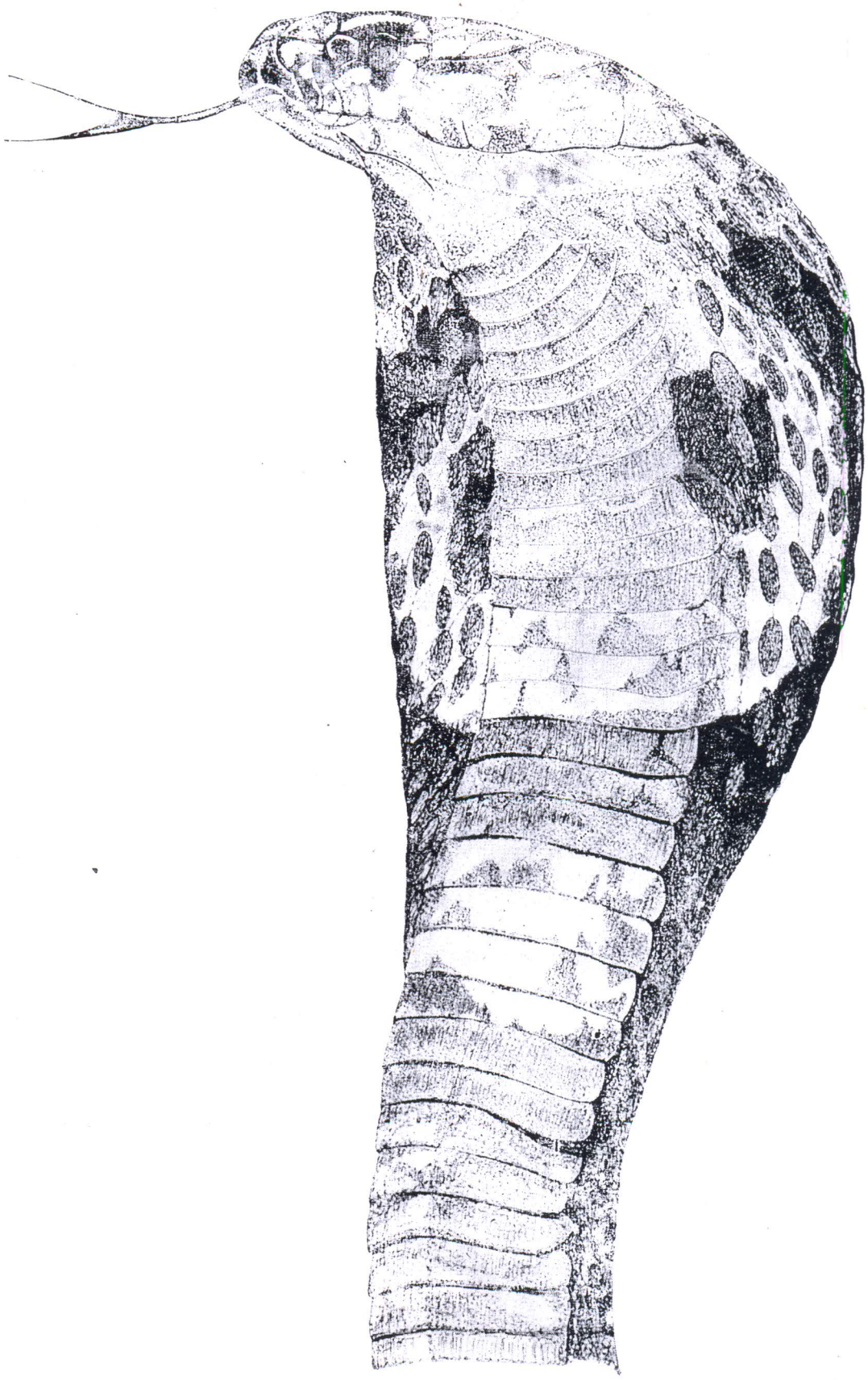
HAMADRYAD

12 No: 1 MAY 1987



H A M A D R Y A D

12 : No. 1 May 1987

CROCODILE BANK NEWS

Crocodylus palustris is feeling the pinch of inflation, and to meet rising costs, the Croc Bank has raised the entrance fee to Rs 2.

So is the newsletter, and since we are too civilized to raise subscriptions, we are decreasing the issues to two a year (May and September). As things were, subscriptions did not even cover postage. The newsletter still runs at a loss, but donations keep it afloat. On this score, special thanks to Dr Roger Conant, Dr Jeff Lang, Dr Salim Ali and Dr Mike Ewert.

The Croc Bank was very fortunate in having a visit from freshwater turtle expert Dr Mike Ewert, from the University of Indiana, and his sister Gretchen, during February-March. Mike made many good suggestions about improving the turtle programme. He helped draw up a project for getting embryos out of their diapause and continuing development. We hope to see Mike at the Croc Bank for a longer period.

Dr Jeff Lang has been here since January and plans to stay on until after the mugger hatching session in June. He has been at the University of Manchester during '86, working on crocodile egg physiology (or was it psychology?) and will return to North Dakota, his home base, this summer. He is being assisted in his research at the Croc Bank by Simon Wakefield from England.

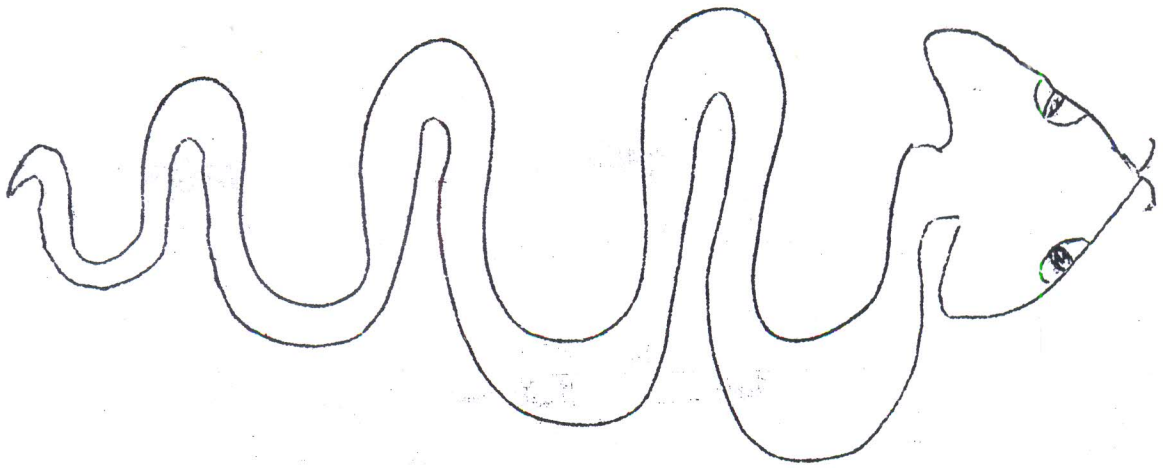
Dr Jack Frazier is in India on a one year study on tortoises and spent two weeks at the Croc Bank. Since his visit coincided with Mike Ewert's, a very chelony time was had by all. Other visitors included Dr V B Singh and Dr L A K Singh representing the crocodile group of the Government of India.

The Bank participated in the annual trade fair in Madras, helping set up an environmental exhibit organized by the Indian National Trust for Art and Cultural Heritage.

