



Research with zoo animals



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Clinic
of Zoo Animals, Exotic Pets and Wildlife



What kind of research is of interest?



Conservation of biodiversity is set as a main driver

**Developing
the research
potential of
zoos and aquaria**

The EAZA Research Strategy



What kind of research is of interest?

To the zoo / zoo community

- conservation-related issues
- issues related to animal welfare (i.e., captivity)

reproduction, diseases (diagnostics and intervention), management, biological characteristics, enrichment, nutrition

To many students / researchers

anything that allows work with zoo animals

- high 'adventure' factor
- pioneer situation
 - easy way to expertise position
 - perception of low failure risk
- automatic justification (at first)



Counting the books while the library burns: why conservation monitoring programs need a plan for action

David B Lindenmayer^{1*}, Maxine P Piggott¹, and Brendan A Wintle²

Conservation monitoring programs are critical for identifying many elements of species ecology and for detecting changes in populations. However, without articulating how monitoring information will trigger relevant conservation actions, programs that monitor species until they become extinct are at odds with the primary goal of conservation: avoiding biodiversity loss. Here, we outline cases in which species were monitored until they suffered local, regional, or global extinction in the absence of a preplanned intervention program, and contend that conservation monitoring programs should be embedded within a management plan and characterized by vital attributes to ensure their effectiveness. These attributes include: (1) explicit articulation of how monitoring information will inform conservation actions, (2) transparent specification of trigger points within monitoring programs at which strategic interventions will be implemented, and (3) rigorous quantification of the ability to achieve early detection of change.

Front Ecol Environ 2013; 11(10): 549–555, doi:10.1890/120220 (published online 11 Nov 2013)



What kind of research is of interest?



Assessing the *effectiveness* (or not) of specific conservation measures is a vital and challenging area of research.

**Developing
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potential of
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Does conservation need fences, guns, education ... or science?





What kind of research is of interest?



Developing
the research
potential of
zoos and aquariums

The EAZA Research Strategy

EAZA Research Project Example

Breeding biology and reintroduction of amphibians

Site and scale

Collaborative working group for breeding amphibians

Collaborators

Moscow Zoo; various research institutes

Disciplines

Natural history; *in situ* wildlife management

Summary

A special Working Group for breeding of endangered, exotic and problem amphibian species was established in the 1980's by scientists from Moscow Zoo, the Koltzov Institute of Developmental Biology and the State Research Centre's Institute of Biophysics. As a consequence of studying breeding biology, methods for hormone stimulation of amphibian reproduction and husbandry guidelines for all life stages have been developed. These methods made it possible to establish new wild populations of the banded newt *Triturus vittatus* and Eastern spadefoot toad *Pelobates syriacus*, within their natural habitats in the Caucasian Natural Reserve and Armenia respectively. These populations are still thriving and further reintroductions within the natural range of *P. syriacus* are underway. See also Amphibian Ark Project (Glossary).

Publication

Goncharov *et al.* (1989)

Illustration



Source:
J. Semprina



What kind of research is of interest?



Wider needs and benefits As well as underpinning practical or applied science, zoo research can make a general, perhaps major contribution to fundamental or theoretical knowledge.

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What kind of research is of interest?

**ASSOCIATION
OF ZOOS &
AQUARIUMS**

AZA believes that contemporary animal management, husbandry, veterinary care and conservation practices should be based in science, and that a commitment to scientific research, both basic and applied, is a trademark of the modern zoological park and aquarium.

Types of Research

Research investigations, whether observational, behavioral, physiological, or genetically based, should have a clear scientific purpose with the reasonable expectation that they will increase our understanding of the species being investigated and may provide results which benefit the health or welfare of animals in wild populations.



What kind of research is done in zoos?



Research efforts on these topics will, in turn, typically draw on combinations of major scientific disciplines such as anatomy, anthropology, biochemistry, biogeography, bioinformatics, biotechnology, ecology, education, endocrinology, ethnology, ethology, evolution, forensics, genetics, genomics, information technology, nutrition, parasitology, pharmacology, physiology, population biology, psychology, sociology, taxonomy and veterinary medicine.

The EAZA Research Strategy



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Appendix VIII. Zoo research: sample serial publications

This list provides examples of printed and online serial sources of research information and potential outlets for zoo-associated research papers. It has, with kind permission, been adapted and expanded from a list in the *World Zoo and Aquarium Conservation Strategy* (Chapter 3) but is by no means comprehensive. Please refer to the EAZA website (www.eaza.net) for updates.

