

species of 265 and 362 g recorded at Copenhagen Zoo (Crandall, 1964) and a growth chart for a Kodiak bear *Ursus arctos middendorffi*, also recorded at Copenhagen (Reventlow, 1963), the cubs' ages were estimated to be ten days. Their eyes and ears were still closed and there was no tooth eruption. They were well furred, the hairs being short, stiff and black except for some gold colouration on the back of the ears and on the muzzle and a gold chevron marking on the chest. Vibrissae were not yet visible. The limbs and claws were well developed and the animals were capable of some forward motion.

The first two days' feed consisted of one part evaporated milk (Carnation) diluted with three parts water, to which were added ABDEC vitamin drops in the proportion of 0.6 cc/88 ml milk solution. The concentration of the milk formula was increased to 1:2 on the third day, and again on the seventh to equal parts milk and water, when vitamin-mineral supplements were also increased. Details of the feeding

schedule and of the cubs' growth and development are shown in Table 1.

PRODUCTS MENTIONED IN THE TEXT

ABDEC: multivitamin solution, manufactured by Parke-Davis & Co., Brockville, Ontario, Canada.

Calcium Sandoz: solution of glucono-galactogluconate of calcium, manufactured by Sandoz Pharmaceuticals, Division of Sandoz (Canada) Ltd, Dorval, PQ, Canada.

Carnation evaporated milk: manufactured by Carnation Co. Ltd, Toronto, Ontario, Canada.

Ferrocebrin: iron and vitamin supplement, manufactured by Eli Lilly & Co. (Canada) Ltd, Toronto, Ontario, Canada.

Pablum: mixed infant cereal, manufactured by Mead Johnson, Toronto, Ontario, Canada.

REFERENCES

- CRANDALL, L. S. (1964): *Management of wild mammals in captivity*. Chicago & London: The University of Chicago Press.
- REVENTLOW, A. (1963): Kodiak bear (*Ursus arctos middendorffi*). In: International survey of hand-rearing techniques and animal milk analyses. *Int. Zoo Yb.* 4: 312.

Manuscript submitted 2 June 1975

Breeding and hand-rearing of the Marbled cat

Felis marmorata [Plate 53]

at the Los Angeles Zoo

ROBERT G. BARNES

Acting Associate Curator, Los Angeles Zoo, 5333 Zoo Drive, Los Angeles, California 90027, USA

The Marbled cat *Felis marmorata* is seldom exhibited (only 6.4 individuals in five collections listed in Volume 15 of the *International Zoo Yearbook*) and has rarely reproduced in captivity. Little is known about its habits in the wild. A number of births have taken place at the Los Angeles Zoo and in 1974 a ♂ kitten was successfully hand-reared. We believe this to be the first successful rearing in captivity.

BREEDING

The original pair, the ♀ of which arrived in February 1966 and the ♂ in January 1969, was housed inside the Nursery building away from the public but exposed to constant keeper traffic

both day and night. They were kept in a wire-mesh cage, 1.5 × 1.5 × 1.0 m high and provided with a nestbox for security. Their first litter (1.1) was born on 5 February 1971, 81 days after the only observed copulation. The ♂ kitten died two days later and the ♀ was removed for hand-rearing but died on 14 March. In 1972, two ♀ kittens were born, one on 27 and the second on 30 January. The mother made no attempt to care for them and both died within a few hours of birth. No gestation period was recorded.

The original ♀ was sold at the end of 1972 and replaced with a year-old imported ♀, who was put with the ♂ in August 1973 in an exhibition cage, 10 × 7 × 3 m. A nestbox was provided

in an adjoining off-exhibit holding area. The pair was seen to mate on 14 and 30 June and showed interest during the period 10-12 July. Although the only observed coitus on the last occasion was on 11 July, it may have occurred unseen on the other days. The birth took place on 4 September, giving a possible gestation period of 82, 66 or 55 (± 1). From our observations, we concluded that the Marbled cat is polyoestrous and mating and/or oestrus can occur in any month of the year. We believe the gestation period is in the range of 66 to 82 days but more data are needed to establish this accurately.

