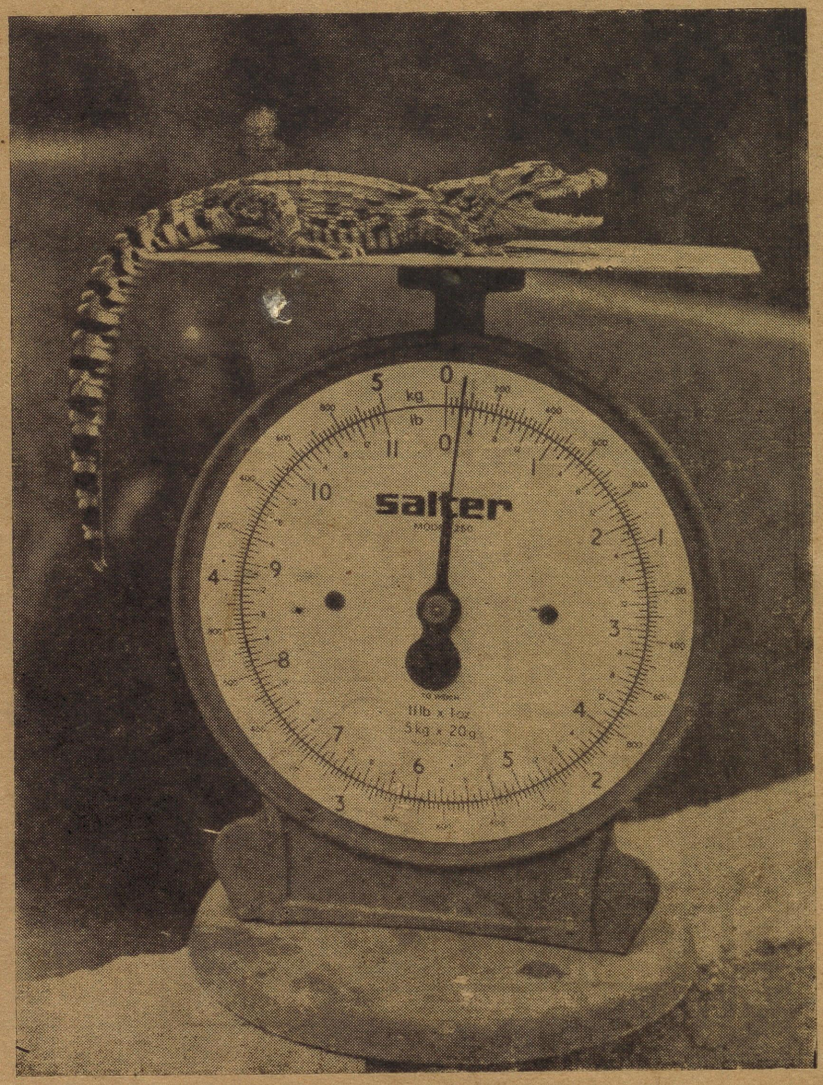
INDIAN CROCODILES - CONSERVATION AND RESEARCH

Proceedings of the First Indian Crocodile Researchers' Symposium
Katerniyaghat, Uttar Pradesh, India
21–25 January 1979



1982

Compiled and Edited
by
L. A. K. SINGH and B. C. CHOUDHURY

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Proceedings of the First Indian Crocodile Researchers' Symposium held at Katerniyaghat, Uttar Pradesh, India. 21 - 25 January , 1979

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Contact: B. C. Choudhury, Nehru Zoological Park, Hyderabad

"The Conservation of flora
and fauna is neither a whim nor a luxury
It is essential for mankind's
future survival."

SMT. INDIRA GANDHI

Cover: Conservation and research on Indian Crocodilians in action - Photo: B. C. Choudhury

The beginning of the next year will carry with it the concluding fragrance of a nine-year old intimate collaborative effort from the Government of India, United Nations Development Programme and the Food and Agriculture Organisation of the United Nations, that had focused on a primary objective to give a fresh lease of life to the Indian crocodilians. The crocodilian fauna of India, that includes the Gharial (Gavialis gangeticus), the Mugger (Crocodylus palustris) and the Saltwater crocodile (Crocodylus porosus), appear to have responded well to the surprisingly sudden affection they received from these and the several State Forest Departments.

Eleven special sanctuaries, totalling to an area of approximately 20,000 sq.km, and 12 other managed areas have provided "homes" for these crocodilians, and outside these areas also they are secure because of the protection provided by the Wildlife (Protection) Act,1972, the regulations under the export instructions, religious symbol instruction, and the CITES. Projects to captive rear crocodilians is now backed by such a propulsive enthusiasm in the country that every now and then we hear of fresh thoughts to commence rearing stations. It is not bad as long as we know what we are after when it is not entirely an ehthusiastic approach or public education. Already there are over 16 well-set stations in 9 different states, and natural waters have been repopulated with a total of 1623 crocodilians from these rearing stations. All these have been possible only because of a very well conceived work plan which, however, I must confess, is not without limitations.

Looking back to 1974, we were as novice in this type of crocodilian management as should be any one born with a cultural heritage to 'fear or worship' this creature. Weighing the situation, FAO [1,2] had rightly

pointed out that "to maximise the success of the operation India should produce its own experts in crocodile population ecology at an international level. As a result of experience gained from extensive on-going research a truly Indian approach to crocodile farming can be developed which will not be dependent on outside inputs". Three states namely, Orissa, Uttar Pradesh and Andhra Pradesh fondled the suggestion and inducted M.Sc. graduates in Zoology as Ph.D. scholars who were then considered as 'investments' to "offer the best guarantee of continuity at a sophisticated management level after the (FAO) Consultant leaves" the country.

By 1976 six crocodilian researchers were already in position trying to refine the methodologies under the 'grow and release technique' of crocodilian conservation and captive breeding, and also collect data for their Ph.D. theses. Most of these research scholars were either stationed or were busy for their research in such remote areas in the country that even the postal department was unable to keep the link undeterred through all the seasons of a year. The Government, however, had Dr. H. R. Bustard, the FAO Consultant (later Chief Technical Advisor) to monitor all the research activities and be, in close liaison with the Indian University Professors, the immediate link among the scholars.

During the fifth year of operation of the project, when the Central Crocodile Breeding and Management Training Institute began its first training course at Hyderabad, it was urgently felt necessary that all researchers should meet and discuss the various aspects of conservation and research that they have remained involved with, so that the training at the CCBMTI could be circumspect. The FAO was instrumental to make this

materialise. Dr. Bustard had taken all the responsibility to liaise with the State Forest Departments and obtain the kind consent of Sri V. B. Singh, IFS, Chief Wildlife Warden, Uttar Pradesh to preside the meeting and also provide all the necessary facilities to hold the symposium at Katerniyaghat during January when the trainees of the CCBMTI will also be there to participate and benefit from the proceedings.

As expected, some of the very important aspects like status, rehabilitation, captive breeding, nesting ecology, parental care, growth and techniques could only be discussed along with a few from pure research. It was startling to find that even though the symposium was not a very complete picture of the research knowledge existing then, 60 papers were presented and discussed leading to the development of several recommendations at the end of each day.

At the end of the last session, Shri Sushant Choudhury was elected the second Convenor-Secretary, a proposal was encouraged to form a common forum where all the crocodilian researchers and workers can meet, and then it was greatly hoped that the proceedings of the 1st meeting will be published soon as a Symposium Volume. In 1981, before Dr. Bustard 'retired' from the project a new thought was given to publish the abstracts at the least. This also was delayed because we, the researchers were too busy with our work to meet again to work out for a 'very best' publication. A couple of weeks back Binod (B. C. Choudhury) woke me up from the slumber and in our spare time both of us worked on it like dogs to bring out the abstracts in the present form. We were the rapporteurs for the symposium, hence had all the proceedings written in our record already containing the abstracts. In the meantime, we have

received very encouraging supports of all expected kinds from our colleagues, and thus are able to produce a few copies possible with our light-purses.

This hurried effort is only to keep harmony, belated though, with the promise made with respect to this symposium in the Indian Crocodilian Bibliography published by the FAO. We feel satisfied that we are able to bring it to light before the conclusion of the project itself, and express our hope that the new Wildlife Institute of India and/or the FAO component of it will again come forward for arranging another similar symposium, this time perhaps extending it to the turtles and other 'herps' too.

I wish to record my gratitude on behalf of all the researchers to Sri V. B. Singh, IFS, State Forest Departments of Orissa, Uttar Pradesh and Andhra Pradesh., Government of India, U.N.D.P./F.A.O., Dr. H.R. Bustard and Sri Pushp Kumar, IFS (Director) and his staff and trainees at the CCBMTI in 1979.

Hyderabad
December, 1982

Lala A. K. Singh
Convenor-Secretary

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1. F.A.O. (1974) : India : A preliminary survey of the prospects for crocodile farming. Based on the work of H.R. Bustard, FO:IND/71/033: 1-66 pp

2. F.A.O. (1975) : India : Gharial and Crocodile conservation. Management in Orissa. Based on the work of H.R.Bustard, FO:IND/71/033: 1-15 pp

FIRST INDIAN CROCODILE RESEARCHERS SYMPOSIUM ON "INDIAN CROCODILES - CONSERVATION AND RESEARCH" HELD AT KATERNIYAGHAT, U.P. INDIA. 21-25 Jan 1979.