Animal Behaviour
Animal Conservation
Animal Welfare
American Zoo and Aquarium Association Conference Proceedings (Annual and Regional)
Animal Keepers Forum
Applied Animal Behaviour Science
Aquarium Sciences and Conservation
Australasian Regional Association of Zoological Parks and Aquaria (ARAZPA Newsletter, website)
Bongo (Journal of the Berlin Zoo, contains scientific articles on animal husbandry and conservation)
British and Irish Association of Zoos and Aquaria (BIAZA Research Newsletter, BIAZA Research Symposium Proceedings, BIAZA Research Guidelines)
Conservation Biology
Copeia (American Society of Ichthyologists and Herpetologists)
Dodo (Journal of Durrell Wildlife Conservation Trust)
European Association of Zoos and Aquaria (EAZA Research Committee Newsletter, EAZA News, EAZA Conference Proceedings, EAZA website)
International Zoo News
International Zoo Yearbook
Journal of Applied Animal Welfare Sciences
Journal of Fish Biology
Journal of Herpetology
Journal of Mammalogy
Journal of Wildlife Management
Journal of Zoo and Wildlife Medicine
Oryx: The International Journal of Conservation
Pan African Association of Zoological Gardens, Aquaria and Botanic Gardens (PAAZAB News, website)
Ratel (publication of the Association of British Wild Animal Keepers)
Reproduction
South East Asian Zoos Association (scientific papers from conferences available on SEAZA website)
Thylacinus (Australasian Society of Zoo Keeping)
Turtle and Tortoise Newsletter (Chelonian Research Foundation)
Wildlife Information Network
World Association of Zoos and Aquaria (WAZA News, WAZA Conference Proceedings and website)
Zeitschrift des Kölner Zoo (Journal of Cologne Zoo)
Zoo Biology
Der Zoologische Garten (The Zoological Garden)
Zoo Vet News (American Association of Zoo Veterinarians)



Practical problems related to these approaches

As well as observational data, a wide variety of materials and methods may – subject to risk assessments, biosecurity and health and safety precautions – be obtained from studies of living zoological collections and associated products (e.g. skins, bones, teeth, etc.).

- sample size
- permits (CITES, internal and official animal welfare committees)
- logistics of physically attaining the sample

For example, some cultures such as hair and urine are important in non-invasive studies of stress. All animals die eventually, and post-mortem material can be readily obtained and be deposited in museums and universities reference, especially material from threatened species.

Equally important are the computerised records and archives that zoos and aquaria maintain on breeding, e.g. parentage, clutch/litter size, inter-birth interval, infant survival, group composition, behaviour, medical issues etc.



Practical problems related to these approaches

- sample size
- permits (CITES, internal and official animal welfare committees)
- logistics of physically attaining the sample
- logistics of sample storage and transport



The most important methodological question

As well as observational data, a wide variety of materials and methods may – subject to risk assessments, biosecurity and health and safety precautions – be utilised in studies of living zoological collections and associated products (e.g. tissue and blood samples, faeces, urine, bones, eggs, nests and feathers). For example, some substances such as hormones contained in faeces and urine are important in non-invasive studies of stress. All animals die eventually, and post-mortem material can be usefully stored and be deposited in museums and universities for future reference, especially material from threatened species.

**Opportunistic sampling or
experimental design?**

Equally important are the computerised records and archives that zoos and aquaria maintain on breeding, e.g. parentage, clutch/litter size, inter-birth interval, infant survival, group composition, behaviour, medical issues etc.



Fundamental approach

Sodium metabolism in black rhinos across different dietary intakes?

Stress hormones in orangutans related to group size?

Opportunistic

- use inter-zoo variability (in diets, in group composition)

you need a lot of zoos that only have to give you access to the samples you need

Experimental

- change diets/group size within a constant group of animals

you need a few zoos that permit changing husbandry routines and are willing to officially perform 'animal experiments'

