

# **GHARIAL RECOVERY ACTION PLAN**



**The Gharial Multi-Task Force 2006**

<b>ABOUT THE GHARIAL MULTI-TASK FORCE .....</b>	<b>3</b>
<b>INTRODUCTION .....</b>	<b>4</b>
<b>A. SUMMARY .....</b>	<b>6</b>
<b>B. CURRENT AND PAST DISTRIBUTION .....</b>	<b>6</b>
<b>C. HABITAT .....</b>	<b>6</b>
<b>D. THREATS .....</b>	<b>6</b>
INDIA: .....	6
NEPAL (CHITWAN NATIONAL PARK): .....	7
<b>E. STATUS .....</b>	<b>7</b>
<b>F. PRIORITY GEOGRAPHIC AREAS FOR CONSERVATION.....</b>	<b>8</b>
PRIMARY (KNOWN GHARIAL BREEDING POPULATIONS) .....	8
SECONDARY (KNOWN HISTORICAL HABITATS WITH OR WITHOUT REMNANT GHARIAL POPULATIONS) .....	8
<b>G. PRIORITY ACTIONS.....</b>	<b>8</b>
<b>H. PRIORITY AREAS FOR MANAGEMENT .....</b>	<b>9</b>
<b>I. PRIORITY AREAS OF RESEARCH .....</b>	<b>9</b>
SURVEYS/MONITORING .....	9
<i>India:</i> .....	9
<i>Other gharial range countries:</i> .....	10
OTHER RESEARCH .....	10
<b>K. IN SITU AND EX SITU CONSERVATION APPROACHES .....</b>	<b>12</b>
<b>L. GMTF INPUTS TO GHARIAL MANAGEMENT PLANS AND CONSERVATION ACTIVITIES .....</b>	<b>12</b>
INDIA .....	12
OTHER RANGE COUNTRIES .....	13
<b>M. RESPONSIBILITIES OF GOVERNMENT/FOREST DEPARTMENTS.....</b>	<b>14</b>
<b>N. STATE GOVERNMENT’S ROLE .....</b>	<b>15</b>
<b>O. CENTRAL GOVERNMENT’S ROLE AND ADVOCACY/LOBBYING .....</b>	<b>15</b>
<b>P. ROLE OF RESEARCH INSTITUTES/NGOS.....</b>	<b>15</b>
<b>Q. COMMUNITY INVOLVEMENT .....</b>	<b>15</b>
RIPARIAN PEOPLE AND GHARIAL CONSERVATION .....	15
<b>R. EDUCATION/PUBLICITY/AWARENESS.....</b>	<b>16</b>
<b>S. REFERENCES.....</b>	<b>17</b>

## **About the Gharial Multi-Task Force**

At the 17<sup>th</sup> Working Meeting of the IUCN/SSC Crocodile Specialist Group in Darwin, Australia in 2004, a report from India by R.K. Sharma and D. Basu showed that the gharial (*Gavialis gangeticus*) was in a state of rapid decline and that urgent action was needed. In response several CSG members got together to form a task force, now named Gharial Multi-Task Force (GMTF). At that time the statement of purpose and objectives was prepared and circulated by the Task Force Co-Chairman, Nikhil Whitaker and the registration and groundwork for a gharial website (<http://gavialis.org>) was done by Akira Matsuda.

At the 18<sup>th</sup> CSG Working Meeting in France GMTF members organized a Gharial Crisis Workshop to discuss the gharial situation and to plan future action by the Gharial Multi-Task Force.

### **GMTF (India) Core Group Members:**

B. C. Choudhury	Lala A. K. Singh
Dhruvajyoti Basu	Nikhil Whitaker
Goutam Narayan	Raj Gupta
Harry V. Andrews	R.K. Sharma
Rom Whitaker	

## Introduction

The recent resurgence of concern for the gharial's survival at the June, 2006 Crocodile Specialist Group meeting in France was unusually delayed, as the gharial population reversal was reported in 2004. The synergy of a forum such as this and that of field authorities who carry out the day to day gharial conservation activities has been near non-existent so far; a situation which clearly has to change if the gharial is to receive even a 50:50 chance of survival.

