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Protecting Endangered Species: A Case Study of Indus River Dolphin (*Platanista gangetica minor*)

Muhammad Rizwan Ali

Edited by:
Awais Ihsan
COMSATS University Islamabad, Sahiwal Campus, Pakistan

Reviewed by:
Hafiz Iftakhar Hussain
Department of Pathology, CUVAS Bahawalpur, Pakistan
Qudsia Yousafi,
COMSATS University Islamabad, Sahiwal Campus, Pakistan

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Abstract: River dolphins i.e., Amazon river dolphin (*Inia geoffrensis*); Bolivian river dolphin (*Inia boliviensis*); Ganges river dolphin (*Platanista gangetica*); Indus river dolphin (*Platanista gangetica minor*); La Plata dolphin (*Pontoporia blainvillei*), are the most endangered species live in geographically isolated rivers and estuaries of South Asia and South America. In addition to these river dolphins, Baiji (Yangtze or Chinese river dolphin; *Lipotes vexillifer*) was also a freshwater dolphin, recently considered extinct. Habitats of river dolphins, including Indus river dolphins, are experiencing combinations of persistent natural and anthropogenic threats. Habitat destruction and fragmentation, changing climatic conditions, overfishing, bycatch and entanglement in fishing tools, sedimentation of riverbeds, chemical and noise pollution, human interference, and accidental vessel strikes are significant threats to the survival of Indus river dolphins. Conservation efforts like habitat restoration and protection, legislation and fishing regulation, awareness-raising campaigns, dolphin monitoring and research, National and International cooperations, and National Heritage Animal status helped to increase the survival of critically endangered Indus river dolphins..

Keywords: Anthropogenic effects, freshwater ecosystem, habitat restoration, species conservation, water pollution

***Corresponding author**: Muhammad Rizwan Ali, email: mjamshad18@gmail.com

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1. Introduction

Cetaceans are taxonomically the most diverse clade of aquatic mammals including whales, dolphins and porpoises. Dolphins are aquatic mammals, that belong to infraorder Cetacea which comprises five families, including Odontoceti (echolocating toothed whales). Marine dolphins are generally found across the world, with a diverse range of sizes and colors, and they rarely come close to the land. However, there are few species of freshwater dolphins living in the largest rivers of the world. Fossil records of river dolphins dated back to the Middle Eocene time (Hamilton et al., 2001). Ancestors of modern dolphins were terrestrial mammals, which became aquatic around 39-44 million years ago (Bianucci et al., 2013). Organisms facing the threat of extinction are termed endangered species.

2. Types of river dolphins

There are following species of freshwater dolphins found in the world (Braulik et al., 2021; Page and Cooper, 2017).

2.1. Genus *Platanista* (Indian region)

i. Ganges river dolphin (*Platanista gangetica*): Ganges river dolphin is found in the Ganges, Brahmaputra, Karnaphuli and Meghna river systems in India, Nepal, and Bangladesh.

ii. Indus river dolphin (*Platanista gangetica minor*): Indus river dolphin is found in the Indus river system, Pakistan.

2.2. Genus *Inia* (Amazon Region Dolphins)

i. Amazon river dolphin (*Inia geoffrensis* or *Inia geoffrensis geoffrensis*): Amazon river dolphin found

in the Amazon and Orinoco river systems, South America (Ladegaard et al., 2015; Melo et al., 2021).

ii. Bolivian river dolphin (*Inia boliviensis* or *Inia geoffrensis boliviensis*): Bolivian river dolphin is found in the Beni-Mamoré and Madeira River basins (Emin-Lima et al., 2022).

iii. Araguaian river dolphin or Araguaian boto (*Inia araguaiaensis*): is a species of river dolphin found in the Araguaia and Tocantins river basins in Brazil. It was officially described as a new species in 2014, making it one of the most recently discovered species of cetacean (Hrbek et al., 2014).

2.3. Genus *Pontoporia* (Brackish water dolphin)

i. La Plata dolphin (*Pontoporia blainvillei*) or Franciscana: is a species of river dolphin found in the waters of the Atlantic coast of South America. They are the only species of river dolphin found in coastal waters and estuaries of Argentina, Uruguay, and Brazil.

2.4. Extinct Yangtze River Dolphin (*Lipotes vexillifer*)

In addition to the abovementioned freshwater dolphins, Baiji (Yangtze river dolphin or Chinese river dolphin; Lipotes vexillifer) a freshwater species of this group was recently considered extinct (declared functionally extinct in 2006) (Bin et al., 2022).

