CHAPTER 33

Crocodile Farming in Thailand

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THE outlook for most wild animals in Thailand, including crocodilians, can only be described as bleak. Most Thais will kill any crocodiles encountered opportunistically and may seek them out deliberately to kill them. However, perhaps more important, there has been a steady loss of wetland habitats. Widespread deforestation has affected the mangrove swamps along both coasts, and these were the best habitats available in the country for saltwater crocodiles, *Crocodylus porosus*. Tarutao National Park, in the Bay of Bengal near the Thai-Malay border, is perhaps the only place in Thailand where wild *C. porosus* are seen regularly today.

The populations of Siamese freshwater crocodiles, *Crocodylus siamensis*, have suffered a similar fate. The habitats they occupied originally were the same ones shared by a number of extinct or endangered species of wildlife (for example Schomburgk's deer, Eld's deer, hog deer and wild water buffalo); lowland swampy areas which have been turned into ricefields. There may still be a few *C. siamensis* at Beung Boraphet Lake in Nakon Sawan Province and the Forestry Department has received reports of some in the north of Loei Province. This species is likely to be extinct in Thailand within the next few years.

That this situation was likely to develop in Thailand was correctly predicted by Mr Utai Youngprapakorn, in the late 1940's. On the strength of his convictions, he started the Samutprakan Crocodile Farm in 1950, with 20 wild caught crocodiles and an investment of US$500. Today (1985) that farm contains some 14,000 crocodilians, and is an example of how conservation aims can be achieved through profitable business enterprise. The Samutprakan Crocodile Farm continues to stand by its offer to the Thai Government — it will make crocodiles available to them for restocking when and if it becomes feasible to initiate such a programme.

The Samutprakan Crocodile Farm was designated an IUCN breeding station for endangered species in 1971. The term "farm" is used in the context of how it was defined in the proceedings of the first working meeting of the Crocodile Specialist Group of the International Union for Conservation of Nature and Natural Resources (IUCN) — "an establishment whose products are ultimately obtained from eggs laid on the farm" (Bustard 1971). In this sense, the crocodiles at Samutprakan are farm animals. It cannot yet be said that these animals are "domesticated", but the first steps towards the selective breeding of crocodiles for optimum domestic production have been made; hybrids of *C. porosus* x *C. siamensis* have proved to be a good farm animal.

Most crocodiles on the farm are *C. porosus*, *C. siamensis* and the hybrids of these two species (Table 1). However, there are also indigenous false gharials (*Tomistoma schlegelii*), of which none have been sighted in the wild for 20 years, and five exotic species: *Alligator sinensis* (Chinese alligator), *Alligator mississippiensis* (American alligator), *Caiman crocodilus* (spectacled caiman), *Crocodylus rhombifer* (Cuban crocodile) and *Crocodylus novaeguineae* (New Guinea freshwater crocodile). *Caiman crocodilus* is now breeding successfully, and the other exotic species are expected to do so in the near future.

This chapter summarizes the way in which the Samutprakan Crocodile Farm currently operates, and presents information on various aspects of farm management that may assist others involved in similar programmes elsewhere in the world.

COMMERCIAL ASPECTS

Crocodiles grown for skins are usually slaughtered at three years of age (some may take up to five years to reach the required size), before the law of diminishing returns sets in. The cost of feeding and maintaining a crocodile for more than three years exceeds the worth of its skin and meat, even though the animals themselves are larger. The unprocessed skin of a three-year-old *C. porosus* now sells for about US$250 and the skin of an equivalent aged *C. siamensis* for about 10% less. Sixty percent of the skins produced at the farm are processed and sold locally (mostly to tourists), and the other 40% are shipped abroad in a raw, salted form.

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Table 1. Numbers of crocodilians held at Samutprakan Crocodile Farm in 1984.

