

Gharial *Gavialis gangeticus*

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Common Names: Gharial, Indian Gharial, gavial

Range: India, Nepal, Bangladesh (extinct?), Bhutan (extinct), Myanmar (extinct), Pakistan (extinct)

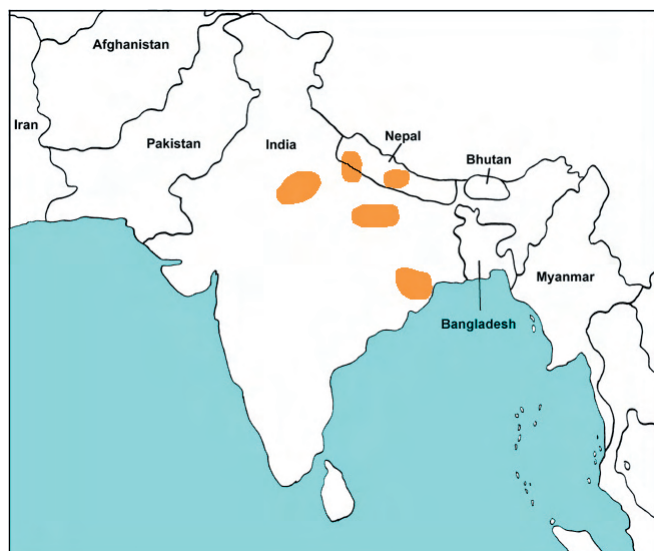


Figure 1. Distribution of *Gavialis gangeticus*.

Conservation Overview

CITES: Appendix I

CSG Action Plan:

Availability of survey data: Inadequate

Need for wild population recovery: Highest

Potential for sustainable management: Low

2009 IUCN Red List: CR (Critically Endangered. Criteria A2bc. C1. A2: population decline $\geq 80\%$ over the last 10 years or 3 generations (whichever is longer); C1: population size estimated at less than 250 breeding adults; IUCN 2009) (last assessed in 2007).

Principal threats: Habitat destruction, pollution, limited distribution, incidental and intentional killing by fishing activities.

Ecology and Natural History

The Gharial is characterised by its extremely long, thin jaws,

regarded as an adaptation to a predominantly fish diet. It is one of the largest of the living crocodilians (males up to 6 m, and average weight of around 160 kg). The species is the only member of the Family Gavialidae, although recent molecular evidence suggests that *Tomistoma schlegelii* also belongs to this family (Densmore 1983; Willis *et al.* 2007). The Gharial is arguably the most thoroughly aquatic of the extant crocodilians, and adults apparently do not have the ability to walk in a semi-upright stance as other crocodilians do (Bustard and Singh 1978; Whitaker and Basu 1983). Adult males grow a bulbous nasal appendage, which resembles an Indian pot called a 'ghara', from which the species derives its name.



Figure 2. *Gavialis gangeticus*, featuring the distinctive 'ghara' of adult males. Photograph: Grahame Webb.

Historically, *G. gangeticus* was found in the northern part of the Indian subcontinent, in the Indus (Pakistan), Ganges (India and Nepal), Mahanadi (India) and Brahmaputra (Bangladesh, India and Bhutan) River systems. The presence of the species in the Irrawaddy River system in Myanmar has also been reported (Smith 1931).

The Gharial is typically a resident of flowing rivers with deep pools that have high sand banks and good fish stocks (Whitaker and Basu 1983; GCA 2008). Exposed sand banks are used for nesting. Although the function of the 'ghara' is not well understood, it is apparently used as a visual sex indicator, as a sound resonator, or for bubbling or other associated sexual behaviours (Martin and Bellairs 1977).

The Gharial appears to be primarily a fish-eating species, but very large individuals are reported to eat other prey. Females reach sexual maturity at around 3 m total length. Nesting occurs during the annual dry season in hole nests excavated in river sand banks (Whitaker and Basu 1983). Clutch size is 30-50 eggs, and the eggs are the largest of any crocodilian (average 160 g). Unlike most other crocodilians that carry their young in their mouths from the nest, the Gharial does not appear to do this because of the unusual morphology of its jaws (Singh and Bustard 1977). However, post-natal maternal care has been observed.



Figure 3. Gharial hatchlings in the Girwa River, Katarniaghat Wildlife Sanctuary, India (June 2007). Photograph: Suresh Chaudhari, Lucknow, UP, India.



Figure 4. Adult male *G. gangeticus*. Photograph: Jeff Lang.

Conservation and Status

The Gharial is one of the most endangered of all crocodilians, and the most endangered large animal on the Indian subcontinent (GCA 2008). It is currently estimated that there are <200 breeding adult *G. gangeticus* in the wild. This represents a decline in the population of over 80% since the 1940s (a time-span equating to roughly 3 generations), and qualified it for Critically Endangered (CR) listing on the IUCN Red List (Choudhury *et al.* 2007).

