



Ganges River Dolphin (*Platanista gangetica gangetica*): An Indicator of Ecosystem Health in the River Basins

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Along with turtles, crocodiles, and a few different species of sharks, the Ganges river dolphin (*Platanista gangetica gangetica*) is one of the oldest animals on the planet. The Ganges and Brahmaputra river basins in India, Nepal, and Bangladesh are home to this species. It generally lives in countercurrent systems of the main river channel and feeds mostly on fish. The Gangetic river dolphin is considered important because it acts as an indicator of the health of the overall river ecosystem. It was designated as the National Aquatic Animal of India on 5 October 2009. This species is now extinct in most of the areas where it once existed, due to serious threats from water development projects, pollution, poaching, and deaths from accidental entanglement in fishing gear. Currently, their population is estimated to be less than 2000 individuals. The Ganges river dolphin comes under Schedule I of the Wildlife Protection Act (1972). They are classified as Endangered in the IUCN Red List and included in CITES Appendix I. The Wildlife Institute of India launched an initiative called "Development of a Conservation Action Plan for Dolphins" in 2016 with the intention of saving these endangered dolphins.

Keywords: *Ganges river dolphin; protection; conservation; development; health; indicator.*

1. INTRODUCTION

All life and almost all human activities depend on freshwater and its biodiversity, including industrial production, shipping, domestic water needs, waste absorption, health, and food production [1,2]. Since humans have chosen to live near freshwater resources, freshwater ecosystems and species have faced many negative pressures as a result of human use [3]. As freshwater biodiversity is declining much faster than the most severely affected terrestrial ecosystems, and therefore inland water species diversity is among the most threatened of all ecosystems [4].

Ganges river dolphins are acknowledged as a key species in their ecosystem because they play an important role in conserving the ecosystem and ensuring its proper functioning. They belong to the Platanistidae family and are locally known as Susu. It can be found along the Ganges, Brahmaputra, Karnaphuli-Sangu, and Meghna river systems, as well as their tributaries, from the Himalayan foothills to the edge of the tidal zone in India, Bangladesh and Nepal [5]. Despite the lack of accurate population data at the time in the nineteenth century, dolphins were extremely common throughout their distribution area [6]. However, as a result of several stresses, the distribution range and abundance of this species have decreased to only 4000–5000 [7] and later 1800 individuals [8,9], respectively in all tributaries of its distribution. A recent assessment by Das et al.,

[10] found a 24.37% decline in the Ganges river dolphin range since 1878. The IUCN Red List has also designated the species as Endangered [11].

Now many aquatic species are becoming increasingly rare due to changes in land use, reduction in water flow, pollution, change in river shape, loss of nesting sites, poaching, increased mortality in fishing nets, and collection of eggs for human consumption, [12-14].

2. GANGES RIVER DOLPHIN AS ECOSYSTEM INDICATORS

River dolphins are apex predators found in many of the largest tropical river basins in Asia and South America and are considered excellent candidates for ecological indicators [15]. Gomez-Salazar et al., [16] studied the relationship between indices of ecosystem degradation and river dolphins as ecological indicators. They used river dolphins to assess three ecological indices of freshwater ecosystem degradation: (i) river dolphin population, (ii) average dolphin group size, and (iii) dolphin sighting rate. In specific areas of the Amazon and Orinoco rivers, a strong negative correlation between estimates of river dolphin numbers and indices of habitat degradation was found. According to a report investigated by Nabarun Guha on 24 August, 2022 in Assam, across Brahmaputra and its tributaries like Kulsi and Subansiri, the population of gangetic river dolphin is currently declining due to sand mining and dam construction [17].

This species was once found in abundance in the Ganges, Brahmaputra, Meghna, and Karnaphuli rivers of Nepal, India, and Bangladesh, but in today's time this species is disappearing from most of the historical areas due to fishing accidents, river pollution, plastic disposal, drainage, restricted flow, ship traffic, dredging in

waterways, and climate change [18]. During the COVID-19 lockdown period, both anthropogenic activity and fishing decreased significantly, leading to improved river health and improved upstream dolphin movement. It showed that if our rivers are clean then the aquatic life will be safe and satisfied [19].