SUMMARY OF PROGRAMME

20 January 1979	Assemblage and Registration
21 January 1979 0800hr to 1400hr	Field trip to Katerniyaghat Sanctuary and census of wild gharials.
22 January 1979 0900hr	Opening of the Symposium and Presidential address.
0915 to 1600hr	SESSION I STATUS OF INDIAN CROCODILIANS Chairman - H.R. Bustard
23 January 1979 0900hr to 1100hr	SESSION II REHABILITATION OF INDIAN CROCODILIANS Chairman - B.C.Choudhury
1130hr to 1330hr	SESSION III CAPTIVE BREEDING OF INDIAN CROCODILIANS Chairman - S.Maharana
1430hr to 1600hr	SESSION IV PARENTAL CARE IN INDIAN CROCODILIANS Chairman - S.Kar
24 January 1979 0900hr to 1100hr	SESSION V CAPTIVE GROWTH IN INDIAN CROCODILIANS Chairman - L.A.K.Singh
1130hr to 1630hr	SESSION VI NESTING AND POPULATION STUDIES IN INDIAN CROCODILIANS Chairman - H.R.Bustard
25 January 1979 0900hr to 1100hr	SESSION VII RESEARCH PAPERS (OBSERVATIONS AND HYPOTHESES) Chairman - A.K.Srivastava
1130hr to 1330hr	SESSION VIII TECHNIQUES IN CROCODILE REARING AND MANAGEMENT Chairman - S.Choudhury
1430hr to 1700hr	(Chairman and Researchers only) RECOMMENDATIONS AND FUTURE PROGRAMMES

*****

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PRESIDENTIAL ADDRESS

(Abstract) (++)

The Gharial Rehabilitation Programme in Uttar Pradesh

V.B. SINGH

In 1975 gharial was uniformly rare to the point of being extinct in most of the rivers in Uttar Pradesh. The only breeding population in the entire state existed in the Girwa River of Bahraich Forest Division. A project which could take care of protection and also provide sufficient number of gharial juveniles to repopulate the rivers was the need. These objectives could be achieved by (i) grow and release operation, and (ii) creation of sanctuary to protect the existing breeding population. The former included collection of eggs from the wild in Girwa and Chambal rivers, incubation of the eggs, rearing the young ones and release of these before a size of 2 m. The methods of nest location, egg incubation in the river bank and at the rearing centres, transfer of eggs from the river bank to the rearing centres, hatching, design of the rearing pens, food supply, and protection against winter and disease have been discussed in detail. A maximum of 12 nests from the Chambal and 4 from the Girwa have been collected in any single year. Hatching success have ranged from 71 to 95%, and survival in the first year 27.5-95.7% for different years of operation. During three years of operation between 1975 and 1977 a total of 800 gharial were reared at two centres of the state, one at Kukrail near Lucknow and the other at Katerniyaghat sanctuary. The Katerniyaghat Sanctuary was created in 1976 encompassing an area of 400 sq.km. Release of the gharial is planned for 1979.

(By 1982 a total of 693 project-reared gharial juveniles have been supplied from the state to release in the National Chambal Gharial Sanctuary (635) and the Katerniyaghat Sanctuary (58). Uttar Pradesh has the addi-

tional distinction of having reared a total of nearly 1400 gharial between 1975 and 1980--Eds.)

(++) The paper forms a part of Singh, V.B. (1978): The status of gharial (Gavialis gangeticus) in Uttar Pradesh and its rehabilitation. J. Bombay nat. Hist. Soc., 75 (3) : 668-683 - Eds.

CHAPTER - I

STATUS OF INDIAN CROCODILIANS

1. General status of Crocodilians in India.

H.R. BUSTARD

The status of the gharial and saltwater crocodile, which were extremely 'endangered', and that of the mugger 'depleted' in 1974, are now improving because of concentrated conservation measures in various states. Uttar Pradesh, Orissa, Rajasthan and Andhra Pradesh are now more actively involved in providing conservation measures for the gharial, Orissa and West Bengal for the saltwater crocodile, and Tamil Nadu, Gujrat, Andhra Pradesh, Kerala, Uttar Pradesh and Orissa for the mugger. Most of the causes for the decline of Indian crocodilians have either been controlled or eliminated altogether by the total legal protection with the creation of special crocodilian sanctuaries supported by the provisions under the Wildlife (Protection) Act,1972.

*****

2. Status of Gharial in 1974

H.R. BUSTARD

The gharial, formerly an abundant species, faces a critical situation in which its survival is in jeopardy. Surviving populations are extremely small. The population on the Mahanandi river in Satkoshia Gorge is down to five that include only three females. In Rajasthan the species still occurs in Chambal River. The best comparatively safe habitat is the 19 km stretch of the Chambal between Rana Pratap Sagar Dam and Jawaharlal Sagar Dam. The gharial is probably extinct in West Bengal. In Uttar Pradesh the species is barely surviving in the world famous Corbett National Park. In the Hahraich Division in the Girwa River 11 gharial are reported to be surviving. A total of about 60 to 70 gharial are estimated to be surviving in the country and twice as many in Nepal. However, it is important to note that in giving information on the status the trend of the adult population is accounted for.

(Dr. Bustard had visited India in 1974 to report on a 'Preliminary Survey of the Prospects for Crocodile Farming in India'. The report was published as an F.A.O. document FO:IND/71/033, Oct.1974-- Eds.)

3. Status of the gharial in Uttar Pradesh(*)

V. B. SINGH

Not very long ago, several rivers in Uttar Pradesh had a good number of gharial. In the course of fifteen to twenty years, there has been a drastic depletion in their populations so much so that in some rivers gharial have become extinct. Based on surveys during 1975 and 1976 the estimated figures for the different 'gharial rivers' in the state are: Narayani:2 subadults, Ghaghra:5 adults (isolated), Girwa:2 males, 9 females and 17 subadults and young ones, Chambal (U.P./M.P.):10 isolated adults, Ramganga: Corbett Park - 5 isolated adults, in the plains 4 isolated adults, and Ganges:4. A verj ety of causes contributed to the large scale destruction of the species. Some of these are lack of an enforcement organisation, indiscriminate shooting and netting, use of nylon gill nets for fishing, construction of reservoirs and barrages, and removal of eggs by tribals and local people for use as food. A scheme of work planned in 1975 includes detailed survey of the existing crocodilian population in the state, translocation of isolated populations to protect viable populations and locate nesting sites, establishment of breeding centres, and essential research on the ecology of crocodilians.

(*) Forms a part of the paper: Singh, V.B. (1978): The status of gharial (Gavialis gangeticus) in U.P. and its rehabilitation. J. Bombay nat.Hist. Soc., 75(3):668-683 --Eds.

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4. Census of the gharial in Katerniyaghat Sanctuary

A.K. SRIVASTAVA

A visual count was made of the gharial inhabiting the 12 km stretch of River Girwa in the Katerniyaghat Sanctuary during November 1977 - February 1978. It is concluded that the sanctuary holds 2 males (4-5 m), 7 females (3-4.5 m), 17 of 0.9-2.7 m and 5 of 0.6-0.9 m size classes (see paper 5 for comparative population figure next year --Eds.)

5. Results of a census of the gharial in Katerniyaghat Sanctuary by CCBMTI trainees in 1979

S.P. RAMANAND AND V. K. JOHRI

The survey was conducted on three occasions during which the team was divided into four groups, each initially led by an experienced researcher. Two groups walked along either bank from upstream toward down, and two others from downstream to the upstream. Each group noted down the number/size of the gharial against the time/location. At the end of the survey the data were computed to indicate that the sanctuary of 12 km stretch holds a population consisting 2 adult males (4-5 m), 7 adult females (3.0-4-5m), and 19 subadults and juveniles (0.9-2.7 m). During the survey a mugger of about 3 m size was also observed. (Wild laid eggs are collected since 1975, hence no hatchling class were noted - Eds)

*****

6. Status of gharial in Orissa

H.R.BUSTARD & L. A. K. SINGH

The state of Orissa in eastern India, situated between 17-20°N and 81-88°E, is at the southernmost distribution (*) of the known range of the gharial. Although gharial were reported to be in occurrence only in the Mahanandi, the species, however, was widely occurring in most of the main rivers like Brahmani, Baitarani and their tributaries. Probably they also occurred in the Sileru. In 1975, eight gharial were known to occur only in the Mahanandi downstream of the Hirakud Dam over a stretch of nearly 200 km. Major causes for the decline of the species in the state were use of nylon set nets for fishing, indiscriminate killing and egg robbing.

(*) see paper 8 -- Eds.

7. Status of the gharial in Chambal river (Madhya Pradesh/Rajasthan)

D. BASU and S. CHOUDHURY

The Chambal river, from its source in the Aravalli Range to its confluence with the river Jamuna, flows south-north, and between approximately 26° 45'N/76° 30'E and 26°30'N/78°15'E, over a length of 120 km, forms the border between the states of M.P. and Rajasthan. Gharial occur all throughout this stretch of the river. During a survey conducted on behalf of the Wildlife Preservation Organisation of Uttar Pradesh during 1976 and 1978 to locate breeding group of gharial, we have been able to confirm the presence of 9 male and 21 female adult gharial all above 3.3m. Also counted were 14-sub-adults (1.8 to 3.0m) and 29 juveniles (1.2 to 1.8m). Though the species was fast approaching extermination, the proposal for the initiation of a project on the National Chambal Gharial Sanctuary by the GOI/FAO/UNDP through the Forest Department of Madhya Pradesh, Rajasthan and Uttar Pradesh should ensure the future of this unique crocodilian in this river.

8. Occurrence of gharial in Andhra Pradesh

H. R. BUSTARD and B. C. CHOUDHURY

During the course of a state wide survey information were obtained concerning the occurrence of gharial in trans-Godavari region, particularly from the Pranahita-Godavari confluence to the lower Papikonda Gorge. Fishermen operating in this area have reported of the presence of a slender long-snouted crocodile ranging in size upto 5.5 m, around late 1960s. Similar reports were also obtained for the 250 km stretch between Pochampad and Lanjamadugu. The latter is a deep gorge holding a population of mugger but also presents features that could be ideal for the gharial. These observations may call for the extension of the distributional limits of the gharial down south.

9. The Gharial conservation project and the present status of the gharial.

H. R. BUSTARD

The gharial conservation project was commenced in 1975 following the author's 1974 recommendation, in the states of Orissa and Uttar Pradesh. These were later follwed by small scale rearing projects in the states of Rajasthan and Andhra Pradesh. The major projects operated by means of controlled incubation of eggs obtained from the wild and captive rearing of young for subsequent release to the wild combined with the creation of special gharial sanctuaries. By 1978 two gharial sanctuaries one each in Orissa and Uttar Pradesh were operational and one in Andhra Pradesh on the Godavari river, and one along the Chambal river at a National level was in the process of finalisation for creation. By 1977 a total of 1054 gharial had successfully been reared in these state projects.