The gharial still faces a high probability of extinction as we have witnessed in range countries such as Pakistan, Bhutan, Myanmar and probably Bangladesh (sightings there are probably migrants from India). Apart from a period in the early phases of Project Crocodile, when population increases from supplementation created the false impression in some quarters that its survival had been secured, the status of gharial will perhaps forever swing between Critically Endangered and 'Conservation Dependent', a point that is not being elaborated here but any assertion that conservation action can ensure the species survival in the wild except as relict populations, in the face of the growing human pressures, is debatable. These arguments should not however detract from the need to continue doing everything possible to conserve gharial along with the other biodiversity of our rivers.

The gharial, in spite of high fecundity and a massive egg collection/head-starting/release programme (12,000+ eggs collected, 5,000+ young gharial released) is faring much worse than the tiger. Compared to the many reserves that have been set aside for the tiger, breeding populations of the gharial survive in only three reserves in India, namely, Katarniaghat, Chambal and the Son, and one in Nepal at Chitwan. It may be noted that recovery of populations in all these areas occurred by enhancing a remnant population of adults and nowhere was a population successfully established through reintroductions.

The failure of reintroduction attempts in the Mahanadi River at Satkoshia Gorge, Orissa (2 remaining out of over 700 released), only confirms the difficulty of this proposition. The likelihood of locating new conservation reserves for the gharial by habitat assessment can only be viewed as a long term strategy with equal chances of success or failure. For example, the Son river seems of minimal value for a gharial conservation area with just a few, small viable areas of habitat separated by long stretches of rocky tracts totally uninhabitable by gharial.

The causes of the complete extirpation of gharial in the Brahmaputra system in Northeast India have not gone away, so even if suitable habitat is identified for reintroductions there is little likelihood of survival without mitigating the negative anthropogenic influences. The Chambal River still represents the most viable reserve for the gharial in India.

Little can be done for the gharial until our respective Governments recognize the gharial problem as part of a larger malaise affecting all our rivers and show the will to resolve it effectively. Those spearheading the attempt to save the gharial and other riverine fauna

(and the rivers themselves!) in the gharial range countries, would do better to spend much more time in the corridors of power in their respective capitol cities using advocacy and lobbying to educate the people at the helm of affairs. Unfortunately, today's political scenario is quite different from what it was in the past and recently even the tiger disappeared completely from a well known reserve in India. In this highly deteriorated conservation scenario, instilling political will is going to be much, much harder. Actions need to be prioritized and an all out effort needs to be taken by all of us to make sure the GRAP recommendations are actually implemented at the local and Central Government levels.

D. Basu  
Gharial Surveyor, Uttar Pradesh Forest Dept.

## **A. Summary**

**Order Crocodylia**  
**Family Gavialidae**  
*Gavialis gangeticus*, (Gmelin, 1789)  
**Gharial**

At present there are an estimated 200 breeding adult gharial left in the wild. There are three places in India where a total of 88 nests were recorded and one location in Nepal where 6 nests were recorded in 2006. It is extinct in Pakistan, Bhutan, Myanmar and probably Bangladesh. The gharial is now, unenviably, the most endangered large animal on the Subcontinent. Its link to and dependence on the integrity and health of large rivers is one primary reason for the proposal for uplisting the gharial to Critically Endangered status and tells us loud and clear: our rivers are dying. Most of India's rivers are no longer able to support populations of gharial, river dolphins, otters and other major river fauna and the few suitable habitats left are mere fragments. Working energetically in collaboration with agencies and individuals equally concerned about the plight of the rivers and its unique and valuable biodiversity, the GMTF is cautiously optimistic that a difference can be made and the gharial will recover.