The Tamil Nadu Energy Development Agency has donated a windmill to the Bank and this will enable us to pump water for all the hatchling ponds.

Since Brenda Bhaskar left in May last year, we have not had a secretary, and advertised a couple of months back for one in the local papers. Among others, we had several applications from highly qualified accountants, claiming they have always wanted to work in a bank!

Late news: happy to say that Romaine Andrews has joined us and is resurrecting the office.



A NOTE ON LONGEVITY OF A KING COBRA (*Ophiophagus hannah*) IN CAPTIVITY

An adult king cobra, brought to the Nandankanan Biological Park on December 2, 1973, died on May 17, 1983 after 9 years and 5½ months at the Park. It was housed in a spacious enclosure with a floor space of 36 sq metres and 1.5 metres in height. It was feeding on freshly killed non poisonous snakes like rat snakes and checkered keelbacks. It was fed once a week and during cooler weather its food intake was much reduced. The Park has been maintaining king cobras since June 1973 and this is the longest captive period established so far. At present we have two adults, brought in on January 8, 1984 and February 10, 1984 respectively.

Gowda (1963) states that king cobras do not usually do well in captivity. According to Whitaker and Whitaker (1981) king cobras caught as adults do not live long. This particular snake has lived for over twelve years in captivity (Daniel, 1983).

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SNAKE COLLECTION DATA FROM BHAVNAGAR CITY, GUJARAT FOR 1984

I have kept and studied snakes for several years and often, residents of Bhavnagar city call me to collect a snake from houses or gardens. I usually identify the snake, record details of size, sex and colour variation, and release it as far away from the city as possible.

Old Bhavnagar, once a serene, beautiful princely state is now a thickly populated and highly congested city. Surrounding this core, New Bhavnagar and its suburbs sprawl in every direction, elbowing out traditional farm lands. But in spite of this, reptiles prevail to some extent. It is good to know that snakes manage to hold out in spite of the drastic environmental changes taking place all over India.

During my informal study, I have collected and recorded seven specimens of Elaphe helena (trinket snakes) from Old Bhavnagar. The longest recorded trinket male was 110 cms in length (Smith, Fauna of British India, 1943). In August '84 I caught a male trinket of similar length and, on the same day, a female measuring 134 cms. Below is a listing of snakes caught in Bhavnagar city during '84.

No.	Date	Species	Sex	Length
1	25 Jan	Eryx johnii	F	60 cms
2	11 Feb	Eryx conicus	F	50 cms
3	11 Feb	Typhlina bramina		13 cms
4	13 Feb	Lycodon aulicus	F	40 cms
5	13 Feb	Oligodon arnensis	(young)	17 cms
6	14 Feb	Naja naja naja	F	129 cms
7	16 Feb	Lycodon aulicus	M	52 cms
8	7 Mar	Ptyas mucosus	F	180 cms
9	8 Mar	Naja naja naja	M	85 cms
10	31 Mar	Naja naja naja	F	100 cms
11	1 Apr	Naja naja naja	F	95 cms
12	14 Apr	Naja naja naja	F	150 cms
13	18 Apr	Xenochropis piscator	(young)	25 cms
14	29 Apr	Naja naja naja	M	152.5 cms
15	30 Apr	Boiga trigonata	F	35 cms
16	3 May	Elaphe helena	M	75 cms
17	2 Jun	Typhlina bramina		8 cms
18	7 Jun	Lycodon aulicus	F	47 cms
19	28 Jun	Elaphe helena	F	65 cms
20	14 Jul	Naja naja naja	F	118 cms
21	18 Jul	Ptyas mucosus	F	144 cms
22	31 Jul	Xenochropis piscator	F	50 cms
23	31 Jul	Naja naja naja	(young)	36 cms
24	4 Aug	Xenochropis piscator	M	130 cms
25	6 Aug	Lycodon aulicus	F	60.8 cms
26	8 Aug	Ptyas mucosus	F	105 cms

No.	Date	Species	Sex	Length
27	10 Aug	Ptyas mucosus	M	240 cms
28	17 Aug	Elaphe helena	M	110 cms
29	17 Aug	Elaphe helena	M	105 cms
30	17 Aug	Elaphe helena	F	134 cms
31	20 Aug	Lycodon aulicus	F	44.5 cms
32	20 Aug	Amphiesma stolata	(young)	12 cms
33	20 Aug	Naja naja naja	F	133 cms
34	8 Sep	Elaphe helena	M	38.5 cms
35	10 Sep	Ptyas mucosus	M	187 cms
36	12 Sep	Echis carinatus	F	68 cms
37	18 Sep	Ptyas mucosus	F	110 cms
38	27 Sep	Naja naja naja	?	115 cms
39	1 Oct	Bungarus caeruleus	M	81 cms
40	8 Oct	Naja naja naja	F	67.5 cms
41	10 Oct	Naja naja naja	F	71 cms
42	13 Oct	Elaphe helena	M	81 cms
43	4 Nov	Xenochropis piscator	F	135 cms
44	5 Nov	Ptyas mucosus	M	102 cms
45	9 Nov	Lycodon aulicus	M	45 cms
46	12 Nov	Naja naja naja	F	93 cms
47	31 Dec	Naja naja naja	F	105 cms

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POISONOUS SNAKEBITE CASES IN RAIDIGHI RURAL HOSPITAL, WEST BENGAL, IN 1985 AND 1986

Year	Men	Women	Cobra	Krait	Expired after treatment	Patient brought dead
1985	4	10	5	5	1	1
1986	6	6	5	7	3	2
Total	10	16	10	12	4	3

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WOMAN DIES FOR WANT OF ANTIVENOM SERUM

On October 19, '86, an ayah (maid) at a noon-meal centre saved ten children from being bitten by a cobra, but herself fell a victim to cobra bite. Mrs Susila, an ayah at the noon-meal centre of Palayar village six kms from Kumbakonam town, was going, along with the ten children, from the neighbouring Harijan colony to the centre. On seeing a cobra.. on a temple wall on the way, she asked the children to run away, and tried to prevent the cobra from moving towards them. In the process, the cobra attacked her and bit her several times. She was rushed to the Patteeswaram Primary Health Centre, where the necessary antidote was not available. She was later taken to the Government Hospital at Kumbakonam, which too did not have the antidote. She succumbed to the cobra bite on the way to the Thanjavur Medical College Hospital. (Indian Express, 21 October '86)

LETTER TO THE EDITOR IN RESPONSE TO THE NEWS ARTICLE

Sir- I refer to the news item about a snakebite death in Thanjavur because of the non-availability of antivenom serum. The inadequate supply and distribution of antivenom serum, because of which thousands of snakebite victims die every year, is a subject about which I have written and addressed meetings for many years. At a screening of our film on snakebite earlier this year, the Minister of Health assured us of his government's seriousness regarding this problem, but the result is still to be seen. In a welfare state such as ours, it is ridiculous to allow people to die for want of a medicine that costs a mere Rs. 40. A doctor from Bihar told us recently that his hospital has not been able to get antivenom serum for the past six months. The situation is no better in Tamil Nadu. Health officials' claim that antivenom serum is stocked at all primary health centres is simply not true, as poor Mrs Susila found out in Thanjavur this week. (Rom Whitaker, President, Irula Snake Catchers Cooperative, Madras 603 104)

FOREST EMPLOYEE SAVED FROM PYTHON'S HOLD

It was a miraculous escape from the jaws of death for Nanaiah, a Forest Department employee. When he was walking in a forest in Makutta on the Kerala border recently, a python grabbed him, entangled him and started swallowing him. Providentially, some other Forest Department employees who passed by, saw Nanaiah sinking deep into the coils of the snake. Losing no time, they brought axes and sickles and started attacking and cutting up the python and extracted Nanaiah from what would have been certain death. The Forest Department has arranged for his treatment. (The Hindu, 3 December '86).

