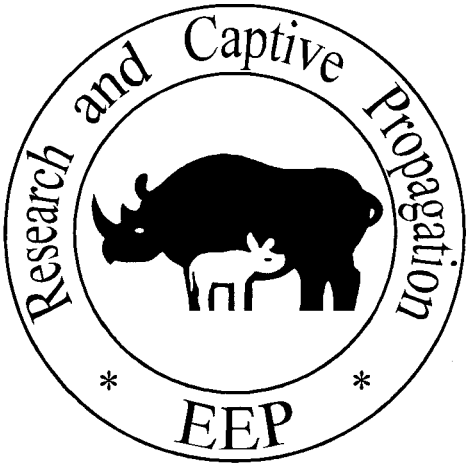

Research Commitee Newsletter

8th Issue, March 2002

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1. News and Reports from Research Committee

1.1. News from EAZA's Research Committee

As usual, the Research Committee had a meeting during EAZA's annual meeting, which was held in 2001 at Prague/CR. The committee endorsed formally the establishment of the European Zoo Nutrition Group as well as the European Zoo Nutrition Resource Center. Joeke Nijboer from the Zoo Rotterdam/Netherlands was invited as link person and member of the Research Committee.

To improve the communication between the Research Committee and the Institute for Zoo and Wildlife Research (IZW) at Berlin, its deputy director, Dr. Katharina Jewgenow was invited as member of the Committee. The 4th International Symposium on Physiology and Behaviour of Wild and Zoo Animals will be held September 29th to October 2nd, 2002, at Erkner near Berlin. During this symposium the Research Committee will organize a workshop on „Problems and Benefits of Ageing in Animals". Alastair McDonald from the University at Edinburgh kindly agreed to take the lead in preparing and conducting this workshop.

In order to include the aquaria into the zoo-world, EAZA and EUAC had agreed to reserve one seat in each committee for an aquarium-person. For the Research Committee EAZA-Council has approved Flegra Bentivegna, Aquarium Naples/Italy.

1.2. 4th international symposium on - "Physiology and behaviour of wild and zoo animals".

Dear colleagues,
On behalf of the organization committee and the IZW we are happy to send you the first circular for the 4th international symposium on

"Physiology and behaviour of wild and zoo animals"

that will be held in Berlin between 29th September and 2nd October 2002.

Our aim is to bring together scientists from various disciplines working with free-ranging and captive animals to encourage an exchange of ideas.

We have secured an impressive list of plenary speakers that include

Donald Broom	Andrew Kitchener
Terry Burke	Bill Sutherland

The main topics of the symposium will be

- reproductive biology
- stress and disturbance
- behavioural science
- wildlife conservation
- evolutionary genetics
- nutrition and digestive physiology

Six workshops will be held, their preliminary titles are

- non-invasive monitoring of hormones
- costs and benefits of aging
- animal welfare and conservation
- communication in mammals
- chronoethology -chronoecology
- ultrasonography in conservation biology

More information about the symposium, Registration Forms and forms for the submission of Abstracts can be obtained from our new IZW homepage {HYPERLINK "http://www.IZW-Berlin.de" }www.IZW-Berlin.de

We wish to extend a cordial invitation for you to attend the symposium, and look forward to meeting you at the symposium in 2002.

On behalf of the organizing committee

M. East, G. Fritsch and M. Dehnhard

2. Research Reports from Research Departments

2.1. Research Projects in Cologne Zoological Garden

Projects co-ordinated by Dr. L Kolter

Seasonality of food intake in the Grizzly bears (*Ursus arctos horribilis*) and Spectacled bears (*Tremarctos ornatus*) at Cologne zoo.

***(Marita Krämer**, Diploma thesis, University of Cologne), Status: completed*

Northern bear species, like the Grizzly bears, maintain a clear seasonal cycle of feasting and fasting also under zoo conditions, which coincides with the seasons of high and low abundance of food in the wild. In the habitat of tropical bears, like the Spectacled bear, times of food shortage occur, too, but they are less pronounced and less predictable than in the range of the Northern bear species. It was examined whether Spectacled bears show a seasonal pattern of food intake and how it compares to the food intake in Grizzly bears.

Consumption of food and nutrients was estimated for 2 Grizzly bear females and 2 Spectacled bear females in spring, late summer and early winter.

There was a pronounced pattern of food intake in the 2 Grizzly bear females. In late summer the animals consumed about 15 kg of a mixed diet (fruit/vegetables/meat) each. In early winter (December),

when they became very calm (but no hibernation) and in spring after they started to become more active again the food intake was reduced by 70%. The amount of food consumed by the 2 Spectacled bear females varied much less between the seasons: it ranged between approximately 5 kg and 3 – 3,5 kg. Preferences for certain food items differed individually and seasonally.

Feeding and nutrition of sun bears (*Helarctos malayanus*)

***(Rebecca Riese**, Diploma thesis, University of Cologne, in co-operation with the Institute of Animal Nutrition, University of Bonn, and Gabriella Fredricksson, Kalimantan). Status: completed*

There is evidence that weight in captive sun bears is much higher than in wild ones. The amount of food and its composition as well as low locomotor activity may contribute to the increased weights.

Food intake was estimated for 1,2 sun bears. The nutrient composition of the zoo diet as well as of the major food items in the wild was analysed. Activity budgets and the amount of different locomotor patterns were recorded.

The domestic fruits offered to the bears are higher in monosaccharides but lower in crude fibre compared to the wild fruits. The main source of fat in the wild are insects. The amount of crude fat in insects is considerably lower than in the zoo diet. The captive sun bears were active only during 30% of the observations - the main activity was feeding and searching for food on the ground. Currently quantitative information concerning the amount of different locomotor activities of wild bears is not yet available, but it can be assumed that particularly the energy consuming climbing occurs much more frequently in the wild than in captivity.

Food intake and thermoregulation in a group of Rhinoceros Iguanas, *Cyclura cornuta*

*(**Susan Naacke:** Diploma thesis, University of Cologne). Status: completed*

The diploma thesis aimed at determining the effect of the social position on the individuals' access to food and opportunities for thermoregulation by selection of heated spots in C. cornuta.

The social structure and enclosure use was determined and the individual consumption of food was estimated in a group of 1,3 animals during summer and winter conditions. The temperature of the body surface was monitored once a week for one day. Air temperature and humidity were recorded over the whole period of the study.

Complex social and spatial relationships existed between the 3 females. The male dominated over all the females. The access to food and to the heated places was affected by the social position. Enclosure structures which prevented visual contact during feeding facilitated the access to food in the lower ranking animals. The most preferred heated (warmer) places were monopolised by the high ranking animals during the morning prior to feeding, which had marked effects on the increase of the individual's surface temperature.

Projects co-ordinated by Dr.W.Kaumanns Working group Primatology

Feeding ecology

Energy Intake and Obesity in Captive Lemurs

*(**C. Schwitzer**, Dissertation, University of Cologne, supported by Konrad-Adenauer-Stiftung e.V.), Status: analysis ongoing.*

Obesity is supposed to be a common problem in captive lemurs. This can be caused by the over-provision with food. Furthermore, due to their low basal metabolic rates lemurs might gain a relatively high amount of energy from their food.

This study analyses relations between obesity and energy intake. Therefore, the nutrient and energy intake in different species of lemurs living under different conditions is being examined quasi-experimentally. Relations between quality, quantity, and distribution of food, feeding behaviour, energy intake, and body weight are being analysed.
The results of the study will contribute to a better understanding of the feeding ecology of lemurs. Furthermore, data for the optimisation of conservation programmes will be provided. The investigation can provide models for the study of obesity in humans.

Schwitzer, C. & W. Kaumanns (2001): Body weights of Ruffed lemurs (*Varecia variegata*) in European zoos with reference to the problem of obesity. Zoo Biology 20(4), 261-269

Feeding Behaviour of Douc Langurs (*Pygathrix nemaeus*) in Captivity

*(**K. Klumpe**, Diploma thesis, University of Potsdam), Status: terminated, publication in prep.*

Food intake was recorded quantitatively over a period of three months in nine captive Douc langurs. Nutrient and energy concentrations of the consumed diets were calculated and compared to data from corresponding studies. Determinants which might influence food intake were assessed, an activity budget was drawn up, and dominance hierarchies were described. The diet consumed by the langurs consisted of 33% vegetables, 21% leaves, 21% fruits, 12% salad and 14% other food items. The results showed that the different foodstuffs differed in their acceptance by the animals. Leaves always had the highest amounts of leftovers. A greater diversity of leaves offered, however, correlated with a higher leave intake. Regarding the nutrient composition of the consumed diet, a high content of water-soluble carbohydrates and a low crude fibre content were obvious when compared to the diets of wild colobines. The amount of energy consumed by any of the Douc langurs was lower than the calculated energy requirement.

During the daily observation time, the animals spent 56% with resting and sleeping, 22% with eating, 6% with locomotion, and 3% with grooming. In all three study groups, males were dominant over females, and old females were dominant over young females.

Feeding Behaviour and Nutrient Utilisation in Greater Bamboo Lemurs (*Hapalemur simus*)

*(**V. Dunkel**, Diploma thesis, University of Bonn), Status: data collection ongoing.*
The project is carried out in co-operation with J. Ganzhorn, University of Hamburg.

Bamboo lemurs are highly selective folivorous primates. Their diet in the wild consists almost exclusively of bamboo, and the different sympatric *Hapalemur* species utilise different species and parts of bamboo. In this study the feeding behaviour of a captive group of *Hapalemur simus* will be analysed with regard to quality and quantity as well as nutrient composition of the consumed food. The digestibility of different nutrients will be determined through faeces analysis. Emphasis will be laid on the animals' utilisation of secondary plant components. Moreover, preferences for certain bamboo species or parts of them will be investigated. The study will provide data on nutrient requirements as well as on factors which influence food intake in Greater bamboo lemurs.

Pilot projects:

Feeding Preferences of Captive Kikuyu Colobus Monkeys (*Colobus guereza kikuyuensis*)

*(**N. Peters**, University of Munich, Undergraduate practical training, supported by Studienstiftung des Deutschen Volkes), Status: manuscript in preparation.*

To help understand food choice in colobine monkeys, this study will provide quantitative data on individual food intake and feeding preferences in a captive group of Kikuyu colobus monkeys. The study will be continued as a diploma thesis.

Social Systems

Social and Competitive Behaviour of Adult Female Hamadryas Baboons (*Papio hamadryas*)

*(**E. Krebs,** Dissertation, University of Cologne), Status: terminated, parts published.*

In this study the social relationships between female hamadryas baboons in a large zoo colony were analysed. The sterilisation of the adult males which was carried out for birth control purposes led to an increasing number of cycling females and an increasing degree of estrus synchronisation. Two one-male-groups with ten females each were observed. These two groups differed in the mean age of the members. The agonistic behaviour between the females within both groups increased over time. The females of the older group showed a higher frequency of aggressive interactions against each other than those of the younger group. A linear female dominance hierachy in the older group was found.. The adult males (harem leaders) differed in their aggressive behaviour (herding) towards the females. The younger haremleader herded more frequently than the older one. In periods with many females in estrus the females of the older group increased their spatial distances to the haremleader and some of them developed social and sexual relationships with subadult males (followers). In contrast to that the females of the younger group reduced their spatial distance to the male and had no contact with followers. The increasing number of agonistic interactions were discussed with reference to intrasexual competition for the access to the male. In the same way as the agonistic behaviour, the sociopositive interactions between the females were probably influenced by the haremleaders, too. There is evidence that the males are able to influence the structure of the hamadryas social system by influencing the females. In cases with a high male influence the females within a one-male-unit show only low degree of differentiation in their social interactions. In the case of low male influence hamadryas females show a strong linear dominance hierarchy and a high degree of differentiation. Differentiation in female social relationships as well as strong linear dominance hierarchy are two of three characteristics. WRANGHAM (1980) postulated for *female-bonded* groups. It is assumed that all species of the genus *Papio* are *female-bonded* . In the case of a high influence of the male, there is little possibility for the females to develop both differentiation in their social relationships and a

strong linear dominance hierarchy. In that situation hamadryas females show the characteristics of the *non-female-bonded* social structures (WRANGHAM, 1980).

Krebs, E. (2001): Social and competitive relationships among adult female Hamadryas baboons (*Papio hamadryas*). Folia Primatologica 72(3), 169

Contribution to the Study of a Captive Group of Hamadryas Baboons, *Papio hamadryas*, at Cologne Zoo: Social Interactions of Male Leaders and Non-Leaders in a Clan

*(**V. Bolland**, Diploma thesis, Université de Liège), Status terminated*
In co-operation with M.-C. Huynen, Université de Liège.

Although there have been several studies on the colony of Hamadryas baboons at Cologne Zoo, male-male interactions have not been investigated in detail yet. This study intended to provide data on the interactions of male harem leaders with male non-leaders in a clan, as well as such of non-leaders with adult females. The data can be used as a basis for future studies.
Twelve male Hamadryas baboons (six harem leaders and six non-leaders) were observed on altogether 59 days. Focal sampling and scan sampling were used to record behavioural data as well as data on space use. The results showed that interactions occurred between harem leaders as well as between non-leaders, and also between leaders and non-leaders. Interactions between harem leaders only rarely involved physical contact. Grooming was observed mainly between non-leaders, but also between leaders and non-leaders. Between non-leaders and adult females, affiliate as well as sexual interactions could be observed. They were, however, less frequent than those between harem leaders and adult females.

Social Relationships in a Captive Group of Bonobos (*Pan paniscus*)

*(**D. Hase**, Diploma thesis, University of Cologne), Status: data collection ongoing.*

This study investigates the social relationships in a captive group of five Bonobos, consisting of three males and two females. Behavioural data is being collected through focal sampling, data on space use through scan sampling. A necessary change in the group composition is being used in the sense of an experiment.
The study can provide data on the nature of interactions in Bonobos. It may help to improve the understanding of the Bonobos' social system.

Space Use and Social Structures in Captive Orang Utans (*Pongo pygmaeus*)

*(**D. Claßen**, Diploma thesis, University of Cologne), Status: terminated.*

Space use and social interactions were investigated in a group of eleven Orang utans. The animals stayed on or near the ground of their enclosure for 50-80% of observations. Subadult and adult males preferred the edges of the enclosure, whereas adult females mainly used the less structured centre area as well as areas close to the visitors' viewing windows. The mean proportion of social interactions among the total daily activity was 27.5%. These interactions were dominated by approaching and following, short touches and social play, as well as grooming. Agonistic interactions were rarely observed. The orang utans kept a mean interindividual distance of eight metres.
The observed large but highly variable interindividual distances and the fact that the animals were usually widely distributed within their enclosure, as well as the high proportion of differentiated, mainly socio-positive interactions point to an individual-based fission-fusion social system rather than to a semi-solitary way of life.

Other Projects

Non-invasive Recording of the Physiological Status of Douc Langurs (*Pygathrix nemaeus*) through Analysis of Hormones from Faeces

*(**C. Ademmer**, Diploma thesis, University of Cologne), Status: terminated.*
The project is carried out in co-operation with M. Heistermann, Dept. of Reproductive Biology, German Primate Center, Göttingen.

In this study the relationships between changes of group composition, faecal glucocorticoid levels (5-β-Androstandiol), and reproductive status in a captive colony of nine Douc langurs were examined. The reproductive status of the five adult females was assessed by measuring faecal pregnanolone.
Changing the group composition resulted in an increase of 5-β-Androstandiol in the faeces of several individuals (even those not involved in the actual change) after a lag-time of one day. The intensity of the hormonal response differed between the individuals and probably also between sexes. Regarding the females' reproductive status, under baseline conditions (before the change of group composition) all five adult females cycled regularly. After the change, irregularities in the cycle of three females could be observed.
The results of this study are an important prerequisite for establishing methods of hormonal analysis which can be used in field studies on Douc langurs.

Contribution to the Study of Bonnet Macaques (*Macaca radiata*) in Tamil Nadu, South India: Activity Budget, Social and Interspecific Relations

*(**M. Mehu**, Thesis, Université de Liège), Status: terminated. In co-operation with M.-C. Huynen, Université de Liège.*

The adult members of a group of 21 Bonnet macaques were studied for three months in Tamil Nadu, South India, an area characterised by agriculture and secondary vegetation. The study site is heavily frequented by humans. The results showed that adult Bonnet macaques spent most of their daily active time on feeding, resting, and social activities. Females were closely associated with each other. Both males and females showed dominance hierarchies. Dominant males had the highest affinities to dominant females with regard to distances, sexual and affiliate behaviour. Although several animal species occur in Tamil Nadu, the Bonnet macaques concentrated their interspecific activities on humans. This was mainly due to tourists feeding the monkeys.

Analyses of Captive Primate Populations

*(**W. Kaumanns, E. Krebs & C. Schwitzer**), Status: ongoing, parts published.*

In this study, different European (EEP-) populations of primates are being analysed in detail with regard to their demographic and genetic development. Emphasis is laid on the individual's reproductive output. The study intends to assess the actual management of captive primate populations. The findings will be discussed with reference to the goals of captive breeding programmes to maintain genetically viable, self-sustaining reserve and/or model populations over a long time-span. Primate specific dispersal patterns, social structures, life history parameters and aspects of the socialisation process are being considered. It is assumed that a more complex management of captive primate populations is required, which more consequently deals with ongoing selection processes. The latter may result from individual differences in reproductive output.

