10/12/1980

Procedure for Farming.

1. Farm should be ~~only~~ closed farm in the IUCN sense

2. Each farming enterprise would require to be licensed by the competent authority (State Forest Dept) who will require to satisfy themselves that the concerned SFD personnel have the state of D would require quarterly return of the stock on the firms. The technical knowhow of the ~~farming~~ required technical expertise to successfully operate a crocodile farm. This may ~~[illegible]~~ be granted on the

3. A licence to farm would only be granted on the basis that each farming enterprise would make available to the competent authority (SFD) for liberation in to the crocodiles (of release size) free of cost. The numbers to be stock sanctuaries 1.20 m so provided would not be less than ~~[illegible]~~ 20% ~~[illegible]~~ nor more than 5% ~~[illegible]~~ of the number available ~~for~~ each yr for commercial purposes.

4. Only the ~~[illegible]~~ conservation authority (Wiwing (the SFD)) would be permitted to harvest eggs from the wild.

5. The hatchlings resulting from such eggs may be made available to non-forest dept farms if so desired, however with any harvesting of eggs from the wild it will be a requirement that 5% of the hatchlings hatched be returned to the wild at a size 1.20m. This requirement will be binding on any farm exception such hatchlings resulting from wildlaid eggs from the SFD.

6. Free range farming by the conservation authority may be taken ~~out~~ later.

Involve the issue of diplomas for short-term train courses (3 months - midway - mid Tel) by the CCBMTI; by sponsored candidates by 2 interested parties.

together with approved adequate physical facilities for ~~rearing~~ breeding and rearing mugger crocodiles.

	Wild Egg Collection	Cotton egg	Hatching at 60%	Loss in 1st yr 10%	Available ~~Release back~~ for IInd yr ~~to wild 5%~~	Release back 5%	Available IIIrd yr	Breeding stock ~~5%~~	Available for Cocoon IIIrd yr	R
1st yr	300	–	180	18	~~162~~	8	154	~~12~~	–	–
2nd yr	300	–	180	18	162	8	–	–	–	–
3rd yr	300	–	180	18	162	8	154	36 3BP 2M + 27F		
4th yr	300	–	180	18	162	8	154	12 4BP 3M + 9F	118	
5th yr	300	–	180	18	162	8	154	12 4BP 3M + 9F	142	
6th yr	300	–	180	18	162	8	154	12 3.9F	142	
7th yr	~~300~~ 270	270	342		162	8	154	12 3.9F	142	[illegible]
8th yr	~~300~~ + 405						154	12 3.9F	142	No wild egg collection

9th	~~200~~ + 540 + 90							12 9		
10th								12 10		
11th	810 +									
12th										
13th										
14th										
15th										
16th										
17th										
18th	2790		1674	168						full capacity
19th					1506	nil				
20th							1506	nil		
									1506	

		1s 66%	1st yr	Available for IIs yr	Release 5%	Available for IIIrd year Crypto	Pool Requirement HP	YP	QP
1st yr	300	[illegible]	18	—	—	—	2 set		1 set
[illegible]				162	8	~~154~~		2 set	
						154			

Proposal of a Salt-water Crocodile Farm

Why Salt-water

1. Rare 1. Conservation aspect
2. Economic aspect (Best skin)
3. Suitable for farmer being a fast growing species
4. Breeding success achieved already.
5. Feasibility

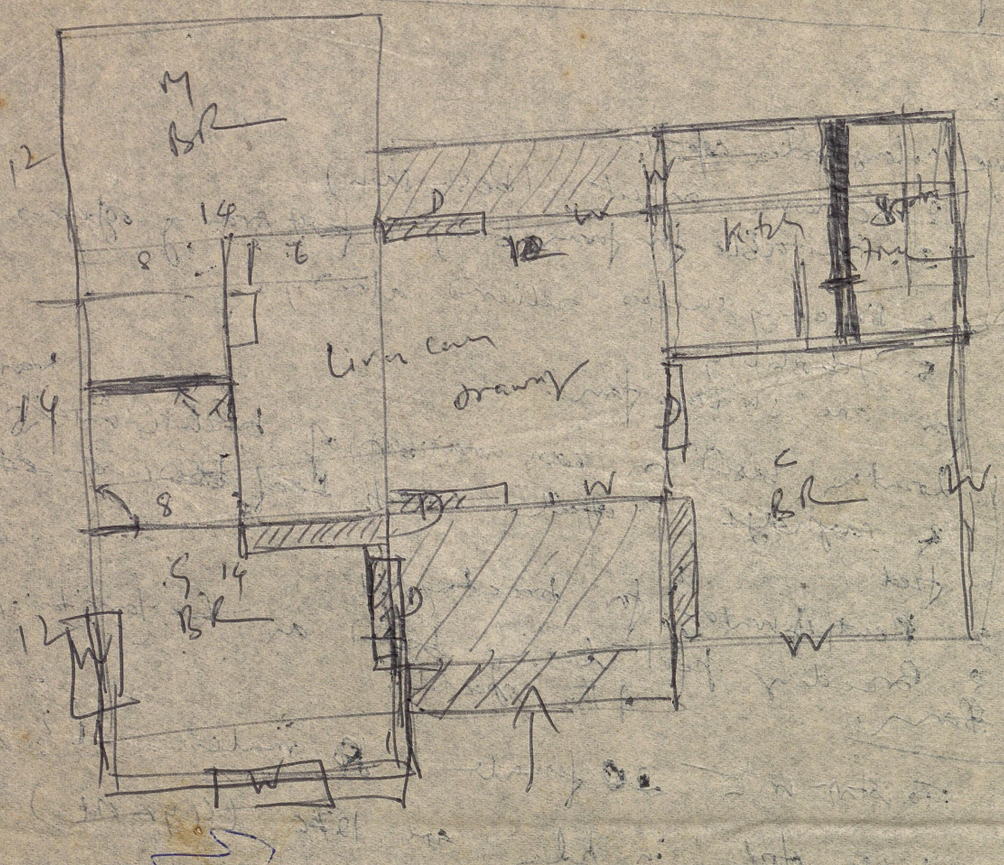
Requisites for one S.W. Croc farm

1. Location based on easy availability of brackish-water trash fish & rayhage - offal. Cheap beef, ~~[illegible]~~ ~~etc~~ as feed
2. Plenty of water, for breeding pool
3. Breeding pool lating - based on the territoriality of this species.

Proposed Farms

To start with 20 female 8 males (?)

Earliest available stock in India are 1276 (4 yr old) expected to breed by 85/86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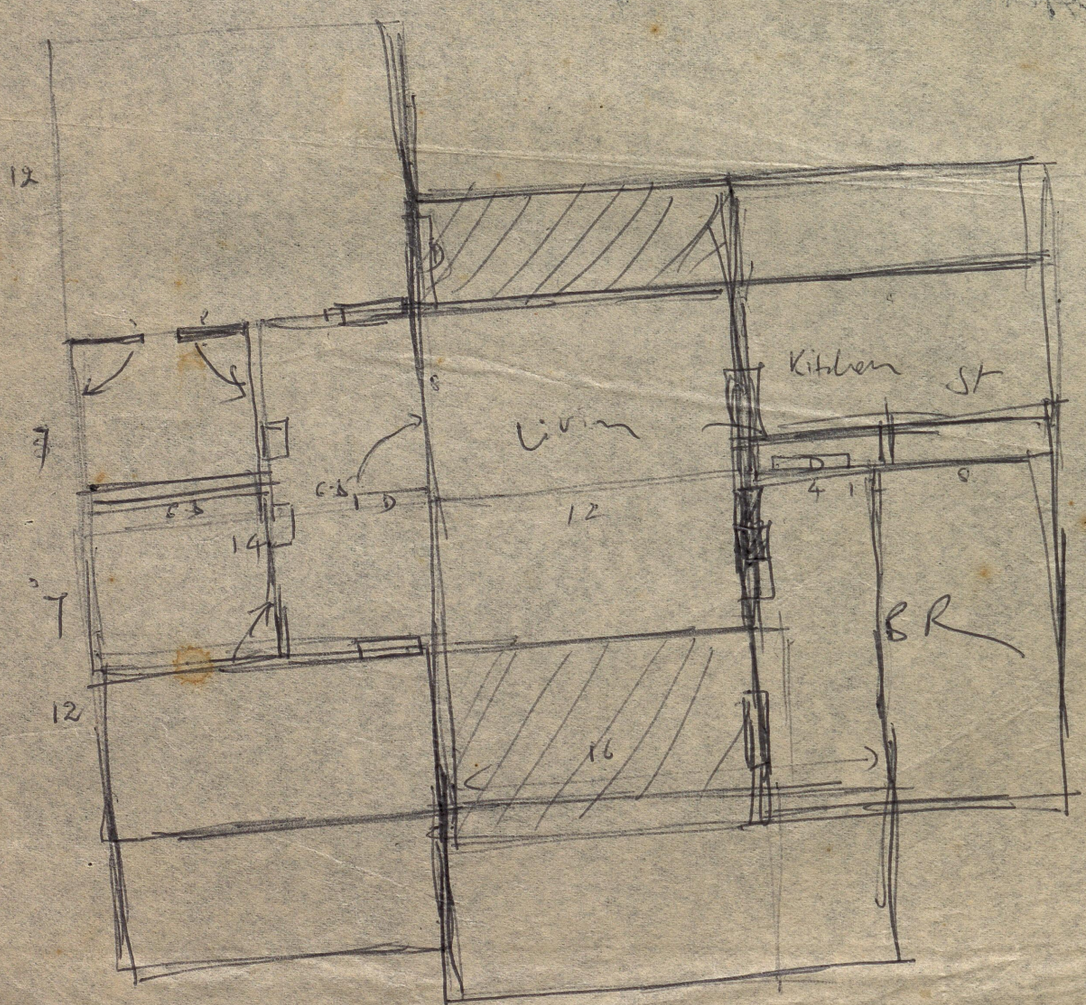
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10/12/1980

Discussion with APF Corporation

1. Could they operate C. farms as a subsidy to their own operation
2. They want the feasibility.

1. Small farms by APFDC

2. Endangered species

Mussel Crawfish farms at Vizag by APFDC

1. where to get the seed

2. Trash fish availibility – 45 paise/kg

Marine fish
May be nice for S.W. Cross

1. (A) to hatchie distribute hatchings
2. Rearing / Exploitation
3. 10 acre ideal

① over a fixed period 14/12/1980

Project formulation – of 5/yr / with cost 16/12/1980

② Assistance sought financial

Project – Formulation

		♂	female
1.	Captive breeding group – Stock to be obtained	10 +	25

2. Designing the proj stocking rates

3 – Zoo units on breeding

(1) 3 male + 9 females in each unit

(2) 3 male + 9 female in each unit

(3) 3 male + 9 female in each unit

Total 9 male + 27 female

3 Breeding Unit Farms Phase I.

for ADFIC.

Year I 1981-82 | 1977 stock

1. Construct III breeding enclosure.

2. Stock crocodiles. | 3 yr olds.

Year II 1982-83 | ~~capacity 400~~

Construct Hatchery 30 nest capacity & ~~Hatchling pool~~ Prior to Feb 83

Construct Hatchling pool prior to April 83 for 400 hatchlings 2 sets of 10 each

Year III 1983-84 — 0

Breeding Commence & construction of yearling pools. 2 sets

Year IV 1984-85 | Breeding commence

~~Construct Hatchery~~ ~~Prior to~~ | 1 construction of 1 set hatchling pool

1 set yearling pool

2 | 1 set

Year V 85-86

86-87 — 3 yr slaughter starts

15 x 2[illegible] - 400 eggs / yr -

20

25

30

35 fine to six 800 eggs /

Financial Implication

	Male	female	Egg production on an average of 10/15/20/25/30 each year / clutch	Hatchlings at 70% success	number with 10% loss at end of 2nd year available for crophing	10% stock for breeding addition 1:2 ratio male [illegible]	[illegible]
1981	20	50 4yr old	—	—	—	—	
1982	20	50	—	—	—	—	
1983	20	50	—	—	—	—	
*1984	20	50 Fr. Breedir	500 eggs	350	—	[illegible]	
1985	20	50	750	525	—	[illegible]	
**1986	20	50	1000	700	315	30	285
1987	20	50	1250	875	473	50	423
1988	20	50	1500	1050	630	63	567
1989	20	50	1500	1050	787	80	707
**1990	30	70	1700	1190	945	95	850
1991	45	105	2350	1645	945	95	85[illegible]
		50+20+35	1500		1071	107	96[illegible]
		30 15 10	500		1481	148	133[illegible]
			350				

$12\frac{1}{2}$ p.a. C.I.