## **B. Current and Past distribution**

Current Range:

India, Nepal (Ganges and Mahanadi River basins)

Past Range:

Pakistan (Indus River--presumed extinct)

Bhutan (low elevation Brahmaputra river drainage--presumed extinct),

Bangladesh (Ganges and Brahmaputra River basins--presumed extinct)

Myanmar (Irrawaddy and Kaladan Rivers--extinct)

## **C. Habitat**

Gharial habitat consists of deep pools of flowing rivers characterized by high sand banks and healthy stocks of fish. Survival in reservoirs needs to be ascertained as a possible way to ensure long term survival as rivers become increasingly inhospitable.

## **D. Threats**

**India:**

1. Dams and irrigation projects changing river courses and drastically reducing river flow during the dry season as well as increased river flow during monsoonal flooding due to deforestation.

2. Illegal fishing in Protected Areas, retaliatory killing by fishermen, entanglement in hooks and nets, drowning, de-beaking and beheading of gharial caught in nets.
3. Already marginal habitats are rapidly becoming uninhabitable for gharial due to barrages, dams, canals, siltation, sand mining, water removal for agriculture, riverbed cultivation, livestock and human disturbance at basking and nesting beaches (over 80% habitat loss already likely).
4. Other conservation problems include poverty-driven dependency on biomass resources, development activity (including 428 small, medium and large irrigation projects on the anvil for the Chambal River Basin alone), irregular water releases from dams, grazing by feral cattle in the PAs, mining, riverine agriculture, ravine formation (erosion) and increasing pollution from industry, sewage, pesticides and fertilizers.

**Nepal (Chitwan National Park):**

1. Reduced habitat and food resources due to increased demographic pressure and the creation of irrigation canals at the south end of Chitwan Park.
2. Pollution coming from the two beer and paper factories which dump waste into the Narayani River at the north end of the Park.
3. Disturbances causing stress and disruption in basking activity. A site can have as many as 51 disturbances per day (fishermen and tourists) during optimal basking period.
4. Deaths caused directly by fishing nets, which are unquantified but significant especially for young gharial.
5. Collection of gharial eggs for consumption by tribal people and use of gharial in traditional medicine.
6. The dam in the south of the park, which has changed the river course, is responsible for the scarcity of fish and the flooding of egg-laying sites during the high water period.

**E. Status**

The species is in the Endangered category of the IUCN Red Data Listing and data has just been submitted by the Gharial Multi-Task Force to the IUCN/SSC Crocodile Specialist Group to support relisting of the species to Critically Endangered, with less than 200 breeding adults in the wild.

Today three widely separated breeding subpopulations are left in India, Chambal river--68 nests in 2006, Girwa river--18 nests in 2006 and Son river--2 nests in 2006 and one breeding subpopulation in Nepal, Rapti/Narayani river—6 nests in 2006.

CITES: Appendix I

India: Schedule I of Wildlife Protection Act (1972)

Nepal: Wildlife Protection Act

Bangladesh: Wildlife Preservation Law

Pakistan: Schedule III of Punjab Wildlife Act (1974), Schedule III of Sindh Wildlife Protection Ordinance

Availability of Survey Data – Adequate  
Need for Wild Population Recovery – Highest  
Potential for Sustainable Management – Medium

## **F. Priority Geographic Areas for Conservation (in order of size/importance of breeding populations and potential)**

### **Primary (known gharial breeding populations)**

1. Chambal River—National Chambal Sanctuary (tri-state: Uttar Pradesh, Madhya Pradesh and Rajasthan), India
2. Girwa River—Katarniaghat Wildlife Sanctuary (Uttar Pradesh), India
3. Rapti-Nayarani River—Chitwan National Park, Nepal
4. Son River—Son River Sanctuary, (Madhya Pradesh), India
5. Karnali, Babai Rivers—Bardia National Park, Nepal

### **Secondary (known historical habitats with or without remnant gharial populations)**

1. Ken River—Ken River Gharial Sanctuary (Madhya Pradesh), India
2. Ramganga River—Corbett National Park (Uttaranchal), India
3. Brahmaputra River--Kaziranga, Dibru-Saikhowa, Orang and Burhachapori in Assam and D'Ering in Arunachal Pradesh
4. Manas River—Manas National Park (Assam), India
5. Manas River—Manas National Park, Bhutan
6. Mahanadi River—Satkoshia Wildlife Sanctuary and associated rivers (Orissa), India
7. Padma (Ganges) River—Rajshahi District, Bangladesh
8. Indus River System—Sutlej, Ravi and Nara Canal—Pakistan
9. Bado, Sunkosh, Toroa, Raidak Puna and Tsongchu rivers in Bhutan.