Kaumanns, W. & C. Schwitzer (2000): The development of captive primate populations in Europe. Advances in Etho-logy 35, Supplements to Ethology, 159

Studies on the Reproductive System, the Genetic Status and the Parasitic Status of Lion-tailed Macaques (*Macaca silenus*) in Fragmented Populations

*(**W. Kaumanns, A. Kumar, M. Singh & C. Knogge**), Status: ongoing.*

The project is carried out in co-operation with Salim Ali Center, Coimbatore, University of Mysore, and German Primate Center (Dept. of Reproductive Biology / Dept. of Veterinary Medicine and Primate Husbandry). Financial support is provided by Volkswagen Foundation.
The Lion-tailed macaque is endemic to South India and highly threatened by extinction. About 60% of the remaining 2000-4000 individuals live in highly fragmented forests. The project intends to help with the establishment of the infrastructural conditions for field studies on the consequences of fragmentation on the level of reproduction, genetics, and parasitic diseases and to carry out first studies. Relevant knowledge is urgently needed. Materials for hormonal, genetic and parasitic analyses are gained via (non-invasive) faecal sampling on a number of habituated groups in the Anamalai Hills, Tamil Nadu State, and on non-habituated groups in other areas.
First results on the reproductive status of individually known females and on the parasitic load of Lion-tailed macaques living close to humans are available.
Methods for hormonal analysis were developed at German Primate Center by using individuals of the EEP-population of LTM's. Data from the field are used to improve the management of the captive population in Europe. A co-operation with Indian zoos has been established.

2.2. Research Projects in Osnabrück Zoo

*Co-ordinated by Ute Magiera, Zoo Osnabrück, Am Waldzoo 2-3, D-49082 Osnabrueck, e-mail: magiera@zoo-osnabrueck.de in cooperation with Prof. Dr. Bergmann, University of Osnabrück and * Dr. M. Heistermann, German Primate Center, Göttingen*

Environmental Enrichment and possible reduction of stress in primates, examplified at *Orang Utans**

***Julia Kramer**, 2001, Diploma thesis, completed.*

Environmental enrichment leads to an increase of active behaviour and decrease of abnormal behaviour pattern by Orang-Utans (Leyendecker 1999) in Osnabrück Zoo. We assumed that a high level of abnormal behaviour pattern stands for „stress“ and that an increase in stress is accompanied by an increase in cortisol concentration. To proof the effectiveness of environmental enrichment, behaviour and cortisol concentration were investigated under baseline and enrichment conditions. Therefore urine samples were collected in the morning followed by behaviour measurements. Urin-Samples were analysed for immunoreactive cortisol by enzymeimmunoassay following hydrolysis and extraction. All results show no significant correlation between cortisol levels and abnormal behaviour pattern or frequency of use of enrichment program. A daily pattern in the concentration of cortisol for the male has been compiled.
The influence of a series of factors on the psychological well-being and therewith on the cortisol concentration was discussed.

Effects of Environmental Enrichment on *Tapirus terrestris* in Osnabrück Zoo

***Anette Müller**, 2001, Thesis, completed.*

According to a study of M. Penning (1998) feeding enrichment affected the behaviour of 1,2 *Tapirus terrestris* by increasing foraging and exploratory behaviour, but they didn't react on scents and playing objects. In this study the effect of feeding enrichment on daily activity pattern and habituation by repeated offer were investigated. Moreover we tried to find out, if enrichment items have a lasting effect and modify behaviour. For this purpose the observation period was divided into three phases: baseline phase, enrichment phase and post-enrichment phase. During the enrichment phase, the tapirs received three different objects of feeding enrichment. These caused the tapirs to change both, their active and their stationary modes of behaviour as well as their spatial orientation. However, the behavioural changes only lasted as long as the tapirs were supplied with the objects of feeding enrichment. Afterwards they returned nearly exactly to their ususal daily activity pattern. Observations during post-enrichment phase indicated that the animals returned to their prior modes of behaviour. The tapirs didn't habituate on feeding enrichment and used them in constant frequency.

Reproduction behaviour of Humboldt Penguins (*Spheniscus humboldti*) in Osnabrück Zoo

***Carola Harmuth**, 2001, Diploma Thesis, ongoing. In cooperation with Pierre de Wit, Noorder Dierenpark Emmen*

Since few years Humboldt Penguins breed without success in Osnabrück Zoo. Therefore several changes in colony formation, enclosure and breeding caves had occured. At beginning of 2001 the colonie consisted of 7 males and 8 females, 6 pairs have formed.
The Diploma thesis from Doris Linzmeier (1996) points out some factors, which can affect reproductive success in Humboldt Penguins. According to these results we investigated the behaviour of the Humboldt Penguins mainly focusing on pair-interactions and selection of caves. Additionally microclimatic conditions in caves were investigated to find a relationship between fertilizing-/hatching rate and humidity/temperature. For this datalogger were put in each cave, recording humidity and temperature every twenty minutes over the whole breeding season.
In 2001 only 7 from a total amount of 23 eggs were fertilized and only 4 chickens hatched. In 3 eggs dead chickens were found. In cooperation with Pierre de Wit (EEP-Coordinator for Humboldt Pengiuns, Emmen) a questionnaire was drafted and will be send to all EEP-participant to find out, if these are common phenomens in zoos.

References

Linzmeier, Doris (1996): Pairformation, Pairbond and Reproductive Success in Humboldt Penguins (*Spheniscus humboldti*) at Cologne Zoo. Diploma thesis, University of Cologne

2.3. Research Projects in Paignton Zoo

A Survey and Database of Browse Use for Mammals in UK and Irish Zoos

Amy B. Plowman *and* ***Ian Turner***

Introduction

Most zoos recognise that fresh browse is a beneficial, if not essential, component of successful husbandry. However, in many zoos the supply of browse is not as great as keepers would wish. This problem could be partially overcome by increasing the range of plant species approved for use as browse. This range may be limited by a lack of knowledge as to which plants are safe to use for which animals, and whether this depends on specific parts of the plant, such as fruits or bark, or on particular seasons such as during early growth in spring.

Several toxic plant lists are available and easily accessible on the world wide web. However, most of these lists only refer to toxicity to humans and domestic animals. Very few include information on toxicity to exotic animals, many of which are adapted to cope with various plant toxins in ways that humans and domestic animals are not. Thus, there is clearly a need for more information on the safety or otherwise of readily available browse species for consumption by zoo animals. Thus this database was compiled to give zoos more information on which plant species have been used successfully for certain mammals in other zoos.

Methods

A questionnaire was sent to 60 zoological gardens in Britain and Ireland. Respondents were asked to list all plants (excluding commercially supplied fruit and vegetables) eaten by mammals in their zoo, whether these were provided keepers or just available in the animals' enclosure. They were asked to specify if the whole or major part of the plant was eaten or only certain parts (e.g. leaf, flower, fruit), if there had been any adverse effects of eating the plant and to make other comments such as whether plants had good behavioural enrichment value. Several commonly occurring plant species or genera were listed on the survey forms and many zoos also added additional species.

The questionnaire requested the information mostly by mammal family;

for those taxa where it was felt that browse use might vary greatly within a family e.g. between colobines and guenons, it was requested by sub-family; for those taxa where it was felt browse use would be infrequent, e.g. Carnivora, it was requested by order. In practice, many respondents also provided the genus or species name and this information has also been entered on the database. The data can thus be searched by animal order, family, sub-family, genus and species.

All responses to the questionnaire were entered into an Access database, including all comments and adverse effects. The database is designed so that a plant or animal search will only return the number of records for which no adverse effect was reported. Thus, if there were a total of 10 records for willow and gorillas but two had reported an adverse effect, eight records would be returned. Any adverse effects can be found by searching in that section.

Results

Completed questionnaires were returned from 21 British and Irish zoos and one continental European zoo, giving a total of 1827 plant+mammal records.

Plants used as browse

The total number of plant taxa recorded in the database as being used as browse is 113. Individual zoos use between two and 42 different browse types with a mean of 18. The average number of records per browse type is 16.2 but there is huge variation. Only 14 browse types have more than 50 records, another 12 types have between 10 and 50 records, 42 occur between two and 10 times and 45 are only listed once. Table 1 shows the top ten browse types used and their frequency of occurrence in the database.

Top ten browse types recorded in a survey of browse use for mammals in British and Irish zoos.

Scientifi name	***English name***	***Records***
Salix	*Willow*	*205*
Quercus (incl. Q.ilex)	*Oak*	*150*
Fraxinus	*Ash*	*130*
Fagus	*Beech*	*116*
Acer pseudoplatanus	*Sycamore*	*108*
Bambusaceae	*Bamboo*	*80*
Prunus	*Cherry,blackthorn, etc.*	*77*
Castanaea sativa	*Sweez chestnut*	*65*
Tilia	*Lime*	*61*

Mammals given browse

Responses were received for eight mammal orders encompassing 33 families or sub-families and 88 genera or species. Most records were received for Artiodactyla, but the order receiving the greatest variety of browse is Primates and the least Chiroptera..

When grouped by the taxa (order, family or sub-family) requested in the original survey, elephants clearly receive the greatest variety of browse per zoo with a mean of 15. This probably reflects the generally accepted view that browse is especially important for elephants and the need to use many types of browse in order to provide the quantities required. However, there was a huge range with one zoo using three browse types and one zoo using 31 browse types. The groups with next highest diversity of browse used per zoo, unsurprisingly, are the great apes (probably as behavioural enrichment rather than nutritional supplement) and the giraffe/okapi. Those taxa with a low mean variety of browse types provided are, unsurprisingly, the Carnivora and various grazing herbivores and, more surprisingly, the gibbons and Callitrichids.

Adverse effects

Only 35 records (1.8%) included adverse effects. Nearly half of these (17) were from one zoo and referred to gastric problems after eating ripening seed cases of oak, chestnut and beech. These are all known to be high in tannin which may be the cause of the recorded problems. Tannins are also likely to be responsible for three reported cases of changes in urine colour. Only four serious (fatal or near fatal) adverse effects were reported.

Discussion

The database is available on CD-Rom from the Federation of Zoological Gardens of Britain and Ireland. Also on this CD is a web-linked interactive list of all toxic plant information of which the authors are aware.

The database shows that most zoos could readily increase their browse supply by using a wider variety of plant species; 113 plant types are listed in the database but the maximum used by any one zoo is 42 and the average only 18. Fear of toxic effects can prevent the use of many plant species which might be readily available. In many cases this fear is well-founded, but often it is based on assumptions and myth. The adverse effects section of this database clearly demonstrates the difficulty zoos have in obtaining reliable information about plant suitability for different animals. For instance, willow is by far the most commonly recorded browse type, with

205 separate records with no adverse effects. However, one zoo stated they did not use it at all due to the aspirin content of the bark. Another example is oak which is commonly thought to be toxic due to its higher tannin content than many other temperate trees. However, it can be seen that many zoos use it with no apparent adverse effects. Some gastric problems have been noted in particular species but these appear to be related to the presence of acorns which are especially high in secondary compounds.

Hopefully, this database and the accompanying toxic plant lists will help to overcome this problem. It will enable zoos to be in a better position to decide whether it is safe to use a novel browse species and thereby increase browse provision for their animals. However, the occurrence of a particular plant+mammal record in the database without an adverse effect does not guarantee that it is safe and zoos must still use their own judgement.

Acknowledgements

We thank the staff at the following zoos for their time and effort in completing the survey forms: Bristol Zoo Gardens, Chessington World of Adventures, Chester Zoo, Colchester Zoo, Cotswold Wildlife Park, Dartmoor Wildlife Park, Durrell Wildlife Conservation Trust, Edinburgh Zoo, Exmoor Zoological Park, Fota Wildlife Park, Hamerton Zoo Park, Marwell Zoological Park, Newquay Zoo, Paignton Zoo Environmental Park, Parc Zoologic de Barcelona, Southport Zoo, Suffolk Wildlife Park, Tilgate Nature Centre, Tropical World Leeds, Whipsnade Wild Animal Park, Woburn Safari Park.

The Effect of Increasing Dietary Fibre on feeding, Rumination and oral Stereotypies in captive Giraffes (*Giraffa Camelopardalis*)

Emma Baxter and Amy B Plowman (*Full paper is in Animal Welfare* ***10****:281-290 (2001))*

Abstract

Many captive giraffes perform oral stereotypies, in particular tongue-playing, licking objects (including conspecifics) and vacuum chewing. Typically, the diet of these large ruminants in captivity consists mostly of food concentrates which are consumed rapidly and do not provide stimulation for their long, prehensile tongues. In the wild, browsing requires extensive use of this organ but in captivity browse is limited. Consequently, vacuum activities, such as mock leaf-feeding behaviour, and stereotypies may develop. Rumination is also a major component of a giraffe's behavioural repertoire. It is essential for proper digestion, but may also be connected with non-REM sleep. Inadequate opportunities for rumination may also contribute to the development of oral stereotypies. In this study we examined the effect of increasing dietary fibre on the time spent ruminating and feeding of captive giraffes and the extent to which they perform oral stereotypies. Two giraffes of different age, sex and race were studied at Paignton Zoo Environmental Park. Dietary fibre was increased by the addition of coarse meadow hay to their existing diet. Following the addition of hay, time spent feeding did not change significantly but there was a significant increase in the time spent ruminating and a significant reduction in time spent performing oral stereotypies by both giraffes; suggesting that oral stereotypies may be connected with rumination rather than feeding. Stereotypic behaviour is generally accepted to be an indicator of sub-optimal welfare. Thus, the reduction in this behaviour by the simple addition of coarse fibre to the diet can be interpreted as enhancing the welfare of these animals.

Nutrient intake and apparent digestibility of diets by captive duikers at the Dambari Field Station Zimbabwe

Amy B. Plowman (*Full paper in Zoo Biology* in press)

Abstract

The nutrient intake and apparent digestibility of two diets fed to six species of captive duikers at the Dambari Field Station, Zimbabwe, were examined. The original diet consisted of pellets, mixed grain and fruit (approximately 11% protein, 21% NDF) and the revised diet of pellets and vegetables (approximately 14% protein, 31% NDF). The revised diet resulted in an increased intake of protein and fiber and reduced intake of non-structural carbohydrate and fat and was therefore more comparable to the natural diets of duikers. The revised diet also resulted in increased intake of most minerals except sodium. Total dry matter intake increased on the revised diet but estimated digestible energy decreased. The revised diet was intended to provide 75% of calories from the pellets but in fact the revised diet as consumed resulted in 85% of calories being derived from pellets. Achievement of the lower number is recommended to decrease the intake of iron and copper. Fecal quantity was significantly greater and apparent digestibility of dry matter, protein, NDF and ADF significantly less for all species on the revised diet compared with the original. Apparent digestibility of fiber by red duikers was comparable, and affected similarly by the diet change, to that by common duikers. However it was less comparable to that by blue and yellow-backed duikers, suggesting that the diets of free-ranging red duikers may be more similar to common duikers than the other forest duikers.

The Effects of Various Management Procedures And Group Changes On A Captive Troop Of Hamadryas Baboons.

Neil Jordan, Nikki Anderson, Eleanor Condon *and* ***Amy Plowman***

Introduction

Paignton Zoo has held a troop of hamadryas baboons since 1973, when 12 individuals were introduced to new enclosure built to hold 50 animals in total. The largest part of this enclosure is an artificial rock, designed to simulate the sleeping cliffs used by this species in the wild. Additionally, there is a much smaller off-show area comprising an indoor house and outdoor cage where the baboons are confined for a short time each morning while the rock is cleaned. At other times they have free access to all areas of the enclosure.

Due to prolific breeding, by January 1999 there were 83 baboons in the troop, comprising 10 adult males each with a harem of between one and five adult females and their youngsters. There were serious welfare concerns due to overcrowding and action was needed to reduce the population and control its future growth rate. Twenty sub-adult and juvenile males were removed and all 25 adult females were implanted with Norplant contraceptive implants. Norplant prevents embryo implantation but does not stop normal oestrus cycles and their associated physical and behavioural changes. In October 2000 a further 20 individuals were removed, including an adult male and his entire family unit and a number of other juveniles of both sexes.

A study of the behaviour of the troop was initiated in October 1998, before the first management procedures, in order to assess the effects of management actions. This study has been continued with breaks until the present time. Over this time a number of natural deaths of adult males have also occurred and several sub-adult males have matured and acquired harems. This study has also allowed us to investigate the effects of these events on the troop.

Methods

General behaviour

The effects of the two reductions in troop size and contraceptive implantation on the behaviour of the troop has been assessed in two ways: by activity budgets and frequency of displacement activities (as an indicator of psychosocial stress). This has been carried out for all adult males and a random sample of adult females at three times during the year (autumn, winter and summer), every year since autumn 1998.

Female interactive behaviour

The effects of the contraceptive implants on female baboon relationships was assessed between October 1999 and March 2000 by continuous observation of all interactions of each of the adult females. Since females within a harem will 'leapfrog' the normal hierarchy when they are in oestrus it was predicted that aggression between females may increase following implantation, since they should be prevented from conceiving and therefore all come into oestrus regularly.

Male behaviour and alliances

All individuals in the troop can now be individually recognised and we know there are several father/son pairs among the adult males. We have recently been looking for alliances between adult males and any evidence that the troop may contain the other social levels seen in the wild (clans and bands) and whether these are associated with genetic relationships. Results are not available at this time.

Contraceptive effects on oestrus cycles

The effects of contraceptive implants on oestrus cycles of adult females was assessed by visually scoring the perineal swelling state of all adult females, every day since implantation. Swellings are recorded as none, increasing, maximum and decreasing.

Effectiveness of the contraceptive

Records of births, miscarriages and estimated conception dates were recorded to assess the effectiveness of the contraceptive in preventing pregnancy.

Results

General behaviour

Few conclusions could be drawn from changes in the activity budgets over time but the frequency of displacement behaviours indicated clear differences in stress levels:

Adult males showed higher rates of displacement activities than adult females
Both males and females showed higher rates of displacement activities in the cage (small area) than on the rock (large area)
Female displacement activity rates were not affected by any management procedures but are affected by season (lower in summer)
Male displacement rates were hugely and significantly reduced following both reductions in group size (January 1999 and October 2000) suggesting much reduced stress levels. They are also affected by season as for the females.
There is some evidence that female displacement activity rates increase slightly just prior to the death of their harem leaders and male rates increase slightly after the death of other adult males. This is possibly due to increased attention and herding behaviour from other males to the females of a sick male, and then to increased aggression between males competing for those females following the death of the male.