Species	Adults	Immatures	Totals
Crocodylus siamensis	2870	4910	7780
Crocodylus porosus	830	925	1755
Hybrid (*C. siamensis* x *C. porosus*)	320	390	710
Tomistoma schlegelii	5	80	85
Caiman crocodilus	23	202	225
Crocodylus novaeguineae	5	0	5
Alligator sinensis	2	0	2
Alligator mississippiensis	2	0	2
Crocodylus rhombifer	0	4	4

The meat is sold locally (US$5 per kg), mostly to restaurants, which offer it as a delicacy. It is eaten for its tasty flavour, but also as a purported treatment for asthma (whether or not it has any pharmacological benefits is unknown, but proponents keep coming back for more). An average three-year-old *C. porosus* weighs 14 kg (range 10-18 kg), of which about 5-7 kg is marketable meat. Thus the average value of a three-year-old crocodile (skin plus meat) is about US$280.

The farm was opened to the public 12 years ago and now receives about one million visitors annually. To cater for tourism, the grounds were attractively landscaped, shade areas were provided for people, elevated walkways were constructed above the breeding ponds and a range of other facilities and sources of entertainment were provided (gift shop, refreshment stands, elephant rides, photographers, tame pythons, stands selling fish to feed the crocodiles, etc.). There are also 48 other species of native and exotic reptiles, birds and mammals on display.

The commercial and biological success of the farm is, to a great extent, due to a number of favourable conditions at Samutprakan. Perhaps most important, the climate is tropical and suits crocodilians; ambient temperatures and humidities are high throughout the year and there is seasonally high rainfall. In addition, labour costs are low and relatively inexpensive building materials are available — these permit the establishment and maintenance of a substantial physical plant at low cost. The major continuing cost is food for the crocodiles; approximately 4000-5000 kg of trash fish are needed daily at a cost of US$0.20 per kg. If the supply of fish becomes inadequate, we supplement what is available with chicken wings, legs and necks.

BREEDING AND BIOLOGY

Crocodylus porosus and *C. siamensis* make up the bulk of the breeding stock (Table 1), and are housed in relatively high densities within eight separate breeding pools. Each pond is surrounded by a land area somewhat larger than the water area, and there are areas of sand and grass as well as areas of sun and shade for basking and temperature regulation. All ponds and their edges are made of concrete. Water depth is 1.5 m and water level is maintained by introducing fresh water as needed; the ponds are never drained since this disturbs the crocodiles. Although algae and the like occur, it has not proven to be a problem.

Adjacent to the breeding ponds are feeding ponds (water depth 20 cm below the breeding pond), where food is placed each day at 1800 hr. To avoid contamination of the main ponds, the excess food in the feeding ponds is removed and they are cleaned daily. There are a total of 150 nesting stalls around the breeding ponds. Each is approximately 4 × 4 m with a 60 × 60 cm door facing the breeding pond. None of the stalls has a roof and all have a drainage ditch to prevent flooding from heavy rains.

In each breeding pond, the sex ratio is one male to three females. Since a male typically forms a breeding relationship with a maximum of two females in a year, the third female simply helps ensure that each male has two receptive females. The mating season lasts from December until March and most mating activity, including the occasional fight between males, occurs at night. Fighting typically results in one or two fatalities each year.

Since both species are mound nesters (unlike hole nesters such as *Crocodylus niloticus*) nesting material (dried grass, vegetation, sod, etc.) is provided in the nesting stalls around the middle of April. Females choose a stall about one week prior to egg-laying and actively defend it against other females. Nest-building activity takes place at night, with females taking one to seven days to prepare the nest.

To build the nest, a female uses her mouth to crush the grass which is then mixed with sand with her hind legs (the forelegs are rarely used in nest construction). Within the resulting small mound, a depression about 30 cm deep and 20 cm wide is made. Three to five days prior to egg-laying, secretions from the corners of the eyes ("crocodile tears") are pronounced. Eggs are normally laid between 0500 hr and 0900 hr and at the completion of egg-laying the female covers them with grass, often using broad sweeping movements of her tail. The completed mound is 40-70 cm high. Occasionally some females urinate on the nest, and this presumably aids decomposition of the grass. Females are excluded from the stalls (by closing the gate) after egg- laying, and the nesting stalls then serve as incubators.