## **G. Priority Actions**

1. Protection for all habitats that either contain gharial or remain viable as potential gharial habitat based on surveys/assessments.
2. Identification and minimization of negative anthropogenic influences including everything from Irrigation and Water Resources Ministry river development plans to local fishing methods, sand mining and general human/livestock disturbance in gharial habitats.
3. Drafting and implementing Management Plans for all gharial Protected Areas.
4. Identification of suitable habitats for reintroduction, creation of protected areas for gharial and accelerated protection and conservation measures in all range countries.
5. International collaboration among gharial range countries for the conservation of existing populations and re-establishment where the gharial has gone extinct.

6. Follow-ups to increase efficiency at breeding/rearing facilities and reinforcement of the captive population.

#### **7. Awareness-building and fundraising.**

### **H. Priority areas for management**

All river stretches (above and below) immediately outside the main Protected Areas containing gharial need management protocols and enforcement because of the propensity of gharial to migrate up and down river and to being washed down river during the monsoon flood period. This includes research on threats and solutions, education/awareness, fishing method modification where needed and community involvement/uplift/alternative employment.

### **I. Priority Areas of Research**

#### **Surveys/monitoring**

##### ***India:***

1. A clear and concise brochure on census techniques and value should be prepared for census takers.
2. Annual census to be conducted in all habitats with gharial. Compile habitat field maps and record any changes to basking and nesting sites.
3. A permanent central coordinating unit should be created along with a gharial information database. This database should include all survey information, comprehensive census maps showing historical and current ranges, habitat field maps, basking and nesting information, and should be updated annually.
4. Identify communal gharial nesting sites and important basking/fishing sites and provide protection to these areas.
5. Brahmaputra survey for assessing habitat suitability is a priority. Start a gharial conservation project along the lines of those in Uttar Pradesh, Madhya Pradesh and Orissa. Survey Protected Areas with suitable gharial habitat, such as Kaziranga, Dibru-Saikhowa, Orang and Burhachapori in Assam and D'Ering in Arunachal Pradesh as possible reintroduction sites.
6. Orissa: reassess the Satkoshia Gorge situation, search for other reintroduction sites (e.g. Brahmani R., Hirakud Reservoir—seasonal assessments needed to determine suitability of a reservoir as gharial habitat which could actually result in a safer option for long term survival of the gharial considering the deteriorating river situation all over).

### ***Other gharial range countries:***

1. Rivers in Bhutan to be surveyed and assessed for habitat suitability include: Bado, Manas, Sunkosh, Toroa, Raidak Puna and Tsongchu.
2. Same for rivers in Pakistan, Bangladesh and Myanmar which need to be identified and short-listed and collaboration identified/firmed up (refer to Gharial Conservation Partners list in the Appendices).
3. Nepal: urgently needs a regular census/monitoring programme as done for mammalian mega-fauna, upscaling of protective measures for gharial in Chitwan N.P. and other gharial habitats. If security can be assured at other sites within PAs (eg. Karnali R., Koshi R), surveys can reveal whether these remnant populations have both sexes and if not remedial measures taken.
3. Nepal: urgently needs a regular census/monitoring program as done for mammalian mega-fauna, upscaling of protective measures for gharial in Chitwan N.P. and other gharial habitats. Currently the Rapti and Narayani are being checked twice yearly by A. Cadi et al. Security must now be assured at other sites within PAs (e.g. Karnali/Babai R., Koshi R) so that regular surveys can reveal whether these remnant populations have both sexes and if not remedial measures taken.

### **Other research**

In general the GMTF will strive to maintain a strong research presence in each of the main gharial breeding habitats.