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10. Status of gharial in Nepal

H.R. BUSTARD

There are three main populations of the gharial in Nepal, one each in the rivers Narayani, Kali Gandaki and Karnali. The situation in Koshi and Rapti are not known. Important breeding groups of 20 females and a much smaller number of males occur in Narayani. From 1978 a conservation project has started in the Royal Chitwan National Park with 140 captive-hatched young ones. Although killing for the hides is not a problem, nest-robbing for food by local 'Tharu' tribals appear to have drastically reduced the normal population growth. Some of the immediate requirements are a full winter survey of all the gharial-holding rivers, control of egg poaching and regulation of fishing activities.

11. Status of gharial in Bhutan

H.R. BUSTARD (+)

In 1978 the author carried-out a field work in the Manas river bordering to India. The habitat is confirmed to be ideal for the gharial. The last definite record of the presence of the species was of a 5-5.5 m adult seen between 1962 and 1964 during which period and earlier another 4.5 m gharial was also seen. One 1.5 m gharial caught and released in November 1977 by the Forest Department, was still seen.

(+) Published as: Bustard, H.R. (1980): Status of the gharial (Gavialis gangeticus) (Gmelin) in Bhutan. J. Bombay nat.Hist. Soc., 77 (1): 150

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12. Status of the saltwater crocodile in 1974

H. R. BUSTARD

Except for a breeding population each at Bhitar Kanika - off the Chandbali coast of Orissa and Sundarban in West Bengal, the saltwater crocodile is definitely known not to occur in any other former distributional limit of the species in the Indian mainland ranging from Cochin in the Kerala coast to all along the east-coast. Although numbers are now greatly reduced following the post-war hunting for their skins, the species appears to be holding its own in both Bhitar Kanika and Sundarbans with little or no destruction of its mangrove habitat - particularly of land/water alienations. A serious threat to the species, however, is the felling of mangrove timber immediately adjacent to the saline creek habitats.

13. Status of saltwater crocodile in Orissa

S. KAR and H. R. BUSTARD

The 'abundance' of saltwater crocodile in the Bhitar Kanika coast was a report of the past by 1950's. By 1976 the species was restricted to the 176 sq. km sanctuary from its past distribution range of over 100-150 km along the Orissa coastline. The 1976 census in Bhitar Kanika revealed a population of 34 adults and 61 juveniles. Following the conservation project initiated in 1975, by 1978 a total of 95 captive-reared crocodiles have been released in the sanctuary. Research programme includes Ecology and behavioural studies, movement and dispersal in the wild, population trend, nesting biology, captive management technique and growth studies. Elevation of the sanctuary to a National Park, selection of other suitable mangrove areas in the state for restocking purposes backed by a village extension programme are required to gain further public acceptance of the project. All measures to protect Bhitar Kanika Sanctuary habitat is most urgent.

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14. Census of saltwater crocodile in Bhitar Kanika Sanctuary.

S. KAR

During a creek by creek survey of the Bhitar Kanika sanctuary in December, 1976 to January, 1977 adopting a day and night count method, a total of 16 males, 13 females and 5 subadults (2.0 to 2.5 m) were counted. The maximum male size was 7.5 m and that of the female 4.2 m. Smaller juveniles numbered 61 and were mostly observed during the newmoon nights. Best survey periods were observed to be the low tides when maximum mud banks are exposed. In no observation crocodiles of any size, were seen in groups. Adults were spaced out in many creeks.

15. Status of the saltwater crocodile in Andaman Islands

B.C. CHOUDHURY

Until recently there were scant data on the status of the saltwater crocodile - the only species of crocodile occuring in the Andaman and Nicobar Islands. A 40 day survey during June-July 1978 in the Andaman group of islands reveal that despite total protection, large-scale egg robbing continues with killing of nest-guarding females. This, combined with habitat destruction, gives rise to concern for their future. Initiation of a crodile project to take up management work in specially gazetted sanctuaries is considered to be the best way to give a future to the dwindling populations of this crocodilian species in both the Andaman and Nicobar group of Islands.

16. The saltwater crocodile conservation programme and its present status in India.

H. R. BUSTARD

The only full-scale saltwater crocodile conservation programme in operation is the one at Bhitar Kanika sanctuary. The 176 sq. km sanctuary with an excellent mangrove habitat is well protected. A ban on fishing, stoppage of all felling and supply of fuel-wood requirement for people of this area have been initiated to ease off the pressure on mangrove timber. However, encroachment up to 10% area till 1978 (from 1975) poses a serious threat. Crocodile releases have already taken place. West Bengal has also initiated a small project and started egg collection in 1978. Andhra Pradesh is rearing a stock of this species originating from Andamans during 1976 and 1978. Experimental releases have already taken place in Coringa - a mangrove sanctuary declared for this species in the Godavari estuary.

17. The status of mugger in India in 1974

H. R. BUSTARD

Scattered reports on the occurrence of mugger in all kinds of fresh water habitats, ranging from village tanks to river gorges, spread all over the country, make it difficult to assess its status. However, the numbers reported in early 1940-50's and now clearly show it to be a very 'depleted' species. Breeding populations may respond everywhere to conservation management programmes and with some concentrated effort may well develop into a "prospective wildlife resource" for exploitation and utilisation.

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18. The status of mugger in Tamil Nadu

B.C. CHOUDHURY and H. R. BUSTARD

At present the best population of mugger in the country are in Tamil Nadu, inspite of its being killed for the skin, elimination from fishery reservoirs till 1968, and egg robbing till 1974. Man-made lakes like Sathanur, Amaravati and Chidambaram, and a natural pond near Killikudu (Trichy anicut) hold breeding groups resulting in 30-40 nests/year. Preliminary small scale surveys by the Madras Snake Park Trust since 1973 have developed into a large scale operation with the initiation of the Government of India/ U.N.D.P./F.A.O. project since 1976. Ambitious mugger rearing centres have been developed in Sathanur, Amaravati, Hoggenakal and Madras where wild-laid eggs are hatched in captivity for rearing. Large-scale restocking plans for the 1976-stock are in the offing for March,1979. Presently the state holds over 500 juvenile mugger in their rearing pools.

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19. The status of mugger in Andhra Pradesh

B. C. CHOUDHURY

A state wide survey carried out during the winter of 1976-77 in the two major rivers Godavari and Krishna and their associated tributaries and many other man-made reservoirs, revealed mugger to be an extremely, depleted species in Andhra Pradesh. Only six breeding population groups - each not exceeding four to five adults, were located. Organised killing of mugger for their skin during 1960's and removal of mugger from fishery reservoirs are the main causes of their decline. The state provides excellent protected mugger habitats and have launched large-scale programme of reintroduction of the species in such habitats. Wild laid eggs are collected since 1977 for artificial hatching and rearing of hatchlings to a release size. Simultaneous development of captive breeding programme are also in progress. Experimental releases have already taken place in February 1977 at Ethipothala Falls

(See paper 29 - Eds.)

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20. The status of mugger in Orissa

H.R.BUSTARD, L.A.K.Singh and B.C.Choudhury

Mugger crocodile were reported from all districts of Orissa including the western hilly tract till 1950's. Now the mugger is extinct in lower Mahanandi and Brahmani in Orissa. Known populations are either in very remote areas or scattered and small. The best known population is in the Andhra Pradesh-Orissa border in Sileru river and many reservoirs, in particular Jalaput. Some of these scattered populations may still be in a recoverable stage if efforts are initiated now. ~~Discussion~~

Discussion: The need for a full-scale survey, declaration of a mugger sanctuary and a specific mugger project are felt. Inter-state cooperative effort to save the dwindling A.P/Orissa border population required.

21. The status of mugger in Uttar Pradesh

D. BASU

Mugger crocodiles were reported to be 'abundant' in eleven districts of Uttar Pradesh during 1902-09. In recent years mugger are found only in very small numbers in the Corbett and Dudwa National Parks, in the marshy terai areas of Pilibhit, Kheri-Laximpur, Bahraich, Gonda and Gorakhpur districts, and some man-made lakes in the southern districts of Mirzapur, Benaras, Allahabad, Jalaren, Jhansi and Hamirpur. Some of the main causes for the depletion of mugger in Uttar Pradesh are habitat loss, egg robbing by Malla (Fishermen) community, marginal poaching, and killing of mugger considering them "dangerous to livestock"

Discussion: Partial conservation efforts through captive rearing already in progress in the state gharial conservation project, should be upgraded. Other requirements are a captive breeding programme, declaration of a mugger sanctuary and initiation of both battery and free-range farming.

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22. Status of the mugger in Chambal river

D. BASU and S. CHOUDHURY

Historically the number of mugger co-inhabiting with gharial in the Chambal river have been very low. The ratio of Gharial to mugger which used to be 10:3 during the early 1920's has now come down to 7.3:1 (1978). Four nests of mugger are located and collected annually as compared to 12 nests of gharial. Preferred basking and nesting sites are different for mugger and gharial, and such habitats are limiting in Chambal for the mugger.

Discussion: Gharial conservation project in Chambal will also help mugger but no restocking of mugger should be encouraged. Leaving the mugger nests in the wild for natural hatching and population growth may be adequate.

23. The mugger conservation programme and its present status in India

H. R. BUSTARD

Shadowed by the priority in providing conservation measures to the extremely endangered gharial and the saltwater crocodile, mugger conservation facilities were restricted to only those states where no other species of crocodile occured. These included states like Tamil Nadu, Gujrat, Andhra Pradesh and Kerala, and the progress in eight rearing centres have been very encouraging along with the two gharial rearing centres, one each in Orissa and U.P. that have expanded to mugger rearing facilities as well. States like Bihar, M.P. Maharashtra and Karnataka are keen to initiate similar projects. Over 1000 mugger are now (1978) being reared in state projects.

Discussion: Efforts should be made to encourage other states to mark out and gazette mugger habitats for initiating mugger rehabilitation projects like the one in progress in Andhra Pradesh.

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24. The status of mugger in Nepal

H.R. BUSTARD

Mugger distribution is restricted mostly to the foothills of the Himalayas in south Nepal. 'Thals' (oxbow lakes) in the terai region holds good number of mugger. In some 'thals' as many as 200-250 mugger can be seen with maximum sizes over 3.5 m. From the absence of younger size classes it is inferred that nest predation by populations of wildboar (Sus scrofa), and hatchling losses may be considerably high. Effective legal protection being very strict, mugger in Nepal are well protected and the future of the species appear bright.

Discussion: Narayani river holds a small population of mugger but is predominantly a gharial habitat. A thorough survey of all mugger habitats in Nepal is required.