Table 1. Impact of various threats on Ganges river dolphins

1. Pollution	Urban, industrial, and agricultural pollution in Asia is extremely harmful to river dolphins. This pollution from places like Allahabad, Varanasi, Patna, Calcutta, Guwahati, and Dhaka immediately enters the rivers and harms aquatic life. Organo-chlorines, which are present in pesticides and industrial chemicals that bioaccumulate over an aquatic individual's lifetime and are passed from one generation to the next through the placenta, are devastating to the long-term survival of dolphin populations [22-24].
2. Hunting for meat consumption and oil extraction	In the past, dolphins were killed by tribal people and fishing communities in the upper Brahmaputra for their meat and by fishers in the middle reaches of the Ganges for their oil, used as a fish bait or attractant [25,26]. About 50 River Dolphin's oil was extracted during 1990–1992 between Patna and Rajmahal from the Ganges in Bihar [26]. Approximately 25–30 dolphins were killed deliberately for oil during a low water period near Patna between January and April 2001 [27]. Mohan et al. [28] recorded 20–25 dolphins were killed by harpoons annually in Bihar and Assam states of India.
3. Net entanglement mortality	Mohan [29], emphasized the mortality of river dolphins in gillnets. Every year, gillnets kill about 100 dolphins in the Ganges between Patna and Farakka Barrage [25]. In the Brahmaputra, between Dubri and Saikowaghat, about 150 dolphins mostly young were killed [25]. In the Brahmaputra River in 2004–2005, Wakid noted 14 dolphin deaths, of which 12 were due to capture deaths and the remaining three were due to poaching.
4. Sand extraction	Sand extraction also contributes to habitat degradation as it fills dolphin habitat with silt, kills downstream wildlife, and reduces river productivity by blocking sunlight and limiting photosynthesis. The productivity of fish, on which dolphins depend for sustenance, has been negatively affected by this ecological disaster [30].
5. Construction of Dams and barrages	The construction of barrages and dams on the rivers, as well as many of their tributaries, has fragmented dolphin populations into many small groups, some of which have disappeared, possibly as a result of disruption to their food supply [29]. All the dolphins that were previously found above the Kapti Dam on the Karnaphuli River have disappeared, and the dolphins below the dam appear to be declining [29]. According to Behera et al. [31], Ganga river barrages in Rishikesh, Haridwar, Bijnor, and Narora have negative impacts on habitat.
6. Inland navigation	Not enough research has been done on the harmful effects of waterways on Ganges river dolphins, such as underwater noise, ship hits, propeller strikes, pollution, dredging, port construction, etc. According to Dey et al. [32], Ganges river dolphins changed their acoustic behavior when exposed to underwater noise caused by propeller cavitation between 40 and 80 kHz. In West Bengal, India, near the city of Kolkata, dolphin carcasses with propeller-strike injuries have been reported [33]. Harwood [34], reported that sediment disturbance caused by dredging affects river dolphins. They also pointed out that dredging and higher ship traffic is likely to increase the impact on the Ganges river dolphins in the future.