~~100~~ 70
1 $\frac{70}{100} \times 540$
540

100 — 70
1 $\frac{70}{100}$
540 $\frac{70 \times 540}{100}$

Trash Fish Experiment

5 Animals with Trash Fish

from APFDC -

Select - 5 / 3 yr old Gujrati male muggers.

~~39~~ 52 inches

25 cm

10 inches - 52 inches

42 inches

3 ½ yr.

~~42~~ months

12

4th Sept 1980

(1) Ghanial pool proposal - Justification - 1000 proposal for three sanctuaries - one mugger pool has been developed at the 200 cost

2.6 lakh
3 lakh

Action AKM

(2) By 1st week of October the following should be ready
1. The mugger pool to be ready & mugger to be ready
2. Sexing of krishna & released in the mugger pool

Action PK MKN & Chandling

(3) Nagarjunasagar - Proceeding Pool
3a - A scheme for developing Fresh water mugger Rearing Complex at Nagarjunasagar
3b - ~~A~~ Kalinada (scheme for mugger & S.W. croc at Kalinada

- A S.W. croc at Vizag - Physical Inst. & Scheme proposed

State Govt

Action PK

(4) Register of the complex.

Action Prasad & PBK

(5) Mugger from TN (100 to be stored in the complex

Sanctuaries existing & proposed with restocking releases to date

States	SANCTUARIES EXISTING	RELEASES / NUMBERS further stocking proposed per yr thereafter			Recommended / Sanctuary	Release ~~recommended~~	Remarks
		Released	Proposed	To cause every year			
Andhra Pradesh	1. Nagarjunasagar-Srisailam Krishna E.P. Falls	8		3	Good Crocodile habitats are still available but depends on production of hatchlings every year for release.		
		~~200~~	300	30/yr			
	2. Lanjamodgu	30	30	3-5/yr			
	3. Manjira		40	5/yr			
	4. Kinnerasani		60				
	5 Pakhal		40				
T.N	Nil	130 at Kinnur					
		48					

Status	S.E	No 1 Released	Released to 6 Relied during year Thereafter	Total Cancelled so far	Recommended Sanction	No to be Started initially	Every yr Thereafter	Remarks
	[illegible]	300		30/yr				
	[illegible]	11	8	—				

90901 89936

Reptile Resources in India and their Present Status

How to hold 150

Nagarjuna Sagar — Immediate restocking with

Manjira Sanctuary — Proposal.

Lanjamalgu Sanctuary —

Papikonda (where is the dam)

Proposal — Chenal — Release group

C.B. Group — 5 females
1 male

N.J. Sagar — Staffing Pattern is (Crocodile staff)

1 Direct Recruit R.O. (Srisailam)

1. Sanctuary (Dindi)

4. F.G (2 Srisailam)

(2 Dindi)

6 watchers moving in pairs local buffalo

Chenchus
2. 5 km below Srisailam
2 25 km below Srisailam
2. with Sanctuary at Dindi

1. Should Egg be cropped from the wild (Page 5 [illegible])

2. Breeding Stock & Potential Breeding stock.

Present	Breeding Stock		
4♂	2♀	NIP	1980
1♂	2♀		
	+ 2♀		1981
	+ 2♀		1983

Proposal (Breeding stock)

What is required
the need to develop one

Growth rate of DP stock

Need to return to wild

Coringa (Whadis happening)

~~From~~

~~B.C.C~~ ~~To Can~~

S.W. Crocodile Farm at Coringa

Location for Mugger releases.

Dates & location for Releases.

all Gujrati Pulchal &

Kinnerasani

AP Stock - Krishna

NIP breeding group is feeding Krishna sanctuary

Zoo + Preserve Stock

Mugger Breeding Pool NIP - 3 ♂ Seven ♀

3 ♂ + 7 to 8 female

Immediately - 3 males + 2 mature male + 1 mature male

Later at Balance 4 to 5 female

~~Use of Indian Reptiles:~~

Vizag Stole

Urgent

Mugger Terrestrial Locomotion

+ Case history of mugger moving over long distance.

Crocodile farm Proposal

2 separate
1 for Estuarine
Cro
1 for Mugger

1. Location Attributes. (Where depends on the species.

Mugger 1
S.W. crocodile

Building up of Breeding Stock.

IIIrd year stock -
Capture Breed when -

S.W. Crocs from where ?

Muggers from where ?

Muggers start with

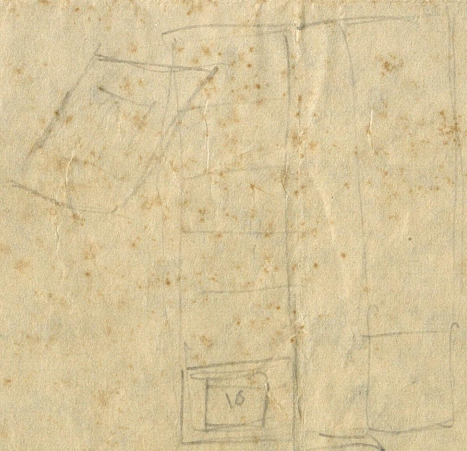
20 Males + 50 Females

8

Sheds

6m X 15m — 8 nos





10.30

10.55

3 female S.W. bees from orig. are of 1977 August -

TW -12 are all of 1979 August

1985

PROPOSAL TO SET UP AN EXPERIMENTAL CROCODILE FARM IN TAMIL NADU

1. PREAMBLE

1.1 Definitions

1.1.1 By "farming" is meant the breeding, rearing and harvesting of crocodiles entirely in captivity, i.e. it is a 'closed-circuit' operation which, once set up, does not interfere with the conservation of wild populations, indeed it can assist their rehabilitation by the provision of young crocodiles for release programmes.

1.1.2 "Ranching" consists of repeatedly collecting eggs from the wild and raising the resultant crocodiles in captivity. It is not contemplated in India at present.

1.2 Rationale

1.2.1 Farming and ranching of crocodiles should be viewed as activities which utilize a renewable resource, that is at present untapped, for the benefit of the people. Both forms of management can readily make a positive contribution to the rehabilitation of wild populations and, if instituted in India, this should be one of the stated objectives.

1.2.2 Elsewhere in the world e.g. Thailand, Papua New Guinea, Zimbabwe, crocodile farming and ranching are making a valuable contribution to economic progress, under the management of both government and the private sector and, in some cases, via specific rural development projects.

1.2.3 During the last 7 years techniques of rearing crocodiles in captivity have been extensively developed in India in the context of the crocodile rehabilitation programme.

1.2.4 The recent FAO-sponsored overseas study tour by five wildlife officials was able to gather a great deal of detailed knowledge on additional aspects that would be involved in crocodile farming. We are now technically prepared to embark on a cautious experimental crocodile utilization project, to examine its feasibility under Indian conditions.

1.2.5 An additional consideration is that several of the existing mugger rearing schemes are currently producing more stock than is required for local release into the wild. (It cannot be released elsewhere because of the importance of maintaining distinct genetic varieties.) A decision is urgently needed on the deposition of this surplus, as to continue to maintain it is very expensive. The most logical decision appears to be its use as a basic breeding stock for a pilot farming trial. (It should be noted that it would take at least 5 years to raise breeding stock from wild collected eggs.)

2. RECOMMENDATION

2.1 In the light of the above, it is recommended that the I.B.W.L. should give approval for the commencement of a limited experimental farming operation, with the following design.

2.2 Objectives

2.2.1 To use a small proportion of existing surplus stocks of mugger in Tamil Nadu to carry out a limited investigation of the feasibility of "closed-circuit" farming, under Indian conditions, as a method of producing crocodile hides of a utilisable quality.

2.2.2 To produce a report to I.B.W.L., based on the results of the experiment, recommending whether or not commercial crocodile farming should be set up in India under Government control. (If farming is recommended, the report will indicate, the methods to be employed.)

2.3 Mode of operation

2.3.1 The experimental programme would be carried out by the Tamil Nadu Forest Department in collaboration with the Central Crocodile Centre.

2.3.2 Existing captive stock would be used as foundation breeding stock for a "closed-circuit" operation.

2.3.3 Experiments would be carried out on breeding (mating, nest building, natural incubation) in captivity e.g. design of breeding enclosures, stocking rates, sex ratios and the selection of fast-growing strains.

2.3.4 Harvesting procedure would be investigated i.e. selection of harvestable animals, skinning method, skin preservation for transport to tannery, packing and transport, utilization of other products.

2.3.5 A full consideration of economic aspects would be carried out e.g. costs of raising harvestable stock, costs of harvesting and marketing operations, various marketing options.

2.4 Legal framework

2.4.1 It is proposed that this purely experimental operation be carried out under the provisions of Section 12 (b) of the Wild Life (Protection) Act, 1972.

2.4.2 It is noted that should the results of the proposed research indicate that commercial crocodile farming is feasible in India, this could not be carried out without an appropriate amendment of the Wild Life Act permitting commercial captive breeding and utilization, under carefully specified conditions. In addition, it would be necessary to obtain exemption from the CITES provision to allow export of skins from captive-bred stock.

Table V

Pilot Crocodile Farming Project 1985-1990

Non-recurring Construction Cost (Yearwise)

	1985-86	1986-87	1987-88	1988-89	1989-90	Total
① Breeding Pools 5 nos @ Rs 50,000 each	2.50 lakh	—	—	—	—	2.50 lakh
② 50 nest-hatchery	0.25 lakh	—	—	—	—	0.25
③ Experimental Fish Pond for supply of brood stock	—	—	1.50	—	—	1.50
④ Water tank Electric Pumps, Pipeline for Gravity flow from Kathanurdam etc	2.50 lakh	—	—	—	—	2.50
⑤ Office-cum-Store cum Laboratory	0.75 lakh	—	—	—	—	0.75
⑥ Feed Room	—	0.50	—	—	—	0.50
⑦ Hatchling Pool (20 nos)	—	1.50	—	—	—	1.50
⑧ Yearling Pools (10 nos)	—	1.50	—	—	—	1.50
⑨ Quarantine Pool (8+4)	—	1.00	—	—	—	1.00
⑩ 2nd Yearling Pools	—	—	2.50	—	—	2.50
12 Holding Pools	—	—	—	2.50	—	2.50
13. Culling-Flaying & Storing Room with storage facilities	—	—	—	1.50	—	1.50
1 Total	6.00 lakh	4.50 lakh	4.00	4.00		18.50
Quarters						
Range officer (1)	0.65	—	—	—	—	0.65
Forester (1)	0.50	—	—	—	—	0.50
Resident-Guard (1)	0.30	—	—	—	—	0.30
Resident-Workers (2)	0.40	—	0.50	—	—	0.90
2 Total	1.85	—	0.50	—	—	2.35
Total 1 & 2	Rs 7.85 lakh	Rs 4.50	4.50	4.00	—	20.85

JUNE 1985

PILOT PROJECT

FEASIBILITY STUDY OF MUGGER CROCODILE FARMING IN 'CLOSED CIRCUIT' FARM AT SATHIYAMOORTHY TAMIL NADU

Project Document Prepared at W.I.I Dehra Dun

Introduction

The mugger crocodile (Crocodylus palustris), a ~~depleted~~ widely distributed but heavily depleted species in India during the mid 70's, has exhibited a spectacular recovery in response to the captive rearing and management projects initiated by several states. ~~The species has also successfully started breeding~~ Captive reared stocks of this species have also started breeding in the wild following re-introduction. ~~and from~~ In captivity, during the last ten year (1975-85) the species has started breeding in ~~captivity~~ in as many as nine crocodile rearing and breeding centres and ten Zoological Parks in India.

In the light of the success achieved with this species, the ~~possibility of~~ Indian Board of Wildlife recommended a pilot level project to be undertaken in Tamil Nadu by the Tamil Nadu Forest Dept. in collaboration with Crocodile Research Centre of the Wildlife Institute of India, Dept. of Forest & Wildlife, but of his to establish the feasibility of crocodile farming* in India, purely as an experimental operation to be carried out under the provision of Section 12(b) of the Wildlife (Protection) Act, 1972.

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* Under this ~~proposal~~ recommendation, "Farming" is meant; the breeding, rearing and harvesting of crocodiles entirely in captivity in a 'closed circuit' operation, which does not interfere with the conservation of wild crocodile populations. This means, that all the hides produced are obtained from crocodiles reared in the farm which have hatched from eggs laid in the farms by captive breeding levels of animals.

