

The Gharial: Guardian of the Riverbanks- Its Habitat, Status, Threats and Conservation Efforts

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SUMMARY

The gharial or ghavial (*Gavialis gangeticus*), a critically endangered crocodylian, is a key species in maintaining freshwater ecosystems. Historically, its population has declined drastically and now the populations exist only in India and Nepal. Gharials prefer deep river channels with sandy banks for basking and nesting but face severe threats such as dams, water diversion, overfishing, and illegal sand mining. Conservation efforts include captive breeding, habitat restoration, legal protection under the Wildlife Protection Act (1972), and international collaboration to restore its population. However, challenges like climate change, river pollution, and human-wildlife interaction affect the persistence of this species. Urgent habitat protection, pollution control, and sustainable river management are crucial to prevent local extinction. Strengthening cross-border conservation efforts between India and Nepal, enforcing anti-poaching laws, and engaging local communities in sustainable practices are vital for the gharial's survival. The next decade will be decisive in securing the future of this species.

INTRODUCTION

The gharial crocodile *Gavialis gangeticus* is the last surviving member of a well-represented family Gavialidae and genus *Gavialis*, which falls within the order Crocodylia. It is considered as a flag ship and keystone species of healthy freshwater ecosystems because it plays a crucial role in maintaining the health of riverine ecosystems. This is a large species, with males documented up to 6 m in length, although individuals of this size are now rare. They are easily distinguished from other crocodylians because of their distinctive morphological characteristics, by an elongate and narrow snout with a noticeable bulbous shaped growth termed a "Ghara" (narial excrescence), which is found only on adult males (Fig 1). It inhabits deep pools and gorges situated at the junctions and bends of rivers. Like all crocodylians, the gharial is a very adept swimmer with webbed hind feet and a laterally flattened tail which provide for superior maneuverability proving vital for capturing fish or its preferred prey. As apex predators, they help regulate fish populations, ensuring a balanced aquatic food web. Their presence in rivers indicates high water quality, as they require clean, unpolluted habitats to thrive. Conservation of gharials not only benefits biodiversity but also supports local communities that depend on sustainable fishing and ecotourism. In recent years, wildlife tourism has contributed significantly to the economies of protected areas such as the Chambal National Sanctuary in India and Chitwan National Park in Nepal, highlighting the economic benefits of gharial conservation.

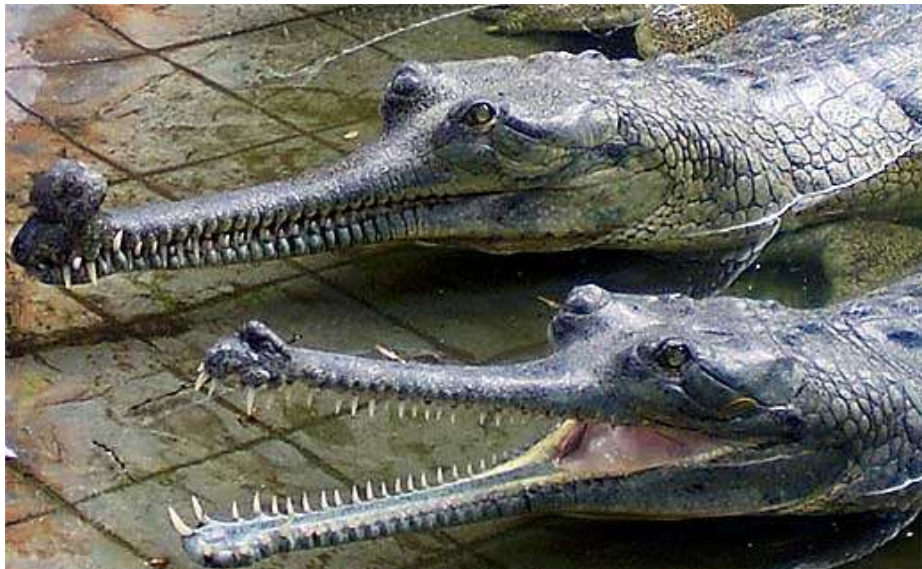


Fig.1 Gharial (*Gavialis gangeticus*)

Population declines and current distribution

Historical estimates suggest that the gharial population ranged between 5,000 to 10,000 in the 1940s. However, by the 1970s, the numbers had declined by over 96-98%, with fewer than 200 remaining in the wild. Currently, the species is one of the most critically endangered crocodylians restricted to a few riverine ecosystems in India and Nepal. The largest remaining populations exist in the Chambal River (India) and the Girwa River (Katarniaghat Wildlife Sanctuary, India), with smaller populations in the Rapti and Narayani Rivers of Nepal.

Indian scenario

India holds the largest gharial population in the world, and within India, the gharial population is restricted to 14 subpopulation units, most of which lie within the Ganga River Basin (Lang et al., 2019). Of these, only four subpopulations are deemed to be breeding populations with annual confirmed evidence of reproduction (Thapaliya et al., 2009). The Chambal River holds the highest number of breeding individuals (~500), followed by the Girwa (~50), Ramganga (~32) and Gandak River (~21) (Sharma et al., 2021; Vashistha et al., 2022).

