

- Breeding of Crocodile -

article for Alipore Zoo Symposium -

From
B.C.Choudhury,
Spl. Crocodile Surveyor,
Nehru Zoological Park,
Hyderabad.

Dt. 25.8.1977.

To
The Curator,
Nehru Zoological Park,
Hyderabad.

Sir,

Please find enclosed with this letter two copies of an article
entitled " Breeding of Crocodiles " written by me as requested by you.

Hope this serves your purpose.

Thank you.

Yours faithfully,

(H.C.CHOU DHURY)

BREEDING OF CROCODILES

Whenever there is an acute shortfall in the Wild population of any animal, there will be a sharp decline in breeding. Gradually a time comes when without concentrated effort to breed them in some method or other it loses all its chance of survival. Over the past centuries many mammals, birds and reptiles have faced extinction eventhough breeding pairs were available isolated from eachother.

Crocodiles belonging to the order crocodilia of class Reptilia are today facing extinction more or less almost in the above mentioned fashion. These closest living cousins of the extinct Dinosaurs are threatened with imminent extinction because of ceaseless killing of Crocodiles for their valuable skins and increasing destruction of their habitats. About three decades ago they were still in plentiful in almost all their range of distribution in the tropical and sub-tropical regions of Africa, Asia, Australia and Central and South America. Their numbers have now declined everywhere and as many as thirteen out of twenty nine species and sub-species are in the endangered list.

Fortunately, before it was too late conservationists all over the world realised this and legal protections have been provided to many species of Crocodiles with a ban on killing and trade of Crocodiles. Efforts are also being made to stop destruction of Crocodile habitats, newer areas are being gazetted as Sanctuaries for Crocodiles and captive breeding programmes are carried out, to save these unique reptilians which came into the world almost sixty to seventy million years ago. Success in this respect is encouraging and many species of Crocodiles have responded well for active management programmes of large populations. Even cropping on experimental sustained yield basis has also been started for American alligator.

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To this date the following species of Crocodiles have been reported to have bred in captive conditions in many parts of the world.

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|--------------------------------------|---------------------------|
| 1. <u>Alligator mississippiensis</u> | (American Alligator) |
| 2. <u>Caiman crocodilus</u> | (Spectacled Caiman) |
| 3. <u>Caiman latirostris</u> | (Broad-Snouted Caiman) |
| 4. <u>Crocodylus niloticus</u> | (Nile Crocodile) |
| 5. <u>Crocodylus palustris</u> | (Indian Mugger Crocodile) |
| 6. <u>Crocodylus rhombifer</u> | (Cuban Crocodile) |
| 7. <u>Osteolemia tetrapis</u> | (African Dwarf Crocodile) |
| 8. <u>Crocodylus siamensis</u> | (Siamase Crocodile) |

In India Baroda Zoo, Ahmadabad Zoo, Jaipur Zoo, Delhi Zoo and Madras Crocodile Bank have bred Mugger Crocodiles successfully, the first three Zoos breeding them since 1960.

Crocodile breeding can be taken up in the following ways.

1. Zoo breeding and Crocodile banks.
2. Formation of Crocodile foundations (as suggested by the IUCN Crocodile specialist Groups first meeting in 1971)

ZOO BREEDING AND CROCODILE BANKS:

The shadow of doubt about the success of Crocodile breeding has already vanished with more and more Zoos reporting of Crocodiles breeding in their Zoos. (International Zoo year Book|Volume 2 to 10) Crocodiles with remarkable longevity record will breed for years once a suitable breeding environment is provided for them.

1. Environment and enclosures:

Surprisingly, eventhough Crocodiles are not distributed naturally in the temperate regions of the Globe captive breeding of Crocodiles have been most successful in European Zoos.

For the purpose of captive breeding tropical and sub-tropical regions of the Globe are suitable because of environmental factors and Crocodiles have a natural distribution in these regions. In temperate and cold zones construction of terrariums including heating systems becomes very expensive and thus is a negative factor.

Most of the Zoos like to exhibit crocodiles as they draw record crowd but ignore to provide a good housing for the exhibits. Hardly any basking areas, which is most important for reptilians is provided. Even when some compromising sort of housing is provided little effort is made to provide mates for the nature individuals.

Enclosures if built for exhibition purpose is rather simple with a poor and small amount of land since the aim is to show the visitors an animal at any time of the visiting hours. But if the enclosure is for breeding purposes it should be different in design with deeper pools and more land area for basking and digging a nest when they lay eggs. The depth of water in the breeding pool should be deep enough keeping in mind the mating of Crocodiles in more open water than the shallow depth and the pre-mating courtship involving a larger water area. Ten to fifteen feet depth would be ideal for a pool (but this may vary with different species).