25. The status of mugger in Bhutan

H. R. BUSTARD

In Bhutan, located on the north-eastern foothills of the Himalayas, historically no mugger have been recorded. Recent investigation confirm this. Mugger have been recorded in the Manas Wildlife Sanctuary, particularly on the Indian portion where perennial rivers provide a good habitat for it.

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CHAPTER - II

REHABILITATION OF INDIAN CROCODILIANS

26. The Government of India/F.A.O./U.N.D.P. Crocodile Breeding and Managment Project in India.

H.R. BUSTARD

Recommendations originating from the 1974 survey by the author on status of Indian crocodiles and their habitats initiated the Government of India to start pilot projects in Orissa and Uttar Pradesh in 1975 to save the extremely endangered gharial and salt-water crocodile, and fast-depleting mugger. By 1979 the project had expanded to seven other Indian States. The objectives of the project have not only been to save the species from virtual extinction but also to protect and preserve the fast decreasing habitats - particularly the mangroves. A simultaneous build-up of a crocodile industry for rational exploitation also considered as the answer to save the Indian crocodilians.

Discussion: A state should not be allowed to run a project without long-term objectives and motivated staff.

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27. Rehabilitation of the gharial in Orissa

H.R.BUSTARD, L.A.K.SINGH and L.N.ACHARJYO

Based on monitoring by visual interpretations, results of the first two years of release operation in the river Mahanadi (Satkoshia Gorge Sanctuary) are discussed. Release:capture:re-release:mortality for 1977-release (April-June) were 26:9:3:2, and 1978-release (February), 46:7:4:0. Individual record-movements for 1977 were 25 km in 15 days, 95 km in one month and 150 km in about 2 months, all in the downstreams, and for 1978 were 40 km downstream in 5 months and 100 km upstream in 5 months. Releases in February indicated movements of lesser distance. All recaptures were in fishing nets outside the sanctuary. In Dec.1978 only one of the 72 released was present within the sanctuary which included a river stretch of 30 km. The gharial were released at 1.2 to 1.4 m size.

Discussion: Some of the reasons for the movements away from the release sites were attributed to bamboo-rafting and fishing within the sanctuary combined with the absence of any pre-conditioning of the gharial to flowing water. Suggested measures were the strict enforcement of ban on movements, and before release an experimental rearing in pools with circulating water.

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28. Preliminary account of gharial rehabilitation in Rajasthan

H.R. BUSTARD

Three gharial (1.5-1.75m) released during 1977 early winter (November) in Chambal River within Rawtbata Sanctuary (now in National Chambal Gharial Sanctuary--Eds.) exhibited 1.3 km movement in six months. Disturbing factors present else-where (see paper 27) are altogether absent. A permanently increased water level due to a barrage downstream and many side creeks favour the suitability of the habitat for release.

Discussion: It was felt that releases made immediate post-monsoon tend to favour the gharial to settle.

29. Restocking of mugger crocodile in Andhra Pradesh:evaluation of a field trial.

B.C. CHOUDHURY

Two and half years' visual monitoring results of a pilot mugger crocodile release carried out in February 1978 at Ethipothala Fall with no resident mugger indicated 100% survival. Movements downstream ranged from 100-800 m even after two monsoons including the worst flood in 1977. The four 30-36 months old, 1.0-1.2 m crocodiles at release time, exhibited wild growth rate comparable to captive growth

(Till now 8 mugger including 3 males have been released, and they have commenced breeding since 1981--Eds.)

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30. Observations on the movement of two mugger crocodiles when returned to the wild.

L.A.K. SINGH

Two mugger crocodiles, at six-months age and 56.9 and 54.3 cm size escaped from captivity into the river Mahanadi during October 1975. The maximum distance moved during the first three months was 4.0 km and the entire observation of 18 months, 10.8 km. Growth of these mugger in the wild was similar to observations in captivity. It is considered that mugger of 55 cm can be released in the wild.

Discussion: Compared to released gharial (see paper 27) mugger exhibited little movement in the same habitat. A release size of 50-60 cm may not be suitable to identify the sex of mugger intended for release, and this indicates that the release size will vary for different species.

31. Results of the saltwater crocodile rehabilitation in Orissa.

H. R. BUSTARD and S. KAR

15 females (1.2 m), with a clipping-code on the 1st scute of the left double-crest whorl, were released in Dangmal and the associated creeks of the Bhitar Kanika Wildlife Sanctuary. Close approach to these was possible for a few days after release. They did not like to remain out in the water current and moved to smaller creeks close to paddy fields of the village. After 22 months 12 could still be located and 3 had moved to the main river.

Discussion: Release sites should be chosen carefully. Gharial also avoid the main water current, and occasionally they can be approached close until two months after release.

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32. Programme for releases and sanctuary management in future.

H. R. BUSTARD

The need for development of a net-work of well protected and managed National Parks and Sanctuaries is stressed for rehabilitating endangered crocodiles. On a species-wise strategy the urgency for the creation of the National Chambal Sanctuary, upgrading the present status of the Katerniyaghat Sanctuary (U.P.) and a well planned management of the Satkoshia Gorge Sanctuary in Orissa are advocated for the gharial. Other than the Bhitar Kanika Sanctuary in Orissa, mangrove areas like Coringa in Andhra Pradesh, Pitchapuram in Tamil Nadu and crocodile areas in the Andaman and Nicobar Islands are to be gazetted, and more attention given to the habitats in Sundarbans for the Estuarine crocodile. For mugger-restocking the following sanctuaries should be created: Moyar and Amaravati in Tamilnadu, Ethipothala, Nagarjunasagar in Andhra Pradesh, Hadgarh in Orissa, and special attention to the mugger habitats in Gir.

Discussion: With respect to gharial definite programmes should also be drawn up in Bhutan, Bangla Desh and Pakistan, and additional sanctuaries in India created in Papikonda (A.P.) and Son (M.P.) (see Appendix for an upto-date list of crocodilian sanctuaries in India — Eds.)

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CHAPTER - III

CAPTIVE BREEDING OF INDIAN CROCODILES

33. Aims and objectives of captive breeding of crocodiles

H.R. BUSTARD

The main objective of captive breeding is to obtain knowledge through research on those aspects of the reproductive biology of a species that may be difficult to study in the wild, and on battery farming for conservation and commercialisation. Within the normal purview of zoo management endangered species have not received special attention. However, a separate project like the one in the Nandan Kanan Biological Park, is an extremely commendable step. Because of high fecundity in crocodilians, captive breeding can bring good success but regrettably, this aspect has not received due consideration. In India gharial have not yet bred in captivity. Only the mugger have bred at a few places like the Ahmedabad and Jaipur Zoos, and Madras Snake Park and Crocodile Bank.

Published as Bustard, H.R. (1980) : Captive Breeding of Crocodiles. In The Care and Breeding of Captive Reptiles. (Eds) Townson, S.N.J. Millichamp, D.G.D. Lucas and A.J. Milliwood. The British Herpetological Society.

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34. Gharial breeding programme at Nandan Kanan - a technical evaluation.

S. MAHARANA

One male and two female gharial (2.8-3.1m) of the Nandan Kanan Biological Park, Orissa were released on the 13th February 1976 into a specially designed breeding pool within the Park premises, with a maximum length of 60 m, breadth 30 m and depth 10 m, and with the provision of a 2.5m high sand bank. Under simulating natural conditions the gharial were observed in courting-display in the winter of 1977/78. Vitamin E were administered as food supplement during 1977 and 1978. Successful breeding is yet to take place.

(Breeding commenced in 1980 when one of the females mated with a male from Frankfurt zoo introduced in this pool in January 1980, and laid 25 eggs, from which 24 had hatched - Eds.).

35. Captive breeding of the mugger crocodile in India : achievements and future

B.C. CHOUDHURY

Out of the 42 recognised zoos in India, in only five the mugger have bred successfully although almost all the other zoos maintain an exhibit for the species. Ahmedabad zoo has set a record of breeding the species since 1960's, followed by Jaipur Zoo, Delhi Zoo, Baroda Zoo, Madras Crocodile Bank and Indira Gandhi Zoological Park at Vizag. Jaipur Zoo presents the best models of pool design with sand, pool, space for egg-laying and a viewing zone. From only one pair this zoo has produced 250 hatchlings. Captive breeding has a definite role in conservation and it should be encouraged in future.

(Since then mugger have bred in Nehru Zoological Park, Hyderabad, Gharial Research and Conservation Unit at Tikerpada, Nandan Kanan Biological Park,, Orissa, and Amaravati Crocodile Rearing Centre, Tamil Nadu - Eds.).

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CHAPTER - IV

PARENTAL CARE IN INDIAN CROCODILIANS

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36. Parental care in crocodilians with special reference to India.

H.R. BUSTARD

A review of the existing literature is provided on parental care in crocodilians starting from Aristotle (4th century B.C) and H.B. Cott (1971) to A.C.Pooley (1974). Describes the parental care exhibited by crocodilians during incubation period, hatching and post hatching period. Participation of male and female in parental duties and described quoting from various authors on Indian as well as non-Indian crodocilians. For Indian crocodilians a review of parental care observed in Indian Zoo have been described.

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Papers quoted above are as follows: (--Eds.)

Cott, H. B. (1971): Parental care in the Crocodylia, with special reference to Crocodylus niloticus. IUCN Publs. N.S. Suppl. Pap., 32:166-180

Pooley, A.C. (1974): Parental care in the Nile crocodile: a preliminary report on behaviour of a captive female. The lammergeyer, 3:22-24.

37. Parental care in the saltwater crocodiles

H.R. BUSTARD and B.C. CHOUDHURY

Local people, who knew this species' habitat intimately, are aware that saltwater crocodile opens the nest, and takes hatchlings into its mouth, and assume this as an act of cannibalism. The possible role of the mother taking the defenseless young from nest to water is discussed. The female with a brood of 25 young close to her head in the water is described. The instances of human being attacked twice in 1978, by nest guarding female in the Andamans are reported and it is inferred after a careful examination that these attacks are purely defensive of the areas adjacent to the nest.