Objectives

(1) The objectives of the proposed project is to investigate the feasibility of producing mugger crocodile hides, of ~~substandard~~ utilizable quality in a closed-circuit farm, to be located in Tamil Nadu where a certain proportion of existing adult surplus stock of mugger can be used to launch the project. (It should be noted that ~~the~~ mugger stocks raised by the ongoing conservation project in Tamil Nadu have already started breeding in captivity since 1982).

(2) Based on the results of the proposed project a report will be published recommending whether or not commercial farming of crocodile should be set up in India; and if farming is recommended, the report will indicate the methods and guidelines to be adopted.

Project Location

Sathanur Dam located in North Arcot District of Tamil Nadu, has been selected as the location for the Pilot mugger crocodile farming project. This location has the advantage of an existing crocodile Rearing Complex, which can be utilised to launch the project, being nearer to a perennial river (Ponnaiar) water supply can be assured, food for crocodiles both beef and fish are available at a cheaper rate easily, and finaly the location has the right kind of climatic condition conducive of good growth. The staff working in the forest crocodile Rearing Complex are well trained in their job.

Proposed Plan of Action:

As set out in the objectives, it is proposed to select and utilise the existing adult mugger available in Three rearing stations (Sathanur, Amaravati and Hogenakal) of Tamil Nadu as initial breeding stock. Ten(10) males and forty(40) females housed in five breeding pools (to be constructed before the initiation of the project) are to be used to produce up to 1200 eggs/year so as to enable a take off of 500 croppable size crocodiles.

It is envisaged ~~that with~~ that from these breeding group a commercially harvestable crop (Chide) ~~[illegible]~~ of 500 per annum can be obtained from the year 1990 ~~[illegible]~~ onwards.

While existing infra-structures with small scale supplementary construction is capable of maintaining the stocks produced for the first two years, there is an additional need of the construction of hatching pools, yearling pools, 2nd yearling pools and holding pool to accomodate upto 3000 mugger of various age class. The additional requirements are proposed to be constructed in the phased manner as indicated in the Table - - - ⊙

Other than the initial breeding group a support group of adult muggers are to be maintained in an open ~~[illegible]~~ pond. This is justified as necessary should any thing happen to main breeding group. This pond is also proposed to be used as fish production pond and experimental unit to study fish - crocodile ~~fish~~ relationships.

Operation

Breeding Group: The 5 functional breeding units with 50 adults and supplementary breeder pond with 30 adults will be stocked with animals chosen from the surplus stock now being reared at three rearing complexes of the State. The sex ratios to be used in the breeding ponds would be 1:4 male to female.

Egg Production: Assuming a 40 fecundity breeding females with an initial clutch size of 20 (averaging to 30 from the 1987-88) ~~as~~ egg production ~~of 800 to~~ is expected to rise from 800 to 1200.

Incubation & Hatchery: A 50 simulated nest unit hatchery is planned, where 1200 eggs can be incubated. The incubation of eggs will be in situ for first 6 weeks and thereafter the eggs will be collected and incubated in simulated hatchery.

Hatching: Hatching percentage is assumed to be 60% of eggs and during 1st year of rearing mortality is assumed to be 10%. followed by 5% each year for

the next two year. For the year three to four, the stocks are expected to be kept only for six months in a holding pool before being culled.

Growth rate:

Under good management regime a growth rate of 1" (one inch) per month is expected. From a hatching size of 10" to an exploitable size of 52", the time required is 42 months (3.5 yrs). However, in the hot and humid climate of Sathanur Dam with practically no winter period we do forecast growth of stock the time period may be reduced by at least 6 months. Giving allowance for other facilities the cropping (harvesting) is proposed to be carried out at an age of 42 months, or three and half year after hatching and rearing.

Food for Stock:

The following norm is proposed to be adopted in feeding. A daily feeding schedule for uninterrupted growth is to be followed. The quantity of food / crocodile is based on the following

Age	Average wt	Food Required % Body wt/day	Actual Quantity
0 - 1yr	1kg	10%	10 gms
1 - 2yr	3kg	10%	30 gm
2 - 3yr	10 kg	8%	80 gm
3 - 4yr	25 kg	6%	150 gm
Adults Breeders	70 kg +	3%	210 gm plus supplement diet or 300 gm

---

Based on the above calculation a crocodile requires 68.3 or 70 kg of food from hatching date to ~~crocodile~~ cropping date or ~~3.5 yr~~ during the period of three and half year of rearing in captivity.

Supplementary diet-

The breeders are to be provided with supplementary diet- for fertile egg laying and large clutch size. Similarly the first- year stock (Catchlings) are to be provided a variety of diet- and medical supplement to minimise mortality and better growth. The picking up of fast- growth rate in future years is dependent on the growth of the first- year. The production of a 'runt' during the first year means an enhancement of Cropable age and there by expenditure.

Health supports:

A veterinary support system and a stock health monitoring programme has to be built-in as the project- progresses. Initially the standard procedure of health care practiced in ~~expecting~~ well managed rearing complexes would be adopted, but- as the stock increases better ~~health~~ manag stock health management- programmes would be worked out.

Management of the Farm

The proposed farm is to be managed by the Tamil Nadu Forest Department personnels headed by a Forest Range Officer (Preferably a wildlife & crocodile management trained person) supported by a forester, forest-guard, workers and office Assistant - under the technical supervision of the Assistant Director of Crocodile Research Centre. (See Personnels Required under Table III)

Quarters for Staff

For the proper supervision & functioning of the farm it is important that the personnels involved are based at Sathanur. Hence and necessary building for accomodation are provided.

The functional personnels requirements remains the same for the total project period. However, the additional supporting staff are required every ~~year~~ year. Starting with six (6) workers, there will be an increase of three (3) workers every year so by 1989-90 the requirement would be ~~six~~ eighteen (18) workers, both for day and night functions of the project complex.

Quarters

Equipments

Co-laboration of Crocodile Research centre of W.I.I

The Crocodile Research Centre of the wildlife Institute of India shall be the Collaborator in the pilot Mugger Crocodile farming Project in Tamil Nadu. One Assistant Director (Shri. B.C. Choudhary) with support staffs from C.R.C. will establish a field station at Salanur Dam to look after the technical aspects related to management, research and economic of the Project.

The experiments proposed to be carried out by the C.R.C scientist are as follows:

(1) Breeding pool designs, stocking rates, sex ratio and their role in egg production.

(2) Incubation Techniques and role on hatching success.

(3) Role of food, temperature pen design and stocking rate on the growth and survival of various age group.

(4) Selection of fast growing and early strains for future farming prospection.

(5) An experimental set up also proposed to examine the role of predatorious mugger in maintaining fish population under control in simulated conditions.

Harvesting & marketing policy & method

While the technical expertise in management of crocodiles in captivity including breeding is highly evolved in India and personnels of Tamil Nadu are well acquainted in the line of specialised work for the last 8-9 years, there is no expertise in ~~flaying~~ slaughtering, flaying, skinning and skin storage etc.

There is a need to explore if such expertise can be made available within India (through Central Leather Research Institute, Madras) or personnels are to be trained abroad in some south-east Asian Countries like Thailand, Singapore or, Papua New Guinea or Australia. Since the first training is expected to start from 1985-90, the need to have trained person in this field becomes necessary earlier and has to be planned from the year 1987-88.

An International market survey of crocodile hides and the gradation of Indian mugger skin in the International market and its price has to be determined before the skin production takes place.

During the project period one such survey has to be carried out by an FAO/UNDP consultant, and the most profitable means of selling the skins (either in raw canned form or as finished product) has to be decided.

Cost-Benefit Analysis:

The project does not envisage to carry out a cost-benefit analysis within the project period. However during the harvesting phase (in 1989-90) the projection of cost benefit can be carried out by a competent wildlife economist, preferably of International repute.

Pilot Crocodile Farming Project - 1985 - 1990

Table I Yearwise Production of Stock

	1985-86	1986-87	1987-88	1988-89	1989-90	Remarks
Breeding females	40	40	40	40	40	
Egg Production	@ 20/female 800	@ 25/female 1000	@ 30/female 1200	@ 30/female 1200	@ 30/female 1200	Females start with small clutch and average around 30 per clutch in 2-3 yr
Hatchlings at 60% hatching success	480	600	720	720	720	—
At one year 10% loss of previous year stock	—	430	540	648	648	
At Two year 5% loss of previous year stock	—	—	418	513	615	
At Three year 5% loss of previous year stock	—	—	—	397	487	
At four year Cropable Stock	—	—	—	—	390	2% are retained as future breeding stock.

Recurring Costs Year wise

TABLE II

	1985-86	1986-87	1987-88	1988-89	1989-90	Total
1. Feed for Crocodiles @ Rs 6/- per kg of prey	Rs 70,000 (for 580 tons)	100,000 (1130 tons)	200,000 (1770)	2,75,000 (2370)	3.25,000 (2570)	9.70,000 ✓
2. Supplement- diet & medicine (10% of feed cost)	7,000	10,000	20,000	27.500	32,500	97,000 ✓
3. Stores & Stock	5,000	5,000	5,000	5,000	5,000	25,000
4. Electricity charges	20,000	20,000	20,000	20,000	20,000	100,000
5. Maintainance of Structure Complex & quarters	20.000	20,000	20.000	20,000	20.000	100,000
6. Running & Maintainance of vehicle & other Equipments	20,000	20,000	20.000	20,000	20.000	100,000
7. Boards & labels for display of stock etc	5,000	5.000	5.000	5.000	5.000	25.000
8. Miscelaneous exp.	2.000	2.000	2.000	2.000	2.000	10.000
	Rs 1.49,000	1,82,000	2,92,000	3.74,500	4,29.500	14,27,000 ✓

Personnels Required / Cost TABLE III

From Tamil Nadu	1985-86	1986-87	1987-88	1988-89	1989-90
Forest Range officer (1) @ 18,000/anum	Rs 18,000	Rs 18,000	Rs 18,000	18,000	Rs 18,000
Forester (1) @ 12,000 anum	Rs 12,000	Rs 12,000	Rs 12,000	12,000	Rs 12,000
Office Assistant (1) @ 12,000 anum	Rs 12,000	Rs 12,000	Rs 12,000	12,000	Rs 12,000
Forest Guard (2) @ 17,000/anum	Rs 17,000	Rs 17,000	Rs 17,000	17,000	Rs 17,000
Driver (1) @ 10,000/anum	Rs 10,000	Rs 10,000	Rs 10,000	10,000	Rs 10,000
Workers (3) @ 500 each	Rs 36,000	Rs 54,000	Rs 72,000	Rs 90,000	Rs 108,000
Skinning Technician (1) @ 12,000	Rs —	—	—	Rs 12,000	Rs 12,000
	Rs 1,05,000	Rs 1,23,000	Rs 1,41,000	Rs 1,71,000	Rs 189,000

~~From CRC~~

Crocodile Research Centre Personnels for the Project

Asst. Director (1)
Office Assistant (1)
Driver (1)
Khalasi (1)

All Staff to be used from Present Crocodile Research Centre of W.I.I at Hyderabad.

Non-Recurring Expendable Items Table IV

	1985-86	1986-87	1987-88	1988-89	1989-90	Total
Deepfrezzer	—	—	Rs 25,000	—	—	25,000
Weighing Machines	Rs 2,000	Rs 3,000	Rs 10,000	—	—	15,000
Generator (1.5 KW) Diesel	Rs 25,000	—	—	—	—	25,000
Computer Equipments	—	—	—	Rs 10,000	—	10,000
Laboratory Equipments	—	Rs 10,000	Rs 5,000	Rs 5,000	5,000	25,000
Incubators Glassware Microscope etc				Rs 5,000	—	10,000
Medical Equipments	—	Rs 5,000	—			
Motor cycle	Rs 20,000	—	—	—	—	20,000
Jeep with Trailor	—	—	Rs 120,000	—	—	1,20,000
	Rs 47,000	Rs 18,000	Rs 160,000	Rs 20,000	Rs 5,000	Rs 250,000/-

MADRAS CROCODILE BANK

Vadanemmeli Perur Post Mahabalipuram Road Madras 603 104

To:

19th September 1987

Department of Environment
Government of India

AND

The Indian Board for Wildlife

Dear Sirs,

Enclosed is a project proposal for commercial crocodile farming to benefit tribal people in the lowest economic bracket in India. I am requesting, on behalf of the Irula people, that this project be favourably considered as a part of the successful process of wildlife resource conservation that India has been giving emphasis to in the past decade.