BIGGEST SNAKESKIN HAUL

Forest cell police seized snake skins worth Rs 20 lakhs from a tannery in Chrompet, Madras. This is claimed to be the single largest seizure of snake skins in the country. Over 1.22 lakh skins were found. (Indian Express, 6 March '87)

INTERNATIONAL SNAKE TRADE

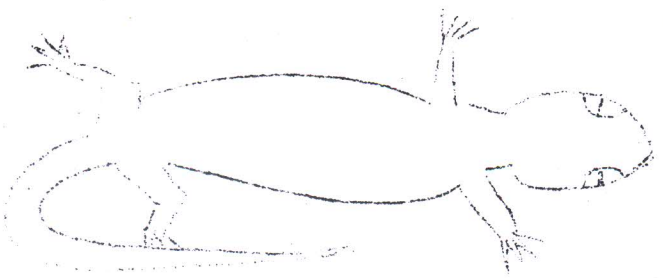
In Herp Review 17(4) 1986, Ken Dodd of the U S Fish and Wildlife Service summarizes the 1977 to 1983 import of specimens and products of snakes listed under CITES (Convention on International Trade in Endangered Species). Snakes not listed include the then unlisted rat snake (Ptyas mucosus). In just two months in 1982, 49,080 rat snake skins and 315,989 products (mainly shoes, belts and handbags) made from rat snake skin were imported. So much for the 'friend of the farmer'. Ken is correct in stating that India has banned Ptyas skin export but he doesn't mention that the Bharat Leather Corporation (Government of India) is permitted to export Ptyas skins seized from or handed over by traders after the ban. It would be interesting to know how much snake skin export has decreased after the ban. Hamadryad reader Asad Rafi Rahmani has written to say that the Central Cottage Industries Emporium, New Delhi is selling snake skin bags, shoes and wallets for a 15% discount. He has enclosed an advertisement in the Times of India of 6 January '87 to this effect, titled "Winter Stunners".

During the six year period covered by Ken's note, 45,039 live Indian pythons (Python molurus), 58,054 skins and 155,814 products were imported. Many probably came from neighbouring countries but the volume is nevertheless staggering. As Ken concludes, "Until data on the biology and life history of snake species in trade are forthcoming, the impact of commercial trade on the status of species listed in CITES appendices will remain unknown. Considering that many heavily traded species, such as sea snakes, are not listed in CITES appendices, that the extent of illegal trade is certainly massive and that the habitats of many of these snakes are being threatened..., such trade figures are sobering and cause for concern."

THE IRULA SNAKE CATCHERS COOPERATIVE

Since the Russells viper and cobra are now on Schedule II of the Wildlife Protection Act, Central Government permission is required to catch and keep these snakes, and for the past few months the cooperative has been unable to produce their venoms. The Irulas are now the only suppliers of venom for the production of antivenom serum. Antivenom is in short supply and it is important that there are no delays in licensing paperwork. For the moment, only krait and saw-scaled viper venoms are being produced.

Many good things have happened at the co-op in the last year. The venom project received a grant from NORAD for a lyopholizer, and the rodent control program has again been underwritten by Oxfam. The Irulas have been doing trial rat catches at farms; they have a jeep at their disposal, and a manager who supervizes the work. A summary of eighty trials during Aug '86 to March '87: 4313 burrows were dug up and 6363 rats caught. The highest number caught in one day was 487, with 5 Irulas working. 119 kg of paddy was found in burrows. Cost of control per rat was 75 paise. (In contrast, a pesticide control program in Lakshadweep spent Rs 14 per rat).



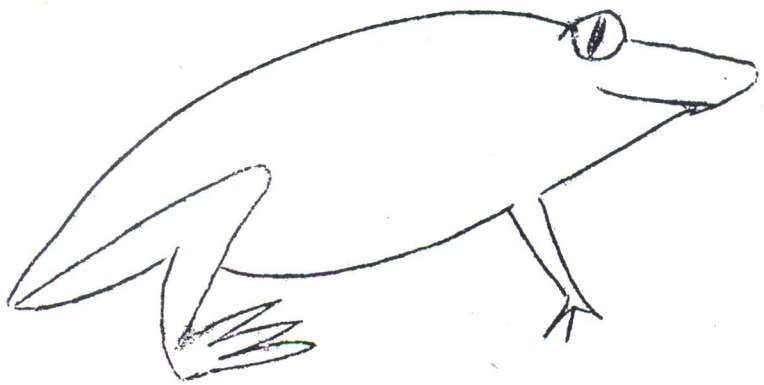
EATS LIZARDS ALIVE

(Indian Express, 11.10.86)- A dead lizard in the ...meals served in schools may send scores of children to hospitals with symtoms of food poisoning. (Ed's note: this is a widespread fallacy in India, and a convenient one for food adulterers) But an 18 year old boy of Ellis Nagar relishes eating live lizards. What started as fun for Murugan has now become a habit. He can swallow or chew lizards with utmost ease. Demonstrating his 'skill' he caught half a dozen lizards and swallowed them. He chewed them as if he was chewing a carrot. Murugan said lizard poisoning had not affected him although he had been eating lizards for over a month now. He said he had been eating chameleons also now and then and, in fact, enjoyed eating them alive.

TRADE IN UROMASTIX

Mr P. Vijayaraghavan of Cochin, Kerala, reported in November '86 that vendors there were displaying, and extracting the fat from spiny tailed lizards, Uromastix hardwickii, which are brought from Rajasthan. According to Mr Vijayaraghavan's estimate, each vendor kills 2-3 thousand each season. "Each day", he writes, "you find at least 20 animals alive, and skeletons simmering in hot oil of another ten or fifteen animals. These people have a printed notice for the sale of this fat and an address where it can be purchased."

We forwarded this complaint to the Regional Deputy Director, Ministry of Environment and Forests, in Madras, and the response was that no such selling was found to be presently taking place. Instructions have been issued to the officials of the local forest Department to be vigilant in the matter.



FROG STUDY

Mr V Sekar, an MSc student of AVC College was selected by the Wildlife Institute of India to carry out a three month study on the breeding biology and food habits of frogs, and was based, during the study period (December '86 to February '87) at the Crocodile Bank. The Irula tribals collected about 700 Rana tigerina and R.hexadactyla and the gonad conditions and stomach contents were analyzed to determine the breeding season as well as to determine the extent of pest predation. Unexpected stomach contents included scorpions (in two specimens) and a saw-scaled viper.

