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Gangetic Gharial (*Gavialis gangeticus*) situation in the world, population and conservation measures in Nepal.

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Introduction

The Gangetic gharial (*Gavialis gangeticus*) is the rarest crocodile in the world. Living in fresh water, Strictly fish-eater, this animal is also the crocodile which spend the most important part of its life in the water.

Gharial population are studied in Nepal since more than 30 years and two gharial breeding centers already exists in two National Park of Nepal (Bardia and Chitwan National Park). Gharial release have been organized nearly every year since more than 25 years and more than 700 young gharials has been released in many rivers of Nepal. Despite all these works, gharial population is still stable and very low – 81 gharials were counted in the whole country in 2008.

That's why a long term conservation program is setting up in 2009 by WWF-Nepal in collaboration with Awely – French NGO working on wildlife conservation - NTNC (National Trust for Nature Conservation) and DNPWC (Department of Nature Protection and Wildlife Conservation).



Illustration 1: Gharial eye, Kasara breeding centre, Nepal. Author: Renan Aufray

1. Gharial population history and actual population

1.1. Gharial morphology and ecology

The Gharial (*Gavialis gangeticus*) is the only surviving member the gavialidae family (Maskey, 1989).

It lives in deep fast-flowing rivers (Shah and Tiwari, 2004) and eat only fishes. Gharial habitat is fresh water and sand banks. Gharials spend most of their time in the water where they find all their food, and they use the sand banks to bask and make nests. Any modification of either of these habitat is extremely dangerous for the gharial survival rate. Gharial use to return every day on the same place to bask; this behavior facilitate poaching.

Its long snout is the most impressive characteristic of this animal; it permit this animal to hold struggling preys as fishes (CSG, 2000) and to swim and move under water with a very low water resistance. This snout is terminated for the mature males by a large protuberance similar to a *ghara*, a traditional pot in India and Nepal. It seems that the *ghara* is the origin of the name gharial.

Maturity appears after 13 years for the males and 16 years for the females when the individuals are about 3 meters long (Maskey and Mishra, 1981; Bustard, 1984; Singh, 1999; Whitaker, 1987). A male have a harem and will mate with all the females of this. The mating period happens for two months between November and January; nests takes place between March and May (Whitaker, 1983) in hole digging on sand banks along the river (Whitaker and Basu, 1983; Groombridge, 1987; Bustard, 1980).

In a breeding center, gharials live about 50 years old, comparing to 100 years in the wild (Whitaker and Basu, 1983; Singh, 1999). Breeding females may lay from 14 to 62 eggs in one clutch (Maskey, 1989). In the wild, the survival rate of young hatchings is not more than one percent (Singh, 1978; Murthy and Menon, 1977; Roy *et al.*, 1982).

1.2. Gharial distribution in the world

Gharial was previously present in all the gangetic plain in several countries of South-East Asia – Pakistan, Bhutan, Myanmar (ex-Burma), India, Nepal and Bangladesh. In the 1940's, gharial population was estimated from 5000 to 10000 individuals. It declined to 150-200 individuals in the 1960's principally due to habitat destruction and uncontrolled exploitation. It's now only present in India and Nepal, about 2000 individuals in India and 81 in Nepal.

1.3. Gharial conservation in the world

The first consideration on gharial was edited by the crocodile specialist group in march 1971 which expressed a major concern on this animal (Das, 1981). India and Nepal listed the gharial on their protected species list. At the same period, India built a breeding center with the help of FAO and UNDP. Since this date, about 3000 young gharials were released in 12 different rivers; the major released program was done in Chambal river (India) where 1718 individuals were release during the period 1979-1993 (Ross, 1998).

Gharial conservation began in 1971 in Nepal with the help of the Frankfurt Zoological Society. It consist on population reintroduction by egg collect, gharial breeding and juvenile release. Until now, nearly 700 individuals were released in 4 different rivers of Nepal (Andrews and Mc Achnar, 1994; DNPWC, 2005).

1.4. Gharial status

Gharial was placed on the first Appendix of the CITES list as an endangered specie but the huge habitat loss and the great decrease of gharial population in its whole distribution change this status in 2007. Gharial is now listed as an Extremely Endangered specie in the UICN Red List.