The temperature of the interior of each nest is measured daily. If it drops below 35.0°C (95°F), more grass is added, whereas if it exceeds 36.6°C (98°F), grass is removed. During very dry years, water may be sprinkled over the nest to aid decomposition and to maintain the heat generated by the rotting organic matter. Several nests may be moved into one stall if a shortage of stalls occurs.

Under these conditions, the following results are achieved:

1. *C. porosus* lay 30-50 eggs, and 40-50% of them hatch in 78-80 days;

2. *C. siamensis* lay 20-40 eggs, and 50-60% of them hatch in 67-68 days.

Between 1976 and 1985, an average of 4356 hatchlings (*C. porosus* and *C. siamensis*) were produced annually:

Year	No. of Hatchlings	Year	No. of Hatchlings
1976	4400	1981	4990
1977	4500	1982	5160
1978	4550	1984	2449
1979	4650	1985	3759
1980	4750		

When the eggs hatch, hatchlings are placed in groups of 10-15 in concrete nursery tanks, 30 × 40 ×50 cm high, with a wooden floor and bathing trough with flowing water. The tanks are screened against rodents and insects, especially mosquitoes, and are protected from direct sunlight and loud noises. Hatchlings seem particularly susceptible to disease and undue disturbance by noise. Each group of five tanks has its own set of cleaning materials and all are kept meticulously clean.

The young are not fed for the first 7-10 days, after which they receive coarsely chopped fish until they are large enough to be moved into larger tanks. Here they are maintained in high densities and are fed whole fish. There are five stages of tank sizes into which young are moved as they continue to grow. They are always kept in crowded conditions, with animals of the same age, after being removed from the nursery tanks. From 10 to 15% of hatchlings die in their first year, after which mortality drops to below 5% per year. Some of these fatalities are stuffed and sold as souvenirs.

AGE, SIZE AND CAPTIVE POPULATION

The largest crocodile on the farm is a 40-year-old *C. porosus* with a total length of 5 metres and an estimated body weight of 500-700 kg. The approximate relationship between age and size of *C. porosus*, *C. siamensis* and the hybrid between these two species is:

Age in years	Total Length (m)	Body Weight (kg)
1	0.6-0.8	1-2
2	1.0-1.2	10-18
3	1.5-1.7	10-18
4	1.9-2.0	20-30
5	2.0-2.2	20-30
6	2.2-2.4	35-50
7	2.4-2.6	35-50
8	2.6-2.8	80-90
9	2.8-3.0	80-90
10	>3.0	100-150

The total numbers of each species of crocodilian in the farm (in 1984) are shown in Table 1.

HYBRID CROCODILES

The attempt to interbreed *C. porosus* and *C. siamensis*, was initially undertaken as an experiment on the farm. These hybrids are now breeding in captivity and the total population of them on the farm is 710. From the point of view of crocodile "production", the hybrids are healthy, fast-growing and have the best characteristics of the parent species — the good dorsal skin of *C. siamensis* and the fine belly skin of *C. porosus*.

ABNORMALITIES

Occasionally, deformed animals are produced, typically ones with tail and spinal abnormalities. This could reflect excessive heat during incubation or genetic anomalies, but they rarely survive and even if they do, growth is greatly retarded; no attempt is made to raise them commercially. About 0.3 to 0.5% of hatchlings are part albinos.

THE FUTURE

The Samutprakan Crocodile Farm will maintain and diversify the breeding of *C. porosus* and *C. siamensis*, in conjunction with new ventures aimed at the captive breeding and raising of other animals (in particular tigers, snakes and lizards). The success to date with crocodilians has led to a profitable business and a large captive population of two species which are truly threatened with extinction in Thailand. There is now a source of animals for restocking the wild, should such a programme be instigated.

REFERENCES

BUSTARD, H. R., 1971. The scope of discussions: the worldwide situation of crocodilians. Pp. 15-28 *in* "Crocodiles". IUCN/SSC: Gland, Switzerland.