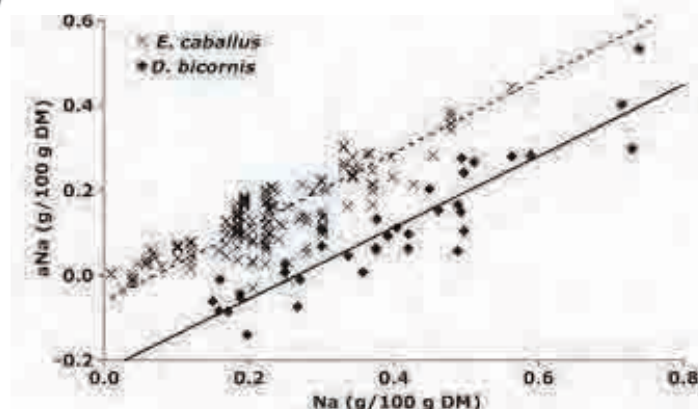




Mineral absorption in the black rhinoceros (*Diceros bicornis*) as compared with the domestic horse

M. Clauss¹, J. C. Castell², E. Kienzle², P. Schramel³, E. S. Dierenfeld⁴, E. J. Flach⁵, O. Behlert⁶, W. J. Streich⁷, J. Hummel^{6,8} and J-M. Hatt¹

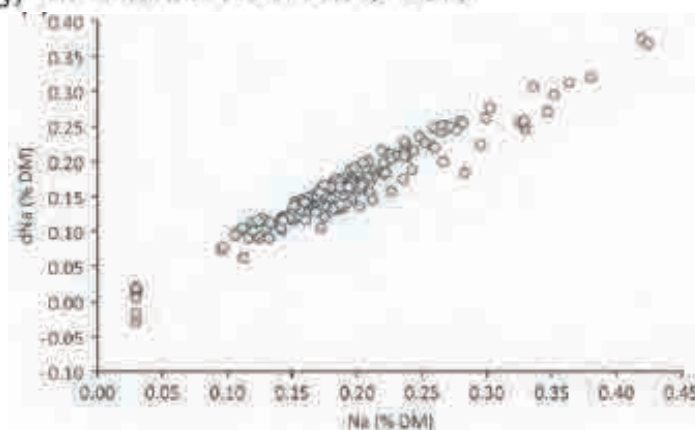
Journal of Animal Physiology and Animal Nutrition **91** (2007) 193–204



Organic matter and macromineral digestibility in domestic rabbits (*Oryctolagus cuniculus*) as compared to other hindgut fermenters

