

---

## News and Views from the Zoo Research Group

---

### ***BIAZA 9<sup>th</sup> Annual Symposium on Zoo Research***

The 2007 annual research symposium will take place at Whipsnade Wild Animal Park, 23<sup>rd</sup> and 24<sup>th</sup> July. As usual all zoo-based researchers are welcome and are encouraged to offer talks or posters and the cost will be kept as low as possible. In previous years the symposium has been well attended by university students and academics but few zoos have been represented, so zoo staff are particularly encouraged to take part this year. Further information will be available shortly, please contact Andy Hartley ([andy.hartley@zsl.org](mailto:andy.hartley@zsl.org)) to be added to the distribution list.

### ***BIAZA statistics guidelines in America***

Amy Plowman, co-chair of the BIAZA Research Group and editor of the group's *Zoo Research Guidelines: Statistics for Typical Zoo Datasets* was recently invited to talk about these guidelines at a discussion session entitled 'Lies, damned lies and statistics: the use and misuse of numbers in zoo research' during the AZA AGM in Tampa, Florida. This discussion session was organised by Chris Kuhar (Disney's Animal Kingdom) to address many of the issues BIAZA dealt with in 2004 when the statistics guidelines were planned, such as small sample sizes, non-parametric data, lack of independence between data points. Despite the subject matter and being held at 7am (when it was still dark!) the session was attended by about 50 delegates. The general conclusions were that there is no need for the AZA to write their own guidelines, they will simply adopt ours (indeed some were already using them) and that they will organise some training workshops on how to use the statistics we recommend. Dan Wharton, editor of *Zoo Biology*, also took part in the session and will be using the guidelines for reviewing manuscripts submitted to the journal. Amy will be writing a technical paper for *Zoo Biology* summarising the main points of the guidelines shortly. Overall it is extremely pleasing to see the BIAZA guidelines recognised internationally in this way and thanks go again to all the authors who helped compile them. For those who have not yet seen the guidelines they are available to download from the BIAZA website (see below). You may also find it useful to read Chris Kuhar's paper on similar issues (*Zoo Biology* 25: 339-352).

### ***Recent workshops and upcoming publications***

Two workshops were held in July at Colchester Zoo during the annual research symposium. The first was attended by a small, invited group, including three journal editors, to discuss how to improve the publication rate of zoo-based research. The second was attended by all the conference delegates and focused on how to write good questionnaires for zoo research. The outputs of both these workshops will be new volumes of the *Zoo Research Guidelines* series which we hope will be of huge benefit to zoos and external researchers. They are currently in preparation and we hope to complete them both by the end of the year. The proceedings of the whole Colchester meeting (8<sup>th</sup> Annual Symposium on Zoo Research) should also be published shortly.

---

## **BIAZA Research Group Resources**

The following resources can be downloaded without charge from the BIAZA website ([www.biaza.org.uk](http://www.biaza.org.uk)):

- Previous issues of *Zoo Research News*
- *Zoo Research Guidelines: Project Planning and Behavioural Observations*. Wehnelt, S., Hosie, C., Plowman, A. and Feistner, A. 2003.
- *Zoo Research Guidelines: Monitoring Stress in Zoo Animals*. Smith, T.E. 2004.
- *Zoo Research Guidelines: Studies of the Effects of Human Visitors on Zoo Animal Behaviour*. Mitchell, H. and Hosie, G. 2005.
- *Zoo Research Guidelines: Sampling Guidelines for Zoos*. BIAZA. 2002.
- *Zoo Research Guidelines: Statistics for Typical Zoo Datasets*. Plowman, A. (ed.) 2006.

The following resources are also available from the BIAZA office (there may be a small charge).

- Abstracts of the 1<sup>st</sup> Annual Symposium on Zoo Research. Plowman, AB (ed.) 1999
- Proceedings of the 2<sup>nd</sup> Annual Symposium on Zoo Research. Plowman, AB (ed.) 2000
- Proceedings of the 3<sup>rd</sup> Annual Symposium on Zoo Research. Wehnelt, S and Hudson, C (eds.) 2001
- Proceedings of the 4<sup>th</sup> Annual Symposium on Zoo Research. Dow, S (ed.) 2003
- Proceedings of the 5<sup>th</sup> Annual Symposium on Zoo Research. Gilbert, T (ed.) 2003
- Proceedings of the 6<sup>th</sup> Annual Symposium on Zoo Research. McDonald, C. (ed.) 2004
- Proceedings of the 7<sup>th</sup> Annual Symposium on Zoo Research. Nicklin, A. (ed.) 2005
- A database of browse use in British and Irish Zoos and poisonous plants information (CD, 2001). Plowman, A.B. and Turner, I.
- A Bibliography of References to Husbandry and Veterinary Guidelines for Animals in Zoological Collections. Macdonald, A.A. and Charlton, N. (eds.) 2000