The mugger crocodile is certainly one of the best candidates for our next domestic animal, just as the alligator in America has become a multi-million dollar industry as a farmed reptile. If it seems repugnant to wildlife enthusiasts and animal lovers, it can only be said that:

a) Large predators like crocodiles are harder and harder to find habitat for.

b) No one in rural India appreciates the ecological value of crocodiles and in general will no longer tolerate them in their rivers and tanks.

c) The hope for this and other wildlife to survive is by our recognition of them as renewable resources to be carefully managed and sanely used.

d) The farm model being used is very humane, clean and conducive to growing healthy and happy crocodiles.

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e) The appreciation of protecting wild crocodile stocks will only be consolidated by the recognition of its resource value, as the mugger joins the ranks of animals which man has domesticated over the centuries.

There are a number of safeguards to prevent other than farmed skins entering the market, as detailed in the proposal. I am confident that this programme can be as effective as those evolved and functioning in Zimbabwe, Papua New Guinea, Australia and Indonesia.

It would be most appreciated, if you would take a few minutes to send your comments on this proposal to Shri. M.K. Ranjitsinh, Member Secretary, IBWL, with a copy to me.

I am taking the liberty of sending you a recent National Book Trust, India publication on snakes, aimed mainly at the younger audience.

With best wishes,

Romulus Whitaker

Romulus Whitaker
Director
Madras Crocodile Bank
Vadanemmeli Village
Perur Post
Madras - 603 104.

Encls. As above.

PROJECT PROPOSAL FOR SUBMISSION TO THE INDIAN BOARD FOR WILDLIFE AND DEPARTMENT OF ENVIRONMENT (WILDLIFE) FOR APPROVAL

TITLE	:	Crocodile farming as a reserved, tribal occupation.
PRINCIPAL INVESTIGATOR	:	Romulus Whitaker (bio-data attached)
TRIBE TO BE BENEFITTED	:	Irulas, Chingleput District, Tamil Nadu
PROJECT DURATION	:	Three years
FUNDING	:	State and Central sources under Department of Environment, Department of Science and Technology and Social Welfare Department schemes for tribal self help.

OBJECTIVES:

1. To set up a closed circuit crocodile farm using F2 generation captive bred crocodilians for commercial production of skin and meat.

2. Recognizing that one of the only ways to gain full public support for wildlife conservation is to prove its direct value to man, to demonstrate that conservation of a large predatory animal can be economically beneficial to the weakest section of society.

3. To allow a tribal people of hunter-gatherers whose traditional prey included crocodiles, to once more use the crocodile as a source of livelihood in the modern context of captive husbandry.

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4. To help establish sound scientific procedures and norms for wildlife based industries in India.

5. To show that conservation is a dynamic process with direct economic relevance and not a dead end.

6. To encourage the establishment of similar projects for tribal people and fishermen, especially those whose traditional fishing, hunting and gathering rights have been curtailed in the last few decades due to establishment of protected wildlife reserves and drastic changes in land use.

BACKGROUND:

I. The Irulas

The Irulas are a Primitive Scheduled Tribe of the plains of Chingleput District and adjacent areas. They are hunter-gathers, most of whom are rapidly losing whatever limited livelihood they are able to obtain in their traditional pursuits. Formerly bow and arrow hunters, now many subsist mainly on gathered tubers, rats and grain obtained from rat burrows. Three ongoing natural resource related projects for these Irulas which keep their traditional skills intact are :

a) The Irula Snake-catcher's Co-operative Venom Centre.

b) The Irula Co-operative Rat Control Project and

c) The Irula Tribal Women's Welfare Society (Forestry Project).

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In former times when crocodiles were common in Tamil Nadu waterways, the Irulas hunted crocodiles for food, even as recently as the 1960's. It is logical that these are the right people to benefit from the development of wildlife resource based industries.

II. The Crocodile Resource

The mugger crocodile (Crocodylus palustris) is a fecund (25 to 30 eggs per clutch, often two clutches per year at the Crocodile Bank), hardy and adaptable reptile. Overkilling for the valuable skin and alteration of habitat by hydel and irrigation projects, saw this species decline to an estimated total population of a few thousand animals in India by the mid 1970's. By that time, the Government of India and an N.G.O. (Madras Crocodile Bank) had started crocodile conservation projects). The Government projects were based primarily on wild egg collection, rearing and release. The Madras Crocodile Bank Trust project was mainly a captive breeding programme. In the twelve years of mugger conservation efforts, much has been accomplished. A number of crocodile reserves have been established, seventeen centres are now breeding the species in captivity and about 1000 crocodiles have been released back to the wild. Currently there are over 12,000 mugger on (mainly Government) "farms" in the country, including over 2000 at the Madras Crocodile Bank Trust.

It is timely to examine the direction that crocodile conservation can now take. A large reptilian predator is not a welcome addition to riverine and lake habitat shared by humans, thus strictly limiting the potential restocking areas. In fact it is unlikely that there will be any significant further release in the country except in a few of the National Parks and Sanctuaries.

..4..

Among the several State Government projects and the Madras Crocodile Bank, we have developed considerable expertise in crocodile biology and captive husbandry with excellent breeding, hatching, survival and growth rates and sound research base with well trained personnel.

The considerable technical and financial input made by the Food and Agricultural Organisation of the United Nations to the crocodile project, inferred that crocodiles in India are a wildlife resource of great potential value. The Principal Investigator's experience as consultant to the United Nations and IUCN in Papua New Guinea, Indonesia, Bangladesh, Mozambique and Malaysia, confirms that India has the same opportunity to convert what was once an endangered species to a source of livelihood for tribal peoples.

PROJECT OUTLINE:

The Irula community proposes, with the financial assistance of the Government and technical assistance of the Principal Investigator and advisors to the project, to set up a commercial crocodile farm near Madras, using the mugger crocodile and the South American caiman (breeding stocks of this common species are established at Madras Crocodile Bank Trust). The object of the farm will be to produce high quality crocodile skins for export and to utilize the meat, fat and other byproducts as local sources of protein and indigenous medicine. A feasibility costing is appended.

Crocodile feed will be primarily in the form of rats caught by the Irulas in its Rat Control Project, "useless" buffalos and trash fish from the bycatch of prawn trawlers off Madras and from the nearby backwaters. A feed source availability analysis has already been carried out.

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Until the Irula Crocodile Project establishes its own breeding stock it will be able to purchase surplus stock of young crocodiles from the Tamil Nadu Forest Department and Madras Crocodile Bank, for rearing to culling size (3 to 4 years). Currently the Madras Crocodile Bank's average annual production of captive bred mugger exceeds 300 and this will increase exponentially as captive bred stock from the mid 1970's reach maturity.

LEGAL CONSTRAINTS AND METHODOLOGY:

The mugger crocodile is protected under Schedule I(II) of the Wildlife (Protection) Act of 1972 and as such cannot be traded in. Thus, upon approval and implementation of the project, farm reared mugger would require an exemption similar to that granted to farmers of alligators in Florida and Louisiana where their conservation measures also succeeded in changing the status of the alligator from endangered species to commercial natural resource.

The mugger crocodile is also on Appendix I of the Convention on International Trade in Endangered Species. Farmed crocodiles would therefore need to be placed on Appendix II of CITES so that they can be traded internationally. This has already been done in the case of a number of countries (including Zimbabwe and Indonesia where skins and meat of farmed and ranched crocodiles are traded in under CITES permission).

Only whole skins would be initially dealt with until effective means are established to allow local manufacture and export of quality items.

..6..

Safeguards:

1. Non-reusable plastic tags attached to each farmed skin at the time of skinning is a standard method, accepted by CITES and used in most crocodile farming operations.

2. Registration of all farmed animals and mandatory annual stock taking to prevent any illegal use of crocodiles.

3. Provision to revoke the licence of any crocodile farm found to be contravening regulations concerning crocodile farming.

4. The Irula Snake-catcher's Co-operative, as a quasi-Government organisation under the Tamil Nadu Ministry of Commerce and Industries, is subject to Government audit and has been working under licence from the Forest Department for the past seven years. Thus, the degree of control available to ensure the proper operation of the project is optimal.

5. Initially at least, the entire skin trade would be channelled through the Bharat Leather Corporation to further ensure control.

PROJECT ADVISORS

Shri. V.B. Singh
Dr. L.A.K. Singh
Shri. Binod Choudhury
Dr. J.W. Lang

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ROMULUS WHITAKER
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CROCODILE FARMING BRIEFING PAPER

BACKGROUND TO THE PROPOSAL

The Government of India became interested in the possibility of developing crocodile farms around 1970 and approached UNDP for assistance. This resulted in the formulation of IND/71/033 - Crocodile Farming in the New Delhi zoo. It was against this Project that Dr. H.R. Bustard was invited to visit India and report on the feasibility of this proposal. Dr. Bustard was also requested to comment on the status of Indian crocodilians with special emphasis on the gharial, then thought to be on the verge of extinction, but for which detailed data were lacking. The results of this survey mission are given in FAO (1974). The report indicated that very substantial crocodile farming enterprises could be developed in India but highlighted the precarious predicament of India's crocodilians. Before commercial farming could be undertaken, it was essential to operate an extensive conservation and rehabilitation programme.

The mission report was accepted by the Government of India and implementation started in early 1975. An account of the early implementation in Orissa was given in FAO (1975). Although it was realised that a large conservation effort, lasting over a number of years was a prerequisite to commercial farming, the commercial goal was borne in mind from the outset. In 1975, an FAO economist Mr. J.M. de Waard was invited to produce a report on crocodile farming based on the pilot Orissa models then getting under way. De Waard (1975) - a 124 page report - was the result of this exercise.

The species to use

FAO (1974) pointed out that the gharial was on the verge of extinction and the saltwater crocodile extremely rare, whereas the Indian mugger was still widespread although in reduced numbers. It was a depleting species, populations being reduced faster than they could reproduce themselves. Of the nine states which joined the crocodile project (Orissa, Uttar Pradesh, Rajasthan, Gujarat, West

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Bengal, Tamilnadu, Andhra Pradesh, Kerala and Madhya Pradesh), six are involved with rehabilitation work on the Indian mugger. These are Tamilnadu, Andhra Pradesh, Gujarat, Uttar Pradesh, Kerala and Orissa. Quite apart from its much less threatened status, the Indian mugger has the advantage of having a widespread distribution, occuring in most states. A further advantage is that it is an easy species for husbandry and breeds very readily in captivity. Because of the above advantages and since the species was not covered in his early report, the Indian mugger was selected for detailed economic study by de Waard (1978) at the request of the Government of India, in the realisation that it would be the first species available for commercial crocodile farming.

Present status of the Indian mugger in the wild in India

The Indian mugger is truly an Indian species although it occurs in the better-watered areas of Pakistan and a small population exists in South-eastern Iran. In the Indian region, it also occurs in the Nepalese terai. In the east, it is said to cut out in Darrang district of Assam. Within India, the species is found throughout the country wherever the habitat is suitable (i.e. in well-watered areas away from the mountains). It extends from the North India terai to extreme South India.

Bustard (FAO 1974) stated,

"In South India (Tamilnadu, Kerala and Andhra Prdesh) populations, though hard hit, could show rapid response to management combined with effective protection. This is probably the case in Rajasthan and Gujarat." The mugger has survived throughout much of this very extensive distributional range because of its adaptability. Muggers occur in village ponds and irrigation tanks in addition to rivers, swamps and lakes. As noted by Bustard, the extensive dam construction work taken up in recent decades in India, which has destroyed much of the former gharial habitat, has created habitats suitable for mugger which would have been extensively colonised were it not for the adverse affect of fisheries management (such as setting of nylon gill nets).

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Since the appearance of FAO (1974), the status of the mugger has become very well known, at least in the states which are operating Government of India/UNDP/FAO assisted State Crocodile Projects. There is a need to up-date knowledge (see below) in states where this information is not available. Today, the best populations probably occur in the states of Tamilnadu and Gujarat but surveys are badly needed for a number of states, most notably Madhya Pradesh, where extensive accounts of mugger were given by wild life authors in the past. The status of mugger is summarised in Table 1. It should be stated, however, that this Table is tentative in as far as a number of states are concerned. It should also be stressed that the status could improve drastically in a number of states if there were financial incentives for taking up the necessary work. The technology of mugger husbandry is now well known in the country.