Breeding enclosures preferably not open to visitors would be ideal. But in the case of it being open to visitors sufficient labling explaining the biological requirement and why a few specimens are kept with less importance to exhibition is to be displayed.

1.a. Light:

Light is an important factor in the enclosures. All reptiles including Crocodiles like bright radiant light at least some hours per day basking and observe a diurnal rhythm of activity. There are usually two main basking periods--early in the morning and late afternoon. The early morning basking, it has been shown play an important role in the restoration of heat lost during

the night and high light intensity during some seasons of the year activates the reproductive organs in crocodilians. Thus sufficient light is a very essential factor. This also helps in good growth of vegetations around the enclosure providing shelter, shade, and hiding place for the animals. Vegetation also ensures humidity and temperature in the breeding enclosures. Temperature being one of the main ecological and physical parameters it should be ensured that a temperature is maintained similar to those known from the wild areas from where the particular species have been obtained.

Water of the pool to simulate a natural habitat should be circulated in the pool or a constant flow be maintained. This apart from giving a simulated water environment also ensures good hygienic condition of the Pools.

2. ESTABLISHING A BREEDING GROUP:

Now with an ideal breeding enclosure ready for a breeding programme a suitable breeding group has to be gathered. Only a healthy sexually mature pair of Crocodiles is usually not enough for this purpose. To establish a breeding group various distinct sizes and age class of a wild population or captive reared crocodiles have to be considered since arbitrarily considered size class will bring infights and the larger specimens will disturb, injure and may even kill smaller specimens.

Crocodiles, particularly the dominant ones establish a territory and drive out other smaller specimens in nature and this has been seen to be true in a breeding group in captivity. At Mauras Crocodile Bank in 1975-76 when the breeding group was established two smaller specimens were killed in this way by dominant ones. It is therefore advisable to form a breeding group of which all the specimens have been reared earlier in one group or at least are physically of same size.

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Depending on the size of the breeding enclosure the total number of specimens to be left has to be considered. One male to three females is a good sex ratio. The Thailand Crocodile breeding farm reported that usually a male Crocodile forms a relationship with only two females during breeding season but the presence of a third female helps in assuring the male to be acceptable by at least two females. The above mentioned sex ratio has also been found to be the case in Africa in the case of Nile Crocodile as shown by Dr. Hugh B Cott.

As crocodiles are slow breeders breeding only at about six to ten years of age (but this differs with species to species) it is always better to start with specimens of known age and sex. This helps in gathering good scientific data and also cuts down the guesswork and expectations. Determining the sex of selected specimens are not a difficulty, the standard method being cloacal probe by finger to locate the penis of the male.

3. FOOD AND CARE OF THE BREEDING GROUP:

Food should be similar as in the wild mostly a variety of animals such as insects, crustaceans, molluscs, fish, amphibians, birds and small mammals. As far as possible live food is preferred to chopped meat enriched with extra vitamins. Live food is preferred ~~to~~ with fur feather etc., fulfils the total requirements of the Crocodiles. Crocodiles also have to remain active moving around searching for food thereby increasing the metabolism. Deficiency in diet also results in low percentage of egg-laying and hatching.

Crocodiles once they reach two years of age (1.5 metres in size) surprisingly need very little care and seldom suffers from any disease. One of the established Crocodile Farm in Thailand which raises about 18,000 Crocodiles reports that hardly 5% of more than one year old Crocodile die of any disease. However care should be taken about quality of food and hygiene of the pools.

Once a breeding group starts breeding they continue to breed and their number increases every year. With the same resultant groups more breeding populations can be formed and lent to other institutions for further breeding programmes or Crocodile foundations can be formed for propagation of these endangered species.

To sum up a breeding programme would succeed with the following factors.

1. Climate.
2. Good breeding enclosures.
3. Good Breeding population with a good sex ratio.
4. Good husbandry conditions.

In India now we have taken up Crocodile conservation in a much larger scale involving all the three species of Crocodiles found in India. In this, wild laid Crocodile eggs are collected and hatched in artificial hatcheries and the young ones are reared for more than eighteen months when they reach about 1.5 mts in size. This eliminates the loss of hatchling as happens in the case of natural nests predated by various predators. The reared Crocodiles would be then released into gazetted sanctuaries affording strictest protection. At the same time Government of India encourages captive breeding programme of Crocodiles by various Zoos.

Gharial (Gavialis gangeticus) the North Indian long snouted fish eating Crocodile which was almost on the verge of extinction is slowly being rehabilitated with more than six Indian States running projects to save them.

