

Rearing and reproductive success in captive lowland gorillas (updated)

Angela Meder

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The reasons for hand-rearing and the reproductive success in captive born gorillas are analyzed in the following paper. For this purpose I studied the International Gorilla Studbook material, the literature, the North American Regional Studbook (Wharton 1988) and some zoos by visiting them. Besides I sent individual questionnaires to those zoos from which informations were not available from the references mentioned above. The results of this survey were published in Kirchshofer (1989). Additional informations for the revision were taken from the new studbook issue and from personal communications in 1989. I want to thank all persons who have contributed to this survey by readily answering questions that sometimes required a lot of time. Thanks also to Markus Grabert who wrote the computer programme for the Fisher-test.

Taken into consideration for the analysis were only those cases in which the reason for hand-rearing was given. Only those infants were considered that had been removed because of lack of maternal care. Infants were not included if the removal for hand-rearing was not necessary or if it was done as a precaution or for medical reasons. "Hand-reared" gorillas were defined as having been removed from their mothers within the first year, "mother-reared" means that they had spent their whole first year with the mother (12 mother-reared infants born in 1988 and 1989, who were less than one year old, were also included).

The respective studbook-numbers of the individuals are added as footnotes. The data were analyzed statistically with tests of independence (G-test or Fisher-test, depending on the sample size; Siegel, 1956; Sokal & Rohlf, 1981).

Reasons for hand-rearing

Within a sample of 207 hand-rearings the following reasons were given for removal from the mother:

increase of birth number / zoo policy / precaution (no immediate risk for the infant)	58 cases (28%) 1)
caesarean section	3 cases (1%) 2)
mother was ill	2 cases (1%) 3)
infant was ill or hurt	13 cases (6%) 4)
insufficient milk supply / undernourishment	14 cases (7%) 5)
mother did not allow the infant to suck	26 cases (13%) 6)
no interest	43 cases (21%) 7)
rough treatment by the mother	17 cases (8%) 8)
neglect after initial good mothering	31 cases (15%) 9)

Effects of management and experience on maternal behaviour

Isolation of the mother from conspecifics at birth: The mothers were isolated in 68 cases. 28 infants were naturally reared (41%) 10), 40 were rejected 11). In 143 births without isolation of the mother there were 77 natural rearings (54%) 12) and 66 rejections 13). These differences are not significant.

Observation of mother-rearing within the group: 35 females had the opportunity to observe the rearing of an infant within their group before giving birth themselves. 27 of them (77%) reared their first offspring 14), 8 rejected it 15). Out of 64 females who could not observe a gorilla being reared in their close proximity, 24 (38%) accepted their first offspring 16) and 40 rejected it 17). This difference is

significant ($p < 0.001$; G-test).

If the females observed a natural rearing for the first time after having rejected one or several infants, they accepted in 5 (18) out of 15 cases (33%) the infant born immediately after that experience, in 10 cases they rejected it again (19).

Improvement of maternal behaviour after the rejection of one or several infants was also observed spontaneously: 9 (20) out of 18 females (50%) reared their infants after having observed a natural rearing in their groups, 9 did not rear them (21). A mother-rearing without this experience was shown by 12 (22) out of 20 mothers (60%). 8 mothers who had never observed a natural rearing in their groups rejected all infants (23). The difference is not significant.

Improvement of maternal behaviour (partial mothering after complete rejection or permanent after partial mothering) occurred at various times. Between infants 1 and 2 the maternal behaviour was improved by 8 (24) out of 32 mothers (25%), 24 did not improve it (25); between infants 2 and 3 improvement was shown by 10 (26) out of 27 mothers (37%), 17 did not change their behaviour (27). To infant 4, 4 (28) out of 15 females improved their behaviour (27%), 11 females showed no change (29). After the 4th infant maternal behaviour was improved only in one case, as far as I know (between infants 8 and 9: Mimi, Stuttgart). Only live births were considered.

Reproductive success in gorillas born in captivity

For this analysis all individuals with known rearing histories were considered who were born until 1979 (at least 10 years old) and reached at least 10 years of age.

Females: Out of 46 hand-reared females 26 (30) gave birth (57%). 15 females have already copulated with males (31), in 5 individuals no sexual activity has been observed so far (32). The first offspring of 23 mothers survived (674's infant died at once, 601's and 685's infant after a short time). 10 females reared their infant naturally (33), 2 females had their infants removed immediately, although mothering was good (56, 474) and in 2 cases the infants were removed because they looked undernourished (223, 438). 9 mothers rejected their first infants immediately or within the first 3 months (34). 13 females gave birth to further live offspring; 4 females improved their behaviour (35), 6 did not (36). In 2 mothers the second infants were removed like the first ones as a precaution, in 3 cases I have no information regarding the rearing of the latest offspring.

Out of 23 naturally reared females, 20 (37) were reproductively successful until the end of 1989 (87%), one infant (mother 661) died the first day. In one female copulations were observed (696), in one (624) no sexual behaviour, for one (678) I could not get any information. Out of 18 mothers with known maternal behaviour, 11 reared their first infants normally (38), 5 rejected them (39) (the female 700 had a forceps assisted birth). In one female (660) the first baby died after a short time, the second one was naturally reared. In one female (437) the first infant was hand-reared as a precaution, the second one died on the first day of life and for the third one I have no information. One female (413) rejected her first infant and reared the second one. One mother rejected the first two infants and reared the third one (522). 2 females (543, 683) did not show sufficient mothering up to their third infants.