1. A study on local fishing techniques and fish ecology with a view to mitigate the human/gharial conflict.
2. Study on gharial relationship with commercially valuable fish to determine whether they are beneficial or detrimental to fisheries (i.e. do they primarily eat predatory fish?)
3. Study, mapping (continual updating required) of key gharial basking, feeding and nesting areas so that protection can be concentrated (for example only a fraction of the 428 km river length of the Chambal National Sanctuary is actually in regular 'use' by gharial).
4. Study and mapping of threats such as fishing, sand-mining, riverbed cultivation and pollution with inputs from experts in these fields to provide solutions.
5. Study the issue of sand-mining and see if it can be done sustainably in designated areas without damage to the river's geology (ground water, erosion, siltation) and ecology. Study and identification of other sources of sand for the construction industry which do not impact rivers/water tables that are important water sources for human survival.

6. Sustained research on gharial hatchling survival, territory, homing, dispersal and migration of all size classes of gharial and refinements of head-starting/supplementation techniques.

7. Research on river water management and impact of dams, barrages, canals, pollution and excessive water extraction on water levels and flow.

8. Study of the relationship of gharial and mugger to determine whether an increase in mugger numbers is detrimental to gharial survival.

9. Socio-economic, demographic studies to help determine what would be best for riparian people. For example if sustainable use of gharial and mugger are going to be considered who will benefit? Can outside contracting be allowed for fishing, sand mining and other activities, and if so how do the local people benefit significantly?

10. The genetic situation in smaller populations needs to be checked and monitored because of the very low number of isolated wild individuals and small size of the few existing breeding groups.

NOTE: many of the studies on river ecology, fisheries, water management, mapping, existing and future threats (via river development plans) have already been done by other Government and private agencies/individuals and need to be identified and compiled.

### **11. Head-starting protocol updating and scientific planning**

Release retention/survival has been very low at most release sites and it is now imperative to modify release strategy in response to monitoring results of past efforts and update protocol according to IUCN Reintroduction Specialist Group guidelines. Some of the areas of importance are:

a) Ascertaining whether continued reintroduction is actually an effective conservation tool (as opposed to natural hatching/recruitment with emphasis on effort and money spent on security in the habitat, conflict mitigation and community uplift/involvement)

b) Assessment of habitat suitability, including ensuring that fish stocks are adequate, and that negative anthropogenic influences are under control

c) Release protocol - numbers, sizes, place of release, whether 'soft release' should be tried to acclimatize the releases to river currents and the release site

d) Post-release monitoring to be done regularly following a systematized protocol and as a responsibility of the concerned State Forest Department for critically endangered species

Most important of all, effort must be made in ascertaining why retention and survival of released gharial is so low (beyond the enlightenment that most are flushed downriver, out

of the PAs, with the annually predictable monsoon floods) and to initiate effective action for habitat security and to mitigate negative anthropogenic influences in Protected Areas. To continue with reintroductions without addressing the existing pressures on the habitat and following a carefully planned scientific protocol is a waste of time, money, effort and gharial lives.

### **K. In situ and ex situ conservation approaches**

1. Enforcement of protection in PA's.
2. Attempts made to mitigate human/gharial conflict.
3. Research into the causes of low survival and retention rates of reintroduced gharial. If reintroduction is determined to be an effective conservation tool, supplementation with head-started gharial for some populations to be carried out by Forest Department to ensure wild population viability.
4. Linkage with zoos and conservation organizations for awareness-building, education programs, and fundraising campaigns

### **L. GMTF Inputs to Gharial Management Plans and Conservation Activities**

#### **India**

1. Assistance to gharial Protected Areas authorities to draft management plans for the species and habitat and train personnel to implement such plans. Plan up to 10-20 years ahead for gharial breeding and head-starting centers.
2. Skill Development and Training: providing opportunities for Wildlife staff to learn survey/census, captive and wild management, nuisance croc capture and control techniques.
3. Encouragement of additional expertise and a second line of crocodile researchers
4. Project gharial habitats as biodiversity-rich wetland areas of multiple species management for fisheries, tourism, genetic banks and downriver people's livelihoods.
5. Develop and strengthen the policy and legislation for Integrated River Basin Management with appropriate safeguards.
6. Approach the State and Central Governments to act on recommendations made by the GMTF and CSG for the protection and rehabilitation of the gharial. This can also be done by having GMTF and CSG representation on State and Central Wildlife Advisory Boards.