K. B. Hagen¹, A. Tschudin¹, A. Liesegang², J.-M. Hatt¹ and M. Clauss¹

Journal of Animal Physiology and Animal Nutrition © 2015

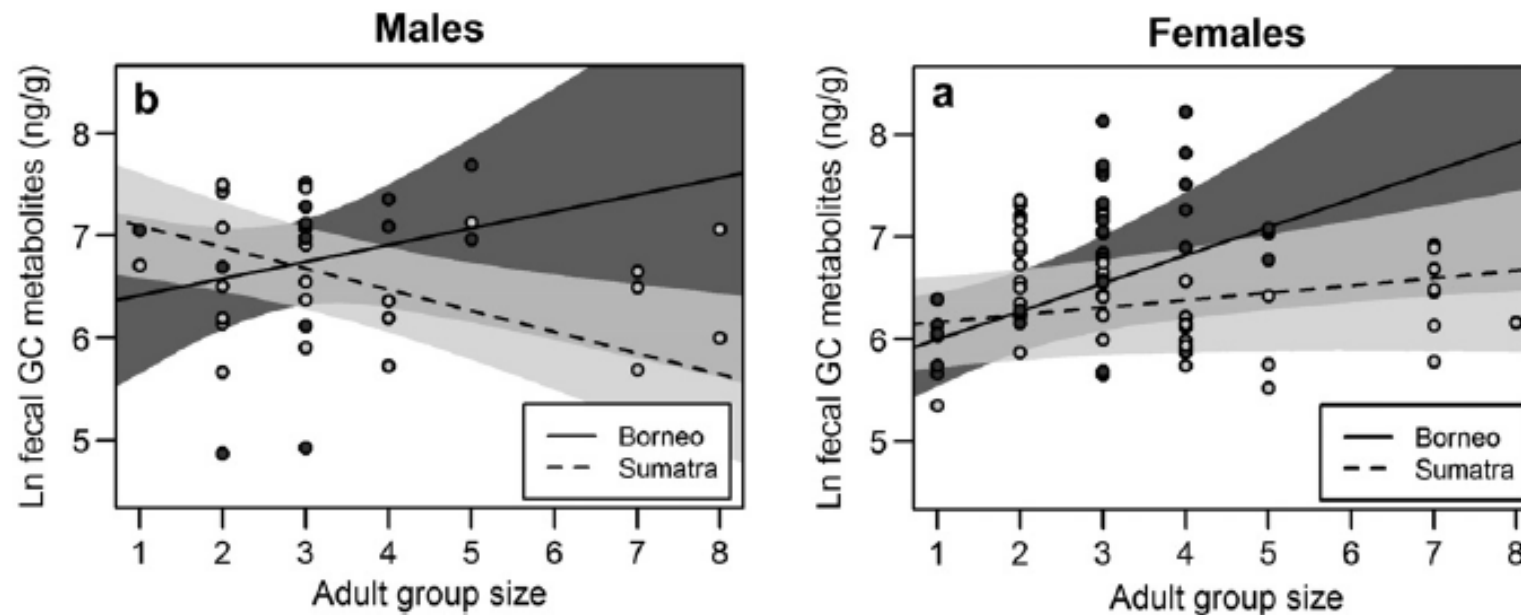




Species-specific patterns in fecal glucocorticoid and androgen levels in zoo-living orangutans (*Pongo* spp.)

Tony Weingrill^{a,*}, Erik P. Willems^a, Nina Zimmermann^b, Hanspeter Steinmetz^c, Michael Heistermann^d

General and Comparative Endocrinology 172 (2011) 446–457

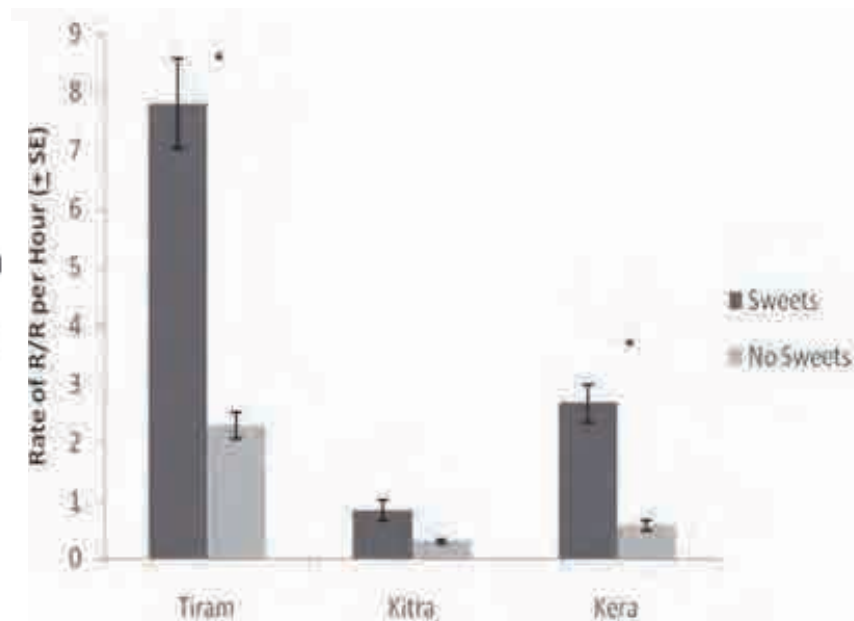
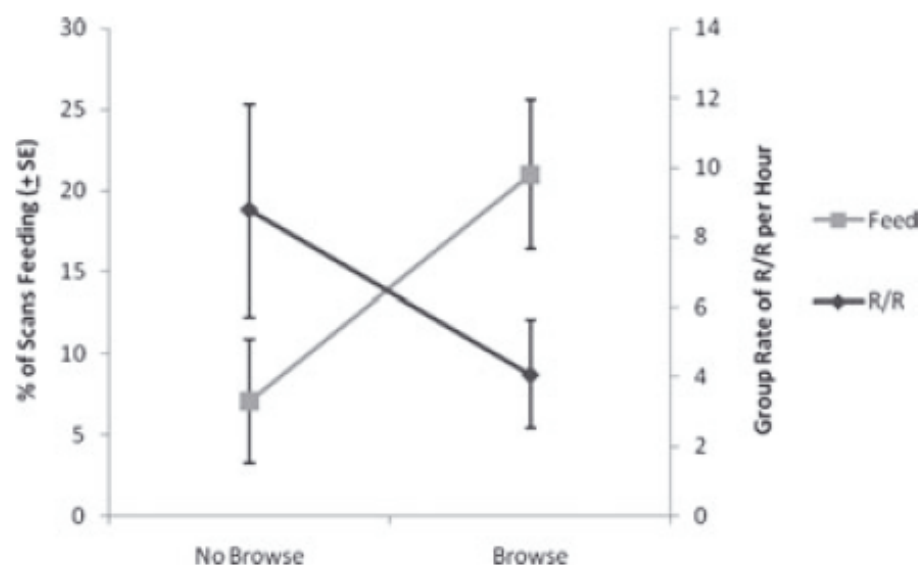
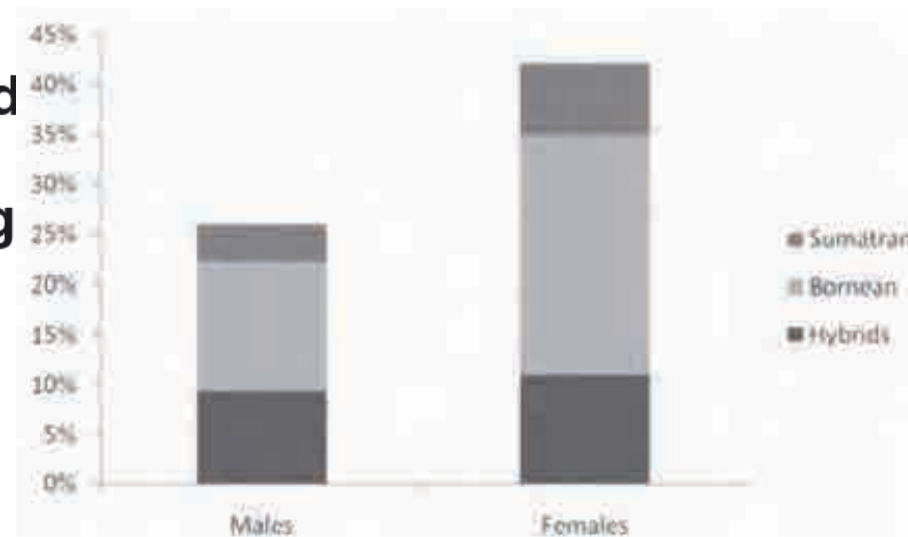