## To carcass or not?

Vicky Melfi and Kathy Knight, Paignton Zoo Environmental Park

### Introduction

The use of carcass feeding for zoo-housed carnivores is variable within and across zoos and species. The costs and benefits associated with carcass feeding are often debated but there are few empirical data on which to base these arguments. One of the greatest reservations associated with the use of carcasses is the potential for disease and other health risks. By contrast carcass feeding is considered to improve the mental and physical fitness of carnivores through the expression of natural feeding/hunting behaviours. This project collected data to test whether these two arguments were valid. Two specific aims were: 1. to assess whether the provision of carcasses compromises the health of zoo-housed carnivores and 2. to evaluate whether environmental enrichment can compensate for not providing carcasses or live prey?

### Methods

1. Surveys were sent to 192 accredited zoos worldwide, supported by letters of endorsement from the BIAZA research committee and relevant TAGs. Data were requested on 8 felid (lion, tiger, jaguar, leopard, ocelot, caracal, fishing cat, Pallas' cat) and 9 non-felid (polar bear, brown bear, grey wolf, African wild dog, bush dog, fennec fox, fossa, binturong, kinkajou) species. The survey included sections on health problems, feeding method and other environmental variables that could affect health. Twelve independent variables (IVs) were included in the final analysis: feeding method, species, enclosure size, enclosure complexity, amount of non-food enrichment, frequency of keeper observations, frequency of vet observations, frequency of parasite testing, wild prey caught, and sourcing, screening and storage of carcasses and meat. Three measures of health (dependent variables, DVs) were used: parasite occurrence, disease occurrence and death/injury directly due to feeding method. For preliminary analysis feeding method was categorised as **Carcass** (an animal with or without fur, feathers, innards, appendages), **Meat** (unprocessed meat i.e. on the bone) or **Commercial** (a formulated meat based diet). If responses indicated that a variety of feeding methods was used, the most commonly used diet was used in analyses i.e. x fed weekly versus y fed opportunistically, x was taken as the predominant diet. If animals received any carcasses on a weekly basis they were classed as being carcass fed. A forward stepwise binary logistic regression model (Tabachnick and Fidell, 2001) was used to investigate the relationships between DVs and IVs.

2. Published papers where the main topic was carnivore environmental enrichment and/or carcass feeding (from the journals Applied Animal Behaviour Science, Animal Welfare, Shape of Enrichment, and Zoo Biology) were used to gather data on carnivore species, type of environmental enrichment and/or carcass provision and the feeding behaviours stimulated. Environmental enrichment was defined as the provision/addition of novel stimulus to elicit a change in behaviour. Examples of this include, novel scents and objects, and novel feeding methods. Carcass feeding was defined as the provision of whole/partial animals with/without, fur, feathers and appendages. Carcasses could range from pinkies and chicks to a whole horse. All carnivore taxa were included in this part of the study.

### Results

1. Carcass feeding is routinely implemented for many carnivores and is the predominate method if feeding felids (Fig. 1). North American zoos tend to use commercial diets more than zoos in other regions (Fig. 2). There appears to be a lower incidence of health problems associated with commercial diets (Fig. 3).

Fig 1: The most common feeding method for each carnivore species in all zoos (N=171)