STATE MUGGER PROJECTS

Information on the state mugger projects is given in outline form below and information is summarised in Tables 2 and 3. These notes give background information on work which requires to be done, information which is also given, as far as sanctuaries are concerned, in Table 3. The next section sets out in more general terms what now requires to be done.

TAMILNADU

1. Status in the wild : The status in the wild is well known and is listed as good in Table 1.

2. Sanctuary requirements : No sanctuaries have been declared by this Project and three good sanctuaries are required which must be free from commercial fishing. The areas chosen are Satanur, Amaravathi and a stretch of about 50 km. of Moyar-Kedarhalla river. Furthermore, a 25 km. stretch of the Hoggenakal river (in conjunction with Karnataka as the river forms the inter-state border) is recommended.

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3. Numbers to be stocked :

Satanur	200
Amaravathi	50
Moyar-Kedarhalla	200
Total	450

4. Annual stocking thereafter :

Satanur	10
Amaravathi	10
Moyar-Kedarhalla	20
Total	40

5. Releases to date :

In Krishnagiri (1979)	130
In Hoggenakal (1980)	48
Total	178

6. Captive Breeding : The creation of three captive breeding centres is recommended located respectively at Satanur, a suitable coastal site, and the extreme south of the state.

ANDHRA PRADESH

1. Status in the wild : The status in the wild is well known and is given as depleted in Table 1.

2. Sanctuary requirements : Five crocodile sanctuaries have been declared in Andhra Pradesh, three of which are for the Indian mugger. In addition, releases have taken place into two other wild life sanctuaries in the state. Andhra Pradesh, accordingly, has very adequately fulfilled the sanctuary gazettement guidelines.

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3. Numbers to be stocked (in the three Project sanctuaries) :

Krishna sanctuary	350
(Ethipothalla; 3 females)	3
Lanjumadugu	30
Manjira	40
Total	423

4. Annual stocking thereafter :

Krishna sanctuary	30
(Ethipothalla)	-
Lanjumadugu	3 to 5
Manjira	5
Total	40

5. Releases to date :

Krishna Sanctuary (Ethipothalla)	8
Kinnersani	33
Pakkal	15
	56

6. Captive breeding : These captive breeding centres are recommended located at Nagarjuna Sagar, Visakhapatnam and Hyderabad (existing).

GUJARAT

1. Status in the wild : There is a need for state-wide survey to up-date the status in the wild.

2. Sanctuary requirements : Mugger management has already been undertaken in Gir National Park. Two other sanctuaries should be set up and managed for mugger in this very important mugger state.

3. Numbers to be stocked :

Gir (Hiran Lake)	150

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Stocking rates for the other two sanctuaries to be advised when selected.

4. Annual stocking thereafter : 10

5. Releases to date : ... ... Nil

6. Captive breeding : Two captive breeding centres should be set up in the state (Table 4).

NOTE : At present there is very considerable under utilisation of the mugger resource in Gujarat. Eggs are only collected from Gir and at present it is believed that only 5-6 of approximately 25 available nests are collected each year.

UTTAR PRADESH

1. Status in the wild : The status in the wild is fairly well known in this state with the country's major gharial project. Corbett National Park is the state's major mugger area, greatly potentiated by the completion of Kalagarh dam (all within the park) in the mid-1950s. Mugger also occur in Dudwa National Park, Katerniaghat (gharial) sanctuary and the National Chambal Gharial Sanctuary and in small numbers in many other areas of the state.

2. Sanctuary requirements : No other sanctuaries are proposed.

3. Numbers to be stocked : A census should be carried out in Corbett National Park and the holding capacity estimated. A group of at least 20-30 animals should be introduced into Dudwa to strengthen the very small number presently existing there.

NOTE : It is not proposed to potentiate muggers in gharial sanctuaries.

4. Annual stocking thereafter : To await above information.

5. Releases to date : Nil

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6. Captive breeding : The captive breeding facility in Kukrail should be stocked quickly with the aim of achieving captive breeding in 1981. It is envisaged that Kukrail would remain the state's major crocodile centre due to its convenient locality, close to Lucknow, and the very extensive (and outstanding) facilities developed there since 1975.

NOTE : No egg collections are being carried out in Corbett National Park.

KERALA

1. Status in the wild : A detailed survey is required.

2. Sanctuary requirements : Mugger presently occur in Neyyar, Perambikulam and Periyar sanctuaries. No specific additional sanctuaries are proposed.

3. Numbers to be stocked : Detailed surveys are required.

4. Annual stocking thereafter : Dependent on (3) above.

5. Releases to date : Probably nil.

6. Captive breeding : It is thought that the facilities at Neyyar should be expanded for this purpose.

ORISSA

1. Status in the wild : A detailed survey is required.

2. Sanctuary requirements : Two sanctuaries have already been declared and managed for crocodiles in Orissa. Satkosia for gharial and Bhiterkanika for saltwater crocodiles. Furthermore, Hadgarh sanctuary has been declared as a mugger sanctuary but no restocking has taken place. Releases are also planned into Similipal National Park this winter. An active programme to

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delineate a suitable mugger sanctuary area in Southern Orissa (Gangam or Koraput Districts, such as Bhanjanagar or Balimela is required). This sanctuary will then be built up by releases. This proposed sanctuary, together with Hadgarh Sanctuary (where releases have yet to take place) and Similipal National Park (where releases are scheduled for this winter) will provide adequate provision of mugger in Orissa.

NOTE : It is not intended to release mugger in Satkosia Gorge gharial sanctuary (Mahanadi).

3. Numbers to be stocked : This can only be done following survey.

4. Annual stocking thereafter : Dependent on above.

5. Releases to date : Nil

6. Captive breeding : A captive breeding centre for all three Indian crocodilian species already exists at Nandankanan Biological Park. The creation of a second breeding centre to complement this is recommended. This should be in coastal Orissa.

WHAT REQUIRES TO BE DONE

1. It will be necessary to fully utilise the existing resources by an expansion of rearing projects in all six existing project states together with extension of the project to other suitable states including Madhya Pradesh and Karnataka. Pending creation of such expanded facilities the existing resource should be fully utilised by those states having facilities.

2. Continuing to build up the resources in suitable National Parks/ Sanctuaries (Table 2).

3. Updating data on the present status of mugger in the country, particularly in states where mugger are the only crocodilian species.

4. Continuing the policy of the creation of well protected sanctuaries for re-stocking initially and later on to be recepients of a certain

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percentage of farmed stock (see detailed guidelines, Appendix A), the continued return of some mugger to the wild by the farms will be essential since the states undertaking mugger farming must ensure a healthy wild breeding population of mugger dispersed in at least two or three well protected sanctuaries,

5. Creation of captive breeding stations as a catalyst to the main conservation project initially and as a source of eggs for battery farming. It is envisaged that many of the existing rearing stations will be expanded into battery farms. Details of proposed rearing station expansion/captive breeding farms are given in Table 4.

Table 1: STATUS OF MUGGER CROCODILE IN INDIA

States	Safe	Good	Depleted	Rare	Not known	Extinct	Remarks
Tamilnadu		X					
Andhra Pradesh			X[1]				
Kerala			X				
Karnataka					X		
Maharashtra				X			
Madhya Pradesh					X		
Orissa				X			
West Bengal						X	
Bihar				X			
Uttar Pradesh				X			
Gujarat		X					
Rajasthan					X		
Assam						X	

[1] Status raised from rare to depleted in view of 58 already released and proposal to now release additional 130.

Table 2: SANCTUARIES - EXISTING AND PROPOSED

tates	Existing Sanctuaries	* Required sanctuaries	Additional recommended sanctuaries
amilnadu	NIL	1. Sathanur 2. Amaravati 3. Moyar-Kedarhalla (a fifty km stretch of Moyar-Kedarhalla)	Hoggenakal a 25 km stretch (jointly wi Karnataka)
ndhra Pradesh	1. Ethipothalla ** 2. Krishna Sanctuary (Nagarjunasagar-Srisailam) 3. Manjira 4. Lanjamadugu 5. Kinnersani 6. Pakkal	NIL	1. Kadam 2. Gosthani 3. Sileru (with Orissa a stretch/stretches of Sileru river including Jalaput reservoir)
erala	1. Neyyar 2. Perambikulum 3. Periyar	NIL	NIL
rissa	1. Similipal National Park 2. Hadgarh Sanctuary	NIL	Balimela and with AP a stretch or stretch of Sileru river including Jalaput reservoir.
Uttar Pradesh	1. Corbett National Park 2. Dudwa National Park 3. National Chambal Gharial Sanctuary	NIL	NIL
Gujarat	1. Gir National Park	Two further sanctuaries selected following proposed state-wide survey	

These are the minimal sanctuaries which it is considered the concerned state should gazette and manage for mugger crocodiles.

* Ethipothalla was recently included in Krishna Wildlife Sanctuary.

Table 3. MUGGER REARING STATIONS AND THEIR STOCK AS OF MAY 1980

States	Rearing Centres	Year of initiation	Present stock (approximate)	Remarks
Government of India aided Projects:				
Tamilnadu	1. Madras	1976	50 ♀	Part of 1976
	2. Amaravati	1977	200 ♀	1977 and 197
	3. Sathanur	1977	400 ♀	stock has
	4. Hoggenakal	1977	100 ♀	been release
	5. Coimbotore	1976	25 ♀	back to the wild.
Andhra Pradesh	1. Hyderabad	1977	200	Part of 197 stock releas back to wild
Kerala	1. Neyyar	1976 ♀	50 to	
	2. Peruvannamuthi	1977 ♀	100	
Orissa	1. Tikerpada	1975	15 ♀	Stock brough
	2. Similipal	1979	25 ♀	from Tamilna
Uttar Pradesh	1. Kukrail	1975	100	
Gujarat	1. Gir	1977	400	Part of 1976 1977, 1979 stock have b sent to othe states.
State Projects:				
Karnataka	1. Bannerghatta	1977	50	
Maharashtra	1. Tarobe	1978	50	
Private Projects				
Tamilnadu	1. Madras Snake Park, Crocodile Bank Trust, WWF aided.	1974	300	Part of 1974 1975, 1976 stock sent t other state projects.

Table 4: PROPOSED REARING STATION EXPANSION/CAPTIVE BREEDING FARMS

States	Location
Tamilnadu	A. Sathanur B. Suitable coastal site C. A site in the extreme south of the state
Andhra Pradesh	A. Vizag B. Hyderabad*/Manjira C. Third site to be selected.
Kerala	A. Neyyar*
Orissa	A. Nandankanan* B. Coastal Orissa C. Western Orissa near Hirakud
Uttar Pradesh	A. Kukrail*
Gujarat	A. Baroda B. Other site to be selected

Note: The above sites are those recommended for development by the State Forest Departments.

* These marked thus (*) involve the extension of existing facilities.

APPENDIX A - PROCEDURE FOR FARMING

1. The proposal is two-fold (a) to develop large farms holding all their own breeding stock, and (b) to provide hatchlings for rearing in small village farms. Additionally, free range farming (by the conservation authority) may be taken up later.

2. The proposed procedures set out below assume that the pre-requisites already proposed (copy of which is attached herewith as Appendix B) will be followed.

3. Farms should be "closed farms". This means that all the hides produced are obtained from crocodiles reared in the farms which have hatched from eggs laid in the farms by captive breeding herds.

4. Each farming enterprise would be required to be licensed by the competent authority (State Forest Department) who will require to satisfy themselves that the concerned personnel have the required technological expertise to successfully operate a crocodile farm. (This may involve the issue of Diplomas for short-term training courses of 2-3 months duration by the Institute to sponsored candidates of interested parties, together with approved adequate physical facilities for breeding and rearing mugger crocodiles). The State Forest Department would also require quarterly returns setting out stock held on the farms.

5. The licence to farm would only be granted on the basis that each farming enterprise would make available to the competent authority (State Forest Department) young crocodiles of release size (1.20 metres) free of cost for rehabilitation in the states sanctuaries. The numbers to be so provided would not be less than 2%, nor more than 5%, of the number available each year for commercial purposes.

6. Only the conservation authority (Wild Life Wing of the State Forest Department) would be permitted to harvest eggs from the wild.

..... 11

Hatchlings resulting from such eggs may be made available to non-forest department farms if so desired. However, with any harvesting of eggs from the wild, it will be a requirement that 5% of the hatchlings hatched be returned to the wild at a size of 1.2 metres. This requirement will be binding on any farm accepting such hatchlings resulted from wild-laid eggs from the State Forest Department.