A SHAMEFUL EXPORT

(Editorial in Times of India of 2.12.86)

For a government that says it is at once committed to both export promotion and ecological conservation, it must be a little embarassing to have to face criticism from exporters' lobbies for its inconsistent policy. The Seafood Exporters' Association of India has squarely blamed the government's so-called restrictions on frog-catching for the drop in the export of frogs' legs from the high 4,368 tonnes in 1981 to 'a meagre 1746 tonnes' this year. Some of us will of course pity the European gourmet who this year will have to pay a higher price for the delicacy which our exporters have taken such pride in serving him over 25 years; some will also bemoan the loss in export earnings that this disastrous fall represents. But most of us should be pleased with it. Indeed, we should welcome a total ban on frogs' legs exports. And not just for reasons of preventing cruelty to animals, which in this case remains a valid consideration, if only because frogs are brutally cut into two halves and left to writhe, bleed and die when their legs are excised. A weightier reason is the ecological one: the frog is a highly efficient devourer of insects and a necessary part of the eco-system; its destruction disrupts the ecological balance and increases the incidence of pest outbreaks, necessitating the use of poisonous pesticides. It takes 60 legs, ie, the killing of 30 frogs, to collect a kilo of exportable meat, This works out to the slaughter of no fewer than 50 million frogs a year, at the current rate, to earn about Rs. 10 crores or thereabouts. These 50 million animals would have consumed several

hundred thousand tonnes of insects a year and saved a great deal more than Rs 10 crores in pesticide use and several times more in avoidable ecological disruption, where costs are incalculably higher. Instead of banning frogs' legs export outright, the government has merely imposed a prohibition of frog-catching during the two-month breeding season in the monsoon. Such half-hearted measures will not do. There must be an immediate ban on this destructive trade.

ENCEPHALITIS AND FROG LEGS!

(Indian Express, 22.11.'86)

Could the rise in the incidence of malaria and lately the dreadcd encephalitis be a consequence of the accelerated export of frog legs? This question was posed in the Lok Sabha on Thursday by the Human Resources Development Minister, Mr V.P. Narasimha Rao, while replying to a call-attention motion on the outbreak of dreaded encephalitis in epidemic form.

GOVERNMENT BANS FROGLEGS EXPORT

(Indian Express, 6.3.'87)

The government on Thursday banned with immediate effect the export of frog legs. The ban follows conclusive evidence that frogs have a very important role in the control of agricultural pests and mosquitos. The standing committee of the Indian Board for Wildlife had recommended that rana species should be included in Schedule 2, part 2 of the Wildlife (Protection) Act, 1972. As there was hardly any local consumption of frog legs the Ministry of Environment and Forests felt that the most effective method to protect the species was to impose a ban.

THE HIMALAYAN SALAMANDER

Tylototriton verrucosus still occurs in a few water pockets in the Eastern Himalayas. And the only place where it is found in reliable numbers is Jorepokhri, below Sukhiapokhri in Darjeeling, where I have seen and photographed it. Distribution and abundance is yet to be determined but it has been recorded from Darjeeling district, West Bengal, Sikkim, Lohit district of Arunachal Pradesh and Manipur. But Jorepokhri has by far the largest population. Urgent conservation measures are needed because of the two major tanks they inhabit here, one has been drained. This salamander inhabits both temporary and perennial pools and bogs, resting at the bottom of the pond or on submerged stones. It occasionally swims up to the surface to breathe. During the winter, adults hibernate under stones or barks of fallen trees. Salamanders move slowly in water. Their food comprises aquatic vegetation, insects, larvae and tadpoles and earthworms. They breed in the summer, after a couple of showers, and congregate at pools to lay eggs.

Dr Lahiri, who was the superintendent curator of the Alipore Zoo, Calcutta, has prepared a management plan cum project for the conservation of the salamander. He is presently Director of the Padmaja Naidu Hulamalayan Zoological Park, Darjeeling.
(by Rupin Dang, Army Public School, Delhi, In Environment Today, Vol. II)

CHECKLIST & DISTRIBUTION OF AMPHIBIANS IN PAKISTAN

With the addition of a new frog (Dubois and Khan, 1979), 17 amphibians are now known from Pakistan (Khan, 1976, 1980, 1986). Following is an up to date checklist and summary of distributions.

Taxon	Baluchistan	Sind	Punjab	N.W.F.P.
Bufonidae				
Bufo himalayanus	-	-	-	+
B. melanostictus	-	-	+	+
B. olivaceus	+	-	-	-
B. stomaticus	+	+	+	+
B. surdus	+	-	-	-
B. viridis arabicus	+	-	-	-
B.v. pseudoraddei	-	-	-	+
B. latastei	-	-	-	+
Microhylidae				
Microhyla ornata	-	-	+	+
Ranidae				
Rana breviceps	-	+	+	+
R. cyanophlyctis	+	+	+	+
R. syhadrensis	-	+	+	+
R. ridibunda	+	-	-	-
R. sternosignata	+	-	-	-
R. tigerina	-	+	+	+
R. vicina	-	-	+	+
R. hazarensis	-	-	-	+

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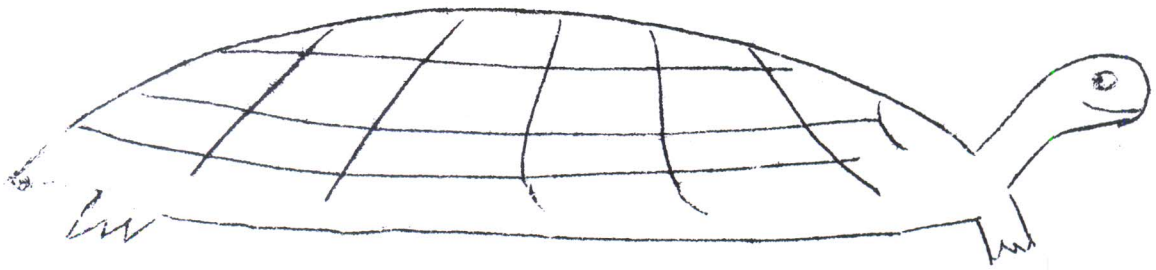

LIVE TURTLE FOUND IN TIRUMALA HUNDI

(The Hindu, 20.11.86)

An unknwon devotee has offered a live turtle for Lord Venkateswara at Tirumala. The cute little turtle wrapped in a piece of cloth was found this morning when the temple staff were sorting out the contents of the hundi. The temple authorities, surprised at the freak offering, consigned it later to the temple tank. It is surprising how the turtle stayed alive having remained throughout the night in the airtight safety vault of the temple where the large hundi vessel, crammed with an assortment of offerings, is sealed and kept every night before the closure of the temple.

OLIVE RIDLEY NESTS

S M A Rashid of the University of Dhaka, Bangladesh, was been working on marine turtles since 1983. He writes to say that he found a nest of 196 Lepidochelys olivacea eggs on St Martins Island in January '84. Hawksbills also occasionally nest on this island .

TURTLES AND POLLUTION

According to Shri V B Singh, Adviser, U.P. Govt, on wildlife and conservation, fresh water turtles are the best scavengers of rivers like the Ganga where dead bodies or partly burnt bodies pose problems of pollution. The State Forest Department has prepared a 250 crore research project to introduce five species of fresh water turtles into the Ganga to combat pollution. (From 'Corsonat', Vol 2 No. 2)

A TRIP TO THE CHAMBAL

Chandini Menon and Mike and Gretchen Ewert spent five days on the Chambal with Dr S J Rao and R.K. Mishra. At Morena they visited the well maintained Deori Rearing Centre where Kachuga kachuga, K.tentoria, K.tecta and K.dhongoka are being reared. On the river, they saw a Chitra in the water and many softshells basking. At Rohn there are huge, twisted laterite formations, sheer cliffs dropping 20 ft into the river. Here they saw shoals of enormous cat fish, basking kachugas and softshells in the river as well as a couple of gharial.

