BIODIVERSITY CONSERVATION CURRENT STATUS AND FUTURE STRATEGIES

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2016
Educationist Press
an imprint of
Write & Print Publications
New Delhi-110 015

ISBN: 978-93-84649-??-?

Published by	:	Hitesh Mittal For **Write & Print Publications** H-13, Bali Nagar New Delhi-110 015 Phone: 011-45635684 E-mail: info@writeandprint.com Website: www.writeandprint.com
Laser Typesetting	:	Anshu Gupta New Delhi
Printed at	:	Salasar Imaging Systems Delhi - 110 035, Phone: 011-27185653

Dedicated

to

my father

Late Sh. L.P. Sharma

Preface

Biodiversity is the degree of variations of life forms. It is the very basis of human survival and economic development. However, in recent years, ever increasing loss of biodiversity has posed a serious threat to the survival of mankind.

Biodiversity conservation is a global issue and biodiversity loss affects each and every one. New approaches for biodiversity conservation are urgently required. Public understanding of such issues is extremely important. ***Biological Conservation: Current Status and Future Strategies*** is a humble effort in this direction. The book is a compilation of review articles and research papers written by various academicians and scientists working in the field of biodiversity.

I am thankful to all my authors who have contributed in this book. It is a matter of great pleasure to publish their valuable work in this book.

A large number of people helped me in the completion of this book. I am thankful to all of them who have directly or indirectly contributed in this project. Special thanks are due to Dr A. C. Raghuvanshi, Government Model Science College, Gwalior, for his valuable suggestions and cooperation.

I express my gratitude to my mother for her blessings and inspiration. I wish to acknowledge my thanks to my wife and children who have always encouraged me at every step of my life.

I express my sincere thanks to **Mr. Hitesh Mittal**, **Write and Print Publications, New Delhi** for publishing this book in this nice form.

I hope that this book will be successful in achieving its objective of spreading awareness among the researchers, students and academicians, working in the field of biodiversity and also in motivating the general people to work to save biodiversity.

Prof. Dushyant Kumar Sharma

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Impact of Anthropogenic Activities on the Behaviour of Crocodiles and Perception of Residents in National Chambal Sanctuary, Madhya Pradesh

—RAJESH KUMAR GURJWAR AND R. J. RAO

Introduction

Anthropogenic processes have physically, chemically and biologically modified aquatic biodiversity. The impact of anthropogenic forces on the aquatic biodiversity is either equivalent or greater than natural forces and the importance of human-environment interaction studies are widely recognized to understand the impact of anthropogenic activities on aquatic ecosystems (Singh and Singh, 2006). Major ecological studies on *Crocodylus palustris*, crocodiles and freshwater turtles have been conducted in the Chambal River from 1983 onwards (Singh, 1985; Rao, 1988, 1990; Rao and Sharma, 1997; Rao *et al.*, 1995; Sharma, 1991; Hussain, 1991). The Chambal river gharial (*Gavialis gangeticus*) population is the largest contiguous and most viable population and has been the focus of conservation and restocking programmes. In recent times it has suffered from increasing disturbance from extractive activities and is under severe threat from hydrological modifications due to dam and reservoirs and diversion of river water for irrigation. In the face of increasing proposals for water extraction and impoundments on the Chambal, and nation-wide river linking aspirations, it is critical that species requirements be understood and flow regimes be restored.

The findings of this study indicate that major habitats of crocodiles are under pressure due to increase in human activities. The major threat at present is habitat loss due to human encroachment, and disruption of populations through fishing and other hunting activities. In the present study

it is observed that due to Crocodile-human conflict relationships between local communities and wildlife authorities is not cordial. Locals consider that crocodile programmes in the Chambal River are major obstacles for poverty alleviation as they depend primarily on the river for livelihood and Government restricts use of resources for crocodile conservation. Information collected in this study is useful and thereby provide an insight into the human-crocodile conflict in the National Chambal Sanctuary and help in taking measures for the conservation management of crocodiles. There is a need for greater awareness among the local villagers on the crocodile conservation programmes and its benefits. It is essential to monitor the conflict between crocodiles and people living in the Sanctuary. Since large number of people depends on the freshwater ecosystems there is a need to restructure the crocodile conservation policies to accommodate the people's interest and dependency on freshwater ecosystems. To control crocodile-human conflict mitigation measures like conflict reduction and benefit generation schemes such as improving alternative water sources, the education of local communities on crocodile ecology, conflict avoidance measures and crocodile-specific tourism potential have to be taken. Research programmes should be aimed at undertaking mitigation programmes to be used as baselines for future monitoring projects.