38. Parental care in saltwater crocodile in the wild

S. KAR

Between July 1975 to July 1977 a total of 18 saltwater crocodile nests were monitored in the wild in Bhitar Kanika Sanctuary. At the time of observation, in 10 nests mothers were absent and in 8 the mother observed in wallows. Fresh track marks of egg predators like monitors were observed on nests where mother was not present. Continuous nest-guarding by the female is proved to be absent (see paper 41 - Eds.). There were some changes in nesting sites during the study period which is considered to be a defensive behaviour of the mothers as saltwater crocodiles nest in the same location over the years.

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39. Parental care in saltwater crocodile observed at Nandan Kanan. (*)

L.N. ACHARJYO and C.G. MISHRA

A female reared at the Nandan Kanan Biological Park, when reached 255 cm in length at an estimated age of ten years, began laying infertile eggs in the absence of a matured male. The clutches were with 29, 34, 35 and 34 eggs laid on consecutive years during late May and early June. The oval, hard-shelled and white-coloured eggs measured 69-80 x 40-48mm (n = 50) and weighed 70.5 to 90.0 gm (n = 19). In the first year the eggs were dropped into the pool, but in subsequent years when she constructed a nest, guarded it from the pool or from a dug-out wallow for about ~~two~~ and half months.

(*) Published as (1981) : Egg-laying and Nest-guarding behaviour of Estuarine crocodile (Crocodylus porosus Schneider) in captivity. J.Bombay nat.Hist. Soc., 78 (2) : 387-389.

40. Defence of the nest by the saltwater crocodile against man (*)

S. KAR

On the basis of a study extending over four nesting seasons in the Bhitar Kanika Wildlife Sanctuary in Orissa, it is confirmed that the female saltwater crocodile guards the nest against predators and other intruders. An instance of defence of the nest against man by a 3m nest guarding female is cited from experience gathered during egg collection from the wild.

Discussion: Nest-guarding may vary in degree in different individuals.

(*) Now published as Bustard,H.R. and S.K.Kar (1980): Defence of the nest against man by the saltwater crocodile (Crocodylus porosus Schneider). J.Bombay nat. Hist. Soc., 77 (3) : 514-515

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41. Nest-guarding in saltwater crocodile observed at Nandan Kanan (x)

S. MAHARANA

Crocodylus porosus guards the nest from one or more wallows. Nest-guarding is not a continuous process and in the present study on a captive female, occupied 75% of the total observation period. The crocodile retreated to the pool in the early hours of the morning and also during the day, presumably on thermoregulatory considerations. Absence were usually of short durations, mean 1.46 hours. Nest-guarding occured from different sites. The implications for management are discussed.

(x) Published as Bustard,H.R. and S.Maharana (1982) : The behaviour of the nest-guarding saltwater crocodile (Crocodylus porosus Schneider) - a preliminary quantitative study. J. Bombay nat.Hist.Soc., 79 (1) : 87-92

42. Parental care in the mugger

B.C. CHOUDHURY

The degree of nest-guarding by mugger crocodile from observations carried out both in captivity and wild are given. Captive observations during April 1976 in a breeding pool at Madras Crocodile Bank holding 5 males and 9 females included aggressive behaviour of a nest-guarding female towards human intruders. Similar aggressive behaviour was also observed in the wild in March 1976 both by the author and his field assistants. Presence of the female in water near the nest during early incubation period (as nests were collected for artificial hatching after 4 weeks of natural incubation) was also observed in the wild in Andhra Pradesh in 1977 and 1978. In the wild mugger observed in water within 10-15 m from the nest were assumed to be nest-guarding females, possibly the mothers.

Discussion: The smallest size of a nest-guarding female was reported to be 1.6 to 1.7 m both in captivity and in the wild.

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CHAPTER - V

CAPTIVE GROWTH IN INDIAN CROCODILIANS

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43. Growth of the gharial from Narayani and Kali river, Nepal (1977).

L.A.K. SINGH

During 1977, a total of 590 eggs from 16 nests were collected and incubated in Royal Chitawan National Park. Eggs were incubated for a part in the river bank and then in incubation boxes. Of the resultant 468 hatchlings transported to Hyderabad, India, 230 were shifted to Tikerpada, Orissa for rearing. At the end of one year 78 surviving gharial reached a mean length and weight of 85.60m and 1.096 kg with a range of 59.3-116.0 cm and 0.280-3.120 kg respectively. At 15 months these gharial (n=78) were 69.0 to 110.5 cm (mean 92.7 cm) in length and 0.420 to 2.900 kg (mean 1.478 kg)

(See following paper for a comparison of growth of 216 reared at Nehru Zoological Park, Hyderabad - Eds.).

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44. Growth of the 1977-hatched gharial from Narayani river, Nepal reared at Hyderabad, India.

B.C. CHOUDHURY

From a total sample size of 478 gharial hatched in Nepal in July 1977, 216 one week old hatchlings were reared at the state crocodile project complex at Nehru Zoological Park, Hyderabad. These measured on an average 39.3cm/104 gm. After twelve months, the number now reduced to 29, measured 65.0cm (57.4 to 76.0cm)/ 404 gm (280 to 650 gm), and after fifteen months 66.6 cm (58.4 - 77.5 cm)/ 475 gm (280 - 800 gm).

(See paper no.43 for comparative growth data - Eds.).

45. Growth and survival of two populations of gharial at Lucknow.

S. CHOUDHURY

The paper describes the rearing techniques with survival and growth figures for two populations of gharial, hatched from eggs collected from Girwa river, U.P. in 1975 and Chambal river, M.P/Rajasthan in 1976.

Stock		Hatching	1st. year	2nd year	3rd year
Girwa stock (1975 hatched)	Body length (cm)	35.5	74.1	130.0	178.5
	weight (kg)	0.078	0.641	5.218	17.00
	Survival (%)	n=11	72.7	72.7	54.5
Chambal stock (1976 hatched)	Body length (cm)	36.9	83.3	130.7	-
	Weight (kg)	0.118	1.103	6.098	-
	Survival (%)	n=200	94.5%	90.9	-

46. Growth and survival of two populations of gharial at Katerniyaghat.

A.K. SRIVASTAVA

Gharial hatchlings resulted from eggs collected from Chambal and Girwa rivers reared at Katerniyaghat showed different survival and growth rates in one year. The chambal stock with a survival of 97.5% at the end of one year measured 102.3cm/2.569 kg from a hatching size of 44.6cm/0.112 kg. The Girwa stock with a survival figure of 40% in the same time measured 65.3cm/0.452 kg from a hatching size of 35.9cm/0.097 kg.

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CHAPTER VI

NESTING AND POPULATION STUDIES IN INDIAN CROCODILIANS

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47. Nesting ecology of the gharial in Narayani river, Nepal during 1977

H. R. BUSTARD

Based on field work carried out in the Narayani river, Nepal, it is concluded that the nesting season of the gharial commences with digging of trial nest in the second half of March. The activity is evident first in the downstream, progressing toward upstream. Of 16 nests known of, 4 were laid between 31 March and 1 April, 5 on 2-5 April, and the rest between the 9th and 14th. Egg laying had occurred between 2200 and 2400 hours. Nests were located at a height of 3.2-4.0 m, and straight-line distance of 11 m. The first layer of eggs were at a depth of 27.5-32.5 cm from the surface with an exceptional case of 45 cm. Nest temperature recorded in the morning following egg laying was 27.5°C for two nests. The clutch size ranged from 16-61. In only one case, predation of eggs by human was recorded. Digging of the trial nest by a 3 m-female was observed between 1834 and 1910 hrs. from a distance of 90 m across the river through 6 x 20 binoculars. (see: Bustard, H.R. (1979): A note on nesting behaviour in the Indian gharial, Gavialis gangeticus (Gmelin) (Reptilia, Crocodilia), J.Bombay nat. Hist. Soc., 76 (3) : 519-521 - Eds.)

Discussion: Digging of trial nest considered to be a psychological preparation for the mother and/or testing the suitability of the nesting ground.

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48. Nesting ecology of the gharial in Chambal river (1979)

S. CHOUDHURY

Data presented are based on field experience during 1977-78 in 150 km stretch of Chambal river. The nesting season lasts from 23 March to the second week of April with 41.66% of nests made in the first week of April. In 1977 twelve nests laid were by females ranging between 3.3 and 4.4 m in length in six nesting areas. The temperature in a fresh nest was 28°C and after two months was 34.5°C. The moisture contents of the nests varied between 3.1 and 6.8% by weight when fresh. The nests were located on sand banks with 30° to 40° slope. Two nests were suspected to have been depredated by honey badger (Mellivora capensis) and other potential egg predator seen in the area was Jackal (Canis aureus)

49. Nesting ecology of the gharial in Girwa river

A. K. SRIVASTAVA

Four nests laid between 16 and 19 April, 1977 in a stretch of 12 km of Girwa river in Katerniyaghat Sanctuary, U.P. by females ranging from 3.2-4.6 m in size contained 19, 20, 30 and 89 eggs. Nest width at the bottom ranged from 25-69 cm. Egg sizes ranged from 5.54 x 8.03 cm and weighed 139-171 gm.

*****

50. Selection of nesting sites by female gharial in Katerniyaghat Sanctuary

A. K. SRIVASTAVA

Observations were made in Katerniyaghat Gharial Sanctuary on four female gharial selecting their nesting sites. One measuring 3.2 m made a nest after searching over an area of 120 sq m on the sand banks during 9 day and 3 night visits.

51. Incubation and hatching of a natural nest of the gharial at Katerniyaghat Sanctuary, Uttar Pradesh.

A. K. SRIVASTAVA

A gharial nest, laid in the wild in the Katerniyaghat Sanctuary on 18 April 1977, was left in situ to observe parental care during incubation and hatching. During two observation periods, 10-12 May (22-24 days incubation) and the first week of June (48-55 days incubation), the female, 3.2m long, was observed to be in constant guard from water near the nest. During this it exhibited aggressive behaviour to any human intruder. Aggression included nasal hissing with slightly opened jaws, often accompanied with part-emergence from the water. The nest hatched on 25 June after 67 days of natural incubation.

*****

52. Preliminary observations on a wild gharial population.

H. R. BUSTARD and A. K. SRIVASTAVA

Observations carried-out during early November to late February each year between 1976 and 1978 on a wild population of gharial in the Katerniyaghat Sanctuary, U.P. are reported. Gharial were observed in groups that comprised individuals ranging from 1 m size to adults over 4-5 m. A systematic count of the juveniles indicated a gradual increase from three reported during 75-76 to four observed during 76-77 and five during the 77-78 season.