Salt water or Estuarine Crocodile (Crocodylus porosus) once had an abundant distribution from the West Coast of India to all along the East Coast upto Northern Australia is now restricted in India to Sunderbans, Bhitarkanika of Orissa and Andaman Islands. Projects for breeding and establishing of Sanctuaries for this species are already in progress in all these places.

Indian Mugger Crocodile restricted to small pockets in almost all the States of India is getting a fresh lease of life with the adoption of 1972 Wild Life Act and similar conservation measures.

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BINOD C. CHOULURY
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A.P. Forest Department,
Crocodile Conservation Project,
Nehru Zoological Park,
Hyderabad-A.P.

BREEDING OF CROCODILES

Whenever there is an acute shortfall in the Wild population of any animal, there will be a sharp decline in breeding. Gradually a time comes when without concentrated effort to breed them in some method or other it loses all its chance of survival. Over the past centuries many mammals, birds, and reptiles have faced extinction even though breeding pairs were available isolated from each other.

Crocodiles belonging to the order Crocodylia of class Reptilia ~~have today facing the same problem of becoming extinct~~ ^{are} more or less almost in the above mentioned fashion. These closest living cousins of the extinct Dinosaurs are threatened with imminent extinction because of ceaseless killing of Crocodiles for their valuable skin and increasing destruction of ~~the~~ ^{their} habitats. About three decades ~~ago~~ ^{ago} they were still in plentiful in almost all their range ~~in the range~~ of distribution, in the tropical and sub-tropical regions of Africa, ~~and~~ Asia, Australia and Central ^{and} South America. Their numbers have now declined everywhere and as many as thirteen out of twenty nine species and sub-species are in the endangered list.

Fortunately, before it was too late ~~conservationists~~ ^{conservationists} all over the world realised this and legal protections have been ~~given~~ ^{provided} to many species of Crocodiles with a ban on killing and trade of crocodiles. Efforts are also being made to stop destruction of crocodile habitats, ~~newer~~ ^{newer} areas are being gazetted as sanctuaries for Crocodiles and captive breeding programmes are carried out. To save these unique reptilians which came into the world almost sixty to seventy million years ago. Success in this respect is encouraging and many species of crocodilians have responded well for active management programmes of large populations. Even cropping on experimental sustained yield basis has also been started for American alligator. (Alligator mississippiensis)

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ENVIRONMENT AND ENCLOSURES:

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For the ^{purpose of} captive breeding tropical and sub-tropical regions of the Globe are suitable because environmental factors and Crocodiles have a natural distribution in these regions. In temperate and cold zones construction of terrariums including heating systems ~~xxxxxx~~ becomes very expensive and thus is a negative factor.

Most of the Zoos like to exhibit crocodiles as they draw record crowd but ignore to provide a good housing for the exhibits. Hardly any basking areas which is most important for reptilians is provided. Even when some compromising sort of housing is provided little effort is made to provide mates for the mature individuals.

Enclosures if built for exhibition purpose is rather simple with a pool and small amount of land since the aim is to show the visitors an animal at any time of the visiting hours. But if the enclosure is for breeding purposes it should be different in design with deeper pools and more land area for basking and digging a nest when they lay eggs. The depth of water in the breeding pool should be deep enough keeping in mind the mating of Crocodiles in more open water than the shallow depth and the pre-mating courtship involving a larger water area. Ten to Fifteen feet depth would be ideal for a pool (but this may vary with different species)

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As crocodiles are slow breeders breeding only at about six to ten years of age (but this differs with species to species) it is always better to start with specimens of known age and sex. This helps in gathering good scientific data and also cuts down the guesswork and expectations. Determining the sex of selected specimens are not a difficulty, the standard method being ~~elecael~~ cloacal probe by finger to locate the penis of the male..

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Crocodiles, once they ~~reach~~ reach two years of age (1.5 metres in size) surprisingly need very little care and seldom suffers from any disease. One of the established Crocodile Farm in Thailand which raises about 18,000 thousand Crocodiles reports that hardly 5% of more than one year old Crocodile die of disease. However care should be taken about ~~food~~ quality and hygiene of food and hygiene of the pools.

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To sum up a breeding programme would succeed with the following factors.