7. Support and help facilitate the implementation of the MP Government's Management Plan for the National Chambal Sanctuary in collaboration with Uttar Pradesh and Rajasthan (and identify/promote similar legislation in the other main habitats).

8. A clear and concise brochure on census techniques and standardization of methodology to be prepared for census takers/population monitors.

### **Other Range Countries**

#### **Gharial conservation in other range countries**

Most of the observations and survey/research priorities in this document refer to all the gharial range countries. At this time, range countries that have no gharial left will be encouraged to carry out surveys for remnant populations and habitat assessment for possible future restocking, but this year funds will primarily be allocated for gharial conservation in Key Areas in India. One priority recommendation is the initiation of international cooperation with Nepal and Bangladesh for crocodile management.

1. In Nepal, the King Mahendra Trust, WWF-Nepal and La Ferme dux Crocodiles will be encouraged to provide funds for surveys, especially in Chitwan National Park where security has suffered due to unrest in the country. Form a Crocodile Technical Committee under Nepal's Biodiversity Action Plan, incorporated into the Wetlands Group under IUCN auspices. The crocodile database created by IUCN Nepal to be developed, maintained, and regionalized.

2. In Bhutan the Royal Family, which has already expressed an interest in the survival of the gharial in that Kingdom, will be approached for support of surveys. The active WWF programme there has also been approached and plans are underway though there is a security concern along the border with India where potential gharial habitat occurs.

3. Pakistan has a strong WWF river dolphin and wetlands project, team members have stated their willingness to collaborate with the GMTF.

4. Our colleagues in Bangladesh need encouragement to carry out surveys with Forest Department support. Promote strong protection measures through implementation of the Bangladesh Wildlife Preservation Law.

5. We know nothing about the possibility of suitable protected habitat in Myanmar where gharial could be reintroduced and have had no feedback from several queries sent to wildlife biologists there.

#### **General river improvements to be implemented**

1. Fish ladders to permit fish and crocodilians to bypass dam barriers (one example was made in the British period on the upper Ganges River and needs to be assessed for effectiveness) and river shorelines to be managed to allow for fish spawning areas and crocodilian breeding sites.

2. Wetland/river management to make sure river levels do not fall too low for river health/gharial survival and that every river/irrigation/watershed development project includes a plan for riverine fauna and fisheries enhancement. River level monitoring data is kept by Irrigation Departments and needs to be accessed by river biologists.

3. All major river developments must be 'fauna friendly' and facilitate riverine faunal migrations along river channels.

4. Development of compatible and sustainable use of fish resources and appropriate fishing methods

**Explore sources of funding** from conservation agencies, private enterprise, individual donations, innovative schemes (offering publicity and advertising potential to consumer goods manufacturers for example) and government agencies responsible for the protection and conservation of species, natural resources and habitats (including drinking water and irrigation supplies, fisheries and wetlands preservation).

The responsibility of the Gharial Multi-Task Force and the Western Asian Chapter of the IUCN/SSC Crocodile Specialist Group is that action be taken on the above Recovery Plan.

### **M. Responsibilities of Government/Forest Departments**

1. Regular seasonal monitoring of existing population status and migration by Beat Guards to provide regular updates. Overall gharial census to be included in annual wildlife census activities in Protected Areas. Management Plans for all gharial areas.

2. Rigorous protection of last remaining gharial habitats (particularly in the last 4 known breeding areas on the subcontinent) from negative anthropogenic influences: river development projects that threaten the life of the river, illegal fishing/unsustainable fishing practices, sand mining, disturbance by agriculture and livestock at known basking and nesting sandbanks. PAs such as Chambal National Sanctuary and Katerniaghat Sanctuary should be considered core areas of protection and buffer zones up and down river of the PAs should be formed.