Female interactive behaviour

Most interactions of females occurred with their harem leader and were friendly. The interactions of lactating females (contraceptive not effective) were not affected by the oestrus state of others in the harem. However, the interactions of regularly cycling females (contraceptive effective) were significantly affected by their own oestrus state and that of other females in the harem:
Interactions with other females in the group were more aggressive when the female subject was in oestrus (higher status)
When no females were in oestrus there was an increase in friendly interactions between females (no competition for male)
Interactions with the male dropped when the subject female was not in oestrus but another female was. Females redirected their interactions onto juveniles at this time

Contraceptive effects on oestrus cycles

Total oestrus cycle lengths remained unchanged, at approximately 33 days, throughout the time for which the implants were supposed to be active. However, the number of days during each cycle for which the females had some level of swelling increased significantly from approximately 14 to approximately 19 days. The implants are now thought to have worn off so we will extend the analysis to investigate if this trend is now reversed.

Effectiveness of the contraceptive

One year after implantation there was a 61% success rate of the contraceptive. That is 11 of 18 females who could be assessed had not conceived (seven females were either anoestrus or suckling infants conceived before implantation so would not have conceived anyway). Two years after implantation this had dropped to 43% (10 of 23 females who could be assessed had still not conceived). Of the seven females who conceived in the first year, five did so again in the second year. In addition, six females who had not conceived in the first year did in the second year. All these six did so between 17 and 21 months after implantation suggesting that the longevity of the implants is closer to 18 months than the two years originally predicted.

Assuming conception occurs on the last day of the maximum perineal swelling of the last observed oestrus cycle, the average gestation length was 162 days with a minimum of 106 days and maximum of 184 days. One female was observed to have visual signs of oestrus (perineal swellings) regularly throughout her gestation.

Conclusions

Analysis of displacement behaviour, indicative of social stress, implies that the two decisions to remove individuals from the population had the desired effect of enhancing the welfare of those baboons remaining. This effect was very noticeable for adult males.

Although antagonistic interactions between females were more frequent when they were in oestrus, and the contraceptive resulted in many females coming into oestrus regularly without conceiving, there appear to be no detrimental effects on their welfare. Displacement behaviours and time budgets were not significantly affected.

Norplant implants reduced the birth rate of the population, seemingly without adversely affecting the welfare of the troop. However, they were effective in preventing pregnancy in only 61% of females and the longevity seems to be only approximately 18 months. If available, a more effective and longer lasting contraceptive would be more suitable for managing population growth in this species.

Mechanisms of Social Conflict within Bachelor Western Lowland Gorilla (*Gorilla G. Gorilla*) Groups.

Kirsten Pullen

Introduction

Although some data is available for bachelor groups of mountain gorillas in the wild, there is still some dispute as to whether bachelor groups exist for the western lowland gorilla. However, the establishment of bachelor groups in captivity has been considered a necessary husbandry step in response to growing concern within the EEP for the limited number of breeding situations available compared with the number of males produced. The bachelor group of five unrelated gorillas at Paignton Zoo provides an excellent opportunity for research into the mechanisms of social conflict within the group. This PhD study aims to provide a detailed picture of the behavioural aspects of the bachelor group here at Paignton as the individuals mature. It will also provide a large body of information on the social mechanisms involved in a bachelor groups in comparison to those of breeding groups. The data provided by this PhD will enable the zoos to assess the effect of bachelor groups on the long-term welfare of individuals and to increase the success of the captive breeding programs. The data will also provide detailed information of use to conservation bodies working with gorillas in Africa, in particular the orphanages providing care and rehabilitation for young gorillas orphaned by the bushmeat trade.

Hypotheses

I will be comparing the social mechanisms within bachelor groups to those within breeding groups to examine the hypotheses listed below.

The absence of females will lead to a reduction in the intensity of aggressive incidences (Johnstone-Scott, 1988) therefore, bachelor groups will exhibit lower frequencies of “escalated” aggressive incidences.

Bachelor groups will exhibit higher frequencies of “non-escalated” aggressive incidences, tolerance behaviours and avoidance of conflict behaviours. The relationships within the group, particularly with the younger, sub-adults will be regularly tested through squabbles, play fighting and display to re-affirm dominance.

Bachelor groups should show more intervention behaviour by 3rd party animals demonstrating greater alliance formation. This should be particularly obvious with the reduced available space, inherent in captivity, for avoidance and tolerance techniques to be practiced. In addition the presence of homosexual behaviour should be expected as, for gorillas, it is thought to indicate sexual behaviour rather than dominance behaviour and the silverbacks are seen to compete and display for access to the sub-adult and blackback males. This could also indicate an increase in alliance formation within the group.

The frequencies of "escalated" aggression will increase over time as blackbacks become mature adults and develop the silverback. In addition, frequencies of "non-escalated" aggression, tolerance and avoidance techniques will decrease. The young silverbacks will test the alpha male for dominance as an increase in the benefits from aggression becomes more obvious.

Methodology

I will be comparing a number of established bachelor groups with a number of established breeding groups by collecting non-invasive frequency data on social interactions to determine the effects of competition for females on social conflict mechanisms. I will also be investigating the dyadic and triadic interactions between specific individuals to establish alliances and third party interventions. Data will be collected in a threefold basis.

A baseline on activity levels within groups to give comparative activity budgets between institutions, coupled with an investigation of enclosure use.

A baseline on aggression, avoidance of conflict, tolerance and sexual behaviours, coupled with dyadic/triadic investigation.

Post-event / matched pairs data focusing on aggression, avoidance of conflict, tolerance behaviours and sexual behaviours within the group.

My position at Paignton will allow me to examine the effects of time on a stable bachelor group, including the transition of blackbacks to silverbacks within a group with an established silverback.

I would like to request that any institutions with any information they feel may be relevant, or with bachelor or breeding gorilla groups that may be appropriate to the study and who wish to participate, to contact me through Paignton Zoo.

3. Individual and Students' Projects

Feeding and sexual behaviour in captive *Testudo hermanni*

Nikoletta Chronopoulou

Feeding behaviour and interactions between males and females have been examined on Greek tortoises (Testudo hermanni). The observation has been carried out at the outdoor terrarium in Stein. Two species of tortoises-Testudo hermanni and Testudo graeca- live there together in an outdoor terrarium of about 25 m^2 size. The size of population is 34 animals (27 T.h. and 7 T.g.). The study group consists of 17 adults of Testudo hermanni.

Experiment and questions:

Food is being hidden on different places in wooden boxes inside the enclosure. The feeding places are being changed at regular intervals. Additionally one feeding place is marked in red. The aim of the experiment is to find out:
How long does it take the animals to find new feeding places? Does an active search for the preferred food take place? Does the color influence the choice of food?

Method:

Scan sampling: Every 5 minits is recorded which animal is at which feeding place.
Interaction between males and females.There are two active males in the investigation group. The behaviour of courtship, display and mating are being investigated.

Questions:

Do the males prefer any females? Is there rivality between the males?

Method:

Focal-Animal-Sampling : The males are being investigated alternatively for 10 min each and all behaviour is recorded.

Interactions after socialization of two primate species living in family groups

Cilly Ottemann

This work aims to study which **advantages** and **disadvantages** can be observed if two different species are brought together in one enclosure. The **socialization** of **emperor tamarins** (*Saguinus imperator*) with **pygmy** marmosets (*Cebuella pygmaea*) and that of **red-handed tamarins** (*Saguinus midas*) with a **white-faced saki** (*Pithecia pithecia*) are observed in the Gettorfer Tierpark.

All these species mentioned above are New World Primates which inhabit rain-forest areas near the Amazonas and other regions of the north in Southamerica. The diet includes fruits, insects, seeds, small birds or bats and exudates on which the pygmy marmosets are specialized.

Marmoset and **tamarin social groups** (callitrichines) consists of a single breeding female which typically gives birth to twins. Males play a major role in the care of infants and are transporting them most of the time while other group members take care of infants as well.

Callitrichines have long trunks, tails and legs. **All digits end in claws** except the great toe which is an exclusive characteristic of these primates.

Sakis have broad noses, bushy furs and long fluffy tails. They are most commonly seen in the understory and lower canopy levels, where they move by leaping. Their **social organization** may well be more a **fission-fusion** structure than one of strict monogamy. Saki monkeys have single births and the young are cared by the females.

Mixed species keeping should be an "environmental enrichment" for species in captivity. They are stimulating each other by observing what the others are doing. Especially the two pygmy marmosets are very vigilant because the emperor tamarin group consists of four animals which are much bigger than the two pygmy marmosets.

Several points are of interest during the observation including **activity**, **social structure**, **feeding**, **reproduction**, **play** and time spent for **intra- or interspecific activities** like grooming for example. In the beginning of the work the animals had to be identified individually and now an **ethogramm** has to be made for the four species. Observing the animal's behaviour for the ethogramm is still going on right now.

The main observations started in April 2001 and the collection of data is done by using combined **scan** and **focus sampling**.

John G. Fleagle: Primate Adaptation & Evolution. Academic Press, Inc. 1988

Thesis available now

Terrain-utilization of the *Callithrix jacchus* in the zoo Ueckermünde

Esther Martens

General information:

Callithrix jacchus are frequently kept in human hand or in research-facilities because of their small body size and their high reproduction potential.

Therefore quite a lot of information about their behaviour and their reproductive physiology exists but there is still no complete information about outdoor behaviour.

To fill this information gap it was my work to study the observation of the *Callithi* while outdoors.

The observed group contained a couple and their two young ones. The four monkeys had the possibility to use the whole area of the zoo as well as the existing heated indoor cage.

The study showed that all four animals constantly remained in contact without leaving the group. The monkeys did not use the whole territory, only a small part of it. The way there and back were the same every time. Most of the time they got their food themselves, instead of using the provided food inside the cage. The small monkeys showed no stress or unrest in the free-terrain, they warned each other with a loud whistle in case of danger (e.g. birds). Even though it was raining they preferred to stay outside looking for suitable shelter such as an abandoned nest. Another interesting thing was the fact that the appearance of visitors did not seem to disturb them in their behaviour on the contrary they were very curious. In the indoor-cage they were rather more shy than trustful.

The most frequent locations of the monkeys were in the treetops, mainly in high branches above but also in the low tree and shrub zone. Rather rarely I observed the monkeys on the ground.

With a good conscience I can say through my observation that the *Callithrix jacchus* are suitable semi-free ranging conditions in summer in Northern Germany.

The anthropogenic influence on the social behaviour of captive monkeys

***Alexandra Schwarz**, University of Kiel, C/O Working Group Dr. Böckeler, Department of Zoology, 24098 Kiel, e-mail: schwara@hotmail.com*

During the last couple of years there has been a considerable interest in improving the environment of captive animals. Most of the work has centered on the enrichment of the environment by addition of devices. Nowadays a trend can be observed to build walk-trough enclosures and allow the feeding of animals by visitors in certain cases (e.g. petting zoo). The presence of visitors could be a stimulation to enrich a stimulus-poor environment. In this case the visitor acts as a behavioural enrichment for the animal, but the presence of a stranger could also lead to an increase in the level of stress above the level, which would be in the best interest of the animal (Chamove, A. S. et al., 1988).

This thesis is conducted to figure out, if the presence of visitors and the feeding of the animals by visitors have an influence on the social behaviour of monkeys. Three species of monkeys are observed in the Tierpark Gettorf since February 2001. For each of the three species different forms of visitor contact occur. For one primate group, the black mangabeys (*Lophocebus aterrimus*), there is no direct contact with the visitors possible, because the feeding of these animals is not permitted. For another group, the ring tailed lemurs (*Lemur catta*), contact with visitors occurs twice a day during a guided tour through the open-air enclosure. During this tour, which lasts normally less than one hour, the visitors are allowed to feed the animals with provided fodder. During the rest of the day feeding is not permitted. The last group of primates are the Sulawesi crested macaques (*Macaca nigra*). These animals can be fed with zoo-provided fodder, e. g. peanuts, all the time. The behaviour of the monkeys is recorded using a combination of scan and focal sampling. During the focal sampling the data are recorded continuously while the data collected via scan sampling are recorded in the time sampling mode using instantaneous sampling (Martin, P.; Bateson, P., 1993). The social behaviour is recorded during the presence and absence of visitors. The data collected during the presence of visitors will be compared with the data collected during the absence of visitors to see, if significant differences occur. This work aims to study how the behaviour of monkeys changes due to the presence of visitors.

Special interest is laid on the influence that the feeding of animals by

visitors has on the behaviour of these animals. It has to be figured out if visitors providing food act as a behavioural enrichment for the animals (e.g. increase the amount of time spend foraging) or if they are an additional stress factor (e.g. increase the amount of time spend in agonistic behaviour).

Chamove, A. S. et al., 1988: Visitors excite primates in zoos Zoo Biology 7:359-369

Martin, P.; Bateson, P., 1993: Measuring behaviou. An introductory guide. Second edition. Cambridge University Press

Thesis available now.

Scientific approach to assess welfare and its causes in captive orangutans(*Pongo pygmaeus*, Hoppius, 1763)

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Thanks to Zoos in Münster, Köln, Berlin, and San Diego (USA)
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In this ongoing quality of life study I am working on two main topics. First aim is to operationally define variables that measure welfare in captive orangutans. Second topic is to find out which parameters contribute to welfare in orangutans. Both is strongly recommended by the international studbook keeper Lorraine Perkins.

Common methods to assess welfare are measuring activity, diversity of behaviour, reproduction rate and occurrence of stereotypies or abnormal behaviour. Some of these are not standardized in definition and measurement. Therefore these rather classical methods will be compared to a new one I developped being tested and hopefully established. Presupposed that the orangutan is not a solitary ape by its evolutionary origin I assume that facial expression and body posture survived as a means of communication. Because of that animal welfare status should be expressed by those two and could be judged by naïve (students) and professional (keepers) observers through videotape analysis.
Afterwards the hypotheses that an animal´s welfare depends on its social and/or inanimate environment will be tested.
Enclosure parameters (inanimate environment) are number of loose, movable and unmovable elements, quality of elements i.e. natural or artificial, useable area and volume, way of feeding etc.
Social parameters are group size and composition, dominance hierarchies, sex ratio, and opportunity of female choice.
For that data will be collected in several different Zoological Gardens mainly in Europe, but also in the USA.
Observing each individual´s behaviour by focal animal sampling will provide data on behaviour patterns, activity, diversity of behaviour, stereotypies and its interrelations with the use of enclosure parameters. Further-

more instantaneous scan sampling will give information about each individual's place in the enclosure at a certain time and there-fore about group cohesion and interaction. Use of outdoor enclosures will be correlated to some weather parameters like temperature, humidity, etc.
Multivariate statistical methods will show which environmental parameters are responsible for welfare in captive orangutans. From these results new questions and hypotheses will derive.

Petromus typicus: reproductive biology of a poorly known animal

***Andrea Mess**, Institut für Systematische Zoologie, Museum für Naturkunde, Humboldt-Universität zu Berlin, Invalidenstr. 43, D-10115 Berlin.*

Introduction:

Petromus typicus (Rodentia, Hystricognathi) is an endemic rodent of the Southern African Subregion. It has a long and obviously successful history in xeric rocky habitats, e.g. it is the oldest rodent inhabitant in the Namib (Meester 1965, Skinner & Smithers 1990). Accordingly, it has to be regarded as an animal that copes well with the increasing aridity in this region. Thus, *Petromus* can serve as a model species for the understanding of global change processes due to aridisation. However, important aspects of the biology of *Petromus* are poorly known (e.g. reproductive biology, social structure, cf. Skinner & Smithers 1990), and information on the biological role and presence of defining characters of Hystricognathi were not available a few years ago (early ontogeny and placentation (Luckett 1985)).

Objectives: In order to complete our knowledge on *Petromus*, a breeding group was established. The most important results concerning reproductive biology in captivity are summarised below. See Mess (1999, and in press) for first results on placentation.

Material: The establishment of the breeding group started in 1995 on the basis of 8 animals from RSA. The group is now housed at the University of Berlin and was formerly bred at the universities of Tübingen and Göttingen. It is the first successfully established breeding group in captivity which could be maintained over a couple of years.

Results:

Breeding:

1.)Successful breeding requires the establishment of stable pair bonding. Unfamiliar animals show strong aggressive reactions, but close interaction occurs between partners, including extensive grooming and sharing of the nest or sleeping chamber. The introduction of partners usually lasts about a few weeks and must be surveyed by the animal keeper to control aggressive behaviour.

2.) Both partners are involved in raising of offspring. Older siblings are also integrated in raising of young. Aggressive reactions between siblings of different age were not observed.
3.)Till now 38 births from 11 females occurred. 75% of the new-born survived. Females produced from 0 to 9 births.

Birth and Pregnancy:

1.)In the majority of cases, one or two young are born. Only on one occasion, all individuals of a litter of three new-born were born alive and raised successfully. The average number of new-born is 1.7.
2.) Females gave their first birth at an age of 10 to 26 months, with an average of 14.3 months.
3.)In one case a female was isolated after copulation, indicating that pregnancy at least lasts 12 weeks. According to the shortest distance of births, pregnancy lasts between 84 to 91 days. In many of these cases postpartum copulation were observed.

Development

1.)New-borns are fully furred and have open eyes. Immediately after birth, they were able to climb and show flight reactions.
2.) Birth weight ranges from 11.5 to 23.5 g with an average of 17.5 g, according to data from 27 individuals (13:14). No significant difference in birth weight occurred between the sexes or between new-born from larger or smaller litters. However, females from 3-4 months onwards are usually heavier.
3.) Data indicate that *Petromus* reaches the adult weight at about one year of age.
4.) The life span in captivity is at least 3-5 years.