2. Actual situation in Nepal

2.1. Evolution of the population in Nepal

2.1.1. Gharial population

Gharial studies and monitorings were occurred in Nepal since 1989 by the DNPWC with the help of NGO's and other stakeholders (Maskey, 1989; Maskey, 1998; Mishra, 2002; Ballouard and Cadi, 2005 and Pandit, 2007) .

In 1998, Maskey estimated the gharial population to 55 wild gharials and 50 released ones in Narayani, Kali Gandaki Gandaki, Karnali and Babai river systems.

Mishra in 2002, recorded 12 individuals in Chitwan National Park and estimated a minimum of 50 gharials in the Narayani rivers due to National Park staff observations. In Bardia National Park, 8 individuals were observed in Karnali and Babai rivers and 28 other ones were observed by the population along the river (Mishra, 2002) .

Ballouard *et al.* (2005) made different monitorings in 2003, 2004 and 2005 in Chitwan National Park. The result was respectively of 38 gharials in 2003, 34 in 2004 and 49 in 2005.

In 2007, Pandit observed 19 gharials in Shikaruli – Amaltari and Amaltari – Triveni sections of the Narayani river and 20 gharials in Sunachuri – Kasara and Kasara – Rapti Narayani confluence sections of Rapti river .

In 2008, a monitoring realized by the DNPWC on all the Nepalese river system showed that 81 gharial were living in the whole country (Kadkha *et al.*, 2008).



*Illustration 2: Young gharial in the water, Daumaria Post, Nepal.
Author: Renan Aufray*

2.1.2. Sex-ratio

The sex-ratio never stopped to change with the time. It was estimated to 1 male for 6 females in 1984, it increase to 1:9 in 1987 and 1:10 in 1997. This evolution is certainly due to the decrease of poaching for these years (Maskey, 1998). Poaching is principally aimed on male, the *ghara* is traditionally known to have some magical virtues.

2.1.3. Threats

We have seen that despite of all the conservation actions, gharial population in Nepal is staying at a critically low level. Threats are not completely identified but some are known. We don't know actually which is proportion of each threat in the gharial population decrease.

Poaching: it has been clearly identified by Maskey in 1998 and the last observations show that poaching still exist in Nepal. If before it was mainly aimed on males, it not seems that this differentiation is opened by now.

Pollution: Different companies took place all along the Nepalese rivers. For instance, no threat for gharial were clearly identified but some mark of pollution were observed on the different rivers: foam, dead fishes, health problem after drinking it. The big increase of the Terai population these last years and the large direct use of the river water by this population are two factor which should urge the concerned institution to keep a close eye on the water quality.

Dams: Nepal is a large tank of water. The major part of this water goes to India and irrigate a quart of the country. Huge dams has been built between Nepal and India to increase the power production for these two countries. Dams allow gharials to go in India following the stream, but once in the Indian side, they can't go back in Nepal. During the monsoon season, the huge stream bring a large number of gharial to India. Thus, it's impossible for them to return to their original home, decreasing the Nepalese population.

Nets: Terai rivers are traditionally used by local population for finding their food. These fishermen used to use harmless nets for gharials. These last years, nylon net appears in the villages. These nets

are cheap and easy to use. The problem is that these nets are left in the river without any survey. When gharial are caught in the net, they are not able to escape due to their weak muscles for opening the snout. A caught gharial is unable to open its mouth and to catch fishes. Some death due to these nets have been observed and in 2006, one of the three mature males of the Chitwan National Park has been found, dead of hunger and a net around its snout. It show that this problem is not to be underestimated.

2.2. Conservation program

Since more than 10 years, DNPWC, NTNC and WWF Nepal work on gharial conservation with the help of NGO's and other stakeholders. Two breeding centers have been built in Chitwan National Park and Bardia National Park.

Many studies and survey have been conducted principally by the Dr. Maskey who worked all his life on this specie and whose death in 2007 with 20 other wildlife conservators in an helicopter crash was a human tragedy and a tragedy for gharial conservation.

For the gharials monitorings results, see 2.1.1..

Many gharial release were organized since 1981 in different rivers of Nepal. Eggs are caught by DNPWC staff and other volunteers to be kept in the breeding centers. Gharials are bred during 5 to 8 years and are released in the wild. Some of them are equipped with emitters for studying their preferential habitats, determinate the causes of their decrease and to know what is the becoming of the released gharials.