During the 1970s and 1980s *G. gangeticus* was supported by

conservation programs that were based on head-starting, with animals being released once large enough to secure a better chance of survival (normally over 1 m total length). Initial indications were that these releases successfully built the population within India and Nepal. From low of <200 Gharial worldwide in 1974, surveys in 1997/98 in India and Nepal indicated total numbers had increased to around 1675 (ENVIS 1999), of which 436 were adults (Anon 2006). However, surveys in 2006 showed that the population had dropped to <200 breeding adults and the total population was estimated as approximately 834 (Andrews 2006; data collected by R.K. Sharma 2005, 2006; Boullard and Cadi 2005; L.A.K. Singh. pers. comm.; Tirtha Maskey, pers. comm.).

Surveys in the 1970s revealed breeding populations only in the Chambal, Katarniaghat, and Chitwan. Post-restocking, the Ramganga and Son Rivers have confirmed breeding populations. Restocking has generally failed to establish viable Gharial populations in any new locations.

The drastic reduction in Gharial numbers over a 60-year period is attributed to a number of factors; habitat alteration/destruction, hunting for skins, killing by fishermen, killing for medicinal uses, egg collection, and accidental drowning in fishing nets. Human influences on riverine habitat are a major threat to the Gharial, with sand-mining, agriculture, irrigation channels, dams, barrages, modifications to river course all combining to create an irreversible loss of Gharial habitat (IUCN 2009).

Bangladesh: A review of crocodiles in Bangladesh (Cox and Rahman 1994) suggested that although small numbers of the species continued to be reported into the 1980s it may no longer be found in the wild. Known nesting areas that had supported up to 12 nests as late as 1985, have recorded no nesting since 1990. The species is heavily impacted by fishing activities and habitat degradation. A part of the distribution on the Padma River is periodically moved into Indian jurisdiction as the river channel changes during floods. Stray individuals are reported occasionally, however, surveys are needed to prove whether there is a breeding population of Gharial in Bangladesh.

Bhutan: The Gharial is believed to be extinct.

India: The Chambal River has by far the largest subpopulation of breeding Gharial in the wild, with around 48% of the total population (IUCN 2008). In 2007, 77 nests were found within the Chambal Sanctuary while 24 were found in Katarniaghat Wildlife Sanctuary (Rao 2007). In 2006, 2007 and 2008 two nests were located in the Son River Sanctuary (Andrews 2006; R.K. Sharma pers. comm.). Recent reports confirm that stray animals may persist in the upper Brahmaputra River.

A cause for concern was the drastic decline of *G. gangeticus* in the Chambal during winter of 2007-2008. A toxin is suspected, and the resulting deaths of over 100 Gharial, including around 60% of the sub-adults as well as some adult females in the lower Chambal, represents a significant loss. Evidence points toward pollution as the main cause for this

event, and is yet another indication that India's rivers are dying (GCA 2008). Most of the country's rivers are no longer capable of supporting their once-abundant wildlife, with only fragments of suitable habitat remaining (GCA 2008; IUCN 2009).



Figure 5. International and local Indian veterinarians prepare to autopsy one of >100 gharial that died in the Chambal during the winter of 2007/08 (see Whitaker *et al.* 2008). Photograph: Rom Whitaker.

Nepal: Six nests were counted in 2006 in the Chitwan National Park (16 nests were recorded there in 1977) and the total number of mature *G. gangeticus* in the country is estimated at 35 animals (IUCN 2009). Around 300 animals were released in Chitwan, so again, reintroduction has not worked, although perhaps this supplementation has helped avert total extinction (GCA 2008).

Pakistan: Reports of Gharial in the Sindh region were persistent (Ahmad 1990; Chaudhry 1993), and there is a possibility that only one or two individuals remain. During extensive surveys undertaken by WWF-Pakistan under the "Indus for All Programme and Pakistan Wetlands Programme" in 2008 and 2009, there was no indication of the presence of Gharial. The species is considered virtually extinct in Pakistan.

Myanmar: Historic reports of Gharial have not been verified for many years.

After the 17th CSG meeting (Darwin, 2004), a task force was established to focus on the Gharial and ensure that effective conservation plans were established, and more importantly, that actions were carried out based on these plans. Since 2006 the Gharial Conservation Alliance (GCA; www.gharials.org) has established a good presence within the current *G. gangeticus* Range States. In June 2009, the GCA convened a Gharial Pre-Species Recovery Planning Workshop, in which the CSG participated (Webb 2009), and from which a first draft of a Gharial Species Recovery Plan was developed (GCA, pers. comm.). GCA also facilitated a radio-telemetry study on Gharial movement in the area affected by the 2007-2008 winter die-off. GCA/CSG personnel also confirmed the presence of a fourth breeding population in India: the Ramganga River, Corbett Tiger Reserve, Uttarakhand State.



Figure 6. *Gavialis gangeticus*. Photograph: Jeff Lang.