Discussion:

Reproduction in *Petromus* appears to be a slow process in comparison to other small rodents of the Southern African Subregion such as Muroidea, Gliridae and Sciuridae (c.f. Skinner & Smithers 1990). Striking characteristics of *Petromus* are the late date of first birth and the long duration of pregnancy. Additionally, the small litter size indicates a "low reproductive potential" (Withers et al. 1983). Data on ultrasonography and histological development of the embryo and the placenta referring to the mode of reproduction are provided by Mess et al. (2000). For example, even 5 weeks after copulation, when other rodents already gave birth, the placenta is not well developed and within the interior organisation of the embryo cartilage and bones are still lacking. Data suggest a slow devel-

opment even during pregnancy. The placental system seems to be adapted to cope with low energy input in terms of intense nutrient and gas exchange (Mess, in press). As a specialised herbivore, *Petromus* focuses on nutritional resources with high fibre component, i.e. low energy content (grasses and leaves, see Withers et al. 1980, George 1981, Skinner & Smithers 1990) and has to cope with a low energy supply. Thus, the current working hypothesis is that a valuable strategy to cope with xeric habitats and limited resources has been established.

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Different types of oestrous cycles in two closely related species of South American rodents (*Cavia aperea* and *Galea musteloides*) differing in social and mating systems

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Keywords
Cavia aperea, *Galea musteloides*, Guinea Pigs, Oestrous Cycle, Oestrogens, Progesterone, Social and Mating System;

In a comparative approach two closely related species of South American rodents were investigated: the wild cavy (*Cavia aperea*) and the yellow-toothed cavy (*Galea musteloides*). These cavies inhabit ecologically different habitats and show divergent social and mating systems. In *Cavia* a polygynous mating system emerges, while in *Galea* promiscuous mating occurs. These observations correspond with functional variations in the males' reproductive patterns (e.g. sexual dimorphism, testis size, sperm characteristics), which might be interpreted as adaptations to different reproductive patterns in the females.

In order to elucidate differences in characteristics of the females' oestrous cycles 22 *Cavia* and *Galea* females (eleven of each species) were investigated. The experimental design consisted of three successive stages, during which the females' reproductive cycle was monitored by checking the condition of the vaginal closure membrane, analysing vaginal smears and determining serum concentrations of oestrogens and progesterone.

The results revealed different types of oestrous cycles in the two species. *Cavia* females showed periodical cycles with spontaneously occurring oestrous periods, ovulation and *Corpus luteum* activity. In contrast, in *Galea* females the oestrus was exclusively induced by the presence of a male. After the induction, however, a spontaneous ovulation and *Corpus luteum* activity were observed. To our knowledge this type of oestrous cycle has not yet been described for any other mammalian species.

It is discussed whether these differences in the females' reproductive patterns evolved as adaptation to ecological conditions of the habitat and in which way they might have shaped the evolution of the divergent male mating strategies in the two species.

Pack formation and social behaviour of dhole *Cuon alpinus* in captivity

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The Asiatic Wild Dog or dhole *Cuon alpinus* is rarely kept in zoological institutions. The dhole resembles a large red fox, the coat varying from sandy yellow to reddish colour. White patches on throat, chest and belly as well as on the inner parts of the legs and a black bushy tail are further characteristics. Its dental formula is unique among the dog family. Two molars of the lower jaw are missing as adaptation to a diet consisting nearly totally of meat. The dogs hunt in packs and are highly social. In the wild, the animals are very difficult to study. Because of habitat destruction and persecution the remaining populations are declining fast. The lack of knowledge about the vital needs of the animals to ensure successful captive breeding makes it difficult to establish a captive breeding programme. Until today many data about the dogs are discussed controversially, for example the age of sexual maturity is given as one, two or even three years. Some state a reproductive suppression of females other than the alpha-female, others report communal breeding of several females within the same pack. Clearly, data about optimal sex ratio, group size, minimum enclosure standards etc. to found and maintain successful packs in captivity are urgently needed.
Since February two pack formations in different housing systems (conventional versus landscape enclosure) and with different sex ratios (2,1 versus 2,2 and currently 1,2) have been observed continually at Schwerin Zoo.
Further observations are dedicated to the mating and helping system within packs.

Examinations and plans to optimise the conditions of captivity ofEuropean Otters (*Lutra lutra*) and Asian small-clawed Otters (*Aonyx cinerea*)

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The principle aim of the present thesis is to acquire some helpful information for zoo architects in designing optimised enclosures for European Otters and Asian small-clawed Otters. As a rule architects don't have profound knowledge of the ecology and ethology of otters. The first chapter of the paper points out these aspects. By examining and compiling the available literature the following questions are answered: What are the morphological and physiological particularities of the two otter species? Where are their ranging areas? What are the distinguishing features of their habitats? What is their natural behaviour? etc.
The second chapter imparts knowledge of the current keeping of otters. In order to deal with this problem the author examines the studbook and articles in technical journals about reproduction, breeding, nutrition and diet. The results are for example that shallow waters with a depth of max. 0.15 m seem to be an important necessity for mating and teaching the young cubs in swimming; or that male Asian small-clawed Otters help in rearing the cubs, so that a well structured enclosure for separating the male is not absolutely necessary (in contrast to the European Otter).
In order to analyse the behaviour of captive otters, especially the data of activity from 1989 to 2000 of European Otters in the Zoo Hoyerswerda (Saxonia) are evaluated.
The four main results are: 1. - The feeding time determines the time of highest activity. 2. - Otters prefer underwater entrances, especially in daylight. 3. - The otters in the Zoo Hoyerswerda seem to have two mating seasons in May and December. 4. - Otters mainly use the (unheated) pool in summer from June to September.
After having interpreted and concluded these results, the next chapter presents seven enclosures for *Lutra lutra* (Görlitz, Hoyerswerda, Köln,

Krefeld, Leverkusen, München, Osnabrück) and four enclosures for *Aonyx cinerea* (Braunschweig, Cottbus, Dresden, Köln) inter alia with photos, architects and ground plans. The author visited nine of them, send questionnaires to the two others and interviewed the zoo keepers and directors to get suggestions and recommendations for optimised enclosures. The previously acquired knowledge of the biology of otters was finally combined with the knowledge of existing enclosures so that several recommendations could be made about size, structure, sleeping and breeding boxes, entrances and fence. For example: indeed Asian small-clawed Otters are more terrestrial than other otter species, but they are not afraid of water and also use deep waters; the length of the banks is more important than the total size or the water-land-ratio; the change of different requisites on the small area is decisive for the quality of an enclosure.
Finally the author discusses whether the European Otter or the Asian small-clawed Otter is more suitable for German and Middle European zoos. Corresponding to the main four duties of zoos – conservation, research, recreation and education – advantages and disadvantages of each otter species are discussed so that the zoo direction could carefully consider the different arguments and make a decision on its own.

"Mixed-species keeping of Californian Sea-lions (*Zalophus californianus*) and Bottle-nosed Dolphins (*Tursiops truncatus*) in the Nuremberg Zoo"

Wolfgang Sening *supervised by PD Dr. Udo Ganslo*ß*er; Contact:wolfgang@sening.de or Udo Ganslo*ß*er*

Part 2 of an abstract of a thesis for a diploma, (Part 1: Research Committe Newsletter, 7 th Issue, 08/2000, pp. 55-59)

The Nuremberg Zoo contains a main dolphinarium, which consists of a large presentation pool, a round training pool and a portion of several seperate small pools, the resting-basin-area. There it is possible to observe one of the few societies of Californian Sea-lions and Bottle-nosed Dolphins. Both species are frequently being kept in zoos, but rarely together. In the dolphinarium a total number of 4 dolphins and 6 sea-lions are being kept.

Methods:

The three basins of the dolphinarium were observed from the edge of the basins and the Focal-Animal-Sampling was applied. After 10 min of observation, the focus-animal was changed and even the sequence after one week. For the evaluation, the observation period was splitted into 5 sub-observation-areas (SOAs), each containing 13 days of observation. The behaviours of the animals became statistical appraised (with SsS-Rubisoft and MS-Excel). (For statistical information, please contact the adress in the headline). The hypothesis for the examination was:

Conclusion:

Behaviour of the sea-lions:

In summary it can be noticed that the sea-lions live together socially, also in the normally sexually separated time, without showing sexual behaviours. Josephine was obviously not able to establish the same level of social relationships, in the time she was without her mother (as closest social partner), towards the other sea-lions. In the entire observation period, Ella and Tiffy were a frequently interacting couple. Mike became rut by the estrus female Farah and showed mating-behaviour towards the

adult Sea-lion females. They even responded, after frequent courtship-behaviour by Mike, with mating-behaviour. After the combinations, the contact-frequency reduced itself between the bull and the females again.

Behaviour of the dolphins:

A linear, stable order was observed between Moby, Anke and Nynke, in the entire observation period. The classification of Jenny on the same ranking-level with Nynke below Anke and Moby was recognized unambiguously only in one period. All porpoise-females reduced the quantity of the inserted food to the end of the SOA 3. In the following time, Jenny ate much less than in the first three SOAs. Moby, who showed a very unsteady intake of food in the first three SOAs, clearly stabilized the ingestion to the end of the SOA 3. Possibly, the changes, above all with Moby, indicate a better physical and psychic condition. Maybe, the unclear position-structure was a strange stress-factor for the already, very old porpoise-bull.

The feeding lists can serve however only as a hint. The offering of food served also as an education-measure throughout the trainers. Summarizing, it was possible to determine that a very active exchange of socio-positive contacts took place, espazially between Jenny and Nynke. The position-higher female Anke had more socially-contacts to Moby than the other females. She was a type of a social core in her group, that was attached on the one hand to the frequently interacting couple Jenny and Nynke and on the other hand to the already old dominant male Moby.

Behaviours between the species:

The ranking-order (with Moby at the top, followed by Anke, who was dominant to the porpoises Jenny and Nynke as well as to the sea-lion Mike and at least the sea-lion females on the lower end) represents a confirmation of the frequently low arrangement of the order in the lower rankings, within linear societies (Vogel et al., 1998). The avoidance of fights between the two species of this individualized association (kept in limited space) seemed to work well throughout a between-species-like ranking-order. In contrast to that, a society of dolphins and fur-seals (in the 1970´s), was not successfull, because of strange aggressive tendencies by the porpoise-bull towards the sea-bears (Information by Klinckert, 2000). Obviously, the between-species-like ranking-system didn't work as well, presumably because of the, at that time better physical fitness of the porpoise-bull. In general, a simplification (linearity) of the ranking-system can be observed under the conditions of domestication and zoo-keeping of mammals (Vogel et al., 1998). Probably, for Mike, as well as for Ella,

the porpoise-social-partners did not represent between-species-like sexual-partners, but new interesting playmates. The special-position in the behaviour of Jenny tosses up the question of a reason for it. Possibly, the reason can be actually located in a tactical manipulation or in a sexual intent. Unfortunately, a final clarification is not possible, because, for example the behaviours of the animals were not observed before this observation. A continuing examination is probably not possible under the same conditions, because of the state of health of the porpoise Moby. Nevertheless the aggressive behaviour of the porpoise-bull seems to be a sign in itself. The bull acted aggressively almost exclusively against Mike and Jenny, against Nynke and Ella almost never. The between-species-like social-relationship between Jenny and Mike seemed to bring in disadvantages (perhaps a destabilized ranking-order) to the porpoise-bull or seemed to be an attack to privileges (perhaps combination), so Moby tried to prevent the interaction. A possible explanation for the between-species-like behaviour patterns could be the playing-behaviour and exploration-behaviour. A direct advantage of the behaviour must not necessarily become recognizable with it. The most reasonable explanation for the behaviours in the dolphinarium is founded in the playing-behaviour, because no serious advantages of the between-species-like contacts are recognizable otherwise. Presumably the contacts did not represent manipulative or tactical behaviours. The increase in the ranking (for Jenny, while swimming with Mike) seemed to be a reason for the aggressive behaviour of Moby, but altogether this position-increase is perhaps a more accidental product of a between-species-like playful behaviour. On the basis of the short observation time of this examination, no statement can be made to the fluctuation and quantity of behaviours within the whole year. However the change in the quality and quantity of the social-behaviours (with the porpoises as well as with the Sea-lions) was recognizable in all SOAs. In the wild, the seasonal fluctuation presumably represent adaptations to the environmental conditions, that did not appear under the largely constant conditions of the dolphinarium.

The causes for the formation of between-species-like contacts and their continuation to social relationships, as they are described above, are a complex network of environmental conditions, behaviours (e.g. playing-behaviour, exploration-behaviour) and possible experiences of the animals in the homestead. A final clarification of the formation, also why only a part of the population participated at the contacts, is not possible.

A more detailed summary and literature list is available via U.G.

Characterising habitats used by manatees (*Trichechus manatus manatus*) in two lacation in French-Guyana

Thomas Spiegelberger, *Proposal for a master thesis (Diplomarbeit) at he Technical Univerity of Muinch-Department of Ecology*

Introduction

Kwata NGO is a French Guianan organisation aiming to conduct conservation actions, through ecological studies, management recommendations, and people education. Among various programs (for details, see the web site on www.kwata.ora), Kwata initiated studies on some emblematic and flagship species, such as giant otters, primates, marine turtles, black caimans.

For a better understanding of the complex ecological situation of estuaries in French Guiana, Kwato NGO decided to run a research program on the manatees, which live in transition zones of salt and fresh water.

For this project, they could win the University of Erlangen-Nuremberg, Department of Zoology, as a partner who will lead further research on the manatees in French-Guiana.

The West Indian manatee (Trichechus manatus manatus), completely protected in French-Guiana continues to be threatened by extinction due to various changes of their habitats, increase of (eco-)tourism and in some rare cases hunting.

Its distribution and its status of conservation is quite well described for Florida, Mexico, Costa Rico, Venezuela, Brazil and even for Guiana.

In contrast the population and its habitats in French-Guiana, situated between Brazil and Venezuela, are virtually unknown.

In order to close this gap, Kwata conducted during the year 2000 a large and rather exhaustive interview survey all along the coast, mainly with fishermen, to assess the manatee distribution status in French Guicina. These preliminary results will be published in the early 2001 by Taivy G., de Thoisy B. (in preparation).

The second step is now planned, and is will be focused on a better habitats characterisation what will become subject of this 'Diplomarbeit" (master thesis).

Conceptual framework

Three major sites has been identified by Kwata NGO. Out of these locations the two sites which provide best access will be chosen and will become subject of the research. This is the estuary of the 'crique" Malmanoury (b) and the estuary of the Maroni (a),

Satellite data et aerial images

As a first approach satellite date and aerial images are to be examined. Together with maps this will lead to the identification of different zones. According to Morales Vela, Olivera Gomez et al. (2000) these con be grouped or divided to 4 habitats types: river, lagoon, coast and "criques" (small rivers).

Boat surveys

Boats surveys are carded out regularly In the whole study area during the research.

Throughout a period of three to five months biotic and abiotic factors like atmospheric and water temperature, winds, cloudiness, depth, salinity, grass and algal abundance (compare Axis Arroyo, Morales Vela et al. (1998)) will be measured in order to characterise ecological condition in all the potential manatee habitat.

With the aid of local fishermen and other people who have already observed manatees the real habitats are to be located. This leads to a third systematic of the manatee habitats and will give us an overview of all habitats on the site.

Comparison of the different habitats

By using GIS-program these three different kinds of habitats will be overlaid and compared.

Working with this method allows to find all habitats (potential and real), even if errors are committed in one of the different stages of the project. By missing one area in the first step (analysis of satellite data) it will be found in the next level of research or at least in the third stage (observation). The program can then be adjusted and the project continued on the new the base of potential habitats.

GIS-programs will be used to draw maps showing the size and the distribution of the potential habitats and of the real existing manatee habitats of each level of the research.

Expected output of the study

Different types of manatee habitats will be identified and described considering different biotic and abiotic parameters.
These results can be used to make further research on the manatees of French-Guyana easier. This study can serve as a basis to initiate a management plan for areas where manatees occur.
Also the outcome could be used to design an exhibition or leaflets to inform the public about the manatees and their habitat. This part of the study will be done by the KWATA.
By better knowing where the animals live it will become easier to protect those zones from damage and destruction.

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Thesis available now.

Endocrine and behavioural correlates of musth in captive African elephants (*Loxodonta africana*)

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The phenomenon of musth in male African elephants, *Loxodonta africana*, was first recognised in the early 80's, but its physiological correlates are still poorly understood. Musth is a complex phenomenon associated with increased aggressive behaviour and elevated androgen levels, and although not absolutely necessary for breeding, it is regarded as a part of an important reproductive strategy in free-ranging animals. Further research is however required to determine what initiates musth and what are the mechanisms underlying the associated physiological and behavioural changes. Therefore the overall aim of this study is to describe the behavioural characteristics and endocrine correlates of musth in captive African elephants in order to better understand i) what clearly defines musth, ii) what initiates musth and iii) what determines the intensity and duration of musth and the level of aggression. The study is being conducted on a total of 15 subadult or adult elephant bulls located in 12 different zoos world wide. Faecal samples and observational data are being collected on a once weekly basis over a period of not less than 15 months and in cooperation with *Save the Elephants*, sample and data collection from free-ranging bulls will be carried out for comparison. A clearer picture of musth would not only be of scientific interest, but would also be help to improve the management of bulls in captivity (particularly in terms of safety and animal welfare) as well as population management in the wild. This study forms part of the *Cabarceno Elephant Research Project,* and is funded by *Cantur SA*, Spain.

Evaluation of the onset of reproductive function in the female African elephant

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Over the past years there have been increasing reports that young elephant cows gave birth to the first calf at an unexpectedly early age. It also seems that there are marked differences in the onset of ovarian cyclicity between individuals and locations which might be explained by the origin of the animals, in particular, whether the elephants are wild caught or captive born, or other factors, such as social environment and presence of a bull. This study aims to determine the age at which captive African elephant cows start to exhibit ovarian cycles. Non-invasive hormone analysis in weekly urine samples is carried out in 27 females between 4 and 10 years of age, located in 11 different zoos and safari parks all over Europe. Body development and growth of the individuals are monitored by regular records of weight and / or size. In order to define the impact of social factors, group structure and ranking order of animals are documented and changes of genital appearance and unusual behaviour are recorded. Preliminary results show that ovarian cycles occur in captive African elephants as young as 7 years of age. Data also suggest that there is a correlation between onset of reproductive function and social status in the group.