4. Identify and implement existing and proposed schemes for village uplift, alternative and sustainable livelihoods and community involvement in conservation.

3. Encourage research and NGO involvement in conservation/education activities.

### **N. State Government's role**

1. States and government agencies to work collaboratively, using the abundant statutes already in place, holistic approach to river development management and conservation rather than following their own, limited, departmental agendas.
2. Develop and strengthen the policy and legislation for Integrated River Basin Management at all key locations.

### **O. Central Government's Role and Advocacy/Lobbying**

1. Careful consideration of environmental impacts of river development projects by the Irrigation and Water Resources Ministry with the future availability of safe levels and clean river for humans and riverine species survival uppermost.
2. Liaise with the Government of India to initiate a Project Gharial on the lines of Project Tiger.
3. National Chambal Sanctuary to be up-graded to National Park status.
4. Creation of a central coordinating body for the Chambal by the Government of India.
5. Implementation of all Government sanctioned programmes for community uplifting and development for people in the backward areas along rivers.
6. Core Areas of all gharial PAs to be given high priority with 'no compromise' control on all illegal fishing and other negative-impact activities.
7. Ministry of Environment and Forests to reconstitute the Technical Committee on Crocodile Conservation and to initiate Project Gharial along the lines of Project Tiger.
8. Declaration of the Chambal River as a World Heritage Site and stoppage of all exploitation of natural resources in the core gharial habitat.

### **P. Role of research institutes/NGOs**

Development and implementation of research programmes, community uplift/involvement as outlined above and below. While the Forest Department is responsible for the overall management of the last remaining gharial PAs it can benefit from the collaboration with bonafide researchers and NGOs working collectively for the conservation of river fauna and for an improved quality of life for riparian people.

### **Q. Community involvement**

#### **Riparian people and gharial conservation**

GMTF needs inputs from and collaboration with appropriate NGOs working in gharial areas for the following:

1. Help develop alternative livelihoods for people who lose rights to use riverine habitat as a result of gharial conservation and development of community based Protected Areas.
2. Develop other local economic incentives to elicit support for croc conservation.
3. Development of a means of using crocodilians as a sustainable economic resource wherein a portion of the revenue is for croc conservation.
4. The human-crocodile interface needs to be sensitively managed; local support for croc conservation will only come about if the basic needs of the people are met.
5. Eco-tourism in crocodile sanctuaries is identified as a tool for public support of crocodile conservation by generating local revenue.
6. Establish village eco-development and joint forestry management committees and build public awareness.
7. Innovative eco-development to raise standards of living of important target groups of local river residents and ending unsustainable dependence on natural resources required for river health and gharial survival.

All of the above need a ground level understanding of what people want, not merely what others perceive their needs to be. This is a common pitfall which needs to be very carefully addressed.

### **R. Education/Publicity/Awareness**

1. Local/national/international publicity for gharial: everything from current crisis situation, protective laws to value of gharial in river/fisheries via all media forms.
2. Education programme for public awareness to be launched on why and how to protect crocodilians geared especially for the various target groups (from riparian people to bureaucrats, politicians and potential funders).
3. Education amongst fishermen of the value of the gharial to fisheries, gharial-friendly fishing methods, safe rescue of entangled gharial, nest protection
4. Short conservation film on the gharial with wide target audience emphasizing the gharial as one of the flagship species of a healthy river.
5. Enhance the role of zoos (national and international) in gharial awareness and fund-raising.