OBSERVATIONS ON FRESHWATER TURTLE EGG PREDATION

Introduction

In a perusal of the available turtle literature there is no mention of termites as predators of turtle eggs. The author has made some preliminary observations at Chambal River nesting sites, the Kukrail River and the captive rearing centre at Kukrail near Lucknow.

The Chambal: On the river, during routine survey by boat a nest of a softshell turtle (Trionyx?) was found with one empty egg shell of 3.26 cm diametre containing some yolk material and a number of termites.

Kukrail river: Later (September 1986) during a survey of the Kukrail River (near Lucknow) a fresh softshell turtle nest was detected by following the tracks 52 metres from the water. All the 21 eggs in the nest (eggs measured 3.24 to 3.28 cm diametre) had a small opening at one spot and termites were observed in the eggs.

Kukrail: At the Kukrail captive rearing centre five Lissemys punctata eggs were buried in earth for incubation. After 16 days termites had apparently broken through both layers of the shell of one of the eggs. The eggs were then transferred to a sand nest to protect them from termites.

Discussion

The two most common softshell turtles of north India, Lissemys punctata and Trionyx gangeticus , lay their eggs in both sand and earth. Eggs are commonly preyed upon by jackals, wild cats and wolves. It now seems that the termite is also an important predator on turtle eggs. In addition turtle eggs face considerable threat from sand removal from nesting sites (to use in construction) and agriculture along the river banks.

It is therefore suggested that a maximum number of turtle eggs be collected by trained staff in wetland sanctuaries.

Achnowledgements: I would like to thank Mr R S Bhaduria, Mr Niranjam Singh, Mr Ashok Pai, Dr R J Rao, Mr P D Sharma and Mr R D Gupta for their help and encouragement during this study.

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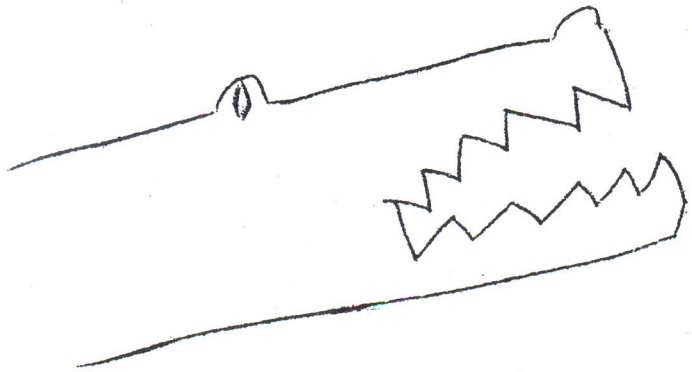
Editor's note: It is unusual that cellulose converters like the termites should be interested in turtle eggs the way ants definitely are. Maybe they are attracted by the moisture inside the egg. This bears further observation.



RESEARCH: M U G G E R M A N I A

Research on the reproductive biology and conservation of the mugger crocodile (Crocodylus palustris) is continuing at the Madras Crocodile Bank. The project is a collaborative effort with Director Rom Whitaker and is funded by the Smithsonian Institution, the National Science Foundation, and the National Geographic Society (USA). The objectives are: 1) to describe reproductive behaviours, 2) to investigate multiple clutch production, 3) to quantify thermal effects on development, 4) to determine the temperature thresholds for sex determination, and 5) to formulate management recommendations which are relevant to rearing and breeding programs throughout India. A brief outline of the study and preliminary data from the 1983-84 field season were summarized in Hamadryad, vol. 10 no. 3, September 1985, pp 13-17.

During the past several years, many people have assisted with various aspects of the project. At present, I am being ably assisted by Curator Harry Andrews, Simon Wakefield, a volunteer from the U.K., and local village staff, particularly Jeevanandam K, Kannappan, Gopi, Radha, Deivasigami, and MCBT workers. Mugger breeding behaviour, nesting and incubation have been studied in detail during the past four nesting seasons, 1984-87.

The 1984-85 field season began in November '84 with continuing twenty-four hour behavioural observations on adult mugger in the breeding enclosures. The establishment of a permanent laboratory enabled us to conduct controlled-temperature incubation studies just a few steps from the breeding enclosures. The lab is now one of MCBT's major accomplishments, thanks to the persistent efforts of Curator Harry Andrews who doubles as diesel engineer, chief electrician, construction engineer, etc. Housed in the air-conditioned lab are a central workspace for data analyses and compilation, a controlled- temperature room for egg incubation, and a dark-room which becomes a second egg incubation room during the nesting season. The laboratory building has its own power supply (to bridge frequent power interruptions) complete with stabilizers and innumerable fail-safe and back-up devices. One recent addition to the gadgetry is an electronic horn which broadcasts 'We wish you a Merry Xmas' and 'Santa Claus is coming to town' when the air-conditioner stops.

The basic incubation technique which we have been using successfully since 1985 utilizes locally-available, Indian made materials in the construction of individual incubation chambers. The chamber is set at a different temperature and housed in a constant temperature room (either at 26°C or 30°C). Each chamber costs about Rs. 1000 (= US$ 75). Local methods for insulating the building, such as a thatch canopy and straw and tile layers on the roof, have helped to stabilize temperatures in the lab.

Each incubation chamber is constructed of large, foam plastic, insulated 'picnic' boxes and contains a tray of water in the bottom of the box. The tray is equipped with an aquarium heater and an air-hose bubbler. A sensitive contact-thermometre is set to control water temperature in the tray to within ± 0.1°C. The temperature of the moist air in the chamber is remarkably uniform and stable, varying less than ± 0.1°C. Although some adjustment of the thermostat is necessary as incubation proceeds (embryo metabolism peaks about half-way through development), the chamber functions well for days without attendance, provided of course there is continuous power. A similar design has also been used with portable 12 VDC units which are able to heat and/or cool. These units function under ambient conditions when cooling is necessary during midday and heating is required at night. By using storage wet cell batteries, this system is completely independent of mains power.

Within the chamber of either design, the crocodile eggs are numbered and suspended on wire or plastic racks. Just prior to hatching, each egg is transferred to a small compartment within a rack-tray. When the baby crocodile pips its egg, it is individually marked to correspond to its egg, and transferred to the hatchery where it will be carefully monitored for growth and eventually sexed.

During the 1985 nesting season, over 225 eggs were successfully incubated at constant temperatures of 28, 30, 31, 32 and 33°C. The resultant hatchlings now weigh 2-8 kg and measure .7-1.4 m as they approach their second year 'hatchdays'. The results of the 1985 lab incubations have formed the baseline for incubation studies in subsequent years. The hatchlings have provided valuable data for various studies which relate incubation temperature to hatchling attributes such as coloration and scutellation, thermal selection, growth, as well as overall vigour and survivorship.

