

Captive Breeding of Crocodiles*

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Captive crocodile breeding presents something of an enigma. Some species breed very readily in captivity, even when kept in close confinement, but few people are aware of this because of the almost total failure of zoological gardens around the world to breed any of their crocodiles. So perhaps it is profitable to start by briefly outlining why zoos generally have had such a poor breeding record with crocodiles.

Most reptile house curators want to show as wide a range of animals as possible. As a result, many zoos have single individuals of a dozen or more different crocodile species which may be housed separately or in groups. Furthermore, since space is usually at a premium (and most reptile houses have to be heated for most or part of the year) they seldom house crocodiles of breeding size, concentrating rather on juveniles and sub-adults. A zoo which does decide to undertake a breeding programme of even medium-size crocodile species comes up against the problems of having to devote very considerable resources to that species unless the zoo is situated in a tropical climate.

In crocodile breeding there is a relationship between space and climate. Except in the tropics, crocodiles require heated accommodation and if this is sufficiently spacious to maintain a breeding herd it is extremely costly.

However, even the largest crocodile species do not require very large enclosures for successful breeding. For instance, I am familiar with a salt water crocodile (*Crocodylus porosus*) near Darwin, Australia, which for three successive years has built a nest and laid eggs in an enclosure measuring only 20 x 10 ft (the female herself measuring about 10 ft).

Nevertheless, if the eggs are to be successfully incubated under average conditions a somewhat larger enclosure will usually be required, whereas most zoo cages for crocodiles are even smaller than the small one I have just described.

It is difficult to generalize on the temperature and space requirements, due to the differing requirements of the score or more recognized species. However, an ideal breeding enclosure would include:

* The word "crocodile" is used in this paper to refer to any member of the order Crocodylia—crocodiles, caiman, gharials and alligators.