*****

CHAPTER VII

TECHNIQUES IN CROCODILE REARING AND MANAGEMENT

53. Hatchery techniques to incubate eggs of the gharial.

H. R. BUSTARD and L.A.K. SINGH

The hatchery is predator-proof and consists of simulated nest chambers, 160x100x70cm in size, constructed above the ground of fine sand held in position by loosely arranged brick walls. Moisture contents of 10% by weight is maintained by sprinkling water according to requirement. A simple technique to ascertain the moisture norm is to press a handfull of sand to see if it just takes and retains the shape of a ball. Temperature is recorded by inserting a thermometer through the free end of a bamboo pipe the other end of which is previously placed in the middle of the egg clutch in the nest chamber. By manipulating the availability of direct sunlight, moisture and hot or cold wind the temperature norm (30°C ±) is kept under control even if the ambient temperature goes up to 46°C. The hatching success during the first two years of use of the technique was up to 100% for some nest, averaging around 65%.

54. Hatchery and incubation techniques for the eggs of gharial at Katerniyaghat.

A. K. SRIVASTAVA

A predator-proof hatchery used for egg incubation consists of pits 100x100x30cm dug into the ground and provided with raised walls of loosely arranged bricks to a height of 50cm. The entire nest chamber is filled with fine sand and left open to direct sunlight for provision of the required incubation temperature ($\pm 30^{\circ}C$). With occasional sprinkling of water the moisture content is maintained at 10% by weight. Hatching success during four years have been 63.6-90.9%. The maximum air temperature during the incubation period raises to over $43^{\circ}C$.

55. Individual identification of the gharial.

S. CHOUDHURY

The colour patterns on the double-crest whorls on the tail are different in each individual. This criterion can be used to distinguish individual young gharial in captivity and wild as well. The number and arrangement of large scutes scattered on the nape region can also form a basis to distinguish gharial in small captive groups.

56. Method to distinguish the gharial and mugger from body spoor.

L.A.K. SINGH

Mugger and gharial are found in the same rivers. Following a step by step procedure in the field these two species can be identified from visual cues like basking site, nature of body spoor, tail scute spoor, pug marks and faecal pellets. When PML and FP are the maximum length of the hind pug and diameter of a normal faecal pellet respectively, the total body length TBL = 16 PML + 41cm = 33 FP + 99cm approx. for the gharial, and TBL = 12 PML + 6cm = 60FP - 21cm approx. for mugger.

CHAPTER - VIII

RESEARCH PAPERS (OBSERVATIONS AND HYPOTHESES)

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57. Orientation of the gharial in captivity

L. A. K. SINGH

Several instances are reported in this study which suggest that the gharial shows a definite urge to orient towards a body of water. The probable cues eliciting such responses are also discussed and thought to be direct vision and visual learning. All observations were recorded in captivity supported by a few recorded in the river Mahanadi when captive - reared young ones were released into the wild.

58. The egg of the gharial and its relationship with the hatchlings.

L. A. K. SINGH

The eggs of the gharial measure 82.2 ± 3.1 mm (74 - 88mm) and weigh 154.5 ± 15.2 gm (145 - 168.5 gm). EB = 6.440 + 0.609 EL, where EB and EL are the breadth and length of the egg. The EL X EB value appears to be limited with an upper value of about 50.16 sq cm, that is, when the EL is greater (up to 90mm) the EB is less ~~than what~~ would be expected from the regression. When TBL and W are the length and weight of the hatchling, TBL = 15.88 + 2.43 EL cm, and W = 49.37 + 0.300 EW gm.

*****

59. Growth and biometrics of the snout of the gharial.

L. A. K. SINGH

Development, structure and biometrical relationships of the gharial snout are discussed. During the developmental stages within the egg the snout is a papillated organ with margins of the jaws closely fitting together. Following growth of the teeth the margins separate from each other to accommodate the teeth. The arrangement of the teeth on the premaxilla follow a definite pattern with respect to the mandibular teeth. The 1st, 3rd snd 4th premaxillary teeth and the 1st, 2nd and 4th mandibular teeth are large. Tooth shedding is a regular feature. At hatching snout is 29.76 ± 1.4 mm in length. Before hatching the ratio between total body length (TBL) and snout length (S) is greater than 12. It is 8.0 at two months after hatching. Later it is 7.5 ± 0.5. The ratio between S and basal breadth (BB) is 2.9 at hatching, 4.6 at two months old and 5.0-5.4 thereafter. Growth of the snout is extremely rapid during the first 2-3 weeks after hatching. TBL = 7.14 (S) + 94.46 mm. No sexual dimorphism was noticed in the length of the snout.

****

60. Courtship behaviour of the gharial

S. MAHARANA

Courtship behaviour observed in captivity at Nandan Kanan Biological Park during the 3rd week of February 1976 and the last weeks of January 1977 and January 1978 included intra-female competition with nasal hissing to approach the male. Initiated by this the male responds with extrusion of air through nasal openings and approach the female. Courting also includes playful snout-strokings before mating.

(In 1978 the male gharial had a genital prolapse during mating - Eds.)

61. Female territoriality in saltwater crocodiles

S. MAHARANA

In February 1978 two one and a half year old male saltwater crocodiles(91.4 cm/2.4 kg and 96.5/2.6 kg) were brought to Nandan Kanan Biological Park with five females, two of one and a half years age (88.9cm/ 2.8kg and 91.4cm/2.6 kg) and three of two and a half years age (116.8cm/4.4kg, 116.8cm/4.8 kg and 121.9cm/ 6.2 kg). These were released into a pool with maximum depth of 3m, length 53.5 m and width 40m. The largest female was observed to be territorial and dominated the rest. After 6 months one male and one female were found dead; the male had lost 1.550kg in body weight and the female 450 gm. After another six months when the remaining four females and one male were measured, the dominant female recorded a growth of 43.1 cm/10.8kg in one year as against a mere mean increase of 23.25cm/ 4.425 kg. for the rest.

*****

RECOMMENDATIONS AND FUTURE PROGRAMME

1. Survey should be carried out all over the distribution range of the gharial in India-- particularly in the states of Madhya Pradesh, Rajasthan, Bihar, Orissa, West Bengal and the north-eastern states of Assam, Arunachal Pradesh and Nagaland. Also, efforts should be made for gharial habitats in the adjoining countries of Nepal, Pakistan, Bangla Desh and Bhutan to identify available habitats and population.

2. Initiate gharial conservation project in at least one of the north-eastern states.

3. Since the saltwater crocodile is linked up closely with the mangrove habitat, all such habitats which by themselves are now endangered, should be listed in an inventory and wherever feasible, saltwater crocodile projects be initiated. This is the only way to save the mangrove and the saltwater crocodile in India.

4. A thorough survey should be taken up immediately in the Andaman and Nicobar Islands to assess the population and habitat of the saltwater crocodile, and initiate a conservation strategy.

5. Conservation problems like encroachment, felling of mangrove along the creeks and illegal fishing etc., which are being encountered off and on inspite of protection in Bhitarkanika and may seem to be the problem in all such habitats, a stringent action plan is needed to stop this.

6. Surveys in Orissa, Karnataka and Maharashtra for identification of the mugger populations and their habitats.

7. Mugger appear to be [illegible]ding better than before' all over its distribution range. Instead of wasting this resource a planned network of rearing stations be developed where the species can be brought up to an exploitable level.

8. It is recommended not to include juveniles in [illegible]ulation counts as their chances of final recruitment into the breeding population is uncertain.

9. All releases should be carried out within a protected sanctuary free from 'conflicting factors'.

10. Recommendations for the creation of new sanctuaries are:
For gharial: Chambal (Rajasthan/M.P./U.P.), Son (M.P.), Pappikonda in Godavari (A.P.)

For saltwater crocodile: One sanctuary in Andamans, and one each in Coringa (A.P.) and Pitchavaram (Tamil Nadu).
For mugger: Nagarjuna Sagara/Srisailam (A.P.), Sileru (A.P./Orissa), Hadgarh (Orissa), Moyar, Amaravati and Sathanur (Tamil Nadu).

11. Elevation of the Bhitarkanika and Katerniyaghat sanctuaries to National Park status.

12. In those habitats where gharial and mugger co-inhabit and restocking plans are in progress, it is recommended not to release mugger.

13. It is recommended to evolve and standardise marking and monitor methods for released crocodilians.

14. Every effort should be made to maintain an ideal proportion of male and female among the released crocodilians.

15. Releases of suitable size crocodilians should be well planned considering factors like habitat condition, proper release season and follow up monitoring.

16. Captive breeding projects beginning with the use of all zoo-held specimens should be encouraged at different places for all the three species. Priority should be given to breed a species within its distribution range.

17. No nest should be collected from the wild disturbing the nest-guarding female as it tends to a change in the nesting site in the following season.

18. Most cases of human attacks by crocodiles are by nest-guarding female. An avoidance of disturbance to such females will decrease this and also the existing animosity toward crocodiles.

19. Growth studies are required in selecting fast-growing strains in all three species for possible use in commercial farming.

20. A detailed assessment should be made of the role of the various factors controlling the results of egg incubation.

21. An analysis of feeding energetics and crocodile-fisheries relationship are essential.

22. Research should be initiated on disease problem.

23. A tentative decision is made to hold the Second symposium at Bhitarkanika with S. Choudhury as Convenor-Secretary.

APPENDIX

CROCODILE SANCTUARIES AND NUMBER OF CROCODILIANS RELEASED[1]

(up to 1982)

Sanctuary/State	Area Sq. Km	Gharial	Saltwater crocodile	Mugger
Chambal(U.P/M.P and Rajasthan)	12,568	635	-	-
Katerniaghat(U.P)	400 approx.	58	-	-
Satkoshia Gorge (Orissa)	796	150	-	-
xCorbett N.P (U.P)		12	-	-
Papikonda(A.P)	591	-	-	-
Bhitarkanika(Orissa)	650	-	210	-
xSundarban (WestBengal)	2,585	-	65	-
Coringa (A.P)	236	-	3	-
Kinnerasani(A.P)	635.4	-	-	33
Hadgarh (Orissa)	191	-	-	-
x Krishnagiri (Tamil Nadu)	?	-	-	130
Lanjamodugu (A.P)	20	-	-	-
Man Manjira (A.P)	20	-	-	-
Nagarjunasagar/ Srisailam (A.P)	3,588	-	-	154
xMudumalai (T.Nadu)		-	-	6
xHoggenakal (T.Nadu)	-	-	-	46
xMundanthorai(T.Nadu)		-	-	21
xSivpuri N.P (M.P)	156	-	-	25
xGir N.P (Gujrat)	1,412	-	-	-
xSimilipal (Orissa)	2,300	-	-	60
xPerambiculam(Kerala)	270	-	-	-
xNeyyar (Kerala)	128	-	-	-
Pakhal (A.P)	860	-	-	15
TOTAL NUMBER RELEASED		855	278	490

x Not specifically created for crocodiles

1. Source of information : Singh,L.A.K(1982):Situation Report:India,Paper presented at the Sixth IUCN Crocodile Specialist Group Meeting held at Victoria Falls,Zimbabwe.