On 4 September a zoo visitor reported the birth of four kittens but it was impossible to verify this without disturbing the ♀ who immediately after the birth secluded herself and the litter in the nestbox. The following morning only one ♂ kitten was found and no trace of any others. The survivor was removed for hand-rearing. The adult ♂ had been removed from the exhibit several days prior to the birth but it was noticed that the ♀ was extremely agitated during the period of separation, calming down

when her mate was returned. Consideration will be given therefore as to whether it would be wiser not to separate the parents prior to the birth of the next litter.

HAND-REARING

Temperature and humidity: The kitten was placed in a small incubator with relatively high humidity maintained. Temperature was kept at 31-32°C for the first few days and gradually reduced to about 27°C until day 58 when, to give the animal more room for exercise, it was transferred to a larger incubator with no humidity control and minimal temperature control. The temperature was maintained at 27°C until day 70 when it was reduced to 24°C. On day 77 the cat was placed in a glass-fronted display cage, 1.5 × 1.5 × 2.2 m, during the day and returned to the large incubator at night. From day 125 onwards it was left in the display cage day and night.

Diet: Initially the kitten was fed a formula of one part KMR to one part boiled distilled water

AGE (days)	QUANTITY OF FORMULA OFFERED/FEED (cc)	TOTAL QUANTITY OF FORMULA/DAY (cc)	FORMULA PROPORTIONS	TOTAL QUANTITY OF ZU/PREEM/DAY (g)	NUMBER OF FEEDS
			KMR/Water		
1	5	35	1 : 1		
6	5	35	2 : 1		
8	5	35	1 : 1*		
12	8	56	1 : 1		
16	8	56	1.25 : 1		
21	8	56	2 : 1		
24	8	56	3 : 1		
26	8	56	5 : 1		
28	8	56	11 : 1		
32	10	70	11 : 1		
47	10	70	Full strength KMR		
52	14	98			
53	14	98		5	
59	14	98		15	2
64	14	84		25	3
71	15	75		35	3
80	15	45		85	4
88	15	15		75	3
95				100	3
133				100	2

*Note that the increase in KMR on day 6 proved too rich for the kitten and the original proportions were reinstated on day 8.

Table 1. Food intake of Marbled cat *Felis marmorata* hand-reared at Los Angeles Zoo.

which it accepted quite readily from a pet nurser bottle. Seven feeds were given between 0830–2400 hours (about every 2½ hours). On day 6 the amount of KMR in the formula was doubled but as this resulted in loose stools and eventually diarrhoea, the original formula was reinstated

on day 8. By day 16 the stools were well formed again and the formula changed to 1.25 KMR to one part water. Concentration of KMR and the amount given at each feed were gradually increased (Table 1). From day 17 to day 29, the formula was supplemented three times a

AGE (days)	WEIGHT (g)	DEVELOPMENT (eyes, ears, teeth, fur)	BEHAVIOUR (locomotion, vocalisation)
1 and 2	100	Pelage mottled with no definite pattern	Made squeaking noises
3 and 4	115		
5		Ears unfolded from head	
7	140		
8			Made squealing noises
10	170		
12		Eyes opened slightly	
13		Right eye half opened	
14	185	Left eye began to open	
15			Stood on all four legs and tried to walk. Made fussing and crying sounds
16		Both eyes opened fully (clear and bright)	
17	200	Upper canines started to protrude through gums	
22			Moved about but still unsteady on feet
23		Lower teeth started to protrude	Sat up, alert to sights and sounds.
24			Hissed at stranger, the first and only time this was heard
25		Lower canines through. Upper incisors started to protrude	
28	225		
35	300		
36		Molars (upper and lower) started to protrude	Very active; climbed on to keeper and played with her hair. Cried loudly when stimulated to defaecate
38			Jumped and playfully attacked objects, including stranger's hand
40			Made meow sound
42	340		
45		Marbled fur pattern on head and back	
49	425		
56	470		
65			Marked increase in activity (see text)
70	680		
71		Marbled fur pattern more definite on sides	
83	925		
86			Purring noticed for first time
98	1105		
112	1400	Marbled pattern very pronounced. Spotted pattern on legs and tail	
115		Lost lower right canine	
117		Lost upper right and lower left canine	
(months)			
5	1925		
6	2155		
8	2875		
9	3095		
10	3405		