The effect of animal transfer on reproductive status and stress level in male and female African elephants (*Loxodonta africana*)

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Although the reproduction rate of African elephants in captivity is still extremely low, facilities breeding this species successfully must be aware of possible inbreeding once the bull´s daughters reach puberty. For this reason, future recommendations of the EEP consider exchanges of bulls rather than transfer of cows for breeding loan. This will also much more reflect the natural breeding situation since in the wild bulls are moving around in search for oestrus females. However, transfers of captive breeding males have not been performed so far, and there is no information on its impact on the bull itself, as well as on the elephants in the group he leaves behind and is introduced to. This study is therefore designed around the transfer of the 21 year old bull CALIMERO from a situation without cows of his own species (Rome), to a facility with two potential breeding females (Basel) and later to a facility with five females in breeding age (Beekse Bergen). Reproductive status of the cows is monitored by measurement of urinary progesterone metabolites, androgen status of the bull by measurement of urinary testosterone metabolites. Levels of urinary stress hormones will be determined in all 12 animals involved in this transfer. Changes of the social structure of the groups are documented as well as oestrus and sexual behaviour. The results of this study will provide practical information on the effect of transfers on elephants and thus help to improve future efforts in relocating animals for breeding purposes.

Foot problems in Indian Rhinoceroses (*Rhinoceros unicornis*) in zoological gardens: Macroscopic and microscopic anatomy, pathology, and evaluation of the causes

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Summary

Foot problems are a common finding in Indian rhinos kept in zoological gardens. Causes and prevention were up to now not scientifically examined. This study was set up to evaluate the occurrence and causes as well as the basic anatomical knowledge of the feet structures from zoo and wild animals. For this purpose 32 (13 males and 19 females) of 35 (15/20) Indian rhinos, living in 11 European zoos, were examined. In addition, a detailed anatomical study was performed on 6 feet of 2 deceased Indian rhinos. Samples of 18 hooves and 19 foot pads from 10 adult zoo animals were histologicaly studied. These results were compared with the findings of the macroscopic foot structures from 10 wild Nepalese animals.

The results show that all breeding bulls (11) as well as 50% of the adult females suffer from chronic foot problems. These problems show as cracks behind the central sole and the adjacent pad. Histologically, this area is made up of two different structures. The horn of the sole is hard and consists of long, thick, and almost straight running horn tubules. The adjacent soft pad is made up of small, thin, and undulating horn tubules. Wild animals do not seem to be affected by these pathological alterations. Their pad appears hard and thick and the soles are long and concave. The apical part of the pad does not seem to carry much weight. Due to hard and abrasive flooring material in indoor and outdoor enclosures, most zoo animals have thin pads and short and flat soles. They foot mainly on the pad. Chronic strain on this highly sensible and fragile area will lead to pathological alterations.

To prevent foot problems, husbandry aspects need to be change with emphasis on the provision of soft and non-abrasive flooring material. It is likely that less pathological problems will occur if the feet have a natural shape and if the weight is mainly carried be the weight-bearing border and the soles.

The aim of the study was to give a detailed description of the anatomy of Indian rhinoceros feet, to enlighten the courses, and to give recommendations how to prevent the occurrence of foot problems in Indian rhinos in zoological gardens.

Conclusion

The study shows that Indian rhinos are confronted with severe foot problems in captive collections. A causal correlation between husbandry and pathological changes is found due to the comparative, histopathological investigation with FP in domestic animals, as well as due to the structural comparison of the feet of 32 zoo animals with 10 wild rhinos. Due to this study an anatomical gain in knowledge concerning the basic foot structures in this species has helped to enlighten some of the pathological findings and supports the thesis that the Indian rhinoceros is naturally a 'sole-walker'.

Primary causes for the occurrence of FP are hard floors, which lead to abrasions on the horn walls, the soles, and the surface of the footpad. In the course of time, pathological alterations will appear within the horn walls and on specifically predisposed areas on the footpad.

Wild Indian rhinos do not show foot problems of this kind. The anatomical features of the horn structures of their feet look different, compared to zoo animals. The anatomical structures of their feet allow the conclusion that they are naturally 'sole-walkers'. Under captive conditions the animals turned into 'pad-walkers'.

The conclusion of this study is that zoo animals are kept under inadequate husbandry conditions that have led to the development of lesions on the footpad and horn walls.

The chronic lesions, especially those seen in the footpad do not show signs of complete regeneration, as most regenerated horn is of functional inferior quality. This inferior quality cannot withstand additional forces. As a consequence, these cracks will enlarge and granulation tissue is increasingly produced. This vicious circle can only be interrupted by means of a correct therapy and the simultaneous changing of husbandry conditions.

In order to maintain healthy foot and skin structures, the Indian rhinoceros needs a habitat where the feet do not wear and that supplies them with enough water to keep skin and horn structures elastic. Hard material is highly abrasive and should be replaced by soft, elastic flooring. In addition they should have constant access to water.

The aim of the future is to keep Indian rhinos whose feet are healthy and resemble in structures those of wild animals.
All the above-mentioned aspects are recommendations. They base on histological and comparative anatomical results of 32 captive and 10 wild animals.

Ethological contribution to the introduction of two new individuals (1.1) in a group of White Rhinoceroses (*Ceratotherium simum simum*) (1.2) in the Réserve Africaine de Sigean (France).

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The Réserve Africaine de Sigean is located in south of France. It is an extensive game park for wild animals : more than 3000 animals inhabit about 260 hectares of garrigue.
In accordance with EEP's advice, which "encourages to re-socialize White Rhinoceroses in order to stimulate breeding", two new individuals (1.1) arrived at the Réserve Africaine de Sigean the 27th of last March. The study consisted of introducing the two new individuals (2 years old) to the elder group (1.2) (all of them are more than 12).
The two groups were in distinct enclosures. Three periods of observation of about one month had been distinguished : all three permitted auditory, olfactory, visual and tactile contacts through bars all day long. Every day of the second period, bars between the two enclosures were opened for about one hour per day. The situation was nearly the same in the third period, but adults were not present in their enclosure.
Both of the two adult females didn't seem interested in the new individuals unlike the adult male, who was very aggressive when the young rhinoceroses were in his enclosure (it charged them systematically) in the second period. This aggressiveness decreased at the time of interactions through bars, and non agonistic behaviours could be observed. The hypothesis of two distinctive territories (the two enclosures) is the most suitable. It is supported by the high number of the adult male's urine-marks close to the bars, and by the young Rhinoceroses' submissive behaviour. Both of them ran away from the male when they were in his enclosure, but they had tactile contacts through bars with him.
The male turned its aggressiveness particularly to the young male. How-

ever the younger is not a potential opponent because of its height, its age and its cut horn (for transport). This aggressiveness bridled the introduction, so we decided to take several steps in the third period. In the adults' enclosure without them, progress was successful : the two young Rhinoceroses had a behavioural catalogue which was increasingly diverse.
As regards reproductive behaviours of the adult male, the rise was very significant in comparison with last year at the same period. Results of the analyses of the female faecal samples are not yet known. However the two adult females behaved in a new way, which may be considered as an indication of cycling. So the presence of the two new individuals in an enclosure close by the adults'one could be a solution. Another solving could be the alternate presence of the three females with either the adult male or the young male.

Comparative behavioural observations of Przewalski-Horses (*Equus przewalskii*), Exmoor-Ponies (*E. caballus*) and Tarpan (*E. ferus ferus*)

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Three different herds of horses (Rebred Tarpans, Przewalski-Horses and Exmoor-Ponies) were observed during a period of six months from March to September 2001. The horses are kept at Tierpark Sababurg near Kassel in enclosures of approximately 10 ha size. They are unmanaged except for supplemental feeding of hay during winter and spring. Serious injuries are also treated. To prevent inbreeding, male horses are exchanged from time to time and most yearlings are removed to stabilize the herd size of approximately 10 adults plus offspring.
Main interest of the studies is social behaviour with special focus on play behaviour between foals, subadults and adults and the effects of stallion exchange on the herd.
Also of interest is the relationship between the leading male and subadults (ranging from 1-3,5 years of age).
Furthermore, dominant and submissive social interactions are to be investigated to define a hierarchy which is supposed to be non-linear.
In addition, positive social interactions are evaluated to examine the existence of enduring individual relationships. Spatial distribution was recorded to be compared with the results concerning the hierarchy and the individual relationships.

Diet selection and preference by bearded pigs (Sus *barbatus*)

Vera Nielewski *and* ***Stefanie Preuß*** *(c/o Udo Ganslosser)*

Our first study in Borneo (National Park Kayan Mentarang/ East Kalimantan) about the diet selection of bearded pigs took place within the context of a research program of WWF- Indonesia on bearded pigs (Sus barbatus). It should be helpful for future projects and this study should result in a better long- term survival of bearded pigs. At the moment the bearded pigs occur in all parts of Borneo, but the high hunting pressure and the timber industrial, which destroy their environment, are responsible for a lower breeding rate.

Bearded pigs are omnivorous animals. This could be assumed from the close taxonomic relationship to the wild pig (*Sus scrofa*). After we finished our study in the Kayan Mentarang National Park, we performed a second study in Berlin Zoo. Resulting of own experience because of a stomach-dissect during the field study and the statements of the native Dayaks, the bearded pigs feed beside the vegetable diet also animalic diet. Our major advantage was now to get more information about the food selection and preference of the bearded pigs with regard to vegetarian or animalic food components.

Bearded pigs (*Sus barbatus*) are regarded as a very mysterious animal partly on the basis on lemming like eruptions. Two assumptions occur: first, as soon as the supply of fruits will decrease, bearded pigs will leave this area to find another one with better food- resources (Leighton and Leighton, 1983 quote from Caldecott, 1990). Second, bearded pigs are always moving (Caldecott, 1990).

In the years where large movements of bearded pigs are reported, characteristically heavy production of dipterocarp seeds are found. – At irregular intervals of two to ten years, several dipterocarp- species as well as canopy members like Burseraceae, Fagaceae, Myristicaceae, Polygalaceae and Sapotaceae fruit almost simultaneously.

These canopy members belong to the food spectrum of the bearded pigs. Now it is logical, that the bearded pigs have to leave a special area, when there is not enough food for them to find a better one, with more food-resources. An explanation for the moving to the mast-fruiting of dips could be, that the seeds of dips are large, energy- rich and have almost no protection against seed- predators (an animal is a seed- predator, if it destroys the seed or eats the fruits before it is ripe). If so, it would be a selection for quality.

Dipterocarps are a food source at time of shortage for monkeys, gibbons and orang-utans, but most mammals and birds do not feed on dipterocarps, except the bearded pigs (MacKinnon, 1996).
Now it is the question, why bearded pigs seem to prefer the seeds and fruits of dips. In the National Park Kayan Mentarang the dips are not the dominant tree species. We wanted to find out, if the bearded pigs are adapted to the available diet in this area or not.
The optimal diet theory predicts, that when a highly profitable food type is abundant and also available, an animal should specialise on that one. But energy is not the most important food component: Proteins, minerals, vitamins, avoidance of toxins can also influence the food choice.
At the time of the study in Kayan Mentarang, less bearded pigs were in this area, because there was no fruiting- time. Nevertheless we found some fruits and also a few feeding-places of bearded pigs with the help of the local people. So it can be assumed at bearded pigs feed everything, which is available, provided that the food has no toxins and is digestible.
In the past the bearded pigs had to maximize their food intake, but simultaneously they had to protect themselves against predators like the sun bear, reticulate python, clouded leopard, some Civets and Crocodylos porosus or Tomistoma schlegeli. But all of theses predators are very uncommon, so that solely humans are the real predator for the bearded pigs. Nevertheless it should be assumed, that some behaviour patterns of bearded pigs result from the natural predator-pressure. So it is possible, that the bearded pigs prefer a reasonably small area for feeding to discover easier the predators.
Also the movements in large groups could be a good strategy for protection. In the past the Crocodylus porosus and Tomistoma schlegeli (but this animal is almost entirely piscivorous) often occurred in the rivers of Borneo. So it was a great danger to cross the rivers and it minimized the risk to be killed by a predator when moving in a group with many individuals.
The second study in Berlin Zoo was a period of observations and feeding trials with a captive breeding group of bearded pigs. We developed specific hypotheses based on our study from Kayan Mentarang and planned two experiments. During the first one, the bearded pigs got animal and vegetable food separately. During the second experiment, the animal and vegetable food was additionally buried. In addition before and after every experiment we recorded control observations in which the pigs received their normal food. Data collection was done by focal animal sampling method and scan sampling method. In addition we also recorded the dura-

tion of food intake (animal food, vegetable food, etc.).
The bearded pigs in the Berlin Zoo also have to make decisions about what kind of food type they feed on like the bearded pigs in the field. Concerning the zoo study the bearded pigs have to decide if they feed on maize or on rat for example. During our zoo study we could observe that this decision differs from animal to animal. Accordingly we could not make a statement if the bearded pigs select the food component in regard of food quality or food quantity. We presume that the order of precedence plays an important part on the food selection in the zoo. Animals with the highest hierarchic position have the most time for selecting food and feeding. None of the other bearded pigs would disturb them. In contrary animals with the lowest hierarchic position have to feed quickly what is reachable for them. They have not enough time to make a decision about what to feed because they would be banished by the other members of the group.
Bearded pigs select food components. According to which criterion this happens has to be find out in subsequent studies. The bearded pigs in Berlin Zoo showed a fixed specialization towards present profitable food types. We could definitely recognize a specialization on maize, peanuts and walnuts opposite to paprika and salad. These food types (maize, peanuts and walnuts) possess a higher nutritive value than paprika and salad. This presumes that the bearded pigs select their food towards quality.
During the experiment-observations we could recognize a definite preference for animalic food types over vegetable food types. If we transfer this on particular animals there are differences with regard to preferences. Consequently we couldn't conclude a distinct deposition if the bearded pig's shows a definite preference or selection on animalic food. Rather the selection and preference is different from pig to pig.

Influence of zoo visitors on behaviour and salivary corticosterone concentrations in zoo animals

Andreas Kalthoff, *Diploma-Thesis, supervised by Dipl.-Biol. C. Schmidt & Prof. Dr. N. Sachser, University of Muenster, Department of Behavioural Biology, Badestr. 9, D-48149 Muenster, Germany*

In the last years several studies focussed on the influence of zoo visitors on captive animals. Especially for non-human primates changes were demonstrated in many behavioural patterns (e.g. activity, social behaviour, aggression and spatial dispersion). However, only few studies investigated other mammals.

The aim of this study was to evaluate the influence of zoo visitors on behaviour and salivary corticosterone concentrations of mammals others than primates. A group of 1,3 white rhinos (*Ceratotherium simum simum*) and a group of 0,2 bushpigs (*Potamochoerus porcus pictus*) kept in the Allwetterzoo Münster were investigated. During the day the rhinos were housed together in an outdoor enclosure which was seperated from the visitors' passage by a border of plants. The bushpigs' indoor enclosure was out of sight of the visitors, but at the outdoor enclosure visitors could directly contact the animals.

In summer 1999 on 39 days (with a total of 148 h) the rhinos' behaviour and on 12 days (with a total of 52 h) the bushpigs' behaviour was observed. At the end of each observation day saliva was collected from all individuals and corticosterone levels were measured by radioimmunoassay. The observation days were classified with regard to three parameters:

(1) number of visitors
(2) noise level and
(3) intensity of optical stimuli from the visitors in front of the enclosure.

According to these parameters observation-days were divided into two categories for each parameter:

(1) "low" and "high",
(2) "quiet" and "loud" and
(3) "inconspicuous" and "conspicuous".

Behavioural data and saliva-corticosterone levels were compared between these categories of visitor performance.

On "conspicuous" and "loud" days the rhinos performed less resting behaviour, whereas the frequencies of comfort and agonistic behaviour were

increased. On days with high numbers of visitors the rhinos were also found in closer proximity to each other. Obviously, salivary corticosterone concentrations were not affected significantly by the visitor performance.

On "full"/"loud" and "conspiuous" days the bushpigs stayed longer in close proximity to the visitors and showed more visitor directed behaviour. Salivary corticosterone concentrations were also not affected significantly by the visitor performance.

The results of this study show that the visitor performance had a distinct influence on the animals' behaviour, but the visitors did not represent a stressor for the animals. For the bushpigs they even were an enrichment of their environment.

How food hiding-places influence the behaviour of giraffes in zoological gardens

***Sandra Sacher**, c/o U. Gansloßer (Dipl.projectt)*

I´m doing my observations in the zoological garden of Nuremberg. The herd of giraffes (Giraffa camelopardalis reticulata) consists of four animals: One bull (13 years old), one adult cow (13 years old), one subadult cow (2 years old ; daughter of the adult ones) and one male calv (7 month old; son of the adult ones).
What concerns my project I want to answer the following questions:
1st: Do food hiding-places result in "better" utilisation of the enclosure?
2nd: Does the introduction of food hiding-places have some influence on the frequency of oral stereotypies?
3rd: Do distances between the giraffes change?
4th: Does the frequency of ingestion alter?
5th: Are there more intraspecific contacts when food hiding-places are placed in the enclosure?
To find out if there are differences in behaviour during food hiding-places are installed in the enclosure five phases take place during my studies:
1st phases: unchanged feeding situation (without food hiding-places)
2nd phases: food hiding-places (all filled with food)
3rd phases: unchanged feeding situation (without food hiding-places)
4th phases: food hiding-places (every day another hiding-place is filled)
5th phases: unchanged feeding situation (without food hiding-places)
I use the scan sampling (5- minute intervalls) to note the position of every individuum inside the enclosure and to find out the distances of the giraffes. The all occurance sampling is used to record individual and social behaviour. Three food hiding-places are used at my experiments: One consists of a tube/pipe which is fixed to the fence of the enclosure. Another is a stump with a hole on its top. It stands in the midst of the grass of the enclosure. The third hiding-place consists of the half of a hollow stump with a rift on the front side. It is also fixed on the fence. All hiding-places are constructed in such a way that the giraffes have to utilize their tongue to reach the food inside the hiding-places.
Till now there are no proved results, because the observation hasn't finished yet. But one thing we can recognize positively: The giraffes discovered all hiding-places and now make use of them quite often. Although two of the hiding-places were discovered during the first two days, it required nine days before the third (the one with the rift on the front side) was discovered and utilized. The reason could be the "secluded" position of the third hiding-place, because it was fixed at a place the giraffes usually rarely stay at.