3. Indus river dolphin (*Platanista gangetica minor*)

Taxonomic classification of Indus river dolphin

- Animalia (Kingdom)
- Chordata (Phylum)
- Mammalia (Class)
- Artiodactyla (Order)
- Cetacea (Infraorder)
- Platanistidae (Family)
- Platanista (Genus)
- Species: *Platanista gangetica minor* or *Platanista minor*

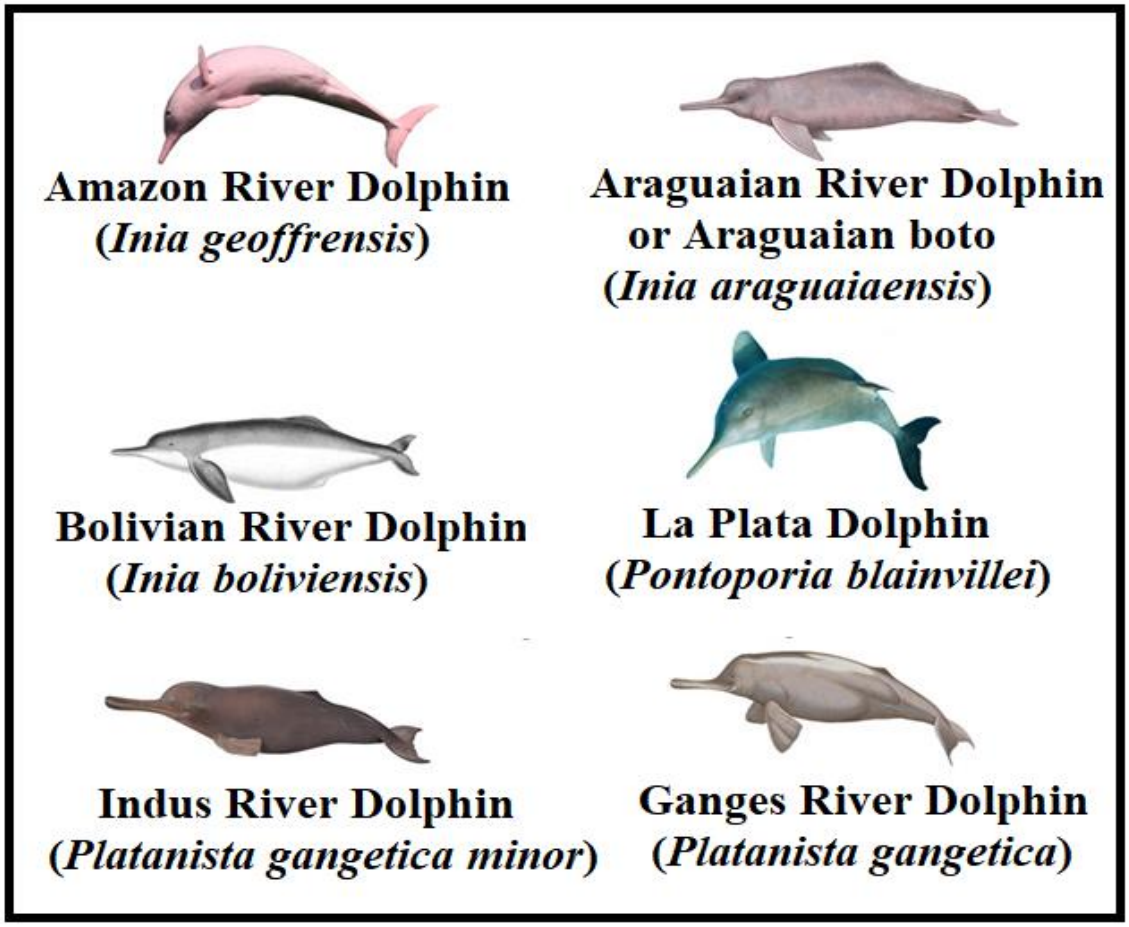

Fig. 1. River dolphins of South Asia and Latin Americas (Adapted from https://www.animalspot.net/dolphin)

3.1. Salient features of Indus river dolphin

Indus blind dolphin, one of the limited odontocetes (toothed whales) freshwater dolphin species, is of the most endangered freshwater mammals (Rafi 2022; Braulik et al., 2021; Nabi et al., 2021; Ibrahim et al., 2021) and highly endangered species. The Indus river dolphin is locally known as Bhulan and declared a National Heritage Animal of Pakistan. It is considered to be a subspecies of the Ganges river dolphin and is native to the Indus river system, in Pakistan. These dolphins are one of the oldest river dolphin species and are called living fossils.