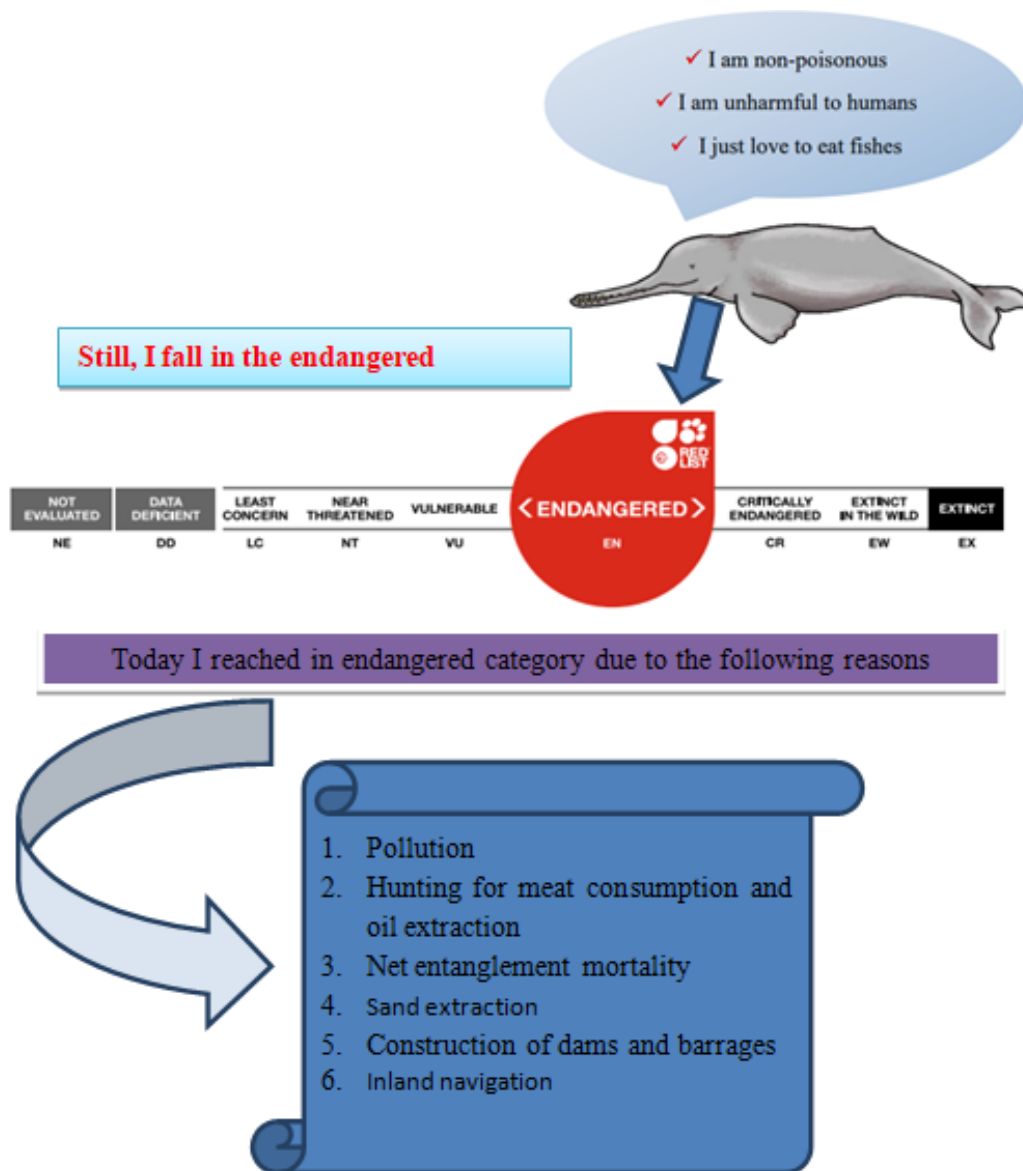


Fig . 1. Threats to the Ganges river dolphin population

Source: Singh et al., [20]; IUCN, [21]

3. CONSERVATION STRATEGIES

The success of any conservation implementation depends on the acceptance and participation of the local human population. Through public awareness, education, and involvement of local people who have a stake in the area, conservation activities should be implemented over the long term [35]. Gangetic river dolphins are legally protected from hunting and intentional harm/disturbance in all ranges where they are found. The Gangetic river dolphin has been given legal protection by the Government of India as it is included in Schedule I of the Wildlife (Protection) Act, 1972. Killing or poaching any

species listed in Schedule I of the Act is a cognizable offense punishable by a maximum fine of US\$500 and/or up to 7 years in prison [15]. The highest level of protection for the species is provided by Bangladesh's Wildlife (Conservation and Protection) Act, 2012, and Nepal's National Parks and Wildlife Conservation Act 2029 (1973), as well as the Aquatic Animals Protection Act 1960, Nepal [21].