Appendix B

IND/74/046 CROCODILE BREEDING & MANAGEMENT

GUIDELINES FOR COMMERCIAL CROCODILE FARMING

In order to continue the impetus generated under this project it is essential that the Government speedily issue guidelines for commercial crocodile farming. Such action is needed now particularly in the case of the Indian Mugger (C. palustris), a depleted species, never endangered, and capable of quick recovery under the project. This species will never become plentiful again unless there is an incentive for large-scale rearing which requires commercialization. The requirements of conservation in selected sanctuaries and National Parks in quite modest - a few thousand individuals.

Suggested Guidelines

1. States participating in the Government of India FAO/UNDP assisted Project on Crocodile Breeding will in due course be allowed to commercialize crocodiles subject to the provisions:

Prerequisites

a) that the said States have gazetted, staffed, and are managing such sanctuaries and National Parks for the concerned crocodilian species as GOI may require to the satisfaction of the Government of India.

b) that the said States have returned to these aforesaid sanctuaries or National Parks sufficient crocodiles of the concerned species to constitute in the opinion of the Government of India's Expert, an optimum population for that sanctuary or National Park.

Operation

c) farming must proceed in such a manner that total protection can be assured to the wild stock (including those in sanctuaries and National Parks)*. This makes it essential at this stage that all farms are Government-operated and/or controlled. Collection of wild-laid eggs will be done only by State Forest Departments (including those laid in sanctuaries and National Parks) subject to a return of 5% of the juveniles to the said sanctuaries or National Parks at a length of 1.20 metres.

Under no circumstances can wild-dwelling crocodiles be slaughtered for their skins.

d) it is envisaged that Government controlled farms, operated either as battery farms or free range farming (see de Waard, 1975), would be the modus operandi. Maximum involvement of the rural poor in such ventures should be ensured as per Project outlines (see also de Waard 1975).

*It is feared that private farming (i.e. by private individuals or Companies) would open a loop-hole in the Wild Life (Protection) Act, 1972 and thereby encourage poaching. Private farming should, therefore, not be approved at the present time, since such enhanced poaching activity would be counterproductive to the present efforts being made by IND/74/046 to rehabilitate India's three crocodilians species in the wild. Later when sanctuaries and National Parks have an adequate cadre of trained staff and are operating under internationally accepted management norms private farming may be entertained.

(H.R. Dustard)

1980

Appendix I

IND/74/046 CROCODILE BREEDING & MANAGEMENT

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(H.R. Bustard)

MODEL CROCODILE FARM AS A TRIBAL AGRO INDUSTRY

By

THILO J. WESTERHAUSEN
Madras Crocodile Bank
June, 1986

S U M M A R Y

1. Surplus crocodile stock is available now from Madras Crocodile Bank and Government projects.

2. It will take 3-4 years for the farm to produce the planned annual output of 1260 skins.

3. Meanwhile, larger F-2 generation crocodiles can be purchased and reared for culling within one or two years so that the farm gains experience and starts earlier revenue earning.

4. Other complimentary business opportunities for the farm are chicken farming, tree farming (fruit and timber) tourism and crocodile by-products (meat, glands, teeth etc.).

5. Feed will be rats, frogs, trash fish and useless buffaloes according to feed availability analysis already carried out. Incidentally, the meat gained from the culled crocodiles covers the food requirements of the entire permanent breeding stock.

6. The technical expertise, research and data base for crocodile farming has been developing for over a decade in India and should logically be put to profitable use.

7. After the fifth year, the annual income of the farm will be between Rs.20,00,000 and Rs. 30,00,000.

..2..

BREEDING CHART

Assumptions: 1) Desired output per year : 1,260 skins.

2) Average clutch size: 25 viable eggs in 1st clutch

20 viable eggs in 2nd clutch

3) Out of 50 females, 20 will double clutch.

4) Permanent breeding stock (P.B.S.)

70 females

15 males

5) 50 1st clutches and 20 2nd clutches per year.

50 females x 25 eggs	:	1,250 eggs
20 females x 20 eggs	:	400 eggs
Total:		1,650 eggs

15% of eggs will be spoilt in the nests : 250 eggs

	1,650	eggs
-	250	eggs
	1,400	eggs that will produce hatchlings.

Mortality of 1-12 month old hatchlings : 10% = 140 hatchlings.

Total stock:	1-12 months old	:	1,400
	13-24 months old	:	1,260
	25-36 months old	:	1,260
	Permanent breeding stock	:	85
			4,005 animals.

..3..

ANNUAL BREAK-DOWN OF OPERATING EXPENDITURES

ITEMS	1	2	3	4 (year)
Labour	36,000	36,000	48,000	60,000
Manager	50,000	50,000	50,000	50,000
Foreman	20,000	20,000	20,000	20,000
Extra labour for skinning	7,500	7,500	7,500	7,500
Crocodile food	34,100	74,000	1,70,200	3,26,100
Fuel for jeep, generator,etc.	30,000	30,000	30,000	30,000
Car insurance	5,000	5,000	5,000	5,000
Worker's compensation	5,000	5,000	5,000	5,000
Small tools	3,000	600	600	600
Postage and stationery	2,000	2,000	2,000	2,000
R.& M. machinery		13,900	13,900	13,900
R.& M. pens		15,700	15,700	15,700
R. & M. buildings		2,000	2,000	2,000
R.& M. fences		2,000	2,000	2,000
Marketing expenses	20,000	20,000	20,000	1,50,000
Travel and leave fares		50,000	50,000	50,000
Purchase of small crocodiles	1,97,000	1,97,000	1,97,000	1,97,000
Total operating expenditures	4,09,000	4,57,000	6,38,900	9,36,800

..5..

ANNUAL BREAK-DOWN OF OPERATING EXPENDITURES

CAPITAL ITEMS	Year (1)	Year (2)	Year (3)
Crocodile Pens	1,00,000	1,25,000	90,000
Management Housing	80,000		
Labour Housing			
Equipment shed, workshop and office	70,000		
Processing shed	30,000		
Water pumps	13,500		
Water well and tank	12,000		
Jeep	1,20,000		
Generator		45,000	
Perimeter fencing	80,000		
Freezer facility		1,00,000	
Company formation	5,000		
Land (2 acres)	30,000		
Purchase of breeding crocs	1,27,500		
Total Capital Expenditure	6,67,500	2,70,000	90,000

..4..

REVENUE FROM SKIN SALES

Number of skins	Grade	Price per inch (U.S.$)**	Value of 18" skin in U.S.$	Total Value in U.S. $	Total Value in Rupees
1000	A	10.00	180.00	1,80,000	22,50,000
200	B	7.50	135.00	27,000	3,37,500
60	C	5.00	90.00	5,400	67,500
			TOTAL: U.S.$	2,12,400	Rs.26,55,000

** Assuming a rate of U.S.$ 1.00 = Rs.12.50. The skin value is based on recent French and Japanese prices for raw skins of "classic" hides.

..6..

TOTAL ANNUAL EXPENDITURES AND INCOME

	1	2	3	4 (year)
Capital expenditure	6,67,500	2,70,000	90,000	-
Operating expenditure	4,09,000	4,57,000	6,38,900	9,36,800
Contingencies (5% of operating costs)	20,450	22,850	31,945	46,840
Total	10,96,950	7,49,850	7,60,845	9,83,640

Total Investment (four years) : Rs.35,91,285

TOTAL INCOME (years 1 to 4) from culling purchased stock : Rs.27,00,000

Year 2 : 200 x 18" = $ 36,000

Year 3 : 400 x 18" = $ 72,000

Year 4 : 600 x 18" = $108,000

TOTAL (dollars) $216,000

TOTAL (rupees) Rs.27,00,000 (assuming a rate of U.S.$1.00 = 12.50)

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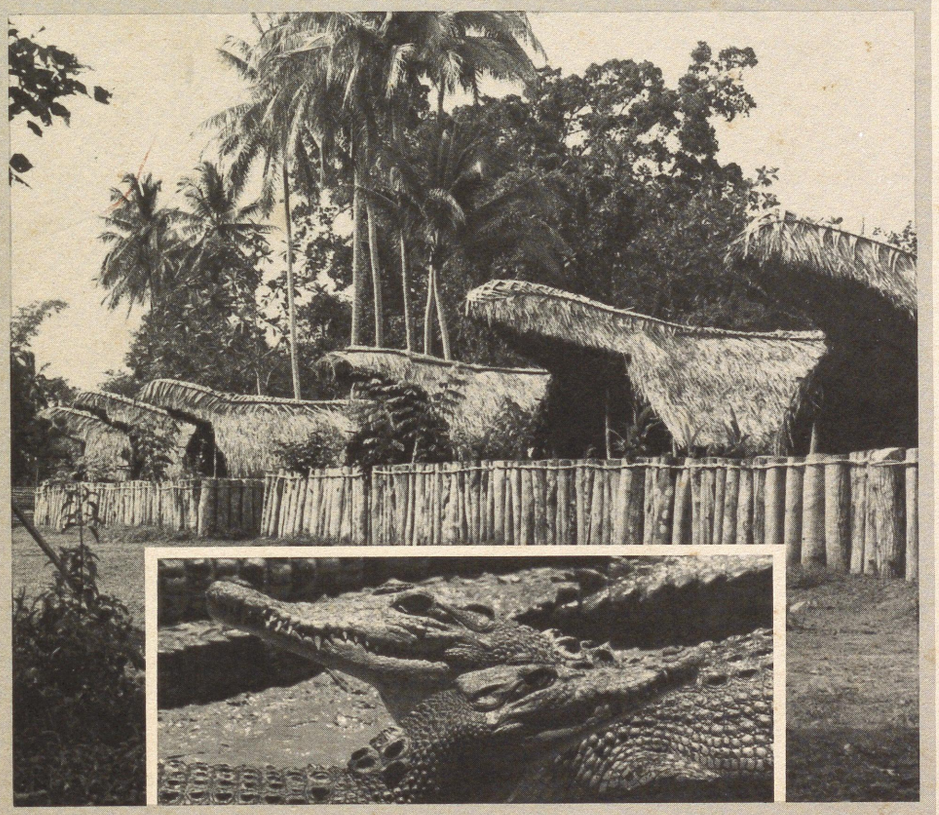
Photos: Neville Moderate



Young crocodiles ready for a feed at crocodile farm at Kabot, Keram River, East Sepik Province, in Papua New Guinea. See story page 2.

Dr H.R. Bustaid

World Plan of Action for TCDC

The comprehensive plan of action proposed to build stronger links of technical co-operation among developing countries (TCDC), and thus to help advance "North-South" negotiations on a New International Economic Order was being reviewed by the TCDC Preparatory Committee at a UN meeting in New York mid-May.

"TCDC is a key instrument by which developing countries can project themselves into a position of greater economic equality with the rest of the world", said Bradford Morse, in his capacity as Conference Secretary-General upon release of the draft plan of action. "The structure of international economic relationships that has prevailed over the past 30 years or so has not been favourable to the necessary growth of developing countries. TCDC can provide developing countries with instruments to refashion that order—and to change the face of development for the rest of this century", Mr. Morse said.

Following its review by the Prep Com., the plan will then be submitted to the Conference proper which is scheduled for 30 August through 12 September in Buenos Aires.

The meeting in Argentina will be the first global conference on international technical co-operation. The draft plan of action is the first attempt to outline on a global scale the responsibilities of all countries as well as the United Nations development system to forge new links of development co-operation to achieve a new international economic order.

Commenting on the newly released draft plan, Abdel Razzak Abdel Meguid Deputy Secretary-General of the Conference, said that developing countries are ready to assume such a role in working for a new international economic order "because the developing countries have created among themselves in the last 30 years a rich storehouse of technical experience in almost every imaginable field".

(Continued on page 11)



Papua New Guinea—The Crocodile Capital Of The World

By Godfrey Wippon

PAPUA NEW GUINEA—the second largest island in the world, lies in the Western Pacific Ocean, south of the equator and north of Australia. The area covers some 300,000 square miles. It is a land of great diversity, ranging from swamps in the coastal areas to steep 15,000 foot mountains in the central regions. More than 700 languages are spoken by 3 million people who are of the Melanesian race.

The country can be described as the island of all types of fauna and wild-life. One of the world's most dangerous reptiles is found here in the tropics. This is the crocodile. It can be sighted in the world famous croc zones—the Sepik and Fly River regions, the Kikori River in the Gulf of Papua and the Ramu River which flows alongside the Sepik in the northern part of the island. These areas cover more than one-third of the island with swamps and river tributaries, and this is where the river crocodile lives. The fresh-water crocodile when fully grown is about 12 feet in length. The other species is the saltwater crocodile which breeds all along the coastal estuaries and the lower reaches of the big river systems. This reptile, which is capable of reaching 20 feet in length, is the larger and more aggressive of the two species. He was often feared as he caused deaths among the coastal people.