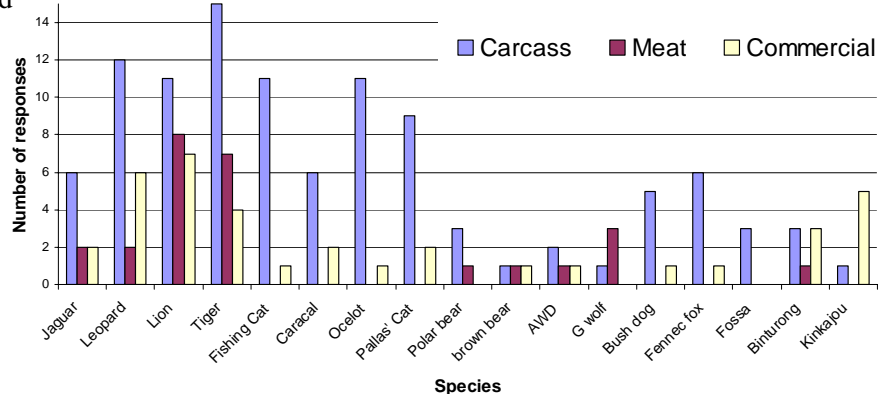


Fig 2: Regional variations in feeding methods for carnivores

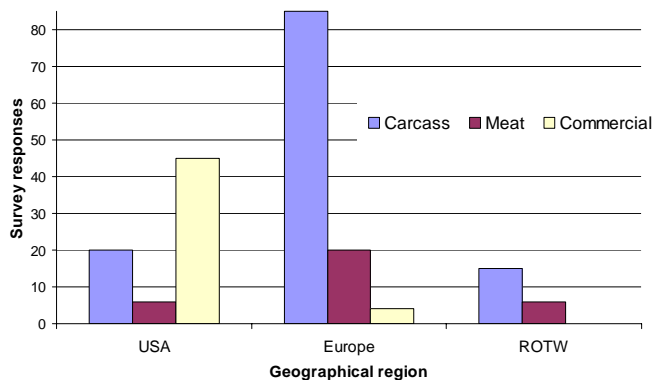
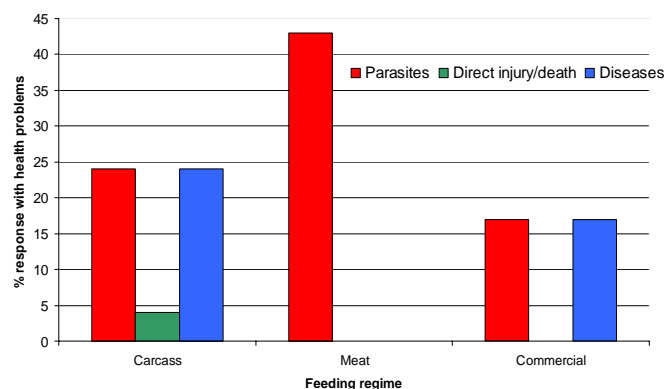


Fig 3: Incidence of health problems in carnivores under different feeding regimes



In total only 9 incidences of injury or death directly associated with feeding were reported, which highlights the scarcity of these occurrences but resulted in no statistically significant associations of this DV with any IV. Occurrence of disease was significantly associated with the frequency of parasite testing; animals tested three times per year suffered significantly less disease than those tested on an *ad hoc* basis (Table 1). Parasite occurrence was associated with feeding method, parasite testing and enrichment use (Table 2). Parasites occurred significantly more often in animals fed either carcasses or meat rather than a commercial diet. Testing for parasites less than three times per year significantly increased the likelihood of parasite occurrence. Animals given enrichment were significantly less likely to have parasites compared to those without access to enrichment.

Table 1: Disease occurrence was associated with frequency of parasite testing.

Variable	B	p	Odds ratio Exp(B)
Parasite test		>0.05	
Test 1 (no times)	-0.105	<0.05	0.900
Test 2 (yearly)	-0.711	<0.05	0.491
Test 3 (twice yearly)	0.259	<0.05	1.296
Test 4(3 times a year)	-2.744	>0.05	0.064

Table 2: Parasite occurrence was associated with the regularity of parasite testing, feeding regime and use of enrichment

Variable	B	P	Odds ratio Exp(B)
Feeding regime		<0.05*	
Feedreg (1) <i>Carcass</i>	20.496	>0.05	7.97E+0.8
Feedreg (2) <i>Meat</i>	23.048	>0.05	1.02E+10
Parasite test		<0.05*	
Test (1) <i>0 x year</i>	1.686	>0.05	5.399
Test (2) <i>1x year</i>	2.036	<0.05*	7.659
Test (3) <i>2 x year</i>	1.157	>0.05	3.182
Test (4) <i>3x year</i>	-1.219	>0.05	0.296
Enrichment	-.406	<0.05*	0.666

2. The data from published papers revealed a total of 16 different feeding/hunting behaviours that were stimulated by either carcass provision or environmental enrichment. A further 5 were stimulated only by environmental enrichment and 3 only by carcass provision. Therefore, to ensure a maximum range of behaviours both techniques should be included in the husbandry regime.