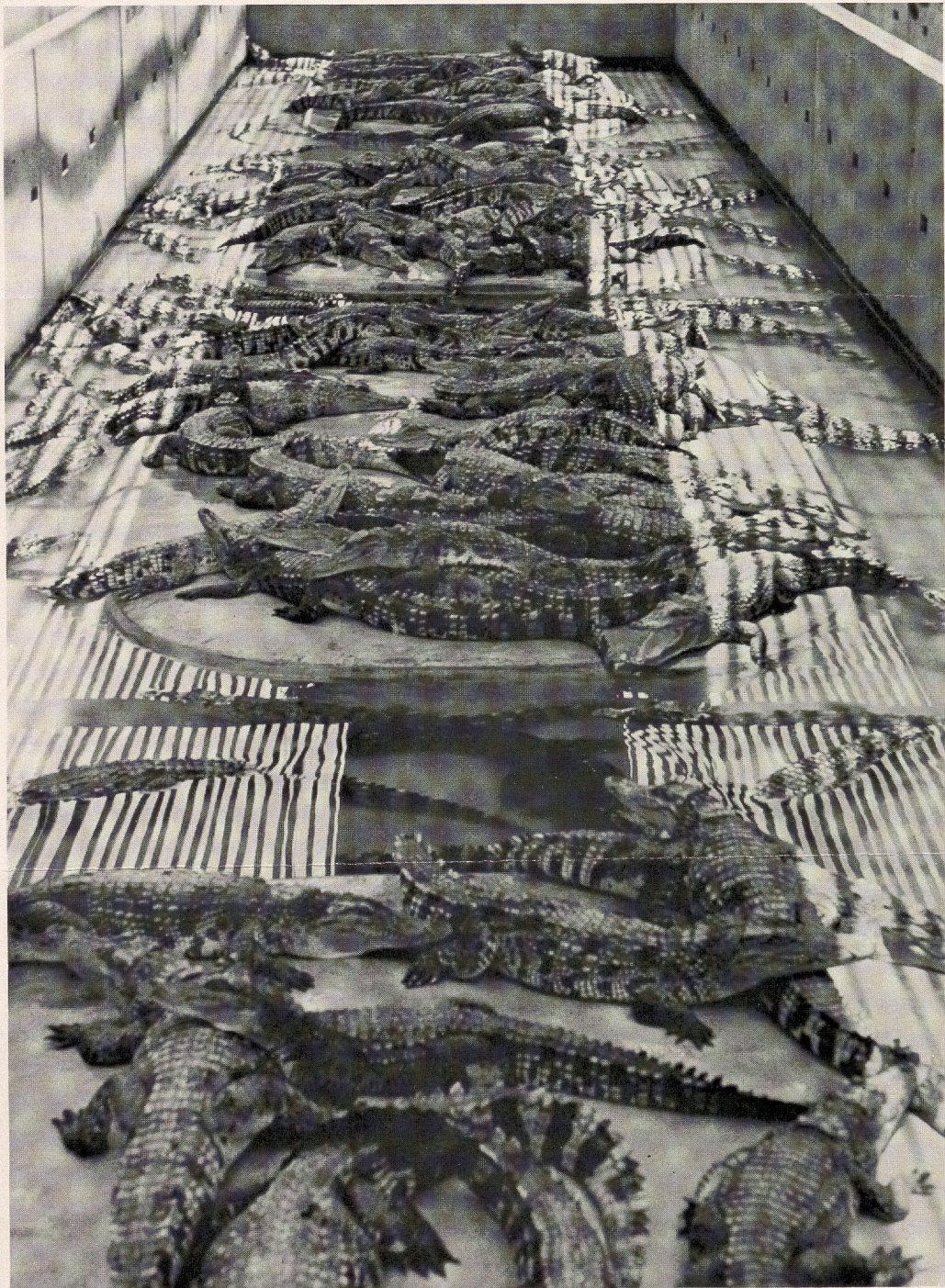


FIGURE 1. Crocodile pen at the Bangkok Crocodile Farm, showing crocodiles almost ready for slaughter.

(1) A pool area about three times the length of the crocodile of breeding size, with a breadth at least equal to that of the crocodile's length, and a land area of similar size. The land area should incorporate secluded corners with screening vegetation or baffles behind which the female can build her nest.

(2) In the nesting season rotting vegetation or sand (here, requirements differ according to the species) must be provided for nest-building activities.

(3) For many species (and this applies to many reptiles other than crocodiles) seasonal variations in temperature and rainfall may be essential prerequisites for the initiation of breeding behaviour, since some species breed in the wet season and others in the dry. In the modern zoological garden it should be possible to provide these variations in environmental conditions.

(4) A temperature of 25–30°C should be suitable for most species other than the Chinese alligator, which may prefer a lower maximum temperature, although its requirements are actually very poorly known.

(5) Zoos often provide additives to crocodile diet in the form of vitamins, particularly for juveniles, although these should not really be necessary, given a sunlight-shade mosaic and a mixed diet. It should be noted, however, that certain fish do not provide a balanced diet, and crocodiles should certainly be fed roughage. For growing crocodiles, food which includes the skeleton is most important. Crocodiles fed on strips of meat or fish without skeletal material frequently develop calcium deficiencies.

The world's first and only large-scale crocodile farm near Bangkok in Thailand (Fig. 1) feeds its crocodiles on a range of fish species and also gives the larger crocodiles ducks which are plucked and fed whole.

(6) Nesting female crocodiles seek out conditions of maximum seclusion. This problem has been solved most skilfully at the Bangkok crocodile farm by surrounding the large breeding pools with a series of small concrete enclosures reminiscent of beach bathing huts, each about 10 × 8 ft and 8 ft high, with no roof but shaded and screened by coconut palms. A small opening in one wall is the sole means of access. When ready to nest, the female crocodile takes over and defends one of these nesting buildings. It provides her with the right degree of privacy as well as a territory to defend—from which other crocodiles can easily be excluded. In the absence of such an arrangement under crowded conditions, crocodiles may well trample incubating nests and so destroy them.

In a suitable climate the eggs can be left to incubate in the mound built by the mother. When the climate is unsuitable, crocodile eggs hatch well in chicken incubators kept at about 32°C and placed in moist sand (Fig. 2). Sand with a water content of about 8% (by weight) is ideal. (See also Bustard, 1969 and 1971.)

The baby crocodiles need to be housed by themselves and should be fed on small whole fish, frogs, crustaceans, large insects or baby mice.

(7) Size segregation is important in any breeding programme for crocodiles as larger animals will terrorize or kill smaller ones. Only crocodiles of approximately similar size should be housed together.

(8) Very little is known about veterinary problems concerning crocodiles. Prevention is better than cure and the right sort of environment and mixed diet should avoid most medical problems.

Hygiene is very important, particularly when a breeding programme is underway and the individuals may of necessity be housed quite densely. At the Thai crocodile farm all of the pens (except the breeding pools) are drained and hosed daily. All pens are constructed of concrete to facilitate adequate cleaning operations.