Prior to outside (European) contact, the people of Papua New Guinea enjoyed an ecologically balanced relationship with their wildlife, and so those in the croc zones hunted water animals for meat and eggs, as they were plentiful at that time.

In the 1950's the foreign hunters and the traders began their exploitation of the crocodile zones using rifles, shotguns, electric torches and gill nets to hunt down the reptiles in an attempt to satisfy overseas fashion demands. In this way the ecological balance was upset, and disturbed ever further as traditional hunters abandoned their customary hunting methods in order to adopt the new ideas in the hunt for the crocodile.

The people, who assumed they were receiving the right price and returns for the multi-skins they were selling, blindly killed off the water species, not realizing they were wiping out their daily diet. Eventually however, the people in the croc zones became aware of this problem and voiced concern over their daily meat, because the crocodile was not as plentiful as it had previously been. They had no way of controlling exploitation and were not receiving sufficient economic benefits from its utilization.

Wildlife Established

It was then that the Government established the Wildlife Section of the then Department of Agriculture, Stock and Fisheries (DASF) in 1968. An Australian, Maxwell Downes, who has returned

Crocodile

Two burning embers
In the torchlight glow
We see the monster close and clear
Head above the water—we came nearer than near
We see his teeth and jaws like steel
That could crush away the life of man
And we shun such a beast as cruel and evil
Devoid of rights to water and land
But yet in our efforts to kill him out
We find he has real worth
For *he* controls the riverine life
And designs the balance so fine
That allows all creatures within his domain to live on Nature's vine
To remove him from his place is to take a king from his throne
And his scores of subjects are leaderless
Controls and disciplines unknown
Thieves and beggars, weeds and parasites in numbers have grown and grown
And now in reflection we see the folly of removing Nature's controls with haste
Because of financial gain or distaste
For this animal that does not please our eye
Is an evolved creation—like you and I
So why should he be hunted to death by man
If he is part of the Creator's plan

John Lever

home, was the Director and also the country's first ecologist. The guardian and father of wildlife conservation in Papua New Guinea, Downes went a long way towards achieving a wildlife conservation programme for the people of his country's former colony. Maxwell Downes quietly developed a national programme for crocodile farming as a means of conserving Papua New Guinea's valuable resource, which was his main interest. Training programmes were initiated in 1975 to educate rural development officers in all aspects of the industry. Downes' programmes included the setting up of a field research station and farms where the last of the earth's largest reptiles were kept and safeguarded for breeding. As a result of his approach, there are now about 300 small farms and a number of village business groups operating in the rural crocodile zones with a capacity for 3,000 crocodiles per farm.

Legislation Not Yet Introduced

But, the Crocodile Trade Promotion Act (1974) is not yet effective as the regulations have not been finalized for Government acceptance. Work is continuing with this important aspect and it was anticipated that it would be completed by January 1978. The proposed regulations, subject to approval, will include a minimum skin size for export as well as the maximum already adopted in the Act of 1966. It is envisaged that the introduction of these regulations will bring about greater control of harvests, and the export product and greatly assist the development of farming.

United Nations Aid

To assist and boost the crocodile industry, the UNDP, which has an office in Port Moresby, the nation's capital, has made available $680,400 to the Government for the conservation and utilization of crocodiles and the subsequent development of the crocodile industry. The financial aid was for a period of four years, 1976-1979. However, most importantly, the FAO recently appointed a young energetic Australian man to assist the Government in this field. He is John Lever, who has been involved in the industry for about 5 years. Lever had worked side by side with Maxwell Downes and gained experience. He is now the Project Manager of the National Crocodile Project with the Wildlife Branch of the new Department of Natural Resources. Lever is not the only FAO expert, as there are 8 other FAO experts, associate experts and volunteers in the country assisting the people with this industry.

Recently John Lever travelled to the FAO Headquarters in Rome to be briefed on what would be expected of him as the expert in this field. He spent 6 weeks visiting a number of reptile skin tanneries and meeting with Government officials in the southern United States, France, Italy and India.

On his return he described the industry in this country as "the Crocodile Capital of the World". Asked for his reasons, he said Papua New Guinea had:

formulated and implemented a realistic development plan for the industry which blends with the people's cultural and economic development requirements;

our crocodile skins are considered to be the best available in the world;

and we have a unique situation where the people who own the resource are doing something constructive to retain the high population rate of crocodiles in natural swamps and river systems.

Lever continued: "Every tannery I visited, wanted us to sell all our skins directly to them. They told me too that our saltwater crocodile skins are the best in the world. In some of these countries I observed manufactured items such as handbags worth $1,000, wallets about $80-100 and belts of about $80, depending on the type of crocodile, but articles made from Papua New Guinea crocodiles were always high".

Lever also said that India was more than interested in the crocodile programmes and wanted to exchange experts and workers.

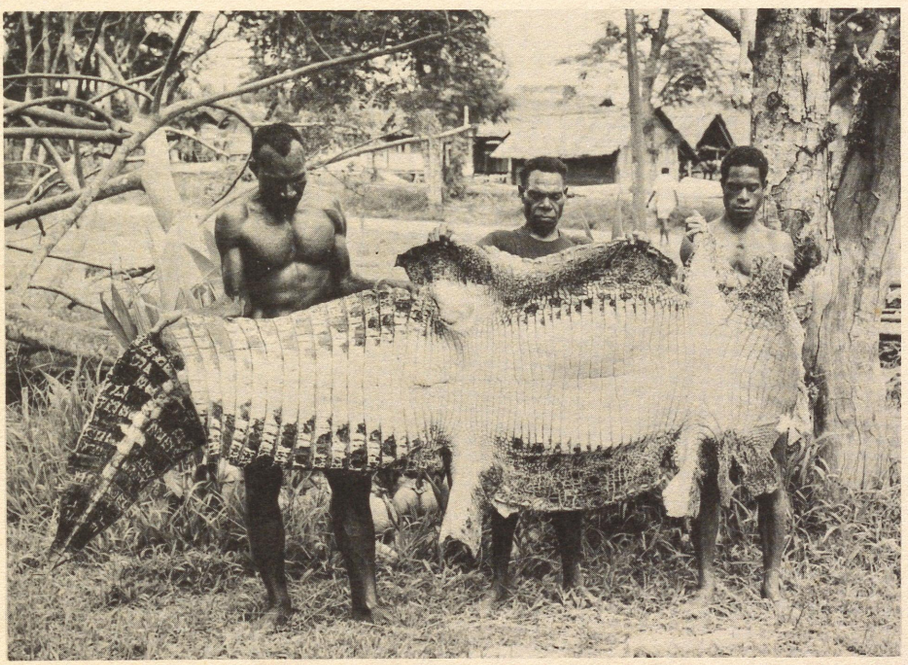
Papua New Guinea—a good place for crocodile

Papua New Guinea conditions and climate are excellent for farming crocodiles. Development of crocodile farms depends on how much interest the people have in those projects and on their skill and patience in dealing with the reptiles.

But this country is different from many other countries because it conserves wildlife not only to stop it from extinction but also to allow Papua New Guineans to continue making use of it in the traditional manner. The crocodile business will prove useful to the country's economy since skins are in great demand and this demand should continue. In the meantime, 30 to 50 thousand skins are sold annually to Singapore, United States and France, and arrangements have been made to begin trade with Italy and Japan.

With more crocodile farms providing a steady supply of skins, a tanning industry could be set up in the country. This will then provide employment opportunities for nationals. As it can be seen in many countries where crocodiles once dwelt, their population has been shot out and the people do not have the chance of developing this industry. It would therefore be foolish to let this opportunity for development based on this traditional resource, be lost to Papua New Guinea. Crocodile farming causes no pollution as would an industrial development, and furthermore, Papua New Guineans are familiar with this animal and this activity fits in well with the village life. ■

Photos: Neville Moderate



Crocodile skin from farm on banks of Angoram, East Sepik Province.

Godfrey Wippon is Information Assistant in the UN Information Centre, Port Moresby.

You Don't Have To Wait For Rain To Grow Leaves

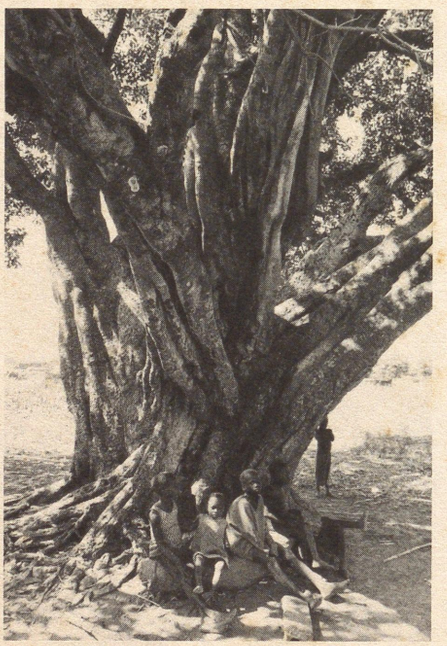


Photo: Ray Witlin/UN

"I don't have to wait for rain to grow leaves," the people of Upper Volta say when they wish to show determination in the face of adversity. Through the Government's country-wide reforestation programme involving villagers in the planting of arid-land tree species, the expression can now be taken literally. Despite last year's sparse rainfall, Eucalyptus, Neem and Cassia leaves are all sprouting forth. The 1977 tree-planting campaign realized 180 hectares of village plantations in five regions, comprising some 100 villages.

The village reforestation scheme is part of a programme receiving support from UNDP, FAO and other UN Agencies, and several bi-lateral donors. It is designed to relieve Upper Volta's "energy crisis"—a critical shortage of firewood.

Firewood is the only type of fuel used by this Sahelian country's six million people. Each man, woman and child, it is estimated, consumes one and a half kilos every day. Since virtually no reforestation has ever taken place in the country, apart from small plantations started with Israeli aid a few years ago, wooded areas have disappeared entirely in many locations and the situation has been steadily growing worse. The annual net wood deficit is now the equivalent of 16,000 hectares of forest.

Within a 35 kilometre radius of Ouagadougou, the capital city, the only trees visible are nut, fruit or spice bearing species such as Karité and Nerer, officially protected by law to preserve their food resources, and certain varieties regarded as sacred such as the majestic, ancient Baobab. The total absence of firewood in this area is having a grave effect upon prices in the city, which burns up 120,000 metric tons of the fuel annually. Every day entrepreneurs send their convoys of donkey carts farther and farther out to scavange for the precious commodity, which sells to urbanites for as much as $6.00 per kilo.

Denuding of wooded areas has had even more serious consequences in the countryside. Rural women, already overburdened with manifold agricultural, marketing and household chores must trek longer and longer distances to find necessary supplies. General agricultural productivity suffers, since trees greatly influence humidity, temperature and micro-organisms in the soil. As is now well known, firewood gathering, together with "slash-and-burn" cultivation and over-grazing has accelerated desertification and threatened ecological equilibrium throughout the Sahel, with disastrous consequences for the region and its inhabitants.

Though international aid agencies such as Danchurchaid have been doing some interesting experiments involving the introduction of solar cookers in Upper Volta, the $85.00 price tag such devices currently carry makes it unlikely that they will be commonly used soon. Firewood is certain to remain the principle source of fuel for the foreseeable future.

Director of the UNDP/FAO-assisted effort, which has been underway since 1975, is a Turkish forester, Dr. Nurettin Turkoz. Under his charge, in addition to the village plantations the project has produced 1815 hectares of new forests as well as many tree nurseries.

Results achieved in these small-scale "industrial" plantations have been quite spectacular. For example, after only two years, Cassias, graceful trees with tiny leaves and bold yellow flowers which are specially bred for arid conditions, have grown to heights of seven feet. They have also revitalized the dry, sandy soil in which they were planted. It is now cool and moist, covered with grasses and small plants.

. . . the women insisted that fruit and Eucalyptus trees be planted, the former to produce extra food, the latter because the leaves, when burned, yield a vapour helpful in the treatment of respiratory infections.

Eucalyptus is also particularly well adapted to the area, since it develops roots which dig deep to tap underground water reserves. Ninety eight per cent of the trees of this species planted by the project have survived without any artificial watering, and only a negligible proportion have turned out stunted and had to be cut down.