What are the main reasons for *joint disease* in *Giraffe-legs* (*Giraffa camelopardalis*) and what can be done for prevention?

Sabine Wieczorek,*„Animal Health", Hauptstr.15, 91474 Langenfeld, Tel:09164 – 99 5006,E-mail:Sabine.Wieczorek@t-online.de*

A widespread probleme for giraffes in captivity is, that they often have damages in their hooves and the leg-articulations above.
The animals don't walk with normal physiological movements, because of abnormal posture of the hooves and their leg-articulations. The consequence is an articulation-stress only on some points, not a physiolocical and regular demand on the whole articular surface.
That leads to arthritis or other joint diseases.
Because of pain these giraffes they don't like to move enough.
Without continual moving the articulations get to less blood supply, can't build the necessary quantity of synovial fluid and so the joint disease progresses.
At the end the animals have tremendous problems to lie down and if they lie, they need a long and painfull time to get up again.
As we know from studies about other ungulates (specially results of veterinarian-studies about horses or cattle) nutrition has a lot of influence on the growth and health of articulations.
Also important is, how long the animal moves, on which ground and in which way and gait.
So my questions are, what makes the biggest differences for the giraffes life in captivity comparing to the animals in nature and I decided to check two main points:
1.) Nutrition items
2.) the Movement

Nutrition

I study now the literature about natural feeding behavior and the contents of natural food of wild giraffes.
These studies show, that it is known, which contents are in natural giraffe-food and it is known, that there are seasonal differences in the need of contents.Also important is, that there are different needs of bulls and cows. I also study the literature on feeding behavior of giraffes in captivity. I will compare now the natural–food-contents to the food that is offered in zoos.

Movement

I did a study about movement-activities of giraffes in captivity and for what reasons they move. I watched two groups, one in Tiergarten Nürnberg, Germany and one in Berlin Zoo, Germany. In Nürnberg I could study three animals, 1,1 and their offspring 0,1. (43 hours.)
In Berlin Zoo I had a look at 1,3 (10 hours).
The first 32 hours in Nürnberg I watched the group with the all occurence sampling.
Every movement-activity was registered. Also in which part of the area the animal moved, changing from one part to another and for what reason (eating and what kind of food, drinking, resting, ruminating, walking around without recognizable reason, gallop)
they moved was recorded.
With the same sistem the group in Berlin was observed.
About 11 hours the groupe in Nürnberg is watched by focal animal sampling
(every movement, without any other atributes). Sometimes the giraffes moved only for some seconds. That was the reason for verry short scans, about 30 seconds for eatch animal.
The results of this study and other literature to this question I want to compare with literature about all the movement-activities (and reasons for movements) of giraffes in nature.
This project needs about one more year to show the final results.
At this time it can be said tendentially, that nutrition in captivity really could be one reason
for joint disease on the giraffe legs.
In fact the content of nutrition in nature has not much to do with the nutrition contents in captivity. And all above the natural nutrition-need in proportion to the seasons and to the different sexes is not comparable to the feeding practice in zoos.
The main point seems to be that giraffes really need high proteins, but in nature it is not usual to get the whole portion in one meal, which they can eat in twenty minutes two times a day.
The biological rhythm of this animals seems to be much more demanding and different.
Also movement-activities seem to be important.
At this time I can tell, that giraffe-groups in nature, which were observed, show less movement-activities than the animals in captivity.
One reason for that result is stabling during the nights and during the

winter in Europe. But also the dayly activities are not comparable to the behaviour in nature, as
some studies show.
Another memorable aspect is, that some movement-activities seems to be destructive,
when the giraffes walk three hours before the night-housing in front of the stable-doors back and forth, using only a few meters of the whole (unused) area, waiting for the prefered food.

Focus

The *feeding-management* is probably the key to both problems.
With offering food on different places, distributed over the whole area, the giraffes have more incentive to walk around, looking for the best places to get food.
The food should be offered in hiding places, where the oral needs of giraffes can also be satisfied and foraging-time of getting food can be extended like in nature, where they would walk from one acacia to the next.
One more important point is *the ground*, where the hoves can be rubbed enough, but not too much and where the articulations hit an elastic material, that can absorb shock.
There are a lot of professionals that developed these kinds of ground for dressage- or jumping-horses, so we can learn from the experience of this scene.
Next year there will be exact results, which hopefully can give useful answers.

Habitat utilization of European Bison (*Bison bonasus*) in enclosure and in freeland

***Almut Popp**, IZW Berlin/ Universität-GH Essen*

For thousands of years, herbivore mammals as the European bison influenced the European landscape intensively, but just during later the large grazers domesticated by human beings fullfilled this function. After the bison was extincted in natural environment by human beings there are intensive tries to reintegrate the animal and to give it back a part of his biotop. But for this occasion research is necessary, because until today the following question is still unsolved: Is the origin of the European bison of forest or of open field? As part of an etho-ecological study, European bison in freeland and four different regional and structural enclosure types were examined. Both habitats were in their utilization compared.

The observation of freeland areas was carried out in the pre-forests of Bialowieza and Borki/ Poland. Since several years there exist free living populations of bisons. The freeland observation of the bison resulted in some sightings within forests and nurseries, but most sightings predominantly in clearings and around the periphery of the forest. Grassy plains and open water were always found in the areas around the observation sites. The enclosure-investigates was held in two bison enclosures of the deer park Springe/ Niedersachsen, in the park Schorfheide/ Brandenburg and in the bison reservation Bialowieza/ Poland. The enclosures were structured differently and the conditions of husbandry were of different levels influencing the vitality and the animals behavior.

The habitat utilization of bisons in enclosure showed coherences of that of open fields. The enclosed-observation area bison also showed a preference for the forest periphery and young growth. Feeding places and sandy resting places were clearly preferred in comparison to forest and pure grassland. The bigger the size of the enclosure, the more the grassland was utilized, whilst the use of the feeding places decreased. Resting was especially predominant in the smaller enclosures, where feeding concentrated on the fodder provided and the general activity of the bison decreased. Each feeding method had an impact on bison location, behavior and available-vegetation utilization.

The different methods of animal husbandry show how important the correct methods are in order to guarantee healthy, robust animal development and to set the conditions for any successful resettlement. The local

resettlement of bison seems possible even in densely populated, highly industrialized areas such as those within Germany. Areas that could be well-suited for resettlement include former coal-mining land and former military training areas. The importance of large herbivores soon becomes obvious when conservation projects such as semi-open pastures are implemented.

Investigations and Behavioral Observation for Optimising the Husbandry Conditions of Goitred Gazelles *(Gazella subgutturosa)*

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The author's principal task was to develop a model of an optimised enclosure for keeping goitred gazelles *(Gazella subgutturosa)* based on behavioral observation and literature research. The background for the model was the conception of a new enclosure (in socialization with Two-humped Camels) for Karlsruhe Zoo.

Procedure:

The literature published so far concerning the keeping of *Gazella subgutturosa* and their ecology in the wild was examined.
The conditions for keeping the gazelles in four different zoos were ascertained by means of questionnaires in the zoos in Karlsruhe, Zürich, Gelsenkirchen and Nürnberg Tiergarten. The survey at the zoos was carried out with the aim of profiting from the long experience of keepers and zoo management regarding the husbandry, housing, feeding, breeding, complications in captivity and including these results when developing the model.
The main focus of the work was the behavioral study with regard to the area available to the gazelles in two different enclosures. General behavioral characteristics were to be determined and questions concerning which parts of a certain enclosure showed the most frequent utilization by the animals and which structural elements and/or external factors are responsible for this were to be answered.
Through the analysis of area utilization, the animals' preferred places were to be demonstrated and this given great consideration later in the model of an optimised enclosure.

Materials and Methods:

The enclosures were divided in each case into 100 sections, each 3 x 3 m long.
Observation took place from 7 a.m to 7 p.m. Recording the groups of

animals took place in single counts at intervals of 5 minutes (with a break of 20 minutes after every recording session and a maximum of 12 recordings per day). Each hour's interval is represented in the evaluation of the overall result by the same number of single recordings.

Results:

A) General behavioral characteristics:

Goitred Gazelles like to sunbathe. The animals lay down preferably on dry and sandy places which show on one side a gaze-protection (e.g. a tree-trunk or a wall).
Hand reared gazelles stay outstandingly often near the stable.
Goitred Gazelles can be attracted through feed offerings in enclosure-areas, which are normally characterized by a low area utilization.
Goitred Gazelles prefer to eat hay from the ground instead of hay stored in a feeding rack (if the quality of the hay remains the same).

B) Area utilization with exclusive utilization of the enclosure through Goitred Gazelles in Karlsruhe Zoo (results out of 700 single counts):

The Goitred Gazelles in Karlsruhe Zoo avoid the hillside-area (40° inclinations) and prefer to stay in the even parts of the enclosure.
High-ranking animals prefer places to lay down, which enables them to have a good panoramic view over the enclosure and the group,

C) Area utilization referring to the socialization with other ruminants (Two-humped Camel, **Camelus ferus bactriana***), in the Zürich Zoo (results out of 300 single counts):*

Goitred Gazelles also use these areas of the enclosure which are situated outside their retreat-area (that fact shows a synergetic effect).
Goitred Gazelles use the areas outside of their retreat-area, in which no representative of the bigger ruminants (*Camelus*) is visible. The animals yield to the camels before an interspecific aggressive behavior occurs.

4. Book Reviews

New books on Zoos

Conservation centres for the New Millennium (ed by A. Plowman & P. Stevens), Paignton Zoo, 1999, 181 pp,

available through Paignton Zoo), is the proceedings of the 5th International Symposium on Zoo Design. The contributions from this conference are organized into several sections: Changing roles and reconstruction, Designing for welfare, Designing for education, Design aims and processes, Techniques. Each section contains both overviews and case studies, from Europe, Asia, North America and Australasia. Also very interesting to read is a discussion, with many "big names" mostly from Europe and the US taking part and, e.g., confronting issues like why to lock/not to lock up animals at night, educating the public about "cruel" aspects of nature etc.

Zoo Culture - the book about watching people watch animals, by B. Mullan & G. Marvin, Univ. of Illinois Press, 1999, 172 pp, US $ 16,95 pbk)

is a cultural, sociological and cultural anthropology discurs on Zoo visitors and zoo organisation. Chapter headings like "Humans in Animal Skins" (about how animals tend to be viewed in an anthropomorphic view), "Containment and Control", "The Animal as Commodity" etc take up some popular ideas about zoos, and view them from the outsider's perspective, sometimes also contrasting with the view of insiders.
The whole book though controversial is good reading in order to get a broader perspective and understanding for the ways critical outsiders think about our institution.

Breeding Endangered Species

The conference document of the 7th World Conference on Breeding Endangered Species, 1999,

is available from Cincinnati Zoo. The book, 350 pp on A 4, includes 23 talks, 33 posters, and 10 workshop reports, covering single spe-

cies (literally from butterflies to gorillas), taxonomic groups as well as theoretical/ conceptional articles (e.g. disease management, human demography, or the hotspot concept). Methods applied are from behaviour/ ecology to reproductive endocrinology and genetics. A very instructive and interesting compilation.

Zoo & Aquarium History

(ed. by V. Kisling), CRC-Press, Boca Raton etc, 415pp, 2001, £ 46, 99).

is a compilation of chapters describing the development of zoos, menageries and other animal collections, by geographic regions, plus a general overview from about 10 000 year ago till the Renaissance. Each chapter is written by an expert from this region, and contains an average of several pages of literature references, illustrations, and some boxes with short biographies of important individual persons or periods of this area.
The book is particularly important to understand the development in areas outside Northern America and Western Europe: India, Japan, rest of Asia, South America, Africa, Australia each are covered in individual chapters.

Animal Welfare

(by C. Spedding, Earthscan Publ., London, 2000,188pp, £ 12,95)

is a very helpful text covering all aspects of animal welfare from organizational aspects, to forms of human use and exploitation of animals to regulations (e.g. on minimum standards) and also descriptions of health, behavioural and husbandry problems associated with keeping or exploiting animals. Zoos and circuses are also briefly covered, with references to the World Zoo Conservation Strategy, and the EU-directive.
The book profits from an objective and broad-based writing, and will certainly help in discussions and dealings with welfare issues.

Endangered Species - Threatened Convention

(ed by J. Hutton & P Dickson, Earthscan, London, 2000, 202 pp, £ 14,95)

This is a collection of essays discussing various problems, benefits and future chal1enges to CITES. The book emphasizes that in many

cases, habitat destruction, as a far more important threat, but also the positive developments and chances in areas like sustainable use community involvement etc are only marginally covered by the philosophy of CITES and its implementation. In several case studies, e.g. rhinos, elephants, and tigers, it is demonstrated that CITES listings were almost irrelevant for conservation of these species, and in other e.g. crocodiles, only after a shift of emphasis to sustainable use and managed trade did numbers increase.

The book is important to unterstand the controversies around CITES and it is perhaps satisfying to see that cooperative breeding programmes are not the only conservation measures sometimes (or often) negatively influenced by it, but also for outlining where, and why, it does indeed work in its intended way.

Primate Conservation Biology

(G. Cowlishaw & R. Dunbar, Chicago UP, 2000, 498 pp,

In this authoritative text, the problems facing primate populations world wide are put into a rigorous framework of theoretical / basic research results. After introductory chapters on diversity, ecology and behaviour of primates, the following ones relate these life history and biology data to the current threats, mostly habitat loss, habitat fragmentation, and hunting. Each chapter is based on firm scientific concepts (hunting, e.g. on optimal foraging theory applied to hunters), and each point is made by illustrating it with data from primate field studies all over the world.

Two final chapters, on conservation strategies (e.g. Red lists, PHVAS, etc) and conservation tactics (including rehabilitations, intro and re-stocking, translocations, but also tourism, sustained hunting etc) again with lots of primate data and examples, provide applications.

In the appendices, a complete list of all primate species with Red List categories, a calculation for life table based Leslie matrices for future population sizes and a list of primate/ conservation organisations are provided. 56 pp of references, with almost 20 refs on average per page, conclude this important text.

Two companion volumes have been published on applied conservation biology by Blackwell recently:

Conservation Science and Action, ed. by W. J. Sutherland, 363 pp, 1998, £ 26,50

is a short textbook on applying concepts and identifying areas most critical (and currently under a most dynamic development) in Conservation biology. The book starts with a discussion of the concept, and its possible operationalization of biodiversity, moves on to extinction, introductions of exotic' species, sustainable and non-sunstainable use, pollution, discusses concepts such as metapopulations, small population biology, and then moves to practical applications like selection of areas for protection, managing habitats and species, economic aspects, conservation education. In its whole span of topics the book always is filled with references to examples and case studies, and thus it is no surprise that 30 pp, with double column print, of literature are included.

The Conservation Handbook, by W. Sutherland, 278 pp, Blackwell 2000, £ 24,95,

is a comprehensive compilation of methods in ecological fieldwork und applied conservation, with case studies, sample protocols and descriptions of literally anything between compiling a species list and going into developmental politics, or manage a reserve, write an action plan, or whatever else a conservation biologist does in order to link his/her scientific expertise with "real-life problems". Each of the 14 chapters starts with the question: Why, to offer a rationale for this particular approach, goes on to describe methods and field techniques often separately not only for plants and animals but also for different taxa or habitats. Methods of predictions and interpretation are also included.
This handbook can serve everyone who goes (ar sends students) on a fieldtrip, as well as educators and interpretators who want to explain to the public how things are done in ecology and conservation.

Hotspots

by R. A. Mittermeier, N. Myers, P. R. Gil, C. Goettsch-Mittermeier, Chicago University Press, 2000, 431 pp, U$ 65.-,

is not only a magnificent book but a new, and sometimes controversially discussed concept in international conservation biology. The brief version of the concept is that 25 areas on earth are home to > 60% of all terrestrial plant and animal diversity - on barely 1.4 % of

earth's terrestrial surface. It is suggested by renowned conservationists (the two senior authors of this vol. among them) to concentrate conservation efforts on these areas in an attempt to maximize benefits. The book is a large, heavy volume, but certainly no coffee table edition, but nevertheless the 25 areas (1 in Northern, 7 in Central/ Southern America, 1 in Europe, 7 in Asia, 5 in Africa. 4 in Australia and the Pacific) are described with the addition of beautifully coloured pictures - not only of plants, animals and their habitats but also of imminent threats and destruction. Potential flagship species, unique/endemic- organisms, and important vegetational zones are described for each region. Tables with typical biomes, their original, remaining and currently protected areas, endemic species percentages etc, also in relation to unit area provide additional numerical background. A most welcome compilation.

Radio - Tracking and Animal Populations (ed. by J.J. Millspaugh & J.M. Marzluff), Academic Press San Diego etc, 2001, 474pp, £ 46,95

is much more than "only" a book on radio-telemetry. Chapters, divided into several sections, discussing, animal movements, resource selection, and demography take up the majority of pages. The book is not only an important "how-to-do" volume for fieldresearchers but also background for a better understanding of behavioural ecology papers. An appendix on analytical software and a list of hardware merchants/producers, and a 44 pp bibliography complete the volume.

F.B. Goldsmith (ed): Monitoring for Conservation and Ecology, 1996 (reprint from 1991), 275 pp, 20£

is a handbook of censusing, surveying and management applications of population counts and species lists, on several levels from individual reserves or countries to national surveys. Most of the chapters address the specific problems and necessities of long-term studies, and both plant, invertebrate and vertebrate communities are covered.