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Linal C. Chaudhary
 Cpl Crocodile Survey Research Section
 M.F. Insect Dept Crocodile Conservation Project
 Melon Biological Park
 Hyderabad

BREEDING OF CROCODILES

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By, B. C. Chandelhury

Whenever there is an acute shortfall in the wild population of any ~~species~~ animal, the chances are that there will be a sharp decline in breeding. ~~This results due to no exp. exchange of gene pool~~ Gradually a time comes when with out concentrated effort to breed them in some method or other it loses all its chance of survival. Over the past centuries many mammal, birds & reptiles have faced the same fate and have become extinction even though breeding pairs were available intact from each other.

Crocodiles, belonging to the order Crocodylia of class Reptilia have ~~almost~~ ^{today} faced the same problem of becoming extinct. These closest living ~~and~~ ^{modern} cousins of the extinct ~~Dinosaurs~~ ^{Dinosaurs} which once ruled the earth's surface has to face and are threatened with imminent extinction because of ~~mass~~ ^{ceaseless} killing of crocodiles ~~and~~ ^{and} ~~habitat~~ ^{irreversible} destruction ~~of their~~ ^{habitats} for their hides valuable hides. ~~Only~~ ^{about} - three decades ago they were still in plentiful in almost all their range in the tropical & subtropical regions of Africa, Asia, Australasia ^{Central} & South America. Their numbers have now ~~almost~~ ^{everywhere} been declined and as many as thirteen out of the 29 species & subspecies are in the endangered list.

Fortunately, before it was too late conservationists all over the world realised this and legal protection has ^{been} given to ^{many} crocodiles with a ban on killing ^{and any trade} of crocodiles. ~~and~~ ^{some} efforts ^{are} taken to ~~breed~~ ^{breed} stop destruction of crocodile habitats, ~~new~~ ^{new} areas ^{are} were ^{being} gazetted as sanctuaries for crocodiles and captive breeding programmes ^{are} ~~were~~ carried out. Success in this respect - is encouraging and many species of crocodylians have responded well for active management programme of large populations. Even ~~breeding~~ ^{breeding} cropping on experimental sustained yield basis has also been started for American alligator (Alligator mississippiensis).

To this date the following species of Crocodiles have reportedly been bred in captivity conditions in many parts of the world

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1. Zoo breeding and Crocodile banks
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ZOO BREEDING AND CROCODILE ^{BANKS} ~~BREEDING~~

The shadow of doubt about the success of ^{crocodile} breeding has already been ^{vanished} lifted with more and more zoos reporting of crocodiles breeding in their zoos (International Zoo Yearbook 2 to 10). Crocodiles with remarkable longevity record will breed for years once a suitable breeding ^{environment} ground is provided for them. M/M
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1. ENVIRONMENT & ENCLOSURES

Surprisingly, even though crocodiles are not distributed naturally in the temperate regions of the globe captive breeding facilities have been most successful in European zoos.

For the purpose of captive breeding, tropical & sub-tropical regions of the globe are suitable because of the environmental factors and crocodiles have a natural distribution in these regions.

In temperate and cold zones construction of terrariums including heating systems becomes very expensive - a negative factor.

Most of the zoos like to exhibit crocodiles as they draw record crowd but ignore to provide a good housing. Hardly any basking area, which is most important for reptilians, is provided. Even when ~~a little~~ some compromising sort of housing is provided no effort is made to provide mates for the mature individuals.

★

Enclosures if built for exhibition purpose is rather simple with a pool and small amount of land since the aim is to show the visitors an animal any ~~any~~ time of the visiting hours. But if the enclosure is for breeding purpose it should be different in design with deeper pool and more land area for basking and digging a nest when they lay eggs. The depth of water in the breeding pool should be deep enough keeping in mind the mating of crocodiles in more than waters than the shallow depths and the pre-mating courtship involving a larger water area. 10 to 15 feet depth would be ideal but this may vary with different species.

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BREEDING

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Indian Mysore, restricted to small pockets ⁱⁿ of ~~at~~ almost all the states is getting a fresh lease of life all over India with the adoption of 1972 wildlife Act and conservation ~~and~~ measures.

particular species.

Once they start breeding and their numbers increase in captivity their conservation is to be thought of carefully. The nesting in natural habitats. Another idea is to create suitable banks where breeding populations can be accumulated ~~and~~ from results of captive breeding and sent to other institutions for further breeding programmes.

CROCODILE REARING & RESTORING:

~~Captive~~ crocodile from eggs laid in captivity or eggs collected from the wild and hatched artificially has to be reared to a ~~some~~ good size before releasing in to wilder habitats for restocking purposes. Rearing crocodiles is difficult for the first year after hatching involving great care and expertise and ~~best~~ suitable food supply, control of ~~blood~~ micro environments and prevention of ~~breeds~~ start of a outbreak of any disease are some of the major problems. However once they cross the first year and reach