MATERIALS AND METHODS

Study Area

Chambal River is one of the major tributaries of the Yamuna River. Located in Central India, the river comprises a significant portion of the Greater Genetics Drainage System. The Chambal River runs according to a north to northeasterly itinerary through Madhya Pradesh, flowing for a considerable distance through Rajasthan, subsequently creates the border between Madhya Pradesh and Rajasthan prior to twisting to the southeast to meet the Yamuna in the state of Uttar Pradesh. The 960 km long Chambal River originates from the Janapao hills in the northern slopes of the Vindhyanchal escarpment, 15 km West-South-West of Mhow in Indore District in Madhya Pradesh state, at an elevation of about 843 m. Major part of the Chambal River has been declared as Wildlife Sanctuary during 1978 (Fig. 1). The sanctuary is protected under India's Wildlife Protection Act of 1972. Parts of the sanctuary are threatened by extensive illegal sand mining, which is endangering the fragile lotic ecosystem critical for Gharial (*Gavialis gangeticus*) breeding. *National Tri-State Chambal Sanctuary Management and Coordination Committees* have been formed for the management of National Chambal Sanctuary.

Collection of Data

The following data collection procedures were adopted and are broadly divided into two categories. Primary data were collected through field

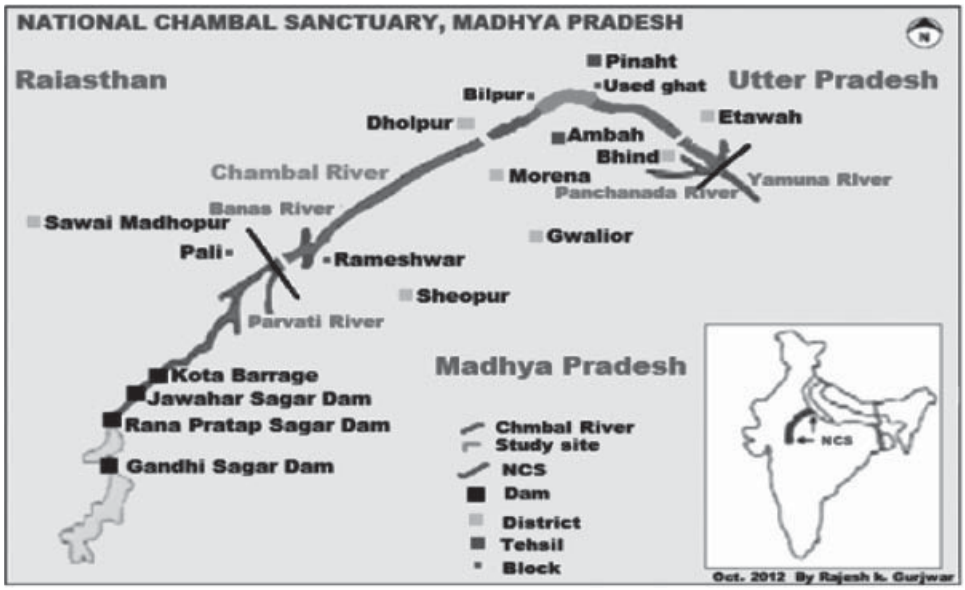


Fig.1: Map of National Chambal Sanctuary showing multipurpose dam on the upper stream, Tributaries and study sites in the present study.

surveys and secondary data were collected from Madhya Pradesh Forest Department.

The field surveys were carried out during March-October 2012. For the collection of primary data regular site visits were made. The field surveys were classified into two sections, river survey and questionnaire survey for the villages. The study site from Bilpur/Kuthiyana to Nayapura (Usedghat) was surveyed through motor boat by traversing along the river. The mugger crocodiles were observed and identified according to the age class. The total count of the individuals was done with the help of binoculars (Nikon Action 8 40) and Nikon Digital Camera (D60, 70-300). The locations were marked on a GIS domain through GPS (GARMIN 60) etc.

Questionnaire surveys were carried out in 15 villages in the study area within the Sanctuary. At Study sites, a total of 100 individuals were interviewed for data like socio-economic information, family income, livelihood, livestock, sex and age of conflict victim, circumstances of attack and compensation amounts. Details of Study sites, including major landmarks, sites of crocodile capture (for translocation), release sites, crocodile nesting sites, basking sites, sand mining, irrigation and other important features and location of villages were recorded using GPS.

The detailed conflict information that was collected was related to human injury/fatality, and injury/fatalities of livestock. Study sites were visited along with State Forest Department personnel to easily identify regions of conflict.