## S. References

- Rao, R.J. and L.A.K.Singh, 1995. Status and conservation of the gharial in India. Zoosprint, Volume X Number 2.
- Hussain, S.A. and B.C. Choudhury, 1991. Ecology of Gharial, *Gavialis gangeticus*, in National Chambal Sanctuary, Study Report, Wildlife Institute of India, Dehra Dun.
- Hussain, S.A., 1999. Reproductive success, hatchling survival and rate of increase of gharial in the National Chambal Sanctuary, India. Biol. Cons. 87:261-263.
- Sharma, R.K., 1999. Survey of gharial in the National Chambal Sanctuary – 1993 to 1997. Envis 2 (1).
- R.K. Sharma and D. Basu, 2004. Recent reversals in the population trends of gharial in the National Chambal Sanctuary. Proceedings of the 17<sup>th</sup> Working Meeting of the Crocodile Specialist Group, Darwin, Australia, pp.180-186.
- Andrews, H.V., 2006. Status of the Indian gharial, conservation action and assessment of key locations in North India. Unpublished report to Cleveland Metro Park, 8pp.
- Maskey, T.M. and H. Mishra, 1985 (?). Conservation of gharial in Nepal. Wild is Beautiful, T.C. Majupuria (ed), Jullundur, Punjab.
- Singh, L.A.K., 1991. Non-survival of gharial in river Mahanadi in Orissa. Technical Report of the Wildlife Wing, Forests and Environment Department, Government of Orissa.
- Singh, V.P., 2005. Evaluation of gharial rehabilitation. Uttar Pradesh Forestry Project Report for Biodiversity Resources. Terai Nature Conservation Society.
- Srivastava, A.K., 1981. Biology of Indian gharial with special reference to its behaviour. PhD thesis, University of Lucknow, Uttar Pradesh.
- Andrews, H.V. and P. McEachern, 1994. Crocodile Conservation in Nepal. IUCN Nepal and USAID NGO Environmental Management Programme, pp. 1-29.
- Ballouard, J.M. and A.Cadi, 2005. Gharial Conservation in Royal Chitawan National Park, Nepal (for La Ferme aux Crocodiles, WWF-Nepal and Dept. of National Parks and Wildlife Conservation, Nepal, pp. 1-18.
- Dorji, Kuenga, 1993. Note from Bhutan for the Crocodile Specialist Group. 2pp
- Bustard, H.R.1975. A Future for the Gharial, Cheetal 17 (2), pp.3-8
- de Vos, Antoon, 1982. India Crocodile Project Assessment. FAO/UNDP Report
- Rao, R.J., 1988. Nesting Ecology of Gharial in National Chambal Sanctuary. Study report, WII, Dehra Dun.
- Shrestha, T.K., 1990. Status, Ecology, Conservation and Management of Genetic Resources of Crocodiles of the Himalayan rivers in Nepal. HMG Dept. of Hydrology, Kathmandu.
- Choudhury, B.C. 1990. Indian Crocodile Conservation Situation Report—Action Plan for the 1990s. Wildlife Institute of India. Report for the CSG Meeting Proceedings, Volume 2, pp. 337-345.
- Rahman, M.M., 1992. The Systematic Status of Crocodiles in Bangladesh: A Country Report. Tiger Paper, Vol XIX:1, pp.10-14.
- Crocodile Conservation and Management in India. Report of a CSG Workshop held at Madras Crocodile Bank, India, March 1993. 27pp.
- Rao, R.J. and L.A.K. Singh, 1995. Status and Conservation of the Gharial in India. Zoos' Print, Vol. X: 2, pp 1-5.
- PHVA for Gharial Report, 1995. Jiwaji University and Zoo Outreach Organisation. 106pp.(edited)

Biodiversity Conservation in Wetland Habitats – Action Plan – Crocodilians. Report of the first Western Asian Conference of the IUCN/SSC Crocodile Specialist Group. Jiwaji Univ., Gwalior, June 1997. 19pp.

Choudhury, A., 1998. Status of the Gharial in the Main Brahmaputra River. JBNHS Vol. 95, pp118-120.

Hussain, S.A. and Ruchi Badola. 2001. Integrated Conservation Planning for the Chambal River Basin. A paper for the National Workshop on Regional Planning for Wildlife Protected Areas, New Delhi. 20pp.

Whitaker, R. 2003. Report on Gharial for the IUCN/SSC Asia Regional Meeting, Colombo, Sri Lanka. 2pp.