Illustration 3: Chitwan National Park staff working with the receptor used for gharial monitoring, Kasara breeding center, Nepal. Author: Renan Aufray

The Gharial Multi-Task Force was created in Montpellier in 2004 to coordinate the conservation actions on gharials.

A long term conservation plan has also been written to ensure a sustainable population of gharial in Nepal. This conservation plan, written by a volunteer from SOS Crocodile - a French NGO - and the WWF Nepal in 2007. This conservation plan was updated in 2009 by an other volunteer from Awely – a French NGO – and the WWF Nepal and was submitted to the World Bank. This conservation program includes scientific studies, ex-situ conservation actions, the integration of favorable measures for gharial habitat in freshwater management and the increase of the local and international awareness. In the same time, an other program is being setting up by Awely and the NTNC to build a fish farm near the Kasara breeding center. This fish farm would provide fishes for the fishermen who lives around and to the gharial bred in Kasara. These live fishes will increase the protein part of the food for the fishermen and they will also increase the live rate of the bred gharials.

3. Annexes

3.1. Map of the different describable arase.

Dessin 1: Gharial habitat in Nepal. Source : IUCN - Nepal, 1993

3.2. Bibliographe

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3.3. Table: Monitoring results since 1981

Illustration 4: Number of released gharial in different rivers of Nepal. Source : DNPWC, 2008 modified

| S.N. | Release year | Narayani | Rapti | Kali Gandaki Gandaki | Sapta Koshi | Karnali | Babai | Total |
|--------------|--------------|----------|-------|----------------------|-------------|---------|-------|------------|
| 1 | 1981 | 50 | 0 | 0 | 0 | 0 | 0 | 50 |
| 2 | 1982 | 50 | 0 | 0 | 0 | 0 | 0 | 50 |
| 3 | 1983 | 25 | 0 | 35 | 42 | 0 | 0 | 102 |
| 4 | 1984 | 15 | 0 | 0 | 0 | 0 | 0 | 15 |
| 5 | 1985 | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 6 | 1986 | 0 | 0 | 0 | 43 | 0 | 0 | 43 |
| 7 | 1987 | 43 | 0 | 0 | 0 | 0 | 0 | 43 |
| 8 | 1988 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 1989 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 1990 | 20 | 0 | 0 | 0 | 0 | 30 | 55 |
| 11 | 1991 | 0 | 0 | 0 | 0 | 0 | 20 | 20 |
| 12 | 1992 | 38 | 0 | 0 | 0 | 20 | 0 | 58 |
| 13 | 1993 | 5 | 0 | 0 | 0 | 0 | 0 | 5 |
| 14 | 1994 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 1995 | 27 | 0 | 0 | 0 | 3 | 0 | 30 |
| 16 | 1996 | 19 | 0 | 0 | 0 | 0 | 0 | 19 |
| 17 | 1997 | 10 | 0 | 0 | 0 | 0 | 0 | 10 |
| 18 | 1998 | 15 | 5 | 0 | 0 | 0 | 0 | 20 |
| 19 | 1999 | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 20 | 2000 | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 21 | 2001 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 2002 | 10 | 0 | 0 | 0 | 0 | 0 | 10 |
| 23 | 2003 | 36 | 0 | 0 | 0 | 0 | 0 | 36 |
| 24 | 2004 | 0 | 20 | 0 | 0 | 0 | 0 | 20 |
| 25 | 2005 | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 26 | 2006 | 0 | 20 | 0 | 0 | 0 | 0 | 20 |
| 27 | 2007 | 24 | 32 | 0 | 0 | 0 | 0 | 56 |
| 28 | 2008 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 29 | 2009 | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| Total | | 399 | 113 | 35 | 85 | 23 | 50 | 705 |

3.4. Abbreviations

DNPWC : Department of National Parks and Nature Conservation. The national department of national parks in Nepal

NTNC : National Trust for Nature Conservation. An old Nepalese NGO working on wildlife conservation in Nepal.

WWF : World Wide Fund for nature

3.5. Contacts for gharial conservation in Nepal

See attached Excel file : Contacts gharial Nepal.xls