## Conclusions

The results indicate that carnivore health may be compromised by feeding carcasses, due to increased risk of parasites, however this risk is also present when feeding meat. Better sourcing, screening, storage and presentation of carcasses and meat should be able to eliminate this risk. However, it is possible that increased occurrence of disease and parasites is an indirect rather than a direct result of feeding regime. The surveys indicated that animals fed carcasses or meat caught live prey more often than those fed a commercial diet. Opportunistic prey can obviously not be screened so could be actually be the main route for disease and parasite transmission. The results also indicate that carcass feeding is necessary to promote the expression of the full diversity of feeding/hunting behaviours and that overall carcass feeding is a suitable, and possibly preferable, feeding method for zoo carnivores.

---

## Research Snippets

---

### **Does positive reinforcement training have an impact on the behaviours of captive brown capuchins (*Cebus apella*)?**

K. Stubbs, J. McKinley, S-J Vick, C. MacDonald and H. M. Buchanan-Smith, University of Stirling and The Royal Zoological Society of Scotland

Appropriate training in zoos for the purposes of husbandry requirements has been shown to: reduce aggression and abnormal behaviour; improve socialization; enhance enrichment programmes; increase the safety of keepers; reduce stress and improve husbandry and veterinary care whilst also allowing for the collection of samples. Despite these positive implications for animal welfare and improved animal management, positive reinforcement training in zoos still faces fierce opposition. The arguments against training are: loss of wild type behaviours and an adverse impact on activity budgets; an acceleration of domestication (which reduces the chances of successful reintroduction to the wild both for the individual and future offspring) and increases in human-directed behaviours. The aim of this study was to examine whether training zoo-housed capuchins (*Cebus apella*) impacts on: activity budgets; time spent at the training wall and/or visitor viewing area; and human-directed behaviours out with training sessions.

The capuchins were trained to station (to stay at a specific location) by the primate keepers. Once stationed-trained, more complex behaviours can be trained for research purposes and to allow improved veterinary care without the need to capture. All data were collected in the exterior enclosure in three phases, each spanning 12 days: Baseline data prior to the commencement of the training programme, and at two intervals following the start of the programme (post-training data are collapsed for analysis). Focal and group scan data were collected. Instantaneous and all occurrence follows (10 mins), using 10 sec intervals were carried out twice daily for each of the seven individuals recording both state and event behaviours. All capuchin-human interactions were recorded on an all occurrence basis. Interactions were defined as any behaviour directed towards visitors, primate keepers and other zoo staff. To assess general location of the group an instantaneous group scan was recorded using 30 minutes intervals from 0900 – 1700 hrs. The external enclosure was split into eight locations (L1-L4 were nearest the training wall; L1, L4, L5, and L8 nearest the viewing area). Location 9 was scored if the capuchin was out of sight. All of the data collected were analysed using paired samples t-tests.

There was no change in activity budgets between baseline and training conditions. Individuals spent significantly less time within one arm's length of each other, and more time three arms' lengths away following training, suggesting a change in group dynamics. There was no significant change in the amount of time the monkeys spent near the training wall, nor the visitor viewing area between baseline and post-training. Although there was a significant increase in "out of sight", this is likely to be attributable to seasonal weather changes. There were no significant changes in the number of capuchin-human interactions between baseline and post-training periods. It is concluded that positive reinforcement training is not detrimental to the monkeys out with training sessions, and should be promoted in zoos to improve animal management and welfare.

Further info: Hannah Buchanan-Smith, Department of Psychology, University of Stirling, Stirling, FK9 4LA, Scotland. E-mail: h.m.buchanan-smith@stir.ac.uk

---

### **Effects of mother and infant characteristics on parenting style, relationship quality and the social development of infant hamadryas baboons (*Papio hamadryas*).**

Louise Millar, University of Exeter and Kirsten Pullen, Paignton Zoo Environmental Park

This study examined the effects of mother and infant characteristics on parenting style, relationship quality, and the social development of infant hamadryas baboons (*Papio hamadryas*). Five mother-infant dyads of hamadryas baboons, which are part of a captive group of 52 baboons at Paignton Zoo Environmental Park, Devon UK, were observed between June and August 2006. Their behaviour towards each other, and the infant's social behaviour, was used to calculate maintenance of proximity, relationship quality, and social interaction quality scores for each dyad. It was then possible to identify each mother as having a 'relaxed' or 'controlling' parenting style, each mother-infant relationship as 'secure' or 'insecure', and each infant as being 'socially secure' or 'socially insecure'. The efficacy of using proximity of the females to the harem leader male as a technique to assess harem hierarchy status was tested and found to be a reliable measure in this case. The scores assigned for maintenance of proximity, relationship quality and social interaction quality were then compared to the mother's age, experience and position in the harem hierarchy, and the age and gender of the infants, and correlations were explored. It was found that mothers of male infants were more likely to control proximity within the dyad ( $\rho = 0.87$ ;  $p = 0.03$ ), and therefore have a more controlling parenting style, than mothers of female infants. Older mothers had more secure