APPENDIX I

CROCODILE REARING /BREEDING CENTRES IN INDIA (UP TO 1982)

LOCATION/STATE	GHARIAL	S.W.CROC.	MUGGER	YEAR STARTED
1.Tikerpada(Orissa)	X	–	X	1975
2.Kukrail, Lucknow(U.P)	X	–	X	1975
3.Katerniyaghat(U.P)	X	–	–	1976
4.Hyderabad (A.P)	X	X	X	1976
5.Deori, Morena(M.P)	–	–	–	1980
6.Dangamal (Orissa)		X	–	1975
7.Bhagabatpur(W.B)		X	–	1976
8. Port Blair (Andamans)	–	X	–	1979
9. Amaravati (Tamil Nadu)	–	–	X	1976
10.Sathanur(Tamil Nadu)	–	X	X	1976
11.Hoggenakal(Tamil Nadu)	–	–	X	1980
12.Masinagudi(Tamil Nadu)	–	–	X	1976
13.Madras(Guindy)Tamil Nadu.	–	–	X	1975
14.Vadanemmeli(Tamil Nadu)++	–	–	X	1977
15.Gir (Gujrat)	–	–	X	1979
16.Gandhi Nagar(Gujrat)	–	–	X	1977
17.Perambikkulam(Kerala)	–	–	X	1977
18.Neyyar(Kerala)	–	–	X	1979
19.Nagarjuna Sagar(A.P)	–	–	X	1977
20.Taroba (Maharashtra)	–	–	X	1976
21.Ranchi (Bihar)	–	–	X	1979
22.Joshipur, Similipal(Orissa)	–	–		

Captive breeding/Rearing centres.

Nandan Kanan Biological Park (Orissa)	X	X +++	X	1976
Ahmedabad(Gujrat)	–	–	X	1960
Baroda(Gujrat)	–	–	X	1965
Jaipur(Rajasthan)	–	–	X	1967
Snake Park/Crocodile Bank, Madras, Tamil Nadu. +++	X+++	X	X	1975
Delhi	–	–	X	1976
Vishakhapatnam(A.P)	–	–	X	1978
Hyderabad (A.P)	–	–	X	1980
Tikerpada (Orissa)	–	–	X	1981
Bannerghatta(Karnataka)	X +++	–	X +++	1980
Kukrail (Lucknow)	–	X+++	X+++	1980
Dangamal(Orissa)	–	X+++	–	1981
Bhagabatpur(W.B)	–	–	–	1981
~~Taroba (Maharashtra)~~			X +++	1981

++A private conservation trust.

+++ Centres where captive breeding attempts are being made.

INTERNATIONAL UNION FOR CONSERVATION OF NATURE AND NATURAL RESOURCES
SPECIES SURVIVAL COMMISSION

ASIAN ELEPHANT SPECIALIST GROUP
CENTRAL INDIA TASK FORCE (BIHAR & ORISSA)

Co-ordinator : S. P. SHAHI. IFS (Retd.)
Hehal Ranchi - 834 005
Bihar (India)

Field Biologist : Dr. SUSHANT CHOWDHURY
Aich Building, Golepahari,
Tatanagar - 831 002
Bihar (India).

February 7, 1983.

Dear Singh,

Just now I received your letter of Dec. 21, 1982 redirected to me from Lucknow. As far as my memories goes back quite a few months ago I had written you about my present assignment with Asian Elephant Group. IUCN/SSC. Presently I am working with Central India Task Force and my head quarter is at Talanagar (Jamshedpur). My present adress is as above.

I am happy to know that you and Binod with yours best effort now completed the forwardings of KTG Symposium 1979. But I am afraid, whether for my papers, you have taken the accounts from my thesis or not? As you know I have given a copy of my thesis for CEMBTI. My papers are still underway for publication. Will you kindly let me know wherefrom you have taken the account of my papers?

As far as expenditures for this publication is concerned I am always with you to bear. Kindly let me know exactly how much comes to my share and in what mode it will be convenient to receive the sum? If any one of you have State Bank of India account Pl. send the account no. and Branch name and I will send through M.T.

Please send the copies of the publication to my above adress

Best wishes from.

Sushanta

Talangagar
February 7, 1982.

Dear Bimal,

Yesterday after my return from the usual field trip I discovered your letter / greeting. I hope you must have my new years greeting card which I forwarded you earlier.

Just now I got a letter from Dr. A.K. Singh regarding 1979 Kalimpong symposium proceedings which you also have written. I am very happy regarding it accomplishment after a long awaiting for which you and Singh worked hard. But I feel concern regarding my papers whether the abstracts or accounts are taken from thesis or not? As you know probably I had given a copy of my thesis to CCMBTI. Kindly ~~let me know~~ regarding the above point.

Regarding the expenditures of the publication I am always with you to bear. Kindly let me know the exact sum which I have to pay you and what mode? It will be convenient if can send any S.B.I account number and Branch name so that it can be sent through M.T.

Please send the my copies to ~~my~~ Talangagar address as below:

SUSHANT CHOWDHURY
AICH BUILDING
GOLEPAHARI
TATANAGAR - 831002
(Bihar)

Pl. Convey my wishes to Dr. Dattriti, Dr. Mir Gauhar ali etc.

Best wishes from.

Sushant

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नवम एशियाई खेल
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Mr. Binod C. Chaudhary
Research officer, Crocodile Project
C/o Nehru Zoological Park
Hyderabad - 500 264

पिन PIN 500264

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Sushant.

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अस्पृश्यता ईश्वर और मानवता
के प्रति अपराध है।
UNTOUCHABILITY IS A CRIME
AGAINST GOD AND MAN

पहला मोड़ FIRST FOLD

दूसरा मोड़ SECOND FOLD

यहाँ काट कर खोलिए TO OPEN CUT HERE

From:
Lala A. K. Singh
C.C.B.M.T.I.
Bahadurpura
Hyderabad 500 264

Dec. 21, 1982

Ajai / Sudarsan/ Dhruba

Dear Sudhakar/Sushant/Dr. Acharjyo:

You will be happy to know that Binod and I are now almost through all the processings to publish the proceedings of our symposium held at Katerniyaghat in Jan. 1979. As you remember, both of us were the rapporters and thus had the entire proceedings written in our record. Besides, you had also provided the abstracts of some of the papers. I had, in addition, the informal position of the Convenor-Secretary.

The proceedings will contain all the abstracts with additional information like the present position of the complete paper (if published, where!) and as far as possible a present-day picture of the topic. All these additional information will be from notes from the Compiler/Editors. The cover has already been printed with a photograph that silently speaks that research is in progress. I am sure, you will love the photograph. That was supplied by Binod.

The text will be cyclostyled within about 60 pages. We expect that a few copies of it will reach you as New Year (paid) presents.

We have estimated that to print 150 copies, which will be mailed also to all the state CCFs, some overseas personnel, Indian administrators (policy makers) etc., the total expenditure will be Rs800.00. Both Binod and I are now spending the amount hoping that you will come forward to make light the pressure on our purse. Please do not hesitate to send any amount you can at my address or to Binod at Nehru Zoological Park, Hyderabad- 500 264.

Let me also point out here that we considered the publication of the proceedings very urgent because there has been a serious threat to the credibility of research being carried out by we the researchers.

We look forward most anxiously to hear from you.

With my best wishes,

Sincerely yours,

(Lala)

Binod

Dt.18.2.83

My dear Sushant:

It is a delight to receive a letter from you after such a long lapse of time. I am happy to know of your present assignment, though we very much miss you from the cross-- hope, you will stage a grand return!

The Proceedings have already come out, as I wrote you; we could finish all the job in the first week of the new year. We have not seen your thesis copy for preparation of the proceeding. We have only published the abstract, which you had earlier written and provided. Extra guidance was also obtained from our personal notes in our capacities as rapporteurs. Anyhow, it has come out, and I believe, you will like the whole effort. I have heard from Sudhakar that he will pay 'something' when his current financial position is a bit better. Dr. Acharjyo has offered to pay something at a some later date. We have sent one copy to each of them and will send more later. In the first week of March we will send you five copies, and if you want more, please do write. The total expenditure we have incurred now mounts to over a thousand-- the details of expenses are all recorded. So whatever you think suitable please do send.

We have not written to ~~Ramnyat~~ Ajai as yet, and also we do not have his present address. Please let us know if you have his address.

Dr. Bustard, after having seen the publication has written that we should arrange reviews of it in Copeia, Herpetologica and Brit. J. Herpetol etc., and arrange to sell at 4$ to USA and 1.5£ to U.K.-- please comment on it.

Are not you coming anytime to this side?
I will write to you more later.
With very best wishes: sincerely yours,

P.S.: After discussing with Binod I will let you know exactly ho
much you should pay, and also we will provide you the account in
SBI, Hyderabad to which you should send the amount. Thank you
this moment for your usual sportive manners in such enterpris

BLL

Tatanagar
March 1, 1983.

Dear Lala,

Thank you very much for your quick answer and hoping you to be hale and hearty. From last week my health is not going well and continuing on medicine. Now however, recovered almost and soon goin my usual tour programmes to Orissa.

As you have written I am waiting for the publication to my end. Any comment on its, sell to various foreign countries as per the suggestions of Dr. Bustard, will be communicated to you soon after going through it.