Ecotravellers' Wildlife Guides

A superb series of guidebooks is being published by Acad. Press, most are (co-)authored by Les Beletsky, the series is endorsed by the Wildlife Conservation Society, each book costs £ 19.95 for appr, 500 pp.
The books follow a similar organi-

sational format, with introductory chapters on eco-tourism in general, geography and habitats of the country in question, parks and reserves, and then taxonomic overviews (first on higher level, e.g. amphibs, reptiles, etc, then on family - by - family basis). The illustrations are outstanding - colour plates of drawings for animals, colour photography for plants and habitats. The taxonomic chapters are interspersed with so-called "environmental close-up", e.g. on biodiversity of specific groups, conservation issues, or specific ecological niches. Some volumes have specific chapters on specific biology, e.g. marine animals' in the Hawai-guide, Galapogos in the one on Ecuador. Currently the volumes on Costa Rica, Peru, Hawais and Ecuador have been available for review. In the-near future, other continents will be covered as well. I will keep you informed, because I think these are among the best volumes if you are planning an exhibit or an educational activity for a certain geographical area !

Ecology of Indonesia

A series of 8 very instructive and well-composed volumes on the ecology of the Indonesian region, with parts on both terrestrial and marine ecosystems. Two volumes, Kalimantan und Sumatra, have been available for inspection. Each volume costs £ 49,95, and each volume contains chapters on all ecosystems of the area, including man-made ecosystems, such as agricultural regions, or urbane ecology. A hightly recommended series on one of the most important megadiversity hotspots (Oxford UP, 1997-2000 appr. 500 + pp/vol.)

The Ecology of Adaptive Radiation

(D. Schluter, Oxford UP, 2000, 288pp, £ 24.95)

The book is mostly concerned with speciation, i.e. microevolutionary processes on species/population level, and it is mostly covering field studies. Nevertheless, a series of experimental and analytical approaches have been integrated. Adaptive radiations form a considerable part of the development of biodiversity, and examples are good educational value. But an understanding of the subtle processes that shape the early stages of those radiations also is necessary for translocation / re-introduction and captive breeding programmes, and this the second reason why such a, seemingly far-fetched topic has to be considered by zoo people. Many examples are drawn from rather small sized vertebrates, which makes the suitability for exhibition planning even higher.

Dispersal

(ed. by J. Clobert, E. Danchin, A. A. Dhondt, J. D. Nicholls, Oxford UP, 2001, 452pp, £ 24,95)

is a second topic from population ecology that has high relevance for captive propagation and conservation management. The chapters cover levels from individual to population, and approaches from endocrinology, body condition and information theory to genetics, parasites or predation. A specific chapter is dedicated to conservation aspects but they are also in other parts of the book.
Chapters are a mixture of overviews and single-species accounts (e.g. on pika, or Naked mole -rats). 68 (!) pp of double-breasted literature references mark the relevance of the topic. An exellent overview of all areas, long overdue

Game theory and Animal Behaviour

(ed. by L. A. Dugatkin & H. K. Reeve, Oxford UP, New York etc, 1998, 32Opp,£ 29,50).

Evolutionary Game Theory has been a powerful tool to develop testable hypotheses and translate mathematical approaches to behavioural ecology into analyses of actually occuring and observable behaviour. The models have become more refined, and thus more realistic, over the years. Most people think about game theory mostly in terms of animal contests, or sexual signalling. These areas, of course, are convered in this volume as well. However, there are many others, e.g. related to habitat selection, foraging, or learning. It is very important for our work to consider that our animals are constantly evaluating and re-evaluating each other. If we do not give them these opportunities, their adaptability will suffer. This book helps us understand the underlying principles even if someone is not specifically mathematically versed.

A Herstory of Primatology

S. C. Strum, L. M. Fedigan (eds):Primate Encounters, Chicago University Press, 652pp, 2000, U£ 35.-

The idea that field studies on primate (and other mammalian) social systems, mostly performed by female researchers, have somehow influenced the change of paradigms in behavioural biology, from maleoriented displaying, compet-

ing and dominance relations to female choice and matrilines, has been discussed quite often. In this volume from CUP, a whole group of eminent primatologists, from several countries and both sexes, present their personal views of the history of primatological studies since WW II, and how gender questions may have changed it. But the book is not only interesting for a reader interested in this particular aspect - it is a review of primatological studies and concepts at the beginning of the 21st century and beyond, which is also expressed by 78 pp of literature references.

Advances in the Study of Behaviour

Four more recent volumes have been brought to my attention, and all 4 of them contain articles that are very important for behavioural management as well as educative purposes:

Volume 25 Parental Care, 1996, 715 pp £ 89.-

In this volume, we find overviews of parental behaviour and parental care not only in birds and mammals, but also invertebrates, fish, amphibia and reptiles (one chapter each for these groups), in total the first 155 pp are dedicated to those taxa who are mostly overlooked in this context.

The next section, titled " Endocrine, neural and behavioural control" is a compilation of 8 chapters (one an birds, the rest on mammals) covering proximate mechanisms. Though, of course, rats and rabbits are the focus of several chapters, sheep, simian primates, and voles are also covered by one chapter each.

The third section, "Functional, ecological and adaptive aspects" is on ultimate factors, with one chapter an field studies on birds, and several on mammals. This third section mostly emphasizes the importance of individual variation between females, maternal styles etc, and its consequences. As we all know, these differences also occur in breeding programs, and we should be well aware of the longterm consequences of them on the quality of a population before e.g. decide to assist by hand-rearing, supplementary feeding or other similar measures.

Vol. 28, 1999, 376 pp, £ 64,95

does not have an overall topic, but is a collection of papers referring to different aspects. Of importance for behavioural management are, among others, Carel ten Cate's and 0.R.Voss, overview of evolutionary consequences of imprint-

ing (how a process of spciation can be started by imprinting some birds on foster-parents !), N.S.Clayton and J.Sola on mimicry in avian food caching (very important for behavioural enrichment) similar by T.J.Roper's Olfaction in birds, and a particularly interesting one, S.Thirgood et al: Intraspecific Variation in ungulate mating strategies. The Case of Fallow deer. Flexibility in mating systems, and the costs and benefits of several alternatives, have to be regarded whenever we want to breed a species. In many species of large mammals, particularly ungulates we do not have possibilities for mate choice and decision-making in mating behaviour. Thus, we often do not know whether our group composition is still within the range of a species' adaptability.

Vol 29, 2000, 306 pp, £ 62.95.

also does not have an overall topic, articles of interest for population Management are e.g. B.Deputte's new, and statistically inovative treatment of primate social ontogeny,D.Todt's & M.Naguib's discussion of bird communication, and U.C.Catchepole's review of a case study in sexual selection and song in Warblers

Vol 30 (P.) B. Slater et al, eds Acad Press San Diego etc, 2001, 319 pp, (£ca65)

This volume, as nearly all the previous ones, is a selection of ethological papers reviewing data on animal behaviour on a firm theoretical and conceptional basis. At least 3 chapters are of interest to population management: H.C.Gerhardt's contribution on acoustic communication in two groups of Hyla treefrog species, L. M. Gosling's & S. C. Roberts' one on scent-marking in male mammals as cheat-proof signals, and H.Drummand's on control and function of avian broodmate agonism. The latter, among others, also outlines under what circumstances certain aggresive or submissive personality traits develop in ontogeny, the first two deal with aspects of mate choice and territories as well as the information content of these. All three can help, and give us ideas about how, and why certain individuals will, or will not, accept their destined partners - something that all too often happens in breeding programmes.

Community and Conservation Ecology volumes by Chapmans & Hall, London

Three volumes dealing with different aspects of ecclogy have been published:

J. P. Grover, Resource Competition. 1997, 342, £ca 25

this volume is a mostly theoretical treatment of interspecific competition and its consequences on population growth.Most data are from plankton and other microorganisms, and most of the treatmenr is in mathematical terms. Thus, whoever wants to read it with an eye on possible applications for larger vertebrate communication, e.g. for planning re-introductions, should bring some time and patience.

Individual Behavior and Community Dynamics, by J.M.Tryxell & P.Lundberg, 202 pp, 1998, £30

is of more immediate importance for behavioural management, because it deals a lot with foraging decisions, habitat - use, territoriality etc. These are all areas which should be used for planning ecologically relevant enrichment programmes, and training captive-bred individuals for adaptive flexibility. The treatments are on a sound theoretical basis, and even though a lot of mathematics is involved, it certainly would be worth to recommend this book to everybody who wants to do “some feeding-enrichment”!

Are We Hardwired ?

(by W. R. Clark & M. Grunstein, Oxford UP, 2000, 322 pp, £ 16.99)

is essentiell a review of behavioural genetics, and physiology, from the basic cell functions to organismal levels for medically interested readers. It is rather instructive to see how the old nature - nature dichotomy gave way to a new understanding of complementary influences by genes and environment,and the additional influence of chance. Though the book mostly is directed towards an understanding of human behaviour, most of the examples are from other animals

Husbandry and Veterinary Care by Blackwell / Parey in German

A lot of superb, though rather expensive, volumes are published by Parey Buchverlag, a subsidiary of Blackwell. They are of much use for both vets and biologists, but also for anybody involved in management and husbandry. Several of these books have been reviewed in earlier issues, e.g. Göltenboth/ Klös - Zootierkrankheiten, or the multi-authored one on New World Camelids. Again a few very recommendable ones were brought to our attention this year:

Veterinärmedizinische Parasitologie, 5th ed., by M. Rommel, J. Eckert, E. Kutzer, W. Körting, Th. Schnieder, XXXV + 915 pp, hbk DM 228.-

This is the latest edition of the standard veterinary parasitology text. Following some introductory chapters on general parasitological methods, the following appr. 100 pp cover ruminants (cattle, sheep, goat), equids, pig, cat & dog, fowl, wildlife (ruminants, wild boar, hare, pheasant/partridge), domestic and freshwater fish, and honeybees. For each taxon,all the parasitic diseases are discussed with lots of b/ w microscopic pictures, drawings, lots of written information and a lt.liste. As we all become more and more aware of growing importance of parasitoses for even behavioural ecology and stress management, this is a valuable reference !

Veterinary Medical Neurology

Veterinärmedizinische Neurologie - Ein Leitfaden für Studium und Praxis, by Marc Vandevelde, Andrä Jaggy and Johann Lang (Hrsg), Parey, Berlin, Wien, 2001)

The second edition has been revised and extended to 280 pages, including 148 illustrations and 38 tables, hardback DM 148.-

The importance of veterinary medical neurology of small and large animals has increased in the last few years, not the last because of the “mad cow disease“.

It is the aim of this book to impart the relevant knowledge about neurology to both practitioners and students of veterinary medicine. The first chapter covers the investigative procedure. The text is well structured, clearly understandable and illustrated with several photographs and drawings.

In the other four chapters the common neurological diseases of dogs and cats, horses, ruminants and swine are described.

In each chapters the different diseases are arranged by their prominent localisation and important references for further reading are added.
Britta Kiefer

Central American Reptiles

West Indian Iguanas, Status Survey & Conservation Action Plan, ed. by A. Alberts , 111 pp, 1999,

including 32 colour pictures, covers 17 species with extensive distribution maps, biological, ecological and taxonomic background, 9pp of references, and including project descriptions for conservation action.

G. Köhler: Reptilien & Amphibien Mittelamerikas Bd 1, Herpeton Verlag, Offenbach, 2000, DM 58.-, 158 pp,

with 178 colour photos, 148 drawings and 96 maps covers crocodiles, chelonians and lizards. Most of the genera containing more than a few Central American species also are treated by identification keys, in all cases we find descriptions of habitats and behavioural characteristics such as activity, antipredator behaviour foraging etc.
Several coloured maps describe vegetation, zoogeographical history and physicogeography of the whole area. The book, in summary, is a valuable one for every person wanting to know more about the biogeography of this connection between the subcontinents.
Vol. 2, Snakes, is planned for early 2001.

All for the Birds ?

A Guide to the Birds of the Philippines (R. S. Kennedy, P. C. Gonzales, E. C. Dickinson, H. C. Miranda Jr, T. H. Fisher, Oxford UP, Oxford 2000, 369pp, £ 34,95

This is a guide book, with 72 colour plates, 500 range maps, and a comprehensive description of all birdspecies in the Philippines. For each species, a detailed verbal description, and some remarks on the external features separating it from similar species, an account of "habits" (habitat, grouping, behaviour...), a paragraph "voice" (most with onomatopoetic descriptions), description of nonbreeding, breeding and immature plumages, conservation status, subspecies, and a status classification into endemic, near endemic, resident, migrant or accidental. Specifically helpful is the fact that next to the colour plates, there is a short, up to 5 line summary of important diagnostic as well as ecological features for quick comparison.

A 5 pp bibliography brings up the rear of the book, which also is the 3rd and last part of a small series on Philippine birds (the others being a bibliography and an annotated checktest)

The Birds of the Thai-Malay Peninsula (O. R. Wells, Academic Press, San Diego etc, Vol. 1 Non-Passerines, 1999, 648pp,£ 61,95)

certainly is too huge and heavy for a field guide, but it is a superb collection of information with 69 colour plates, and for each species appr 1 page of text including a distribution map, often a b/w drawing, Thay and Malay names, reference of type description and type locality and text, in addition to the ident./ description paragraph, on group relation (e.g. sister species or other closely related ones), global range, geographical variation, status and population, habitat and ecology, foraging and food, social organization, movements, survival (mostly reads "no information") voice, breeding (nest, egg & brood descript, cycle, seasonality), mould, and conservation.

The volume is a very useful source of all types of information, which is increased by 19 pp of (double-breasted) references, and an index each also of species names in Malay and romanized Thai.

The introduction chapter, on 34pp, gives a general background to the Thay-Malay biographical areas. We look forward to vol II

Bird life International: Threatened Birds of the Word, (Lynx Editions, Barcelona/Cambridge 2000, 852 pp, £ 115.-)

Bird life International and Lynx Editions with the help of about 1000 people, have produced a superb, heavy hardback tome covering all 1186 species listed as vulnerable or above, and also 727 species listed "near - threatened". Introductory chapters with statistics on countries and habitats with a particularly high number of threatened species, reasons for endangerment, and possible actions (including reference to case studies), and Red List Criteria lead to the main part, a systematic account of species, each with a colour drawing, distribution map, IUCN category including reasons for classification, ecological and population data, threats, monitoring, current conservation efforts and "targets", which is a paragraph listing necessary priority actions, be they research, management, education, legal/policy actions etc.

After the species accounts of endangered species there are the parts on near-threatened, lower risk/ least concern, data deficient and extinct species. There is also a short list of hypothetical extinct species, e.g. those that are possibly only subspecies, like the Dwarf rhea.

The last section is a list of species by territory - which species, and in what status, does a country, territory, etc have. . 47pp of references, with appr. 60 refs/page, conclude this most important volume.

Parrots (ed. by N. Snyder, P.M. Gowan, J. Gilardi, A. Grajal)

is the new Action Plan for this taxon (180 pp, £ IUCN Publ. Unit Cambridge 2000).

The Parrot Action Plan is introduced with two general chapters on parrots & humans, and general principles of parrot conservation. The latter chapter includes very useful overviews of status assessment techniques, threats, conservation actions including captive propagation and its problem, re-introductions and ecotourism.

The following main part is divided into areas: Australasia, Asia (with sub-divisions on continental Asia, Indonesia & Philippinen), Africa and Neotropics). For each area, threats, conservation solutions, and priority projects are discussed in overview before the species accounts. For all areas the species accounts include some taxa, that have not yet received full species status but should be considered for such. Unfortunately, almost no biological, ecological or behavioural information is given in the Action Plan.

Vol 37 of ICY (ed. by P. Olney & F. Fisher), 440 pp £ 67.London 2000

is dicated to psittacines. Before entering into this special section, we find a guest-editiorial by Sally Walker of CBSG-India, on the efforts, problems and successes of CBSG's regional groupings in spreading conservation - related info and competence in regions outside the Western/Northern Hemispheres - a very worth-reading chapter. The following 298 pp are dedicated to parrots. Introduced by chapters on global threats and regional collection plans we then find 21 accounts of either EEP's for specific species written mostly by the coordinators or husbandry, management and breeding of single species in particular(ly successful) institutions. The next 3 chapters are overviews of enrichment/ social management measures, then one chapter on viral diseases, 3 chapters on regional conservation/ education projects, and a list of longevity records.

The rest of IZY 37 then is again on "The Developping Zoo-World", from slugs and sea-anemones to Orangs, and the reference section on studbooks, breeding programmes and regional zoo associations.

Galliform Action Plans

The whole order of Galliformes is now being covered by a superb set of documents published in 2000:

Curassows, Guans and Chachalacas, the Cracidae, 182 pp, compiled by D. M. Brooks and S. D. Strahl, 2000,

is published in English, Portuguese and Spanish. Thus in reality, per language there are about 35pp of text, plus 6pp of references, plus appr 5Opp of appendices, including taxonomic lists, Red list classifications etc. The AP document includes several pages of biological/ ecological data, role of cracids in ecosystems etc, and also lists research priorities, in relation to taxonomy and captive breeding particularly. Thus the AP also serves as an outline of research needs for zoas and private breeders.

Megapodes, 39pp, compiled by W. Dekker, R. Fuller & G. Baker, 2000,

contains less general biological information on the family, but due to the smaller number of species those listed VU and above are in more detail. There is no specific chapter on research needs but a

paragraph on the gathering of basic biological data is included in the 5 year-plan.

Partridges, Quails, Francolins, Snowcocks, Guineafowl, and Turkeys, 63pp, compiled by R.Fuller, J.Carroll & P.Mc Gowan, 2000,

due to the fact that it has to cover > 150 species living practically in all habitats except Antarctica, it is no wonder that species are covered only at a mean rate of two per page in the species account - also relating to the fact that little basic info is available on most of the non-European/North American taxa. The wider importance of captive breeding, also for research purposes, is stressed in the AP, thus again it can also be used to-deterrmine research priorities for combined in-/ex-situ projects.