relationships with their infants than younger mothers ( $\rho = 0.90$ ;  $p = 0.02$ ). Younger infants were more socially secure than older infants ( $\rho = 0.90$ ;  $p = 0.02$ ). Finally, there was a trend towards higher-ranking mothers having infants that were more socially secure ( $\rho = 0.80$ ;  $p = 0.052$ ). These factors may have a long-term impact on the mother-infant relationship and the infant's social development, in particular providing a focus for future study with these baboons. Investigating the effect of infants' early experiences on their future social development would benefit from a larger sample size to allow more robust generalisation to the species as a whole.

Further info: Kirsten Pullen, Paignton Zoo Environmental Park, Totnes Road, Paignton, Devon TQ5 8NN. Tel: 01803 697514, email: [kirsten.pullen@paigntonzoo.org.uk](mailto:kirsten.pullen@paigntonzoo.org.uk)

---

## **Does female mate choice in Canna wood mice (*Apodemus sylvaticus*) enhance reproductive success?**

Sarah Ford, University of Edinburgh

A population of 153 genetically distinct wood mice, *Apodemus sylvaticus*, were removed from the Inner Hebridean island of Canna and housed *ex-situ*, while a rat-eradication programme took place on the island. A captive-breeding programme was established to increase the size of the potential release population. However there was failure to breed, possibly due to the prevention of female mate choice. In many species females are more selective than males in choosing a mate, as most have higher parental investment and more to lose from mating with 'unfit' mates. Benefits of female mate choice include direct benefits for themselves and/or benefits for their offspring in terms of increasing their 'quality', survival and future reproductive success, through a variety of genetic and non-genetic mechanisms.

The present study aimed to enhance the likelihood of breeding occurring in these mice, by allowing female choice in mate preference tests. It was hypothesised that females would express mate preferences, and these preferences would encourage breeding between the pairs. Further, the preference strength was expected to correspond with reproductive success, and subsequent offspring fitness and survival. A digital video recorder was used to monitor female activity in a preference chamber overnight. A preference was expressed when a female spent more than half of her time in close proximity to one of two males. Females were subsequently paired with their preferred male, until all males in the sample had been tested and paired. The study revealed evidence that female wood mice do express mate preferences of varying strength, but these preferences appeared to have little impact on breeding success, as no litters were born that survived past the juvenile stage, with strong implications for captive breeding programmes.

Further info: Sarah Ford, email: [sarahford100@hotmail.com](mailto:sarahford100@hotmail.com)

---

## **Keeping research alive – the role of zoo keepers in research at Drusillas Park**

Clare Reed, Drusillas Park

Research is an important component of both the Secretary of State's Standards of Modern Zoo Practice (2000) and the recently published World Zoo and Aquarium Conservation Strategy (WAZA, 2005). At Drusillas Park zookeepers are being actively encouraged to engage in research projects to benefit both their own development and that of the zoo and its animal collection. Since 2003 a coordinated research programme has been in place to aid the staff and focus research in areas of interest, both for them and the zoo. Data collection, particularly in the form of behavioural observations, is being used as a training tool for new keepers and has been found to increase their animal identification skills and recognition of key behaviours. Involvement in research projects has encouraged further reading and information gathering, developing skills that are particularly useful for those that do not have an academic background.

Communication with other zoological collections and academic institutions has been encouraged and a memorandum of understanding with a local university is in place, which allows staff to make use of the library and its facilities. Dissemination of information, both internally and externally is important and staff are expected to write up their completed projects, eventually giving oral presentation of their results at conferences/symposia, presenting posters or contributing to relevant publications. In order to achieve this it has been necessary to incorporate research into the role of keepers at Drusillas. Time is allotted for data collection, which is incorporated around daily routines and often shared amongst staff members. Incorporating data collection into the role of zookeepers has particularly benefited those studying for Animal Management qualifications.

