sp.*
62	*Scomberomorus guttatus*
63	*Tetraodon obesus*
SHRIMPS:	
64	*Metapenaeus affinis*
65	*Penaeus merguiensis*
66	*Metapenacus lysianassa*
67	*Parapenaeopsis stylefera*
CRABS:	
68	*Scylla serrata*
69	*Uca annulipses*
70	*Sesarma sp.*
71	*Grapsus stringosis*
72	*Grapsus sp*

73	*Ozius regulosus*
74	*Spider crab*
75	*Euriycarcimus*
76	*Charrybdis sp.*
77	*Ocypoda sp.*
78	*Uca lactea*
79	*Uca marionus*
	MOLLUSCS:
80	*Telescopium telescopium*
81	*Cerithiden cingulata*
82	*Tiara sp.*
	CRUSTACEANS:
83	*Scylla serrata*
84	*Exopalaemon styliferus*
	SHARKS-RAYS:
85	*Carcharhinus metanopterus*
86	*Galeocerdo cuvieri*
87	*Glyphis gangaticus*
88	*Sphyrna lewini*
89	*Dasyatis sp.*
90	*Pristis sp.*
91	*Rhinobatos sp.*
	OYSTERS:
92	*Grassostrea rivularis*
93	*C. madrasensis*
94	*Anomia sp.*
	BARNACLES:
95	*Balanus tintinnabulum*
96	*Balanus amphitrite*
	POLYCHAETES:
97	*Hesione sp.*
98	*Perinereis sp.*
99	*Loimia medusa*
	SNAILS:
100	*Natica sp.*
101	*Nerita sp.*
102	*Cerithidea angulata*
103	*Thai carinifera*

104	*Cypraea sp.*
105	*Euchelus sp.*
106	*Littorina sp.*

Table 5. Fish landings of marine fished and shellfishes in the estuaries and associated creeks of Indus Delta.

SPECIES	*LANDINGS IN METRIC TONS*
Sharks	320
Guitarfish	4
Rays	610
Shads	98
Glupaids	14000
Sardinella	9020
Wolf Harrings	24
Bombay Ducks	34
Catfhish	866
Eals	135
Barrcuda	12
Mullets	730
Threa Fins	27
Barammundi	328
Groupers	134
Large Croakers	122
Small Croakers	141
Sea Breams	18
King soldier Breams	146
Silver Whitings	126
Queen fishes	93
Travelly	12
Snappers	310
Grunts	549
Emperors	4
Cutlass fish	57
White pamfrets	157
Black pamfrets	17
Sole	210
Scads	412
Shrimps	9328
Crabs	170

Other fishes	54132
Subsistence catch	3943

Source: Marine fisheries Department, Government of Pakistan.