We have learned a lot from these 1985 hatchlings and are continuing to study them as they grow. In summary, our preliminary results indicate that:

1. Many young may be sexed when they hatch, but sexing by cloacal examination at 6-9 months is the most reliable method. Some females (about 10-30%) are mistaken for males prior to 6 months of age. Thus, sexing hatchling mugger may lead to over estimates of the % of males if such initially ambiguous females are included in the sample.

2. In males, rapid growth of the sex organ (>20 mm in length) occurs at about 1-1½ years of age or about 25 kg in size. Females at this size/age have sex organs which vary from very small to large (5-12 mm in length). Females are generally divisible into two groups based on sex organ size, small vs. large. Large organs are more 'male' like in overall shape, are broader at the base, and seem to appear more frequently among females incubated at high temperatures.

3. The viable temperature range for incubation is 28-33°C. A higher percentage of viable eggs fail to hatch at the extremes, relative to those incubated at mid-range temperatures.

4. In mugger, females were produced at all constant temperatures. Incubation temperatures between 28-31°C resulted exclusively in females (100%). Males were produced only at 32°C (70%) and 33°C (25%).

5. Incubation time (in days, from laying to pipping) varied with incubation temperature. At 28°C, development took 90-101 days. At 30°C, incubation time averaged 82 days. Minimum incubation time was 63 days at 33°C.

6. Incubation time is also correlated with sex. When incubation time exceeded 70 days, the resultant hatchlings were females (100%). Incubation periods of 63-68 days (= 32-33°C) resulted in some males, but males were most frequent at 64-66 days (32°C).

7. There is tremendous individual variation in growth, and it is difficult to attribute a hatchling's growth performance to any single variable, such as size/weight at birth, clutch of origin, incubation temperature, sex, etc. Monthly growth data (size/weight) have been collected for all hatchlings to date, and analyses of these data are underway.

8. Thermal selection of hatchlings has been monitored during 0-6 months of age, and the body temperatures selected by individuals are currently being analyzed to relate to growth performance as well as incubation history.

9. There are obvious differences in colouration and pattern of hatchlings. Although the clutch of origin clearly influences overall pattern and colouration, incubation temperature also appears to alter colouration. Hatchlings incubated at low low temperatures, particularly 28°C, are noticeably lighter ('blonde') in colour and lack the darkly-pigmented markings characteristic of animals at high temperatures.

In 1985-86, difficulties with Government of India formalities prevented me from making an extended visit to MCBT , but the project continued with frequent communications between North Dakota and Harry Andrews at MCBT. We postponed further incubation studies in the lab for a year and instead went back into the 'field' with eggs in

hand. Our goal was to more clearly understand how sex determination in crocodile nests in nature is affected by incubation temperature.

We removed each clutch of eggs as it was laid, measured the eggs, candled them to determine fertility, and then divided the fertile eggs into two equal groups. One group of eggs was placed back in the natural nest along with a soil temperature probe, and the other group was placed in an 'artificial nest' located in an 'opposite' thermal environment within the breeding enclosure together with a soil temperature probe. For example, if the nest dug by the female was in a warm location (exposed, sunny) then the 'artificial' nest was located in a cool, shaded location in the same enclosure. Hatching times were estimated on the basis of soil temperatures and the eggs were removed just before hatching so that each egg could be isolated and each resultant hatchling marked individually. In two breeding enclosures, about 370 hatchlings were produced from both 'natural' and 'artificial' nests. The hatchlings have been sexed and monitored for growth monthly over the last nine months.

The preliminary results are now in. This study has confirmed the conclusions arrived at on the basis of constant temperature incubation of eggs in the lab (3-6, above). In addition, we demonstrated that nest temperatures in the field, although not constant, have similar effects. 'Cool' nests ($\leq 31^{\circ}C$ during the first 40 days of incubation) invariably resulted in 100% female hatchlings. Nest locations which warmed rapidly to $32^{\circ}C$ during the same period produced both males and females; one nest at $32.5\text{-}33^{\circ}C$ produced only females, presumably 'high temperature' females.

The correlations between sex ration of the eggs in a particular location and nest temperatures strongly suggests that the early developmental period, ie first half of incubation, is critical for sex determination. Nests also varied with respect to daily temperature fluctuations, but how the daily amplitude of temperature in the nest influences sex determination in mugger is still not obvious.

One benefit of conducting research at MCBT is the opportunity to study several species simultaneously. In addition to the large number of mugger crocodiles which are nesting in 3 breeding enclosures, saltwater crocodiles (Crocodylus porosus) and spectacled caiman (Caiman crocodilus) are breeding each year. In 1985, controlled temperature incubations were conducted with limited numbers of eggs from both species. In 1986, eggs from both species (both are mound nesters) were placed in typical 'mugger' (ie hole nester) locations and nest temperatures were monitored hourly throughout incubation. Hatching success with both species was high using this method, and we are currently analyzing the relationship between soil nest temperatures and the resultant sex ratios of hatchlings.

The 1987 breeding season is now in full swing. As of mid-April, there are a total of 50 mugger nests; most of the second clutches (unique trade mark of MCBT) have not yet been laid. In addition, the caiman and salties will be nesting shortly. We aren't sure if the gharial will nest this season, but have our fingers and toes crossed. This season, eggs are being incubated in the lab, and 'switch' experiments are underway to determine when the critical period for sex determination occurs under different incubation temperature regimes. For example, eggs are being incubated at 30°C, then switched to 32°C at varying stages of development. Eventually, when each of the hatchlings is sexed, we will be able to define the developmental stage(s) which are sensitive to incubation temperature. On the bases of this information, we should be able to predict very accurately the sex ratio of a particular clutch (in the field and in the lab), from nest incubation temperature and/or the incubation period.

Behavioural observations of adults in the breeding enclosures have continued throughout the 1987 nesting season. At MCBT, the mugger court and mate for an extended period, 3-4 months. We now have evidence that females which nest a second time in a single season court and mate soon after tje first clutch is laid. Individual females engage in these behaviours about 4-5 weeks before laying a second clutch of eggs. In addition to examining in detail the specific behaviour associated with breeding, we are also compiling summaries of the general activity (land vs water) and location of each adult on a daily basis throughout the year.

Temperature is a critical environmental variable, and we are monitoring soil, air and water temperatures in the enclosures, especially during the nesting season. Body temperatures of nesting females are being monitored before, during, and after egg laying, and the temperatures of trial nests and actual nests are also being carefully measured. So far, we have learned that eggs are not laid until soil temperatures rise above 27-28°C but observations this season (which has been unusually cool) indicate that water temperature may also have a strong influence on when nesting occurs, possibly because females may require high body temperatures to produce the hard shelled eggs. Our studies, so far, indicate that 'warm' females lay eggs into 'cool' nests, and vice versa. Although the eggs generally experience some temperature change (on the order of 1-3°C) when they are laid, the thermal matching of female body temperature to nest temperature does not appear to be exact.