Further info: Clare Reed, email: [clare.reed@drusillas.co.uk](mailto:clare.reed@drusillas.co.uk)

## Announcements

---

### ***Public perceptions of carnivore feeding methods survey – request for participants***

At the 7th International Conference on Environmental Enrichment (ICEE), New York, a number of authors contributed to the symposium 'To carcass or not?' organised by Dr Vicky Melfi to discuss the benefits and problems associated with providing carcasses for zoo carnivores. Research suggests that carcass provision for carnivores is beneficial, promoting natural behaviour, reducing abnormal behaviour and is not detrimental to health (see Feature Article). However, carcass feeding is not implemented worldwide. It has been suggested that public perception of carcass feeding may differ internationally, resulting in some zoos being hesitant about using this method of feeding despite it being extremely beneficial. At the ICEE symposium it was suggested that an international survey be undertaken to evaluate zoo visitors' perceptions of carcass feeding. Such a survey has now been created and we are seeking collaborators to carry it out in zoos worldwide, following a standard protocol. The aims of the survey were presented at the Australasian Regional Environmental Enrichment Conference in November 2006 and many Australian, New Zealand and South-East Asian zoos have already agreed to take part. If you are able to assist please contact Kathy Knight ([kathy.knight@paigntonzoo.org.uk](mailto:kathy.knight@paigntonzoo.org.uk)) or Vicky Melfi ([vicky.melfi@paigntonzoo.org.uk](mailto:vicky.melfi@paigntonzoo.org.uk)). Tel: +44 (0)1803 697514.

### ***Latest news from the Wildlife Information Network***

Wildlife Information Network's latest Wildpro volume, "Elephants: Diseases and Treatment" is now available on CD-ROM and on-line. This volume contains detailed, fully referenced and peer-reviewed information on the natural history of the elephant species, their diseases and treatment, including a drug formulary and medication techniques. The accompanying Electronic Library contains the classic 1910 book "Elephants and their Disease" by G.H. Evans, as well as modern husbandry guidelines and disease management guidelines. For more information go to [www.wildlifeinformation.org](http://www.wildlifeinformation.org)

Wildpro "Bears: Health and Management" is nearly ready for review. The main editor, Dr Debra Bourne, is looking for pictures of bears (all species except the giant panda, all ages, including close-ups of the head, feet, tail etc and e.g. skulls), their enclosures, maternity dens, environmental enrichment, hand rearing etc to illustrate the volume (photocredits given). Also, if you have any documents e.g. on behaviour and environmental enrichment, which you would like to make more widely available, these could be included in the Electronic Library (permission from copyright holders required).

Wildpro "Cranes: Health and Management" is in development. The main editor, Dr Debra Bourne, is looking for pictures of cranes (egg to adult), incubators, enclosures etc to illustrate the volume (photocredits given). Also, if you have any documents e.g. on behaviour, diseases, which you would like to make more widely available, these could be included in the Electronic Library (permission from copyright holders required).

For more information on any of the above or to offer material please contact Debra Bourne, tel: 07702892995 or [dbourne@wildlifeinformation.org](mailto:dbourne@wildlifeinformation.org).

### ***8<sup>th</sup> International Conference on Environmental Enrichment, 5-10 August, 2007***

The 8<sup>th</sup> International Conference on Environmental Enrichment will be hosted by Schoenbrunn Zoo at the Austria Trend Parkhotel Schoenbrunn, Vienna, Austria. See the conference website [www.zoovienna.at/icee2007](http://www.zoovienna.at/icee2007) for details.

### ***EAZA Research Conference 2007, 24-25 May 2007***

EAZA, Poznan Zoological Garden and the University of Adam Mickiewicz at Poznan invite you to participate in the EAZA Research Conference 2007, in Poznan, Poland. The conference is aimed at zoo as well as university staff and students. The conference language will be English. Oral presentations and posters will be accepted on research done in or by zoos, rescue centres or scientific collections. Titles and abstracts should be submitted by 15 March 2007. Contact [conference@op.pl](mailto:conference@op.pl) or check <http://www.eaza.net/news/calendar.html> for more details

### ***BIAZA resources for zoo researchers***

In addition to the Research Guidelines series the BIAZA website research section now includes a range of valuable information for students, including where to look to find material already available before contacting zoos about their research and details of the new BIAZA support scheme for student research projects. Under this scheme letters of support may be awarded to students to three different levels to assist zoos in their decision as to whether to become involved with the project. We urge all prospective zoo researchers to look at the site before starting research.

---

## **Your contributions are needed**

Please send articles, announcements, comments or other feedback for the next issue by the end of December to:

Dr Amy Plowman, Paignton Zoo Environmental Park, Totnes Road, Paignton, Devon TQ4 7EU, U.K.

Tel: 01803 697514, fax: 01803 523457, email: [amy.plowman@paigntonzoo.org.uk](mailto:amy.plowman@paigntonzoo.org.uk)