Prevalence of Regurgitation and Reingestion in Orangutans Housed in North American Zoos and an Examination of Factors Influencing its Occurrence in a Single Group of Bornean Orangutans

Christine M. Cassella,^{1,2*} Alyssa Mills,¹ and Kristen E. Lukas^{1,2}

Zoo Biology 31: 609–620 (2012)





Bueraucracy

Know the zoo organisations:

- WAZA, EAZA, AZA etc., e.g. BIAZA
- EEP / SSP – incl. their TAGs

Many zoos want to see the statement of some organisation before they will consider participating in a research project.

Many (esp. British) zoos have a bureaucratic procedure for research that is time-consuming and must be factored into any research plan.

Health & Safety



And another method ...

As well as observational data, a wide variety of materials and methods may – subject to risk assessments, biosecurity and health and safety precautions – be utilised in studies of living zoological collections and associated products (e.g. tissue and blood samples, faeces, urine, bones, eggs, nests and feathers). For example, some substances such as hormones contained in faeces and urine are important in non-invasive studies of stress. All animals die eventually, and post-mortem material can be usefully studied and be deposited in museums and universities for future reference, especially material from threatened species.

Questionnaires !
If you want to do a survey,
travel & interview people
yourself and try to avoid
questionnaires.

Equally important are the records held in zoo and archives that zoos and aquaria maintain on breeding, e.g. parentage, clutch/litter size, inter-birth interval, infant survival, group composition, behaviour, medical issues etc.



Case example: digestion studies

What are the minimum conditions you need to perform reasonable studies on digestive physiology?





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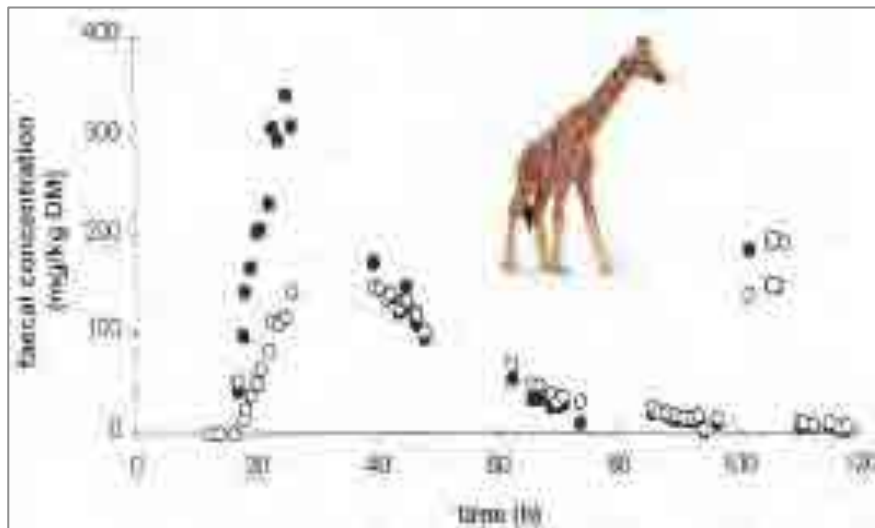