This season, we have also made detailed observations on the clear gelatin coating surrounding each egg when it is laid. The substance is about 98% water by weight, and in appearance and texture resembles the albumen layer inside the egg. Perhaps the most notable feature of the gelatin is that it liquifies within hours after laying, so by the next morning there is only a thin film remaining on the egg surface. Each egg is 'packaged' in an envelope of gelatin which may be removed from the egg by peeling the layers back, like removing one's sock. Obtaining eggs with

the gelatin coating intact initially proved difficult until we perfected a 'net' technique to catch each egg as it is laid. Fortunately the nesting females have so far been tolerant of our interference and placidly lay egg after egg as we gather them up. The gelatin coating clearly serves two functions: 1) cushioning the eggs from breakage and 2) wetting the soil layer immediately surrounding the eggs. We are currently studying how the gelatin outer coating may affect the process of opaque banding which typically occurs within 12-36 hours after the eggs are laid.

The interest in the gelatin coating and its possible functions was sparked by conversations I had with Professor Mark W J Ferguson. I took my academic leave together with wife Gretchen and daughters Cornelia (13 years) and Ursula (9 years) in the Department of Cell and Structural Biology at the University of Manchester. The Department is headed by Professor Ferguson who is continuing his studies of crocodilian development and sex determination as well as a host of other projects in developmental biology.

At Manchester I had an opportunity to collaborate with Mark on a number of projects directly related to the research at MCBT. These included a comparative study of crocodilian eggshell structure and a study of how the eggshell is formed prior to oviposition. I utilized a scanning electron microscope to look at specimens Mark had at hand in Manchester. Another study has involved developing a technique for extracting crocodilian DNA and analyzing specific DNA sequences. These include hypervariable portions which are individually polymorphic and also include gene sequences related to sex determination. Plans are currently underway to participate in a collaborative study with the Centre for Cellular and Molecular Biology in Hyderabad using DNA samples from the mugger crocodiles at MCBT. We are testing this technique by analyzing DNA samples from crocodiles at MCBT with known family histories. We hope to be able to determine with a high level of certainty the degree of genetic relatedness between individuals. This technique, in turn, will allow us to distinguish siblings from groups of mixed-clutch hatchlings and to determine whether one or more males sire a clutch, ie does multiple-paternity occur in the breeding enclosure. We are especially pleased with this collaboration, because all of the research will be conducted here in India.

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CAPTIVE REARING OF GHARIAL (Gavialis gangeticus) IN MADHYA PRADESH

The Madhya Pradesh State Forest Department set up a Gharial Rehabilitation Centre at Deori, Morena in 1979 under the auspices of the national crocodile conservation programme. The main objective of the Centre is the captive hatching of wild-laid gharial eggs and rearing of hatchlings to 1.2 metres for release into natural habitats.

Since 1981, eggs have been collected and transported from Baroli (a wild nesting site on the Chambal River) to the Deori Centre, a distance of about 150 km, for hatching. During incubation special care is taken to maintain optimum temperature and moisture levels in the incubation chambers. Eggs are hatched at 32°C and hatchlings reared on live fish. Initially there were two hatchling pools. Three pools for yearlings have now been added.

The number of eggs collected over the years, and the hatching success at the Centre are given in the table below. At present, 55 gharial are being reared. Under the rehabilitation programme, ten gharial of the 1981 batch were released in the Ken Gharial Sanctuary (on the Ken River, Madhya Pradesh) in February 1985. In September 1981, 4 and 6 gharial of the 1981 and 1982 batches were released at Vanivihar, Bhopal.

Number of eggs collected and hatching success at Deori (One clutch/year)

Year	No. eggs collected	No. eggs hatched	Hatching success (%)
1981	35	26	74
1982	35	35	100
1984	40	37	92
1985	40	40	100

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MAN-EATING CROCODILES: a case history from Irian Jaya

The crocodile family has the unfortunate reputation of being killers of humans. Of the 22 species in the world, only two are occasional man killers, the saltwater crocodile of Asia and the Pacific and the Nile crocodile of Africa. Even with these it is only the occasional specimen that gets into the man eating habit. Bustard and Kar (1982) go a bit far when they claim that the salty doesn't become a habitual man killer. The problem of crocs attacking people and livestock is still (and in some places increasingly) a serious deterrent to gaining public acceptance of these reptiles and constitutes a management problem. In northern Australia wildlife authorities use publicity and a team of expert croc trappers to make short work of any nuisance animals. In March this year an American tourist became the eighth death from crocodile attack in the past two years in Australia. Stringent protection has reportedly made them unusually bold in some areas.

Similar control strategies should be applied in places like the Andamans (India) and parts of Malaysia and Indonesia where crocs are still around. The case of a man eater in Irian Jaya (New Guinea Island) is recorded below from interviews done by me at the village frequented by the croc. Latest reports indicate that it is still active and more than 20 people have been taken. In a similar case, in the Asmat area in the 1960s a crocodile allegedly took 70 humans over a 3-4 year period.

Croc kills at Sawa-erma and Jamas villages

Victim	Date taken	Place	Circumstances
1. Augustino; male, 12 years	Nov '84	Faiy/Pomats junction	Searching for fish bait in knee deep water when grabbed by legs. Croc chased, and stabbed with paddle. Body found whole with few marks.
2. Juarap; male, 19 years	Apr '84	same place	Grabbed by leg while pushing canoe into water. Croc seen with body on back the same day, swimming upriver, chased.
3. Juba; female, 10 years	Oct '83	plantation near Sawa	Washing sweet potatoes in river, croc passed 2 kids swimming and grabbed her; seen by many people. Body not found.

Victim	Date taken	Place	Circumstances
4. Jirasi; male, 28 years	Sept '84	Faiy River sawmill	Caught while hauling logs at sawmill. Body found whole.
5. ?; female, 28 years	No. '83	Pomats River halfway to Jamas	Caught while cutting firewood near river-bank, body not found.
6. Gegam; male, 10 years	Sept '84	Jamas village	Caught while washing in the river at noon school break
7. Tor Ber-wir; female, 10 years	Oct '84	Camp near Wasar River	Caught while taking water in a bucket after bathing. Body not found. Screamed for several seconds.
8. Ampisam; female, 35 years	Jul '83	Camp two bends down from Jamas	Caught while bathing with her children. Body not found.
9. ?; male, 25 years	Jan '84	Unir River	Caught while bathing, body not found
10. Patricias; male, 6 years	Oct '84	Two bends upriver from Jamas	Caught while looking for clams along river-bank. Body not found.

On 16.12.'84 I interviewed villagers from Sawa with the help of Fr Vincent Colo. The head man, Bapak Yohakim Bes, was also with us. The people are terrified but reluctant to kill this croc (or crocs) as they believe it is a person incarnated as a croc, or the spirit of an ancestor seeking revenge. At Jamas the man-eating croc is often seen two bends up or down river. It was seen a week ago. Often 'patrols' in front of the village. Seems to be about 4 m in length and light in colour. There has been constant fear in the village this past year.

Notes from Sawa-erma:

1. The croc recently went under a canoe and lifted it. The people jumped ashore and the canoe went with the croc a little way.
2. A lady in a small canoe was prevented from coming out of a small creek by the croc who swam back and forth at the creek mouth.
3. Some kids in a tree saw the croc below and started yelling. People came and chased it away.
4. At Erma, across the river (where there have been no deaths), a man was on a floating log raft when a nearby fisherman saw small fish jumping and yelled to him. Seconds later the croc lunged

upwards there but the man had already jumped out of the way.

5. The croc is said to be light coloured, about 14 ft long (similar to Jamas sightings). It (or they) have been seen a day apart at the two villages, which are a good 20 km apart, quite a distance for a quick swim by the croc, but not impossible; it could be the same animal.