Grouse, compiled by J. Storch, 112pp, 2000,

has several pages of general biological/ecological info, including a graphic and verbal description of niche/habitat separation between several broadly sympatric species, and much more detailed in the species accounts.

Pheasants, ed. by R. Fuller & P. Garson, 69pp, 2000,

covering over 50 species, of necessity again restricts the species accounts to a mean of 2 species/page. But again, many of the species are almost unknown from the wild any way.

All 5 documents are organized in similar ways, up to similarly worded titles of subchapters. This in itself is a great help, and the whole set is a unique and important series.

Cheating Birds

N. B. Davies (Cuckoos, Cowbirds and Other Cheats, TAD Poyser, London, 2000, 310 pp, £ 19,95),

with superb illustrations by D. Quinn, has written a comprehensive review of data, many of which are from his own group, on brood-parasitism in birds worldwide. Starting with the Common cuckoo, the book then takes us to cuckoos in other continents, including non-evicting species, and then to cowbirds, where sometimes 3 species can have their eggs in one nest, and African parasitic finches.

The author is one of those rare combinations of a dedicated naturalist and competent behavioural ecologist, and thus the book is a good reading from both angles.

Why Tropical Birds are Different

Behavioural Ecology of Tropical Birds by B.J.M. Stutchbury & E. S. Morton, Academic Press, San Diego etc, 2001, 165 pp, £ 26,15 pbk

The reason tropical birds are different mostly is connected with the absence of seasonality in breeding, and breeding related behaviour, such as territoriality, thus has profound influences e.g. on clutch size, replacement of territory holders, but also communication (singing in females is not uncommon in tropical species) . The authors point out that the bias towards temperate zone birds may have produced skewed behavioural ecology concepts and theories, because the majority of studies was, and is, on a minority of species.

From the zoobiology point of view this book is even more important because most of our bird exhibits hold tropical species - and we should aim to treat them adequately both in husbandry and mangement and in educational projects.

German Volumes

M.Stubbe,A.Stubbe (ed.) Populationsökologie von Greifvogel- und Entenarten)Halle/S. 2000, 552 pp, DM 40.-

is the proceedings volume of a meeting on population ecology of raptors and owls. The first 7 chapters introduce and discuss overviews of several monitoring techniques (e.g. satellite telemetry, or simulation models) and aspects such as habitat fragmentation, and dispersal, the final 6 chapters cover reasons for population declines, mortality and loss (e.g. organochlorides, illegal hunting and traffic accidents), and in between we have accounts of projects (6 on owls, 25 on raptors), including one each on the only confirmed Saker falcon breeding pair in Germany, and on a successful Falco rusticolus x F. peregrinus hybrid breeding in the wild. Important for every German-reading bird curator and others

Copies can be ordered from Prof Dr M.Stubbe, Zool Inst. Domplatz 4, D 06099 Halle/S.

„Sammlung Vogelkunde“

is a series published by Aula Verlag, Wiesbden, with monographs on certain species or small groups of birds. Two volumes have been obtained as examples.

Th. Brandt, Chr. Seebaß: Die Schleiereule (Barn Owl.-), 152pp, 1994, and K. Pegoraro: Der Waldrapp (guess what’s called in English), 144 pp, 1996. Both cost DM 39,80,

and are lavishly illustrated with diagrams, maps, colour pictures and beautiful drawings (of birds doing interesting things) . Both monographs are unique among publications on single species because the emphasis in on biology, ecology, eco-ethology and other aspects of the bird’s life, instead of morphology and taxonomy., Thus, the series is of much higher value to curators and educators in zoos than most other monographies on bird species”.

Three Germanvolumes published by Blackwell Wissenschafts-Verlag in Berlin are related to zoo-relevant bird groups:

Ziervögel (Exotic Birds), 1999,XXII + 320 pp, DM 156,37,

This is mostly directed at veterinarians with 260 pp on diagnostics, therapy, anesthesia, and symptoms of many important diseases. This also includes behavioural disturbances, in budgerigars and parrots. Most discussions are, illustrated with colour pictures of victims, and often contain specific pharmacological therapeutics

M. Heidenreich: Greifvögel (Raptors), 1995, X + 294 pp, hbk DM 97.69,

is in many ways similar also with 190 pp on veterinary issues, but a little bit more on breeding, and also 10 pp on legal issues (on European and German national level). This volume also draws considerably upon the lavish illustration (one example, there are nine colour pictures of eye diseases !) Each chapter has its own literature list, which makes it much easier to use for quick referencing on certain diseases.

M. Lantermann, Papageienkunde, 1999, IX + 550 pp, hbk DM 166.15

Werner Lantermann has quite a reputation as a breeder, and writer, of psittaciform birds. His volume covers every aspect from man-parrot-relationships, biology, behaviour and conservation, husbandry/enclosure design and breeding, and a 200 pp systematic part, in 3 biogeographical subchapters (specific, asiatic african, and New World) monographs. Each species is shown as a (often colour) picture or drawing, distribution map, size/weight table, a description habitat, ecology and status, behaviour and vocalizations, breeding and husbandry, rearing/handrearing and other special topics, relation to other taxa, and a few references, Often there are additional drawings of behaviour patterns. A very good and informative volume

Mammalian Ecology in German

Two volumes of the comprehensive series of proceedings volumes from Halle University are dealing with field biology and ecology of mammals

Semiaquatische Säuger Semiaquatic Mammals, ed.by R. Schröpfer, M. Stubbe and O. Heidecke, already publ. in 1992 (DM 35.-), 468pp.

It deals with all kinds of semiaquatic/freshwater mammals from water shrews and desmans to European mink, beaver etc. 12 of the 41 contributions are in English. Contents range from parasitology and diseases to habitat structure (important for constructing exhibits) to craniometry and demography, age determination and status of individual populations.
All the chapters contain valuable lists of references, and the inclusion of many Eastern/East Central European authors and refs. makes the book particularly valuable.

Methoden feldökologischer Säugetierforschung, Methods in Mammalian Field Ecology, a symposium vol. ed. by M. Stubbe, A. Stubbe and D. Heidecke 1995 ,also DM35.-

contains 474pp. 46 chapters, all in German, cover methods of telemetry, trapping questionnaires/interviews, spotlight counting, activity, monitoring, molecular biology, age determination, habitat use, parasitology etc.

Most of the papers deal with small mammals. Unfortunately very few behavioural methods are covered, and techniques such as line transect methodology, distance sampling etc are obviously absent.

Underground Rodents

(E. A. Lacey, J. L. Patton, G. N. Cameron, eds.), Life Underground, Chicago UP, 2000, 462 pp, U$ 24.- pbk, U$ 65.- hbk).

The first comprehensive volume on the biology of subterranean rodents is a compilation of 11 chapters, grouped into several topics. The first group, titled "Organismal Biology" reviews morphology, ecophysiology, communication and reproduction. The next 3 chapters are dedicated to population and community ecology, including spatial and social systems, the last group, 4 chapters is on evolutionary biology including genetics. The whole book is arranged around two central questions: What sort of biological adaptations are found in subterranean habitats, and in what way do different taxa find similar **vs** different solutions ?

Domestic Ferrets in German

H. Schwammer, Frettchen, E. Ulmer Verlag, Stuttgart, 2000, 95 pp, DM 29,80)

is primarily directed towards pet owners, but is a good introduction into husbandry of these small domesticated mustelids. The text is written with competence and, though directed towards laypeople, all the necessary info is given. One minor omission, perhaps should be corrected in a new edition: The fact that young ferrets, in their 3 rd month, are olfactorily imprinted on food which they prefer throughout life.

Rhino

(by Anna Merz, Longhorn Publ., North Riding, SA, 31999, 233 pp, U$ 25.-)

is the description of Ms Merz's famous work establishing and running the Lewa Downs Sanctuary. She describes a lot of aspects of behaviour, ecology and every day life of Black, with some additional info on White rhino, an appendix gives some details on drug administration - nevertheless this is mostly a personal narrative of one

of the most successful and dedicated rhino conservation activists. Though some of her interpretations may be a little bit premature and anthropomorphic, nevertheless the book really makes the reader aware (as the reviewer already was from his own work) that these animals are not as dumb and insensible as the public thinks.

The Bottlenose Dolphin

(by J. E. Reynolds, R. S. Wells, S. D. Eide, Florida University Press, Gainesville, 2000, 304 pp, U$ 34,95)

is a compilation of material that literally starts with human-dolphin relationships in ancient times and reviews all aspects, of biology, anatomy and evolution, until we reach the questions of the future of the species and its management in the future. Included in the text are 13 colour plates of photos, and 94 b/w illustrations, partly drawings, diagrams, and b/w pictures, 29 pp of literature provide ample opportunity for further reading.

Man and Beast

A special issue of the journal Ibex-Journal of Mountain Ecology (No.5 - 2000, available via Gran Paradiso N.P., Via della Rocca 47, I - 10123 Torma, Italy, Fx +39-011-81 21 305) publishes the proceedings of a conference on “Animal Management and Demography through the Ages”. It is a collection of historical and anthropozoological papers, from prehistoric, and historic hunting, use of hunting statistic for wildlife demography,animal breeding and domestication, to present and future problems of game management. Approximately half of the papers are in French, the other half in English, but all very interesting for zoological and socio-cultural backgrounds.

Indian Mammals

(K.K.Gurung, R.Singh: Field Guide to the Mammals of the Indian Subkontinent, Acad. Press San Diego etc,1996, 140 pp, £ 13,95 pbk).

In addition to descriptions, colour and b/w drawings for each species is a section on tracks, and a chapter on "Where to watch mammals", with descriptions of 23 natural parks from India, Nepal, Bangladesh and Sri Lanka, with at least one page of text, including a mammal species list, plus map per park.

New World Camels in German

Literature on South American camelids is scarce, even more so than on the old world species.

Matthias Gauly has edited a German volume (Neuweltkameliden, 173pp, Parey Buchverlag 1997, DM 49,80)

which is subtitled "a manual for keepers, breeders and veterinarians". The book covers anatomy, physiology, husbandry (including housing, fencing, nutrition and handling) reproduction, wool, leather, meat and other production, and diseases (on 45 pp) The list of references (per chapter) includes a lot of publications from the Americas, and a glossary of Native Indian and Spanish terms further allows the reader to explore original publications. In consequence, a highly useful and recommendable collection.

5. Brief Reports from the Editor

Tapir Dissertation in German

Stefan Seitz, who has been working on tapir behaviour and zoobiology already since several years, has now finished his dissertation on behaviour and presentation of Tapiridae in Zoos. The volume is published and available from the author Dr. Stefan Seitz, Bonndorfer Str. 19, D-68239 Mannheim. It contains a wealth of information and should be read by everybody keeping these fascinating Mesaxonians.

Enrichment for wallabies

Oliver Klaus has finished a MSc thesis at Kiel University on behaviour and environmental enrichment in a mixed-species group of Parma and Bennett's wallabies at Tierpark Gettorf. Besides introducing lateral cover (hides) into the enclosure, food placed in boxes etc, significant influences on activities and social behaviour were demonstrated

(contact to author via TP Gettorf or U.G.).

Zoological Record

Zoological Record, the most complete data base on zoological publications world wide, is now available, either directly via Biosis, or via Cambridge Scientific Abstracts, not only in print or CD, but also Online and via Web. 4 week's gratis trial versions, are available.

Rodentia

A new, glossy - paper magazin in German for all friends of small(er) mammals is being launched by Natur & Tier Verlag, An der Kleinmannbrücke 39/41, D-48157 Münster. The title "Rodentia" in narrower than the scope, because all kinds of small furry animals from marsupials to small carnivores are covered. Each issue also contains at least one article on a research project, and one or more on habitat and field studies. Also included is a section on news from Zoos. Most of the articles are with at least a brief reference list and both the authors of many of them and the editor-in-chief are qualified zoologists/ behavioural biologists. It can be hoped that this journal, though aimed at interested laypersons, will be subscribed by as many curators of small mammals as possible.

More small mammals in German:

TheGerman association for small mammals (BAG, Bundesarbeitsgruppe Kleinsäuger)
has again published several issues of their newsletter since our last EAZA Research Newsletter.

3. Number 3/2000, among others, contains a report on small mammals at Poznan Zoo, including Common vampires, and Pigmy gliders.
4. No 1/2001 has an informative article on hystricomorph rodents
5. No 2/2001 reports on sugar gliders, Musk-shrews, cactus mice, and prairie dogs
6. No 3/2001 includes articles on Cuys, some reports on hand-rearing, and on some mixed-species keeping experiences for small mammals.

Asian Wild Pigs

Asian Wild pigs News, the newsletter of the Asian subgroup of the Pig etc SG, can be found at The latest issue, 2 (1), includes, a report on rare Philippine forms and on Pigmy hog conservation.

Federation of Zoos Research News

Research News, published by the Federation of Zoos of Great Britain and Ireland, can be directly ordered from, the Fed. Office at London Zoo, or via email via conservation. fedzoo zsl.org

The last two issues contain the following reports:
Vol 1, No 2 (April 2001):
Space utilisation in Carollia perspicillata. Effects of food presentation on Bushdogs. Re-Introduction of Water voles in Arundel. Feeding , and coprophagy in Black-lipped pika. Lesser slow loris at Paignton. Nutrition of duikers in Zimbabwe. Effects of pups on a newly formed Wolf-pack.
Vol 2, No 3, (July 2001):
Social and conflict behaviours in coatis Interaction between Sulawesi macaques and visitors. Effect of rearing on behaviour and personality in chimpanzee. Diet selection in fruit and bleeding heart doves. Interactions and enclosure use in a mixed species exhibit of new world monkeys. Territorial and aggressive behaviour in free-ranging basilisks. Distribution and conservation of Pteropus rodricensis.

6. Congresses, Symposia

8.3. -11. 3. 30th E.A.A.M Symposium in Aalborg, Denmark

The European Association for Aquatic Mammals encourages authors to submit paper and posters abstracts for the next symposium in Aalborg in March 2002. All topics related to marine mammal science and husbandry acceptable.

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5.4. - 6.4. 5th International Hedgehog Symposium of the European Hedgehog Research Group(EHRG),

Riserva Naturale Orientala Di Offerno, Commune di gemmano, Rimini, Italy

Symposium organizer: Dino Scaravelli, Riserva Naturale Orientata die Inferno Commune die Gemmano, piazza Roma 1, 47855 Gemmano (RN) Italy, Tel +390541,854.060 / 0541.854.080 - Direz 0541.985.730, fax +39 0541/854012.

16.4.-19.4. 5th Baltic Theriological Conference,

Preliminary programme: 15. 04. Arrival and field trip to Nemuno Kilpos Regional Park, 16.04. Expert meeting on protection of the mammal species fron perspective of EU nature conservation requirements, 17./18. 04. Plenary and Poster sessions, 18. 04. Meeting of the Baltic Large Carnivore Ibitiative Group

Contact: Alius Ulevicius, Institute of Ecology,Akademijos 2, LT-2600 Vilnius, Fax 379-2-729257 or litunanin Therilogical Society: Alius Linas, Laima: 370-2-729278

August International Conference on Marine Mammals, Russia.

The Conference is planned to be held at lake Baikal, a pearl of world's nature, in late august -September 2002. The Conference is planned for presenting results of the recent marine mammal investigations, determining the priorities for future research activity, developing national and international cooperative projects and fund rising for future research. All topics concerning cetaceans, pinnipeds, sea otters and polar bears are welcome.

contact: conf2002@2mn.org http://2mn,org/Enl/meetings/mmh2002/conf2002.htm

27.8.- 30.8. Measuring Behavior 2002, the fourth International Conference on Methods and Techniques in Behavioral research

will be held at the Vrije Universiteit of Amsterdam in. Like the previous meetings, Measuring Behavior 2002 will offer an attractive mix of oral papers, poster presentations, technical demonstrations, training sessions, user meetings, scientific tours, an exhibition of scientific books, instruments and software, and a pleasant social program. All presentations will deal with innovative methods and techniques in behavioral research. If the Measuring Behavior conferences are new for you, the proceedings of the 2000 meeting give a good impression of what it is all about (http://www.noldus.com/events/mb2000/). We invite you to visit our web site www.noldus.com/events/mb2002. If you wish to propose a symposium or other conference activity, please send your suggestions to the conference secretariat (mb2002@noldus.nl). We look forward to meeting you in Amsterdam!

Conference Secretariat Measuring Behavior 2002, P.O.Box 268, 6700 AG Wageningen, The Netherlands, tel: +31-317-497677, fax: +31-317-424496, e-mail: mb2002@noldus.nl0

16.9 - 18.9. Workshop on sexual segregation

at the University of Cambridge,Zoology Department, United Kingdom. Different researchers have proposed different hypotheses on why males and females of many animal species segregate into same-sex groups. Different taxa might segregate for different reasons. Little is known about the mechanisms and function of sexual segregation in most species, because sexual segregation, although widespread, is still little researched in most taxa where it occurs, except for ungulates. This workshop aims to further our understanding of the evolution of sexual segregation in a wide range of taxa, and to encourage the discussion and future research in this area.

Abstracts and registration are due May 5, 2002. Please send abstracts byemail only to: kruckstuhl@hotmail.com. Participation is limited, so early registration is recommended. Registration costs will be 50£ (GBP) for regular participants, and 40£ for students. More details will follow the registration. Dr. K. E. Ruckstuhl, Department of Zoology, LARG, University of Cambridge, Downing Street, Cambridge CB2 3EJ, UK, tel: (+44)1223-336643,fax: (+44)1223-336676 http://www.zoo.cam.ac.uk/zoostaff/larg/pages/Publigroup.html Gilbert Roberts, ASAB Newsletter Editor,http://www.asab.org/

28.10- 1.11 2nd International Conference on Rodent Biology and Management (ICRBM)

at the Novotel Coralia Bogot Resort, Indonesia The official language of the Conference will be English

Conference Secretariat: Ms Denise Tart, Austalian. Convention and Travel Services (ACTS), GPO Box 2200, Canberra ACT 2601, Australia, Tel: (+612) 6257 3299, Fax:(+612) 6257 3256.

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