The first Indus River dolphin survey, conducted in 2001, indicated 1200 population of Indus river dolphins, which increase to around 2000 after 15 years (WWF, 2023). This increase in population can be credited to the efforts of provincial wildlife departments, WWF-Pakistan, and Dolphin Rescue Network. Sindh Environmental Protection Agency, Sindh Fisheries Department, Sindh Forest Department, Sindh Irrigation Department, Sindh Wildlife Department, and activists from local communities are components of the Dolphin Rescue Network. This network regularly monitors the Indus River and its adjacent canals and tributaries for the search of stranded dolphins and their rescue.

Average weight (adult dolphin) is around 200 pounds (150-200 pounds) and an average length of 8.2ft (7-8.5 ft). Average life of these dolphins is around 30 years, however, at the age of 6-10 years, they reach sexual maturity. Recent population is a result of continuous conservation and management in Indus river with the help of WWF (WWF, 2023). Bhulan has a long, thin snout and eyes that are located on the sides of its head, which are adapted for hunting in murky waters (Braulik et al., 2015b). Male Indus river dolphins are slightly smaller in size than females. Rounded forehead (melon), collects environmental sounds, and is distinct from the Indus river dolphin, like other cetaceans. They have small but poorly-developed eyes, above the mouth corners. Their belly is pale white (or pinkish), while grey back (NOAA, 2021).

Dolphins prefer deep water (deeper than 3 m) for living, however, Indus river dolphins specially adapted to shallow waters by swimming on their sides. Water temperature between 8 ^{o}C to 33 ^{o}C is suitable for their survival (NOAA, 2021). Bhulan cannot breathe underwater, a large adult dolphin can swim with an average speed of about 6 km h^{-1} and comes to the water surface after every two to three minutes. Like other dolphins, the Indus dolphin has a layer of fat under its skin that helps to keep its body warm and stores energy. Inside its flippers, Bhulans have five fingers, just like humans. These dolphins have sharp teeth, though look scary, but do not bite (harmless to humans) these teeth are only for holding the prey. These dolphins sleep but half of their brain remains active, maintaining their breathing and always keeping them aware of their surroundings (NOAA, 2021).

Fig. 2. Indus river dolphin in Indus River (Photo credit: WWF-Pakistan)

4. Origin of Indus River Dolphin

Ganges and Indus river dolphins are considered to be evolved from common (marine-dwelling relatives) ancestors that colonized the shallow seas that penetrated low-lying areas of South Asia during the Miocene when seawater levels rose and fell. However, dolphins persisted in the freshwater river systems. Calibrated molecular clock suggested the divergence of the Ganges and Indus around 0.13–1.05 million years ago, potentially when dolphins dispersed from the Ganges into the Indus (Braulik et al., 2015a).

5. Major Threats to Indus River Dolphins

Indus River Dolphins are facing severe threats to their survival, mainly due to the following reasons.

5.1. Habitat destruction and fragmentation:

Construction of barrages and canals has fragmented the habitat of Indus dolphins, and reduced the areas suitable for breeding and feeding (Aggarwal et al., 2020; Khan et al., 2017). It is estimated that 80% of the total habitat loss is due to construction of dams and water diversions (Rafi, 2022; Braulik et al., 2021).

5.2. Bycatch and Entanglement in fishing tools:

Bycatch or non-targeted mortality, from several fishing methods, especially entanglements in fishing gears (e.g., gillnets), is a major risk for the conservation of endangered aquatic species (Aggarwal et al., 2020). The dolphins are accidentally trapped or captured in fishing nets and other such tools, in the adjacent pools and side channels along the Indus River. Fishing activities in these areas are greater due to higher fish densities. These can lead to injury or death of dolphins (Kelkar and Dey, 2020).

5.3. Siltation:

The sedimentation of riverbeds due to erosion of river banks, deforestation, land use change and poor agricultural practices, restricted the space and food availability of dolphins.

5.4. Chemical Pollution:

The Indus river and its tributaries are heavily polluted with pesticides, agricultural and industrial wastes, and sewage. Bioaccumulation of these pollutants can immunity and is harmful to the health and reproduction of dolphins and other species dependent on its water. Chemical pollution also kills fish, reducing the food for Indus river dolphins (Ali et al., 205; Kumar et al., 2022; Sultana et al.,2014).