Habitat Preferences

Gharials prefer deep river channels with high fish availability and sandy riverbanks for basking and nesting. Studies in the Rapti River (Nepal) and Katarniaghat Wildlife Sanctuary (India) highlight the following key habitat characteristics:

- Preferred river width: 51-100 meters
- Preferred mid-river depth: 1-2 meters
- Prefer basking on sandy riverbanks
- Require undisturbed areas with minimal human interference

Major Threats to Gharial Conservation

Once widespread across South Asia, its population has drastically declined due to habitat destruction, pollution, and anthropogenic activities. This article synthesizes findings from various studies to analyze the habitat status, threats, and conservation efforts related to the gharial. Several threats have been identified as critical factors affecting gharial survival:

Habitat Destruction – Dams, embankments, and water diversion have altered river flows, reducing habitat suitability

The loss of suitable habitat has been one of the primary drivers of gharial population decline. Hydrological changes in river systems, mainly due to dam construction and water extraction for agriculture, have led to reduced river flow and loss of deep pools that gharials depend on. Additionally, increased siltation from deforestation and agricultural runoff has altered riverbed conditions, making them less suitable for basking and nesting. In the Rapti and Narayani rivers of Nepal, riverbank erosion and shifting channels have reduced the availability of stable nesting sites, forcing gharials into suboptimal habitats where their reproductive success is compromised.

River pollution– Industrial waste, domestic sewage, and pesticide runoff degrade water quality and reduce prey availability

Industrial waste, domestic sewage, and pesticide runoff contaminate river systems, leading to poor water quality. These pollutants reduce oxygen levels, making it difficult for fish—the primary food source of gharials to thrive. Heavy metal accumulation and toxic chemicals further disrupt aquatic ecosystems, causing long-term health issues in wildlife. The decline in fish populations forces gharials to compete for limited resources, weakening their chances of survival. Without strict pollution control measures, river degradation will continue to threaten gharial conservation efforts.

Overfishing & Poaching– Fishing nets trap and kill gharials, while illegal egg collection reduces hatchling survival.

With increasing human populations along riverbanks, human-wildlife conflict has emerged as a major challenge for gharial conservation. Local communities rely on rivers for fishing, irrigation, and transportation, bringing them into frequent contact with gharials. Accidental entanglement in fishing nets often leads to injuries or fatalities for

both gharials and fishermen. In some cases, gharials are deliberately killed out of fear or to prevent damage to fishing equipment. Furthermore, sand mining along riverbanks, especially in India and Nepal, destroys nesting habitats, making natural reproduction even more difficult.

Riverbank Vegetation Overgrowth – Reduced water flow has led to increased vegetation, obstructing nesting sites.

Reduced water flow, caused by dams and water diversion projects, has led to excessive vegetation growth along riverbanks. This dense vegetation obstructs traditional nesting sites, making it difficult for female gharials to lay eggs. Overgrown plants also alter the river's natural flow, affecting the sandy banks where gharials bask and breed. Additionally, the thick vegetation can provide cover for predators, increasing the risk to hatchlings. Addressing this issue requires maintaining natural river flow and implementing habitat restoration efforts.

Flash Floods & Climate Change– Seasonal floods destroy nesting areas and displace individuals downstream

Seasonal floods, intensified by erratic weather patterns, often wash away nesting sites, destroying eggs and reducing hatchling survival rates. For example, in Chitwan National Park, Nepal, severe flooding in 2017 wiped out a major gharial breeding site, drastically reducing that year's hatchling success. Additionally, strong currents can displace individuals downstream into unsuitable habitats, increasing their vulnerability to predators and human activities. Rising temperatures and unpredictable monsoon patterns further disrupt the gharial's breeding cycle. Addressing these challenges requires proactive river management and climate-resilient conservation strategies.

Conservation Efforts

Various conservation programs have been initiated to restore gharial populations, including:

- Captive Breeding & Reintroduction – Over 5,000 gharials have been released into the wild, with mixed success.
- Protected Areas & River Sanctuaries – Legal protection under the Wildlife Protection Act (1972) in India and the CITES Appendix I listing.
- Artificial Nesting Sites – Habitat restoration, including creating artificial sandbanks, has shown positive results.
- International Cooperation – Cross-border conservation between India and Nepal is essential for habitat connectivity.
- Strengthening Protected Areas: Expanding river sanctuaries and enforcing anti-poaching laws can help safeguard remaining populations.
- Community-Based Conservation: Engaging local communities in conservation efforts, including habitat monitoring and sustainable fishing, is crucial.
- Scientific Research & Monitoring: Regular surveys using GPS tracking and satellite imagery can provide valuable insights into habitat changes and population dynamics.
- Policy and International Collaboration: Strengthening cross-border conservation efforts between India and Nepal can facilitate better riverine ecosystem management.

Current conservation efforts in Chambal, India

The Gharial Rehabilitation Center in Deori currently holds a total of 288 gharials. Earlier this year, gharials were released on Jan 13, followed by 32 gharials and crocodile released at sarsaini Ghat on Jan 19. This brings the total number of gharials released in the Chambal river this year to 78. Around 20 gharials are set to be released soon (The Times of India, 2025).

CONCLUSION

The gharial remains one of the most unique and endangered reptiles in the world. Despite conservation efforts, gharial populations remain critically endangered. Continued habitat protection, pollution control, and sustainable river management are essential to prevent further decline. Without urgent intervention, gharials face the risk of local extinction in many river systems. By protecting river ecosystems, enforcing wildlife laws, and promoting awareness among local communities, the gharial can be saved from extinction. The next decade will be critical in determining the future of this species, requiring coordinated action from governments, conservationists, and the public.

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