STATISTICAL ANALYSIS

Statistical analysis of like mean, frequency, cumulative frequency, percentile of available data was done with the help of Microsoft excel.

RESULTS AND DISCUSSIONS

Faunal diversity

The sampling area is a home to wide variety of aquatic animal likes crocodiles, turtles and mammals (Table 1). It was found that Gharial and mugger are endemic to the area and are basking most of the time (Plate 1.).

Plate 1: Mugger and Gharial basking in the Chambal River.

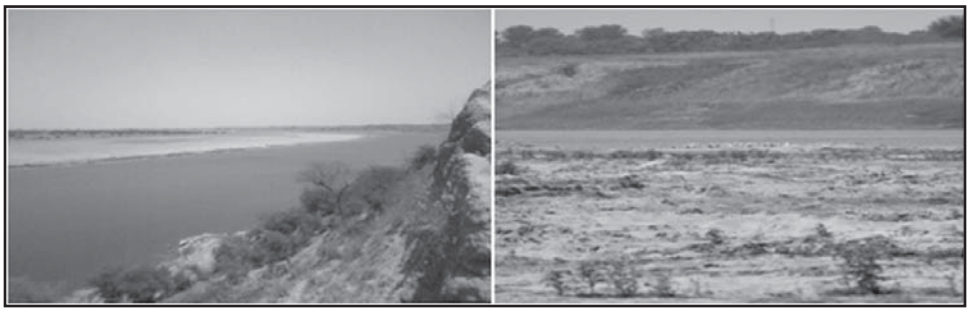
Table 1: Major faunal species of the sampling villages

S. No	Animals	Common name	Scientific name
	Crocodiles		
1.		Gharial	*Gavialis gangeticus*
2.		Mugger	Crocodylus palustris

Crocodile Habitat

Crocodiles (*Crocodylus palustris*) use sand banks throughout the sanctuary wherever suitable habitats are available. Ten micro habitats of Crocodiles were analyzed, such as River bank with sandy substratum, River bank with clay/loamy soil substratum, River bank with aquatic vegetation, River bank with rocky substratum, Mid River Islands, Littoral zone, River bed with rocky substratum, River bed with deep water, River bed with deep running water, and River bed with shallow water pools. Among these micro habitats river banks with sandy substratum were best habitats for aquatic animals (Crocodiles and fresh water Turtles) in the National Chambal Sanctuary, Madhya Pradesh. The Gharial (*Gavialis gangeticus*) of different sizes/ age groups use the sand banks and mid river sandy islands for basking. During the winter season, the Gharials bask on the sand bank long hours. They come outside the water during early hours of the day and lay down on the sand banks for basking till in the evening before air temperature cools down (Plate 2.).

Plate 2: Chambal River showing different habitat types.



Perception of residents

Twenty-nine per cent of the people reported that they are negatively affected by the presence of crocodile and 54% told that they do not have any affect due to presence of crocodile in the area (Table 2; Fig. 2).

Table 2: Perception of residents about the presence of crocodile in the area

Negatively affected peoples	Frequency	Percentage	Cumulative frequency
Yes	29	29	29
No	54	54	83
No response	17	17	100

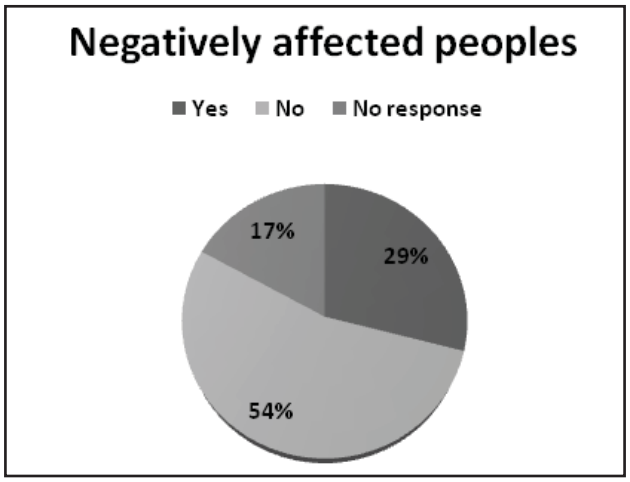


Fig.2: Percentages of negatively affected people in the study area

Eighty five per cent residents living close to the victim of the sampling area believed that their children can't go outside by the presence of crocodiles (*Crocodylus palustris*). Grazing, bathing, fishing, drinking and watering have become different for the residents in the area. The opinion of the residents regarding the discomfort of people is listed below (Table 3; Fig.3).