5.6. Noise Pollution:

Indus river dolphins communicate and echolocate using sound. Normal behavior of these dolphins is interrupted by underwater noise pollution. Noise interference induced by human activities interrupts the feeding, communication, and orientation of Indus river dolphins. Extreme cases of noise can cause temporary or permanent hearing impairment (NOAA, 2021).

5.7. Overfishing

Overfishing is depleting the food supply for dolphins and increasing competition for resources in the Indus river (NOAA, 2021).

5.8. Climate change

Climate change-induced anomalies in water flow and temperature is causing severe impact on the habitat and food supply of dolphins.

5.9. Human interference

Dolphin population is also affected by human activities such as sand mining, illegal hunting, and boat traffic. Moreover, accidental vessel strikes can harm Indus river dolphins.

5.10. Vulnerable water security:

In the future survival of river dolphins in South Asia is closely associated with regional water security and rising freshwater demands (Braulik et al., 2012). Water resources, in Pakistan, are highly vulnerable (Khan, 2019) mainly due to anomalies in rainfall patterns and temperature, glacier melting, mismanagement, inefficient use, and political conflicts over the distribution and management of water resources (Alkon et al., 2019; Kulkarni et al., 2021; Roic et 2017; ul Hasson et al., 2019). Erratic and declining freshwater availability is posing severe threats to the long-term future of dolphins in the Indus river.

6. Conservation Efforts for Indus Dolphin Protection in Pakistan

Several conservation efforts helped to protect the Indus river dolphin in Pakistan, these efforts are briefly included below.

6.1. Habitat restoration and protection

Projects to remove barriers and restore Indus river system connectivity, protected areas and community-based conservation programs for the improvement and protection of dolphin's habitat. Guddu – Sukkur part of Indus river is a protected area, generally called as Indus Dolphin Reserve. It was declared a Ramsar

wetland under the Ramsar Convention on Wetlands and Key Biodiversity Area (KBA) (Khan, 2006).

6.2. Legislation and regulations Enforcement regarding fishing

Seasonal fishing bans, Fishing gear restrictions, and community-based fisheries management are being implemented to reduce the impact of fishing on the dolphin's population (Khan, 2017).

6.3. Awareness-raising campaigns

Educational programs and awareness campaigns are being conducted to educate local communities, fishermen, and policymakers about the importance of protecting the Indus river dolphin and its habitat (Khan, 2017; NOAA, 2021).

6.4. Monitoring and research

Regular monitoring and research of the Indus river dolphin population and its habitat is being conducted to understand the species and to inform conservation management. Sindh Wildlife Department, Engro Foundation is actively involved in the protection of primary habitat of Indus dolphins, which is around 500 km part of Indus River, stretched between Taunsa and Sukkur barrages.

6.5. National and International Cooperations

Pakistan is working with international organizations, such as the World Wildlife Fund (WWF), to develop and implement conservation strategies for the Indus river dolphin. WWF-Pakistan and Sindh Wildlife Department collectively started initiatives to rescue the entangled Dolphins in canals and return them to Indus river, since 1992. There were 147 Dolphins entangled in these canals as reported in the period from 1992 to 2017. Overall, 130 Dolphins were recovered and successfully returned to river. However, a strong network was developed with the cooperation of WWF-Pakistan and Sindh Wildlife Department along with several other groups to rescue and monitor the Dolphins in Indus River. On the other hand, soundproof trucks are also used during rescue operations as standardized measures and tools (Rafi 2022).

6.7. National heritage animal status

The Indus river dolphin is now considered a National Heritage Animal of Pakistan and the government has passed laws to protect them.

It is important that the available data have shown an increase in the population of Indus dolphins. It is essential to check the water quality throughout the year for the protection of Indus Dolphins (Ibrahim et al., 2022). To minimize the mortality of Indus Dolphins there is a dire need to reduce illegal hunting, use of blubber, and anthropogenic pressure (Ibrahim et al., 2021). Conservational approaches e.g., ban on fishing and transportation, further work on tagging, assessments, reproductive success, and genomics will be the possible strategies to recover (Nabi et al., 2021). There is the utmost need for proper water management, conservation policies, and continuous collaboration to develop inclusive water management (Momblanch et al., 2022). 2022).

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