Priority Projects

High priority

1. **Protection of suitable habitats (India):** All protected areas that harbour gharial (Chambal, Katarniaghat, Corbett, Ken and Son River) require effective protection from illegal activities that threaten all wildlife, and Gharial in particular, by improving enforcement programs. Habitats contiguous with established Protected Areas (such as the Ghagra below Katarniaghat Wildlife Sanctuary and the Yamuna below the National Chambal Sanctuary) need to be included wherever possible in management zones, as these areas are also important for long-term survival of the species, and to increase Gharial habitat. Downriver migration of Gharial is a well-established behaviour.

Considering the critical importance of the Chambal for the future of Gharial, proposals to upgrade its status to a National Park and World Heritage Site need to be pursued. This would allow increased budgetary allocations from the Central Government as well as provide more rigorous protection and raise media and public awareness.

The Central and State Governments need to maintain the integrity of river ecosystems so they continue to harbor aquatic fauna. This includes controlling the pollution of rivers by industry, development of infrastructure, and river fishing.

2. **Monitoring existing populations (India):** A program of continuous monitoring of known Gharial populations is essential. Given the critical status of the species, it simply cannot afford to have any of these populations face a rapid decline without immediate efforts to identify and eliminate the cause. The 2007/2008 die-off of 113 sub-adult and adult Gharial along the Chambal from what has been identified as a nephrotoxin(s) (Whitaker *et al.* 2008) serves as a harsh warning. Nesting and basking sites should be identified and mapped; census techniques need to be refined so that they are scientifically credible.

3. **Identification and minimisation of negative anthropogenic influences (India):** This wide-ranging action needs to include all the stakeholders such as the Ministry of Irrigation and Water Resources, river development, local fishing methods, sand mining and general human/livestock disturbances of Gharial habitats. These activities that negatively impact the entire riverine ecosystems need to be identified, pinpointed and mapped.

4. **Ensure that conservation programs involve local people (India):** Major threats to Gharial include accidental drowning in fishing nets, and often, animals found entangled are intentionally killed or de-beaked by fishermen. In some areas, collecting Gharial eggs for local consumption is also a threat. A comprehensive program for involving local people in the conservation of Gharial is vital to ensure long-term and continuing success of any management program. This plan must include educational materials, signs, and instill pride amongst the locals in having such a rare crocodile in their rivers.

Zoos need to play a bigger role in lobbying for public sympathy. GCA has begun work on this. Most importantly, alternate livelihoods are needed for the very poor river dwellers so dependent on local resources. Social welfare programs instituted by the various Government and NGOs need to be implemented in these areas so that the pressure on natural resources may be minimized.

Ecotourism has the potential to bring additional income to the local population which may shift their current antagonism to sympathy for the Gharial.

5. **Research (India):** Research, encouraged by the Ministry of Environment and Forests and State Wildlife Authorities, needs to address key management issues such as the Gharial's role in the ecosystem, fish ecology, relationship between Gharial and Mugger (*Crocodylus palustris*), establish minimum water flow needed for the survival of Gharial and other river fauna as well as investigate the genetic relationship of remnant populations. Socio-economic studies are also needed to better understand the impact of local anthropogenic pressures on the habitat. This is essential in order to draft realistic management plans.

6. **Protection, monitoring and research of current populations and habitat (Nepal):** Existing National Parks with Gharial populations (Chitwan and Bardia) need protection against illegal activities. Current population needs to be monitored annually. Rivers such as the Karnali, Babai and Koshi need to be surveyed. Research programs, encouraged by the Department of Wildlife and National Parks to understand gharial seasonal movement, home ranges and habitat requirements, plus hydrological and ichthyological studies are urgently needed.

7. **Education and alternate livelihoods (Nepal):** Essential, as with all conservation on the subcontinent to have the

river people on the side of gharial conservation as they will ultimately decide the future prospects of endangered species, not the authorities or conservationists.

8. **Development of international coordination for Gharial management and conservation between India and Nepal:** Gharial populations occupy rivers that run between India and Nepal. Independent conservation programs are in effect in each country. Coordinated management of these shared populations would enhance conservation effectiveness. Joint surveys, training, comparison of population trends and coordinated regulations and protection.

Moderate priority

9. **Survey of status and distribution in Pakistan, Bhutan, Myanmar and Bangladesh:** The Indus River, Sutlej River and Nara Canal (Pakistan), Bado, Manas, Sunkosh, Toroa, Raidak Puna and Tsongchu (Bhutan), Irrawaddy and Kaladan (Myanmar), and Padma and Jamuna (Bangladesh) need to be surveyed. Depending on the results of these surveys, actions may need to be taken to ensure conservation of the species (eg setting aside sections of river for crocodile sanctuaries as a first step towards restocking).

10. **Expansion of restocking program in Nepal:** The vast majority of the releases of Gharial in Nepal have been into the Narayani River system. Additional sites in eastern and western Nepal are known and need to be included in the restocking program along with requisite management and protection.

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