Table 3: People due to various activities of crocodile

Activities	No. of Persons (100)					
	Yes	%	No response	%	No	%
Collection of Drinking water	76	76	17	17	7	7
Grazing of animals	17	17	13	13	70	70
Watering to animals	25	25	15	15	60	60
Children's can't go there	85	85	10	10	5	5
Go to fishing	69	69	23	23	8	8
Going to bath	58	58	27	27	15	15

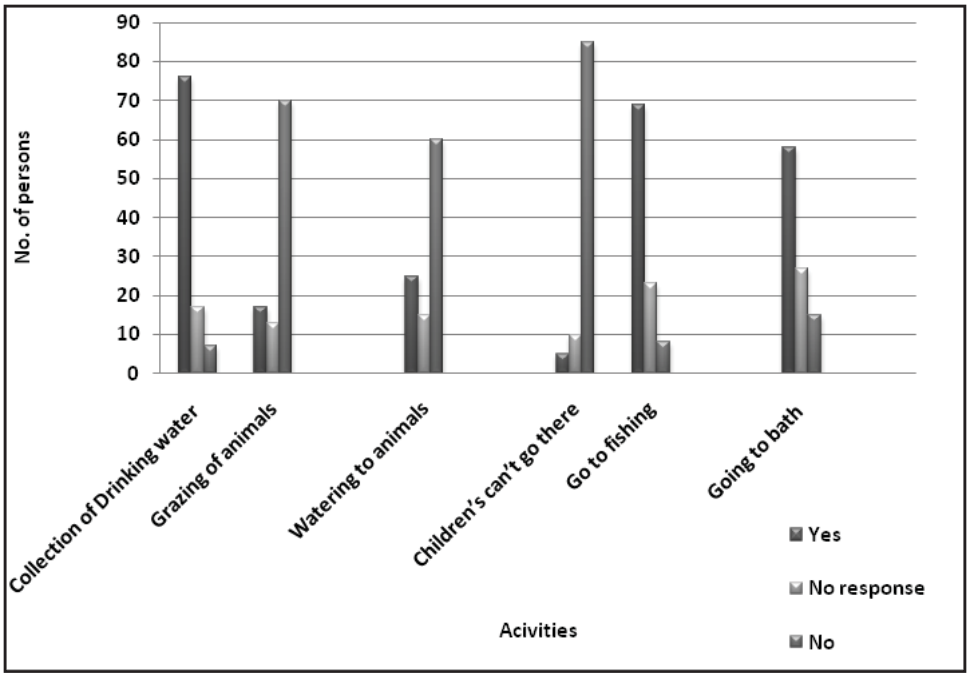


Fig.3: Discomfort activities of people

It was found that most of the people are aware of the crocodile behavior in these villages and 80% of the people have seen crocodile once in their life and to escape from clutches of crocodiles and 75% people think to construct alternate source for drinking water, due to the presence of crocodiles and only 9% people prefer to go for fishing (Table 4; Fig 4).

The data of table revealed that most of the people who were affected by human crocodile conflict received a paltry amount of Rs 5000- 10,000 as a relief from Deori Range. However, most of the respondents interviewed informed.

Table 4: Awareness about Crocodile Behaviour

	No. of Persons (100)		
	Yes	No	No response
Fishing	9	70	21
Seen crocodiles	80	6	14
Thinking for Evacuation	15	65	20
For drinking water	75	10	15
Crocodiles are protected	55	21	24

