

Book reviews

Cheetahs of the Serengeti plains: group living in an asocial species.

Wildlife Behavior and Ecology Series (Edited by George B. Schaller).

By TIMOTHY M. CARO.

ISBN 0-226-09434-0, 1994, XXI + 478 pp., paperback, price US \$ 26.95.

Available from: The University of Chicago Press, 5801 S. Ellis Ave., Chicago, Illinois 60637, USA (Tel. 312-7027740).

This milestone book has two souls: on the one hand, it aims at answering major questions about the behavioural ecology of this exceptionally attractive species; in this sense, it fully exploits all the up-to-date set of conceptual tools characteristic of this discipline. On the other hand, however, it is a really modern natural history book. Thus, the author does not limit himself to formulating and testing hypotheses, but provides a broad view of this species, describing also other facets of its ecology and behaviour.

The main question behind the book is why cheetahs stay together, and the answer is complex: (1) mothers stay with their cubs even after weaning more because of anti-predator benefits than to teach them hunting (chapters 5 & 6); (2) adolescents may stay together after leaving their mother for essentially the same reasons (lowered vigilance and harassment from other predators, including other cheetahs (chapter 7)); (3) some of the males form small, stable groups, and this allows them to maintain small territories in the areas where females are concentrated (chapters 8-11). Unfortunately, reproductive success could not be directly measured for lone and group-living males. The occurrence of co-operative hunting was excluded for all group types, although males in groups enjoyed a higher per capita food intake. Group living may be allowed by the abundance of prey of adequate size.

In addition, chapter 2 provides background information on the study area and on the cheetah; chapter 3 describes methods of data collection, and chapter 4 the reproductive pattern. Chapter 12 analyses the evolution of cheetahs by comparison with other felid species. The hypothesis here is that predation is the main factor shaping life history traits of the cheetah. Chapter 13 focuses on the conservation of this species. As with most mammals and birds, habitat destruction is the major ultimate threat. The author excludes captive breeding as a realistic method, and supports reintroductions and protection also outside parks as the most promising approaches.

I found the book extremely interesting, stimulating and readable. The arguments are reported clearly and convincingly, and data are used to answer the main questions in a very efficient way. The previous papers of the author and his co-workers are collated in a global view, and significant new data are reported. A number of provocative, new ideas are put forward. For instance, the view of the cheetah as a fast, "generalist" predator (not overly specialised in every aspect of its biology, and therefore doomed to extinction, as generally believed) is both innovative and convincing. What is more important, it sheds new light on cheetah conservation (chapter 13). Directions for further research and conservation efforts are frequently suggested throughout the book.

My criticisms are extremely limited: (1) despite the high quality of the work of the author, and long years of observations on a large, diurnal carnivore in an open environment, sample sizes are often small (sometimes too small for statistical testing, as Caro correctly points out). Many questions therefore remain unresolved (e.g. the relation between maternal

antipredator behaviour and litter size; p. 155), as well as the discrepancies between some of the findings of the author and those of his co-workers. For instance, estimates of food intake do not correspond with belly size (p. 102); the estimate of percentage of predators spotted by mothers differs between Caro (p. 142) and LAURENSEN (1994). These limitations are, however, almost a necessary consequence of studying a rare, wide-ranging carnivore. (2) Cheetahs hunt at night (e.g., p. 111), but this confounding factor has rarely been taken into account. (3) Unfortunately, very limited information is available about what happens in the woodlands; this is a topic of special concern for two reasons: from a scientific point of view, the Serengeti case might be an exception rather than the rule, and the social system and its determinants may be different in large parts of the cheetah's range. The conservation of the cheetah is also dependent on this information since much of the cheetah's range (and possibly the most endangered part) is in bush and woodland habitat. There the limiting factors to cheetah populations might be different (e.g. the impact of predation may be lower). (4) The minimum convex polygon is notoriously a very weak method to describe and measure home ranges, especially for a rather nomadic species like the cheetah (e.g. WHITE & GARROTT 1990). More modern and efficient techniques are available (e.g. kernel analysis; WORTON 1989). It is therefore surprising that the author does not analyse his valuable data in a more informative way.

The bibliography is rich (about 800 references), and includes also many references not cited in the text. The oldest one I spotted is from 1919, and the most recent ones are of the same year of publication of the book. The editorial quality of the book is very high (as usual with Chicago University Press). I could spot only very few printing errors (e.g. a cheetah mother should eat more than 0.7 g of food per day!; p. 126). Figures are clear, simple and informative. Occasionally their style is not consistent (e.g. spacing of bars and format of error lines at pages 168-169), but this does not detract from their readability.

References

- LAURENSEN M.K. 1994. High juvenile mortality in cheetahs (*Acinonyx jubatus*) and its consequences for maternal care. *Journal of Zoology, London* 234: 387-408.
- WHITE G.C. & GARROTT R.A. 1990. Analysis of wildlife radio-tracking data. *San Diego: Academic Press*.
- WORTON B.J. 1989. Kernel methods for estimating the utilization distribution in home-range studies. *Ecology* 70: 164-168.

PAOLO CAVALLINI, Dipartimento di Biologia Animale e Genetica, Università di Firenze, Via Romana 17, 50125 Firenze, Italy.

Evolutionary change and heterochrony.

Edited by KENNETH J. MCNAMARA.

ISBN 0-471-95837-9, 1995, XII + 286 pp., cloth, price £ 50.00.

Available from: John Wiley & Sons Ltd., Baffins Lane, Chichester, West Sussex, PO19 1UD, England (Tel. +44 1243 829121; Fax +44 1243 770225; E-mail: GBJWSRG1@IBMAIL.COM).

Heterochrony, the fact that changes in the developmental tempo either of whole organisms or of some parts of them in proportion to others or even between the growth rates of different portions in the same organ or apparatus, has been argued for a long time. Mathematical treatments of these and related phenomena have been proposed and this book is a welcome addition to the literature on the subject as it shows today's relevance of the phenomena which may be related to heterochrony both for evolutionary considerations and for the