As you desired to know the adress of Mr. Ajai Kumar Srivatava, I am enclosing herewith. At present he is in Lucknow and working in a C.S.I.R Institute i.e. Central Drug Research Centre. Hope you will be familiarized with. He is working there in a status of J.T.A. However, he is able to get three advance increments due to his ~~and~~ educational back ground. His present work is concerned with primate breeding and engaged there in primate house.

I will inform you if I have any plan to come to Hyderabad? Pl. do write some thing about institute and its ~~to~~ progress. Training course is still going or stopped now. What else? Best wishes from

Sushab

Adress of Ajai Kumar Srivastave

Mr. Ajai Kumar Srivastava
51, Mahesh Prasad Street
Molviganj
Lucknow - 226018
(UP)

अन्तर्देशीय पत्र कार्ड
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35 INDIA 35

Dr. K. A. K. Singh
C/o Central Crocodile Breeding Management Training Institute
19-4-319, Lake Side,
Rajendra Nagar Road
Hyderabad -
पिन PIN 5 0 0 2 6 4

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इस पत्र के भीतर कुछ न रखिए NO ENCLOSURES ALLOWED
पते में पिन कोड लिखें WRITE PIN CODE IN ADDRESS
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Sushant

पिन PIN

दूसरा मोड़ SECOND FOLD

Sent 10 copies on 28/10/83

Talānagar
2nd April, 1983.

Dear Lala,

I got the publication of KTG. symposium proceedings in time. Unfortunately being out and then become ill for quite a few days I could not attend you. First let me congratulate you and Binod for this nice production. It will be of great interest if this proceeding can be published in some international Journal outside to know much of the conservation efforts done in our country.

I am extremely shocked to learn about the irrepairable loss to Binod. I do not know how should I pass my words of deep and genuine sorrow. I will soon write to him but in the mean time I only pray Almighty God to give him enough strength to bear this blow.

Lala let me know how you got the responses for this publication from all forest department peoples and advocates of our conservationists. It will be matter of pleasure for me. I will highly appreciate if you kindly keep me informed with the activities of CCMBTI and can cater some publications and papers etc.

I am waiting to hear you regarding the monetary contribution which I have to made.

Best wishes from

Sushant

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Dr. L. A. K. Singh
C/o Central Crocodile Breeding and
Management Training Institute
Bahadurpura
Hyderabad - 500 264.

पिन PIN (AP).

पहला मोड़ FIRST FOLD

तीसरा मोड़ THIRD FOLD

दूसरा मोड़ SECOND FOLD

इस पत्र के भीतर कुछ न रखिए NO ENCLOSURES ALLOWED

प्रेषक का नाम और पता :— SENDER'S NAME AND ADDRESS :—

Sushanta
Talanagar

पिन PIN

Binod C. Choudhury

NEHRU ZOOLOGICAL PARK
HYDERABAD - 500 264.
INDIA

7 September 1993.

My Dear Sudhakar/Sushant/Ajai/Soherana/Lala/B.C

Re - Publication of Symposium Volume "Indian Crocodiles- Conservation and Research".

All of you know that this publication was possible because of the initial financial expenditure incurred by Lala and myself. A total of 150 copies were made each costing on an average about Rs 6.00/. After the copies were made several copies were sent to all Chief Wild Life Wardens of all states and researchers abroad for which we have spent an amount of over Rs 200/.

Both of us expect that the cost would be shared by all of us in equal proportions. Each of us will have 10 copies of the publication and contribute Rs 220/ to cover the cost of the preparation of this volume. By separate cover I am forwarding 10 copies of the volume to each of you.

Please forward your cheque of Rs 220/- in my name at your earliest convinience.

Let us also plan to meet at someplace soon and have a much smaller seminar than before. Please give your opinions on this proposals.

With best wishes.

Yours sincerely,

for address see overleaf

BC

(B.C.Choudhury)

Sadhakar :

Sushant :

Indorshan : Mohewana S, Manager
Crocodile farm, Damodar Valley Corporation
Soil conservation Dept. (Forestry Section)
Hazaribagh.

Srivastava . A.K.

Lale . A.K , P.O. Box - 11 , Morena 476 001
M.P

Basu . D.

Dr. Sudhakar Kar.
Research Officer
Saltwater Crocodile Research
& Conservation Centre,
Dangamal, Cuttack. Orissa.

Dt. 15. X. 83

My dear Binod,

Thank you very much for your letter of 7th Sept.'83. I am extremely sorry for my late in reply to you. I am aware of the publication of symposium volume "Indian Crocodiles - Conservation and Research". I am trying to send Rs.200/- of my share towards the cost incurred for the publication of symposium volume. You must be assured of getting Rs.200/- very soon.

It is really essential that we people should meet atleast once in a year but it is the matter of regret that after the departure of Dr. Bustard no body is there to push the matter. It will be most helpful if you can take the intiative.

How is your work going on ? Are you going to attend the Bombay Centenary Cominar ?

Hope you are well with health and work.

With best luck.

Sincerely yours

(S. K. Kar.)

To
B.C. Choudhury
NEHRU ZOOLOGICAL PARK
HYDERABAD-500264
I N D I A

Sent - 16 Photos
on 28.10.83

Dear Sudarshan / Ajai

Sent one copy each on 27/10/83

24.10.83 letter

Re - Symposium volume "Indian Crocodile. Conservation and Research.

...

By now you must have received my letter of 7 Sept 1983. I have received replies from Sudhakar and Sushant and both of them have agreed to send Rs 220/ towards their share of publication cost of the volume.

I am enclosing one copy of the volume and on receipt of your acknowledgement would mail the other 9 copies due to you.

Please make arrangement for payment and collection of the volume at an early date.

There have been requests from various researchers from abroad for copies of the volume and so far Dale and myself have spent over Rs 200/ only on postage of this volume. Hope to hear from you soon

Best wishes

BC

Binod C. Choudhury

NEHRU ZOOLOGICAL PARK
HYDERABAD - 500 264.
INDIA

-Errata-

Page	Line	Printed or	Should read
iii	30	and at	and in

Ajai
51. Mahesh Prasad Street
Malviguny
Lucknow - 226018.

Maharana. Manager
Gradlik Farm.
Damodar Valley Corp.
Soil Conservation Dept (Forest Section)
Hazaribagh
Bihar.

S. Maharana, M. Sc
Deputy Director,
Fisheries and Crocodile Project

DAMODAR VALLEY CORPORATION
Soil Conservation Department
HAZARIBAG - 825301
INDIA

Date 31st Oct 1983

D.O. No. 267

Sub : Indian Crocodiles - conservation and Research.

Ref : Your letter of 7.9.83 & 24.10.83.

My Dear Binod,

Thank you for you remembering me and the pains you and Lala must have taken for the preparation and production of the volume. Though I am not in receipt of your one copy as promised in your last letter, I shall be sending my share of Rs. 220/- that would reach you around 10th November, 1983.

It will be of immense help to the DVC Crocodile Project, if you people can keep it in your mailing list.

Convey my best wishes to Lala and am separately wix writting him to help our Project by his valuable publications.

Yours sincerely,

Maharana
31.10.83
(S. Maharana)

To
Dr. B. C. Chowdhury,
Research Officer,
Nehru Zoological Park,
Hyderabad - 500 264.
I n d i a.

Binod C. Choudhury

NEHRU ZOOLOGICAL PARK
HYDERABAD - 500 264.
INDIA

..2 November 1983...

Dear Joorasan, Subhendu, Bhatt, Maharajatra.

I am enclosing herewith a copy of the symposium paper abstracts published in a book form. You may recall the painful hours you spent listening to our boring talks on crocodiles at Katreniyaghat during the last weeks of January 1979.

It took us more than four years to compile the facts in the present form and another few months to pool our limiting resources to bring this present publication to its present form.

I , sincerely hope you would spend a few minutes with this volume and recapitulate the painful boring hours once again - but this time it may bring back some fond memories as well.

With best wishes from a sincere friend.

Yours sincerely,

Binod

Binod C. Choudhury
Asst. Director, CROCODILE RESEARCH CENTRE
Hyderabad-500 264.

NEHRU ZOOLOGICAL PARK
HYDERABAD - 500 264.
INDIA

To
The Officer In-charge,
Crocodile Research Centre,
Hyderabad-500 264.

Dated the 5th July 1985.

Sir,

Sub: Donation of Publication - reg.

The forum of Crocodile Researchers, India had published in 1982 a proceeding volume of the first Crocodile Researchers' Symposium (held at Katerniyaghat, UP, during January 1979) entitled Indian Crocodiles - Conservation and Research. This publication was appreciated by crocodile workers everywhere as this provided the baseline data on status, conservation efforts, research etc. for the Indian crocodiles. Reviews of this publication has appeared in the IUCN/SSC Crocodile Specialist Group Newsletter and the Bulletin/Journal of the British Herpetological Society.

The forum is left with a surplus stock of 50 copies of the above mentioned publication and would like to donate them to the Crocodile Research Centre for use as the forum members were/are closely associated with the past and present activities of the Centre.

Kindly acknowledge the receipt of the volume.

Yours faithfully,

(B.C. CHOUDHURY)

C.C. Dr. L.A.K. Singh, for information.
Dr. S. Kar, for information.

FORUM OF CROCODILE,
RESEARCHERS, INDIA
NEHRU ZOOLOGICAL PARK
HYDERABAD-500 264.

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Wildlife Institute of India
19-4-319 Lake Dale, Bahadurpura PO
Hyderabad-500 264.

Dated the 5th July 1985.

To
Shri B.C. Choudhury,
Forum of Crocodile
Researchers, India,
Nehru Zoological Park,
Hyderabad-500 264.

Dear Sir,

This is to gratefully acknowledge the receipt of 50 (fifty) copies of 'Indian Crocodiles - Conservation and Research' - a proceeding volume of the first Crocodile Researchers' Symposium held at Katerniyaghat, January 1979), from the Forum of Crocodile Researchers, India. Thanking you for this gesture.

Yours faithfully,

Officer In-charge,
Crocodile Res. Centre, Hyderabad.

C.C. Dr. L.A.K. Singh.
Dr. Sudhakar Kar.

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Research Scholar

Gahirmatha Sea Turtle Project

P.O Sathbhaya 750 220

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To
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To
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