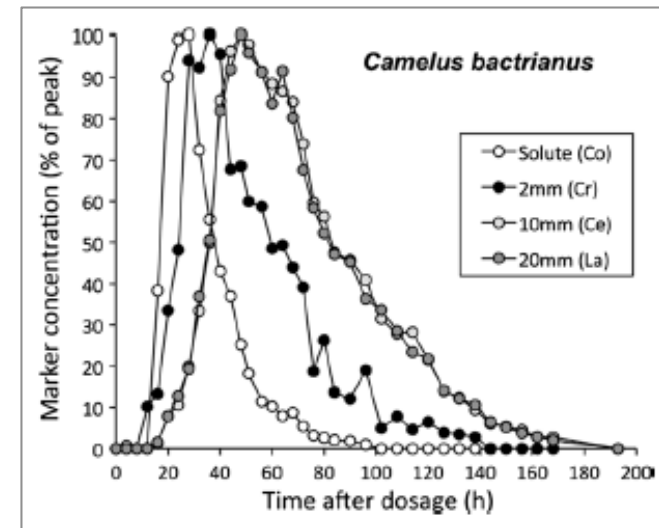
Case example: digestion studies

What are the minimum conditions you need to perform reasonable studies on digestive physiology?

Sampling frequency test



giraffe study



camel study

=> how much are you allowed and are you prepared to work?



The Effectiveness of Indigestible Markers for Identifying Individual Animal Feces and Their Prevalence of Use in North American Zoos

Grace Fuller,^{1,2*} Susan W. Margulis,^{3,4} and Rachel Santymire³
Zoo Biology 30 : 379–398 (2011)

Species	Marker type	Dosage
Fishing cat, <i>Prionailurus viverrinus</i>	Liquid food coloring (green)	0.5–1.0 ml daily
	Sesame seeds	0.125 tsp
	Wilton paste food dye (Christmas red and kelly green)	Enough to color feed well
Giant panda, <i>Ailuropoda melanoleuca</i>	Corn, various colors	NR
Grey wolf, <i>Canis lupus</i>	Rice	1 Tbsp
	Finch seed	1 Tbsp
	Kernal corn	1 Tbsp
	Scratch	1 Tbsp
	Foil glitter	1 Tbsp
	Sweet potato	0.25 cup chunks
	Carrot	0.25 cup diced
	Fresh corn	1 ear
	Beets, chopped	NR



Case example: digestion studies

What are the minimum conditions you need to perform reasonable studies on digestive physiology?

Rhinoceros faeces test: Crude ash content of sample

- sent in by zoo – 50 % dry matter
- taken by doctoral student – 18 % dry matter
- taken by postdoc supervisor – 9 % dry matter

=> how accurate do you work / how high do you rate personal comfort?



Case example: digestion studies

What are the minimum conditions you need to perform reasonable studies on digestive physiology?





Case example: digestion studies

- can you keep animals individually
 - i.e. are there enough enclosures
 - will they cope with being isolated
 - will they fight when put together again
- how many can you keep individually at a time
- can you shift the animals to get at faeces regularly
- can you work 'after-hours'
- can you weigh the animals
- can you process your samples on site / is there freezer space
- can you manipulate the diet





Vital skills I

- do an internship in a zoo to learn basic routines such as
 - handling brooms (use broom and shovel simultaneously)
 - handling & closing doors
 - understanding zoo logistics
- be able to communicate your topic and study goals
- know your animals (but rather listen than talk about what you know)



Vital skills II

- don't come to work later than those who shall help you (e.g., keepers)
- ensure nobody has to wait for you
- if you need help, ensure everybody realizes that you are reciprocating by helping back
- never expect anyone to do extra work for you because you need it or find it interesting
- never act as if a certain task is below your level of dignity that is part of the work of someone who shall help you
- always wash your dishes immediately
- bring your own food, tea, sugar from day 1