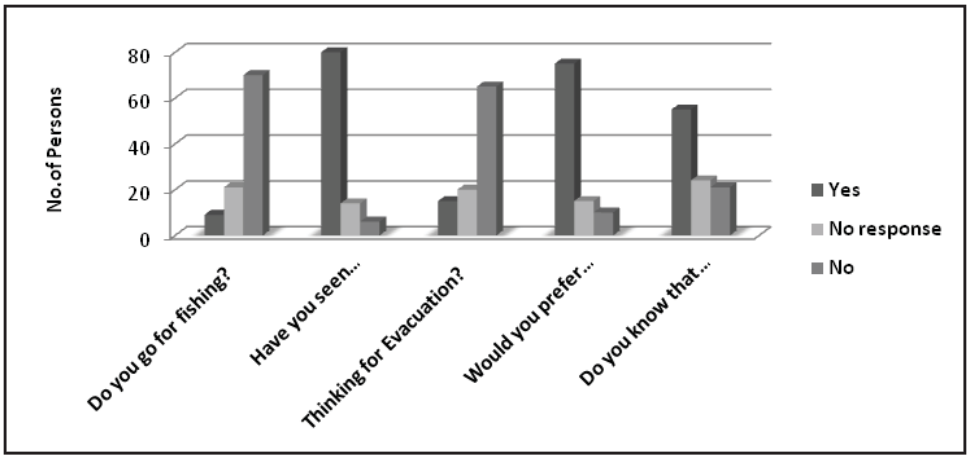


Fig.4: Awareness about Crocodile Behaviour

Human impacts on the conservation of biological diversity are a matter of concern. Many rivers in India have come under tremendous human pressure in the recent years due to several factors. The most important factors are over exploitation of available water, diversion of water due to multi-purpose projects, pollution etc. Rao (1992) reported the impact of human activities on wildlife in the National Chambal Sanctuary. Population reduction of various important aquatic animals from natural habitat may be the result of over exploitation of natural resources. Many of the local people depend on the rivers for their basic needs including frequent visits to the river for various purposes.

The impact due to human activities on the behavior of *Crocodylus palustris,* crocodiles in Chambal sanctuary seems quite evident, as the prime habitat characteristics of the river are the long stretch sand banks that are much useful for the aquatic animals for nesting and basking. Being aquatic animals the reptile in the river such as Gharial, Mugger and fresh water turtles come out on the sand bank for basking and laying eggs specially constructed by individual female. Extraction of sand for construction work is a major usage from different rivers including Chambal River. Sand mining

is one of the major human activities in the National Chambal Sanctuary. Sand is continually extracted in the important nesting and basking site, this has reducing the space of nesting and basking habitat and drastically changed the population trends in aquatic biodiversity including Gharial (*Gavialis gangeticus*) (Plate 3.).

Plate 3: River side villagers are engaged in Transportation on boats, washing, bathing and water extraction on the river bank.

Although fishing is totally banned in the Chambal River to avoid in incidental mortality of aquatic animal in the gills nets, occasional illegal fishing is continuing. There are many reports of crocodile and turtles mortalities by drawing in fishing nets. Two dolphins were recorded to be killed in the fishing nets and the fishermen extracted oil from the dolphins in April 1987. During the current survey fishing in commercial scale was observed on most of the stretch. Fisherman was seen using nylon gill nets and advanced fishing gear. The fishing activities were mostly recorded in zones. These effectively comprise the entire stretch of the Chambal flowing within the sanctuary. During interrogation with fishermen it was revealed that most of the fish contractors are outsiders and they hire the local fisherman communication. Illegal fishing is also rampant severalty depleting the food availability and reducing the carrying capacity of the river for piscivorous aquatic vertebrates like Gharial, Mugger, Dolphin, turtle and otter.

Sand mining, fisheries, Water extraction, wood collection and agriculture have caused great damage to the survival of Crocodiles in National Chambal

Sanctuary. Due to these activities the crocodiles habitats are disturbed, which further adversely affects gharials and muggers in these areas. Diversion of water from the Chambal River for different activities is one of the main reasons of reducing in river flow, which is adversely affecting the geo-morphology, biota and their habitat. Locals use the river for various purposes including drinking water collection, cloth washing, and livestock use. People also cross the river by means of a temporary bridge, cross the river using the boats and Camels and also the river bank is used for burial purposes etc. All the mentioned activities are causing great damage to the crocodiles inhabiting the Chambal and sometimes people also get negatively affected due to the presence of crocodiles in the Chambal sanctuary. This study investigated the impact of anthropogenic activities on the behavior of crocodiles and the perception of residents towards the presence of *Crocodylus palustris* (crocodiles) in the National Chambal Sanctuary.

Agriculture and wood collection is the most serious of long term threats because it damage habitat and alienated wildlife of it. The practice of agricultural on the banks of the Chambal and harvesting of fuel wood leads to heavy erosion in the ravines and shrinkage. During summer when the water level records, the exposed and expanding sand bank are used for growing vegetables and the lamarix growth on the islands which now become accessible is hacker down, disturbing Gharial, Mugger and turtles nesting sites. More importantly human activities on increasing numbers of sand bank due to cucurbit horticulture will definitely alienate Gharial (*Gavialis gangeticus*)of all size classes from basking habitat and will lead to permanent emigration of animal from these area as has occurred in the Yamuna and many other hosts Indian river.

Acknowledgements

We are thankful to Madhya Pradesh Forest Department for permission to conduct research activities in National Chambal Sanctuary. We are also thankful to the Administration of Jiwaji University, Gwalior for necessary support. We are extremely thankful to the field staff in Sanctuary particularly Dr. R.K. Sharma and Mr. Sukhdev for local support in the field and also sharing information on Gharial population.

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