Table 2. Physical and behavioural development of Marbled cat *Felis marmorata*.

day with one drop of the multi-vitamin Hi Vite. On day 53 the cat was offered solid food, feline Zu/Preem, for the first time and readily accepted a small amount from the keeper's fingers. This practice was continued for the next few days and on day 59 weaning began. At the second and fourth of its seven KMR feeds, the cat was offered, from a large spoon, a small quantity (one teaspoonful) of Zu/Preem. On day 64 this was increased to three times a day and the use of the nursing bottle was discontinued, the KMR and the Zu-Preem being given in small dishes. At this time the cat was becoming less interested in the KMR, sometimes refusing some that was offered, even when fed from a bottle, and on day 95 no further KMR was offered. At the same time the amounts of Zu/Preem were gradually increased and the number of feeds reduced (Table 1).

Beginning day 119 the cat was offered a newborn mouse per day in addition to the Zu/Preem. This was not accepted for the first two days but on the third a small mouse cut into pieces was consumed. Subsequently it accepted one mouse per day until day 138 when a whole dead chick was accepted. Chicks and mice have continued to supplement the Zu/Preem diet and at the time of writing (ten months of age) the cat is receiving 100 g of Zu/Preem, in two feeds, plus three chicks per day, six days per week.

It was necessary to stimulate defaecation until day 77, the first spontaneous elimination occurring on day 51 and from then on with increasing frequency.

Behaviour: The animal's behaviour was generally calm and quiet until day 65 when it underwent a drastic change, the cat unexpectedly leaping from the keeper's lap and dashing around the room. From then on, while still gentle and docile, the animal showed a tremendous increase in activity and a great facility in jumping and climbing. Its vocal repertoire is basically similar to that of the domestic cat, although the meow resembles a twittering bird call and it purrs infrequently. It growls only when attacking its dead chick. Table 2 shows the weight gain during the first ten months and some landmarks in its development.

ACKNOWLEDGEMENTS

I would like to thank the animal keepers involved in the feeding and care of these animals. The writing of this manuscript would have been impossible without their dedicated and conscientious recording of observations. They are: Ann Harrell, Bernadine Foster, Marili Levin, Natalie White, Karen Seaman, Steve Taylor and Robert Leemon. I would also like to thank Mr Michael J. Crotty, Curator of Mammals, for his guidance and helpful comments.

PRODUCTS MENTIONED IN TEXT

KMR: a cat milk substitute manufactured by Borden Chemical Company, Norfolk, Virginia 23501, USA.

Hi Vite: multi-vitamin manufactured by Evsco Pharmaceutical Corporation, Oceanside, New York, USA.

Zu/Preem Frozen Feline Diet: manufactured by Hill's Division Riviana Foods Inc., POB 148, Topeka, Kansas 66601, USA.

Manuscript submitted 14 July 1975

Hand-rearing a Saiga antelope

Saiga tatarica

at the Highland Wildlife Park

EDWARD ORBELL¹ & JOANNE ORBELL²

¹Park Director and ²Children's Park Supervisor, Highland Wildlife Park, Kingussie, Inverness-shire, Great Britain

The first Saiga antelope *Saiga tatarica* to be bred at the Highland Wildlife Park were born on 17 May 1974, both our ♀♀ giving birth within

the same hour, one to a single calf and the other to twins. Within two hours of birth, the twins were suckling but the other calf had not been