To protect and restore habitats, establish protected areas, reduce accidental capture, conduct periodic status surveys and monitoring, rescue, and rehabilitation, capacity building, community involvement, and awareness

generation, the Government of India formulated a separate Conservation Action Plan (CAP) for the conservation of Gangetic river dolphins [36]. As an institutional support for the long-term conservation of dolphins, a National Dolphin Research Center will soon be set up in Patna. Since 2012, the Bihar state government has celebrated "Dolphin Day" on 5 October in an effort to raise public awareness and track government efforts to save and conserve dolphins on an annual basis [15]. Additionally, a concrete action plan for the Ganges River Dolphin was approved at the 13th Convention on Migratory Species (2020) in Gandhinagar, India, which aims to promote conservation and research activities on dolphins in transboundary areas. For the conservation of marine and river dolphin species, the Government of India launched "Project Dolphin" in 2020. At present ex-situ management can be attempted to conserve the Ganges River Dolphin in different parts of the world [37].

4. PROTECTED AREAS WHERE GANGES RIVER DOLPHINS OCCUR [21]

1. Vikramshila Gangetic Dolphin Sanctuary, Bihar, India
2. National Chambal Sanctuary, Rajasthan-Madhya Pradesh-Uttar Pradesh, India
3. Kaziranga National Park, Dibru-Saikhowa National Park, and Orang National Park in Assam, India
4. Bardia National Park in Nepal and Katarniaghat Wildlife Sanctuary (WLS) in India on the Ghaghra (Karnali in Nepal) River
5. Hastinapur Wildlife Sanctuary, Uttar Pradesh, India

6. Sundarbans Tiger Reserve, West Bengal, India
7. Three dolphin sanctuaries or conservation areas in the Bangladesh Sundarbans

5. ROLE OF "PROJECT DOLPHIN" AND "NAMAMI GANGE PROGRAMME" TO CONSERVE GANGES RIVER DOLPHIN

5.1 Project Dolphin: Project Dolphin focuses on the conservation of Ganga river dolphins and river ecology. In the year 2020, Honorable Prime Minister Shri Narendra Modi launched it and India's Ministry of Environment, Forest and Climate Change is funding this project. Creating and implementing a conservation action plan involves systematically tracking the status of target species and any potential risks to them. It aims to address current conservation issues and provide stakeholders with greater ability to participate in dolphin conservation. Dolphins serve as an umbrella species, and their conservation will benefit the health of surrounding habitats and biodiversity, including humans [38].

5.2 Namami Gange Programme: The Central Government of India launched the "Namami Gange Programme" in June 2014 as a "flagship programme" with a budget allocation of Rs. 20,000 crores to achieve the twin goals of effective pollution reduction and conservation and revival of the National River Ganga. Sewage treatment infrastructure, river surface cleaning, river bank development, biodiversity, public awareness, reforestation, industrial effluent monitoring, and Ganga Gram are some of the main pillars of the Namami Gange programme [39].

Table 2. Action for the conservation of the Gangetic Dolphin

Action 1	Initiating state-wise gangetic dolphin population status surveys and threat assessment
Action 2	Setting up of protected areas for the gangetic dolphin
Action 3	Capacity building for gangetic dolphin conservation and management
Action 4	Minimizing fisheries interface and incidental capture of river dolphins
Action 5	Prevention, mitigation, and restoration of impacts on dolphin habitats from developmental projects
Action 6	Community involvement in river dolphin conservation and management
Action 7	Ensuring critical levels of water flow in riverine habitats of dolphins
Action 8	Education & Awareness
Action 9	Rescue & Rehabilitation of gangetic dolphin
Action 10	Initiation of identified research

Source: Sinha et al., [40]

6. CONCLUSION

The Ganges river dolphin is important not only because it is in danger of extinction, but perhaps even more important because it serves as an accurate gauge of the overall health of the Ganga River and their ecosystem. Dolphin populations are clearly under threat from man-made factors such as the construction of dams and barrages, illegal fishing with gillnets, aquatic pollution, drainage for city dwellers, and irrigation. Therefore, we must determine what steps are necessary for the conservation of river dolphins, such as education and awareness campaigns to inform the target population, including fishermen, government employees, school and college students, and the general public. Dolphin populations must be monitored periodically to determine the effect of dolphin conservation programs.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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