(9) There are no hard and fast rules on what makes a viable breeding unit for

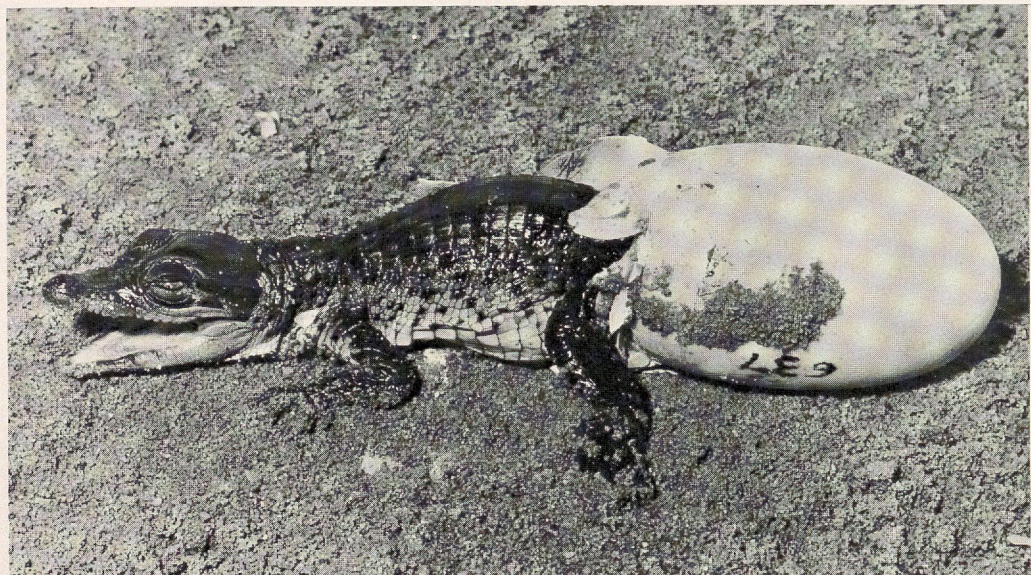


FIGURE 2. Experimental hatching of the New Guinea fresh-water crocodile (*Crocodylus novaeguineae*) in the laboratory.

crocodiles. One pair could be enough, but the minimum recommended breeding unit would be one bull and two cows. The high fecundity of crocodiles (some species lay 40–50 eggs in one clutch) means that even such a small breeding unit could quickly improve the conservation picture for the more endangered species.

With certain species there are indications that better breeding results are obtained when a score or more of breeding individuals are housed together. Utai Yangprapakorn, who has many hundreds of breeding individuals of the saltwater crocodile (*Crocodylus porosus*), assures me he now gets much better breeding results than when he had a relatively small breeding stock.

But any zoos which can provide adequate breeding facilities for one bull and one cow crocodile of any threatened species should be encouraged to do so; they can make a valuable contribution to conservation.

In any zoo the decision whether to add more breeding units or to distribute the breeding stock to other zoos will be influenced by what facilities are avail-

able to expand the breeding programme. However, it is important not to keep the only significant breeding herd of an endangered species in one place, in case of disease, fire or the like. Every effort should be made to spread the breeding population of any endangered species among several institutes. It may well be that certain locations or institutes provide unrivalled facilities for successful breeding of a particular crocodile species, in which case every effort should be directed to building up the breeding herd at this locality, subject to the safeguard of not keeping the entire stock in one place.

It is quite impossible to lay down strict rules on the number of captive colonies required to provide a viable reservoir for ultimately restocking the wild state. Sir Peter Scott's work at Slimbridge with the Hawaiian goose offers an excellent example of this.

It is quite possible, indeed likely, that certain endangered crocodiles will be saved in the future by captive breeding activities centred on one locality or institution—although some of their specimens will have been distributed elsewhere to safeguard the gene pool.

If, as seems likely with many crocodiles, we have to maintain the captive breeding populations for some time before the right political climate for re-introductions into the wild can take place, it is, of course, essential that in the meantime the stocks do not become too inbred. For this reason studbooks should be kept from the start for any endangered species and out-breeding should be borne in mind when specimens are being exchanged between institutions.

To sum up: at least some crocodile species appear to be ideally suited for captive breeding programmes, and their high fecundity means that numbers can potentially be built up fairly rapidly in captivity.