6. It has taken occasional dogs and pigs. Was regularly seen prior to 1983 basking on mud banks and not bothering anyone. It regularly follows canoes. Total range seems to be from Pupis to Jamas. People generally believe it is two crocs.

7. Men have gone after it but very half heartedly because of superstitions. It is known as a 'buaya jadi jadiyan'. Most of the killings have been in a radius of 10 to 15 km of Sawa-Erma. Shrimping etc has stopped from fear.

In one case it was pursued as it swam along with one of its victims draped half on its back, still alive. The pursuers got within range but couldn't throw spears lest the victim be speared. The croc then submerged.

Reference

Bustard, H.R. and S.K. Kar(1982): Crocodile predation on man. Brit. J. of Herp. Vol. 6, No. 6, June 1982.

Rom Whitaker
Madras Crocodile Bank

HERPETOLOGICAL REFERENCE CENTRE

The Crocodile Bank has the best herp. reference library in India but it is far from complete. We want to be able to offer local and foreign herpetologists the maximum opportunity for reference work here. Part of the reason for the paucity of herp work in India is the lack of reference material. We would particularly welcome donations of herp journals. We have in exchange some publications which will not fully compensate your donation, but please let us know what you can contribute and we can work out some reciprocal arrangement.

BEAUTY AND THE BEAST

(by Yu-Meith Heu, in the Asia Magazine, June 6, 1982)

The crocodile's image undoubtedly is a tarnished one in most cultures, if not all. It is feared and reputed to be a voracious eater. It is regarded as dangerous to man but itself endangered by man, for the beast has a beautiful skin.

In Malaysia, crocodiles can, to a certain extent, be protected and conserved in breeding farms. Such farms exist as the crocodiles are reared for the princely price of their skins. The only such farm in Peninsular Malaysia is at Pondok Upeh, Balik Pulau, about 28 km from the throbbing heart of Penang's Georgetown. Another is believed to be in Sarawak and, outside Malaysia, there is a large farm in Singapore. The Penang farm is run by Tulin Enterprises Sendirian Berhad, a Bumiputra-Chinese joint venture. Headed by its managing director, Encick Ahmad Kechik, the half hectare farm was set up in 1977.

The farm now boasts about 1,200 crocodiles- 99% of them belonging tothe Crocodylus porosus species, locally known as buaya tembaga. Of this number, 300 form the breeder stock. They are fenced within a natural pond which creates an environment conducive for successful mating. The remainder, at various stages of growth, are kept in concrete ponds.

The farm presently gets a supply of baby crocs from within the country and imports others from neighbouring countries such as Thailand, Indonesia and Burma. However, the farm hopes to soon set up its own hatchery as importing the hatchlings proves difficult and expensive. The farm's aim is to get incubators from Japan to facilitate the hatchery. A 15% success rate in hatchings last tear has prompted the move.

Crocodiles attain sexual maturity at the age of seven. However, many are slaughtered when they are between three and a half to four years old unless earmarked as breeder stock. Investors consider it no longer profitable to keep them after this age as the crocodiles' growth is greatly curtailed after reaching four.

The monetary value associated with crocodiles is attractive considering the negligible breeding and rearing requirements. Not only is the skin a saleable item- there is financial value attached to every part of the crocodile. The skin, however, is the most valuable substance. It fetches about US$ 13 per girth inch. This makes a four year olf crocodile worth US$ 330. The head, as a piece of taxidermy, is valued at US$ 20. The flesh can be sold either raw, at US$ 2.50 per 450 grams, or preserved, at US$ 15 for the same quantitiy. It is exported to Hong Kong where it is considered a delicacy with medicinal value. When boiled with Chinese herbs it is said to aid those with breathing problems. The blood, many claim, cures skin ulcers... The secretion from crocodiles' glands is utilize in the manufacture of perfume while the teeth can be formed into pendants, necklaces, rings.

INDIAN WILDLIFE ACT AMENDMENTS FAVOUR REPTILES

Since the Wildlife (Protection) Act of 1972 came into force there have been several amendments. The latest was in November, 1986, when the most notable changes were the shifting of several of India's most common snakes upward to Schedule I and II in order to protect them from unregulated exploitation for skins. Formerly, if a snake skin trader was caught with skins he could get off with a fine. The present regulations provide for a mandatory prison sentence (1 to 7 years) if convicted. This is real good for the snakes... but not so good if you have a pet king cobra to feed, or use rat snakes and watersnakes in legitimate research or for public education programmes. Of course you can get permission to catch and keep these snakes for scientific purposes but it is a tedious procedure. The following is a list of the various reptiles protected under the Wildlife Act; these enjoy total protection; capture under permit for scientific purposes only.

SCHEDULE I

Crocs :	C.palustris, C.porosus, G.gangeticus
Turtles:	Pelochelys bibroni, Trionyx gangeticus, Lissemys punctata, Batagur baska, Melanochelys tricarinata, Kachuga kachuga, Geoclemys hamiltoni, Heosemys silvatica, Kachuga tecta, Trionyx hurum, all sea turtles
Lizards:	Varanus flavescens, Calodactyloides aureus
Snakes:	Python molurus, Python reticulatus, Elachistodon westermanni
Ambhibians:	Nectophyrynoides Spp.

SCHEDULE II

Amphibians:	Tyletotriton verrucosus
Lizards:	Varanus salvator, V. griseus, V.begalensis, Chameleo zeylanicus, Uromastix hardwickii
Snakes:	Xenochropis piscator, Ptyas mucosus, Cerberus rhynchops, Naja naja sp, Ophiophagus hannah, Atretium schistosum, Vipera russellii

SCHEDULE IV (capture permit required)

All snakes not listed in Schedule I and II
All turtles of the family Trionychidae
All tortoises of the family Testudinidae
All frogs of the family Ranidae

A LOSS TO CONSERVATION

Miss J. Vijaya, a young naturalist associated for several years with the Croc Bank and recognized as one of the champions of Indian turtles and tortoises, died in April. She had been ill for over a year and unable to work at the Croc Bank. Viji's most remembered feat was living in a rock cave in the rain forests of Kerala for six months to study Heosemys silvatica which she herself had rediscovered after some seventy years during which there was no record of this species. There will be more on Viji's contributions in the next newsletter. In the mean while, may her work and spirit live on.

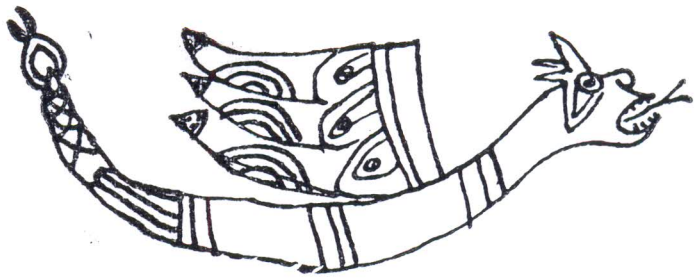
DONATIONS

Local : Rs. 15 annually

Foreign : 5 dollars annually

Cheques should be made to

MADRAS CROCODILE BANK, VADANEMMELI VILLAGE, PERUR P.O.
MAHABALIPURAM ROAD, MADRAS-603 104.



Cover drawing - Shekar Dattatri

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