The number of hand-reared and mother-reared females who have bred successfully is significantly different ($p < 0.01$, Fisher-test). The comparison of those having shown normal sexual behaviour or not does not give significant differences. The treatment of the first infant does not differ significantly between the two rearing groups as well. Hand-reared and mother-reared females who had not reared their firstborn improved their maternal behaviour in the course of several births without significant difference.

Males: Out of 33 hand-reared males, 9 (40) bred successfully (27%). For further 17 individuals information was given about sexual behaviour: 5 were observed copulating with females (41), 12 did not show sexual behaviour (42).

Out of 16 naturally reared males 11 (43) were reproductively successful (69%) and 3 copulated with females (44). For 2 males (406, 687) I have no information.

Reproductive success is significantly higher in mother-reared male gorillas ($p < 0.001$, Fisher-test). The

same differences are found when comparing the portion of hand-reared and naturally reared males that have been observed copulating ($p < 0,001$; Fisher-test).

Conclusions

Gorilla mothers in captivity frequently do not rear their first offspring. This behavioural deficit can be avoided by providing to a nulliparous female the opportunity to observe a natural gorilla rearing within her group. After rejecting their first infants, mothers may improve their maternal behaviour with subsequent births, regardless of their experience with other gorilla mothers. The isolation of a female from her group at birth has no significant effect on her maternal behaviour; however, if possible females should not be separated during and after delivery, because the experience of delivery and rearing may have a positive effect on the other group members too.

Rearing history has an effect on the reproductive behaviour of captive born gorillas. Many hand-reared individuals, especially males, are incapable to perform species-specific sexual interactions, whereas in mother-reared ones this is extremely rare. In almost half of all hand-reared males, for whom information on sexual behaviour are available, no copulations have been observed. Hand-reared females and males breed significantly less than mother-reared ones; besides the mothers reject their offspring more often.

These results are very similar to those of Beck & Power (1988), who thoroughly analyzed the reproductive success of the whole North American gorilla population. They found significantly less reproductive success in female hand-reared individuals too. For males the difference was not significant, but the number of animals included in that analysis was comparatively small.

Supposing the data analyzed here are typical for the whole captive population, it is obvious that hand-reared individuals are not reproducing as successfully as mother-reared ones. The reason for this deficit is probably a lack in social experience with conspecifics during the first years of life.

The importance of keeping hand-reared gorillas with conspecific peers already in the first months has to be emphasized. The infants should be integrated into groups with adult male and female gorillas while they are infants (Meder, in press). This seems to be especially important for males.

References

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Studbook numbers of the animals :

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- 2) 653, 672, 725.
- 3) 343, 846.
- 4) 420, 470, 472, 496, 622, 697, 747, 929, 949, 950, 1044, 1045, 1120.
- 5) 272, 692, 736, 754, 755, 791, 854, 801, 851, 892, 899, 923, 1055, 1105.
- 6) 493, 508, 557, 601, 616, 632, 662, 694, 705, 735, 738, 741, 766, 798, 799, 824, 866, 890, 894, 946, 971, 973, 1042, 1097, 1117, 1119.
- 7) 225, 238, 294, 295, 334, 352, 356, 392, 403, 418, 430, 453, 497, 500, 521, 539, 573, 579, 583, 600, 613, 674, 691, 717, 724, 733, 743, 749, 757, 773, 776, 792, 796, 802, 809, 816, 826, 847, 855, 867, 975, 1065, 1106.
- 8) 247, 275, 431, 436, 456, 479, 538, 584, 598, 665, 668, 793, 804, 819, 834, 849, 869.
- 9) 441, 480, 540, 596, 599, 621, 649, 679, 688, 690, 746, 752, 774, 820,

821, 822, 839, 840, 852, 885, 903, 910, 942, 960, 969, 972, 1028, 1060, 1062, 1071, 1104. 30) 56, 91, 223, 334, 343, 356, 392, 428, 432, 438, 453, 456, 472, 474, 508, 557, 596, 601, 610, 620, 662, 674, 675, 680, 685, 692. 31) 289, 315, 391, 418, 420, 431, 470, 521, 583, 604, 649, 650, 664, 668, 694. 32) 295, 312, 441, 473, 697. 33) 91, 343, 356, 392, 557, 610, 620, 662, 675, 692. 34) 334, 428, 432, 453, 456, 472, 508, 596, 680. 35) 428, 453, 508, 596. 36) 223, 356, 432, 472, 680. 37) 316, 334, 413, 437, 522, 528, 536, 543, 556, 558, 559, 609, 631, 655, 660, 661, 663, 681, 683, 699, 700. 38) 316, 528, 536, 556, 558, 559, 609, 631, 661, 663, 681, 699. 39) 413, 522, 543, 683, 700. 40) 342, 355, 399, 430, 497, 500, 573, 599, 667. 41) 122, 225, 493, 496, 540. 42) 333, 346, 435, 444, 480, 616, 632, 633, 653, 666, 672, 684. 43) 111, 183, 412, 509, 577, 580, 611, 612, 652, 654, 709. 44) 415, 572, 682.