But planting trees, says Turkoz, is really very easy. Much more difficult is the problem of introducing the idea of reforestation to villagers, who have no tradition of tree-planting, but without whose co-operation and participation a scheme is doomed to failure.

Turkoz considers the new industrial plantation near the large village of Kombissiri one of the greatest achievements in rural ecological consciousness-raising. After two years of building relationships of trust with the chief and people of this

A Model Scheme for Captive Breeding and Rearing of Mugger Crocodiles (crocodylus palustris) ~~in Andhra Pradesh~~ for Commercial exploitation.

Following the Wildlife Protection Act of 1972 and subsequently the initiation of GOI/FAO/UNDP crocodile project in various Indian states provide conservation facilities to Indian crocodilian, the present status of the Indian mugger crocodile (crocodylus palustris) may be considered as ~~good~~ safe.

In the ~~time of~~ year 1972 the mugger crocodile, though enlisted in the schedule I was not an endangered species but cross ~~rare~~ becoming '~~rare~~ rare' in its wide distribution range all over India crocodile. With conservation programmes GOI/FAO/UNDP assisted states like Tamilnadu, Gujrat, AP, Kerala, Orissa ~~and~~ and with state run projects Maharashtra and M.P have been constantly increasing the mugger population in their respective states. At the same time with the adoption of 1972 wildlife Act other Indian states without a crocodile project have also been providing protection to isolated mugger populations thereby increasing their number considerably in limited distribution ranges.

Due to their ~~relative~~ extremely small number in the wild the Gharial and S.W. crocodile in India are not quite ~~safe from~~ extinction, but, definitely since the initiation of the project they have been increasing in number both in captivity & wild (because of large scale restocking programmes)..

Considered from the point of its wide distribution and the response that mugger crocodile has given to ~~conservation~~ management ~~with its adaptive of~~ it could be quite possible to produce several thousand muggers in the course of a few years and this may prove to be an important →

wildlife resource which could be considered ~~for~~ harvesting commercially with provision to protect the wild population simultaneously and build up.

The high level of resistance of mugger crocodiles ~~from~~ to infection diseases and its social behaviour of gregarious living makes it an ideal crocodilian species ~~for~~ to be considered for farming. Its growth rate and low food consumption are also added advantages. Most important of all is the ability of this crocodilian species to start breeding at an age of six years, whereas (provided they are of breeding size 1.75m ♀ and 2.25m for ♂) most other crocodilian species take as high as 8 to 12 years to start breeding.

The scheme proposed below therefore is based on the following

1. Mugger crocodile is safe from extinction and its ~~present wild~~ wild population will be protected by all means from ~~are enough from~~ conservationists point of view ~~by the~~ simultaneously even after ~~the~~ initiation of farming programmes. (18% of stock released back to the wild)
2. Mugger crocodiles are early breeders, therefore breeding stock build up would be comparatively easier. The breedable size achieved around ~~at~~ 6th year. ☆☆
3. The growth rate of muggers are good and a commercially exploitable skin size (16 to 18" belly skin width) can be obtained after 36 months of hatching (this period however may be reduced with better growing strains)
4. Being gregarious in behaviour (except during mating & courtship) a large number of muggers can be reared in limited area - one of the main advantages of a commercial project

5. The technique of incubating and hatching Crocodile eggs are known and in captivity as high as 90% hatching success can be achieved.

6. Being resistant to infections diseases - nuggets do not have a high mortality rate in the 1st year after hatching like other species of crocodilians whose losses are expected to be less than 10%.

7. The diet- requirements of nuggets are quite diverse, and therefore, easy to meet- with. The food requirements being beef, freshfish, rats & Bandicoots, and other birds & mammals - which can be made available easily.

8. Starting with about- 10 eggs in the 1st year of breeding by the 5th year or so an average of 30 eggs from each breeding female can be expected. with a definite breeding period of more than 25-30 year.

8 - the proposed centres will be judiciously selected, the prime considerations being the availability of water, food supply and good environmental condition (A place where the winter months are less and day to night- temperature differences are minimal is good for better growth rate of the stock).

Captive breeding of [illegible]

(Crocodylus palustris) Lesson, for Conservation and Utilization in Tamil Nadu.

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1. Occurrence & current status of C. palustris in Tr a fresh assessment.

2. Review of the existing conservation measure and evaluation of progress.

3. Emphasise underutilization of resources (eg laid in the wild, details, collection detail incubation, hatching success, low hatching percentage due to improper incubation etc requirement of good hatchery etc.

4. Creation of Infrastructure for hatchli, rearing facilities, with a view to utilize them as forming complexes later.
   a. Expansion of facilities at Sathama Amaravati, Hoggenakal,
   b. Creation of new complexes at Chidambaram, Killikudu (Trichy and Madras (?)).
   c. On the basis of status of reggi in extreme south of Tamilnadu - a ne complex can be planned

5. Declaration of sanctuaries - with good mugger habitat and restocking the areas with mugger (at least 5% of reared stock in total every year). with proper protection and monitoring programme.

6. Creation of Caption breeding groups (closed farms in the I.U.C.N recommended sense) for battery farming proposals.

7. Development of a lower level management extension programme (meant for foresters, forest guards etc) - to create a cadre of dedicated Crocodile Rearing Complex managers.

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8. Development of a Research component to look into all developmental activities.

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Nile Crocodile

'In Africa over the past 50 years, hunters, game wardens, fisheries biologists, and zoologists have shot thousands of Nile crocodiles', say Professor Carl Gans of Michigan University and A.C. Pooley of the Natal Parks Board, writing in the *Bulletin of the Ecological Society of America*. The result of course is depleted populations—near extermination in Uganda, a 90 per cent decrease in Chad, and heavy declines in nearly every other African country.

Study Them Alive, not Dead

In the early days much of the shooting was the result of misguided ideas about predators; more recently it has been in pursuit of research. How many more crocodiles are to be killed, they ask, 'to prove what we already know'? The latest such project was one in Botswana (involving the shooting of 20,000 crocodiles) that combined analysis of stomach contents (how many times has this been done?) with the sale of skins—a dangerous practice in that it may produce legitimate skins to 'muddle' the numbers that are poached. But there is still much research to be done on live crocodiles, studying behaviour and social organisation, which is highly relevant to both conservation projects in the wild and captive breeding in farms.

ORYX

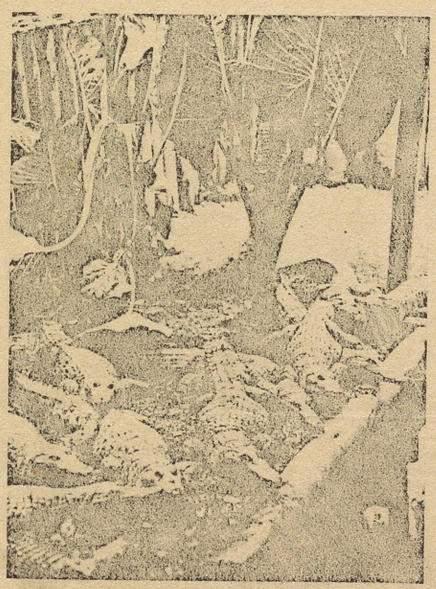
⊙Harvesting crocodiles without tears / *in Papua New Guinea*

Environmentalists and wildlife specialists concerned with the rapid decline of crocodile and alligator populations in Africa, Asia, Australia and South America are beginning to take notice of a remarkably innovative programme that is credited with dramatically reversing a similar trend in Papua New Guinea.

Confronted in the last decade with the impending extinction of its two native crocodile species, the Papua New Guinea Government began to develop and promote a system of crocodile "ranching," which in just five years has not only demonstrated how intelligent management can conserve the species but has also provided a new source of income in the remote villages of one of the newest and least developed nations in the world.

The New Guinean programme is based on an appreciation of crocodile biology. Each year a female may lay between 30 and 70 eggs, but though most of these hatch, predators so relish the tender, remarkably vulnerable young hatchlings that almost none survive the 15 years needed to reach breeding size. Under natural conditions, as a result, there is usually a surplus of tiny hatchlings and a shortage of breeders. This imbalance has been worsened by commercial hunters who always seek the biggest specimens, regardless of the resulting damage to the breeding population.

A management system that meets both cash and conservation needs



Recognizing that a ban on hunting would be largely unenforceable in remote areas (and grossly unpopular where man-eating crocodiles occasionally appear), the New Guinea Government decided in 1970 to restructure the trade so that shooting breeders would lose its attraction and the profit would come from exploiting the hordes of tiny hatchlings that would result. This was done through a law banning the sale of large skins, supplemented by a stiff tariff on small skins.

Today, villagers in the steamy swamps of New Guinea have tens of thousands of tiny crocodiles in their care. They raise them for a year or two and can then sell them for $40 to $100 each. Crocodile farming has already become the main cash earner for the people there.

Because the programme is based on harvesting young hatchlings from the wild, the economic value of the wild population and their habitats becomes forcefully apparent. Since the programme's future depends on them, wildlife protection assumes economic value. Out of pure self-interest, the people become guardians and conservers of habitats and wildlife. In a sense, the farming project is just a tool for conserving the species in its own wild habitat. For this reason, it is operated by the Wildlife Division of the Government.

The villagers have displayed a sophisticated knowledge of the crocodile, which is part of their culture and heritage. They do not have to be taught how or where to catch crocodiles, and the programme has found ready acceptance, unlike efforts to introduce cattle or Western-style crop raising, which require massive education and training.

Despite popular "man-eater" impressions, crocodiles live mainly on fish, though the researchers in Papua New Guinea have found that young ones also grow well on frogs, snails and beetles. The feeding efficiency is astounding: 1.5 kg of food gives 1 kg of weight gain, and 30-cm-long animals can grow to be 1.50 to 1.80 m long in less than 2 years. Crocodile farming is also space efficient: dozens of animals are raised in an area the size of an average Western living room in a swamp or jungle. The crocodile programme is based on living with the existing landscape and resources. It requires none of the bush clearing, fencing, forage-grass planting or pesticide spraying that rearing other domestic animals would demand. In a fragile tropical rain forest ecosystem, these are important factors.

31/3

Dear Dr Chowghdry,

Thank you very much for the comments you have made on the draft of the manual. I have looked them over and agree with most of your suggestions.

It would be very useful to me if we could meet briefly before you leave. Could you please spare me a few minutes and suggest when this would be possible? Thanks!

Wim de Bas



C13b

IUCN CROCODILE FARM INVENTORY

1. Name of establishment/department?

2. Name of owner/manager/supervisor/project leader?

3. Country: State: Town:

4. Address:

5. Date established?

6. Full description and purpose of establishment: e.g. revenue earning display farm.

7. If a commercial enterprise, does the establishment operate on a permit/licence basis?

8. Who issues the permit/licence?

9. How many different species in captivity? (list separately)

a) Species

Adult males: Females: Total No.Juveniles:

b) Species

Adult males; Females: Total No. Juveniles:

c) Species

Adult males: Females: Total No. Juveniles:

d) Species

Adult males: Females: Total No. Juveniles:

e) Species

Adult males: Females: Total No. Juveniles:

f) Species

Adult males: Females: Total No. Juveniles:

g) Species

Adult males: Females: Total No. Juveniles:

h) Species

Adult males: Females: Total No. Juveniles:

i) Species

Adult males: Females: Total No. Juveniles:

j) Species

Adult males: Females: Total No. Juveniles:

k) Species

Adult males: Females: Total No. Juveniles:

10. Total No. of separate pens in use?

11. Approximate area of land and water enclosed:

12. No. of visitors per annum (approximate)?

13. Are educational exhibits provided? (such as photographs with text describing some aspect of biology of the species)?

14. Is there an information guide to answer visitors' question? or a printed brochure available?

15. Has captive breeding of any species been recorded? (supply details)

16. If a percentage is culled for sale of hides, state average number harvested per annum and species involved.

17. Are records maintained of the following: (supply details for 1972/73)

a) No. of wild laid eggs/young harvested?

b) No. of nests robbed?

c) Total number hatched in captivity?

d) Mortality of overall population each year?

e) Number sold live?

f) Total number nests from captive adults on the premises?

g) Species involved?

h) Number of crocodilians purchased?

18. Does the farm liberate young reared crocodiles to selected habitats as part of a restocking programme? (supply details)

19. State general appearance, neatness, layout of the entire farm:

Impressive Good Satisfactory Fair Poor Very poor

20. Are crocodilian products sold on the premises i.e. shoes, handbags, keyrings, wallets?

REMARKS.