



International Wild Equid Conference



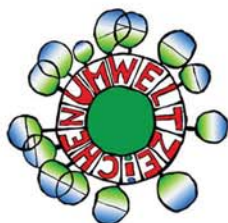
Vienna 2012

18-22 September 2012
in Vienna, Austria

Book of Abstracts



Printed in accordance to the "green meeting" requirements



produced according to the
Austrian Eco-Label criteria
UZ 24 "low pollutant printed products"
Druckeri Janetschek GmbH • UWNr. 637

Print  kompensiert
Ident-Nr. A-10797
www.druckmedien.at

Print CO₂ compensated

 **oekostrom**
die echte Alternative

Electric power from renewable resources

International Wild Equid Conference



Book of Abstracts

Research Institute of Wildlife Ecology, University of Veterinary Medicine
18-22 September 2012, in Vienna, Austria

International Wild Equid Conference

Research Institute of Wildlife Ecology, University of Veterinary Medicine

Welcome



18-22 September 2012

Dear Delegates:

It is with great pleasure that I welcome you to the campus of the University of Veterinary Medicine, Vienna (Vetmeduni Vienna) on the occasion of the International Wild Equid Conference, 2012. Although we have the luxury of occupying this modern campus that was opened in 1996, we are an institution with a long tradition, stretching back to our inception in 1765. During these 247 years we have been constantly adapting to the changing nature of veterinary medicine, advancing developments in science and technology, and the changing demands that society is placing on our services. As a result, the Vetmeduni in 2012 is far from being a traditional veterinary medicine university.

On one hand we seek to combine excellent teaching with outstanding research and active participation in practical treatment of animals. On the other hand we strive to broaden the impact of veterinary medicine by enhancing and facilitating cooperation with associated disciplines. This need is inspired by the recognition that humans are placing an ever-increasing range of demands on a clearly limited environment, and that addressing these real world issues requires the integration of multiple disciplines and a high degree of internationalization. Today our focus extends far beyond the traditional domestic pet and livestock issues, as we actively engage wildlife health and biodiversity conservation issues and relate these to human and environmental health in a “One Health” approach.

As such, this conference on wild equids organized by the Research Institute for Wildlife Ecology, a part of our Department of Integrative Biology and Evolution, is a perfect showcase for our university’s commitment to addressing these pressing environmental issues. The conference will feature presenters from 30 countries, summarizing results gathered from study sites on 6 continents. These represent disciplines as diverse as veterinary science, archaeology, genetics, ecology and ethology. They combine the fruits of basic and applied research, addressing topics dealing with the conservation and management of free-living populations of both wild and domestic equid species. These include species such as the domestic horse and the plains zebra with which we are all familiar and others with exotic names like the khulan or kiang that few people have ever seen.

I hope that these four days provide stimulating scientific discussions and a chance to catch up with colleagues and friends. I also hope that you get the opportunity to see something of the host city of Vienna and experience its unique mixture of history and modernity.



Dr. Sonja Hammerschmidt, Rector of Vetmeduni Vienna

International Wild Equid Conference

Research Institute of Wildlife Ecology, University of Veterinary Medicine

Welcome



Vienna 2012

18-22 September 2012

Dear Colleagues:

It's a great honour to welcome you all to the 2012 International Wild Equid Conference. We are truly excited that you have made the effort to travel across the globe to Vienna to contribute to this unique gathering of wild equid experts. You represent a repository of the world's knowledge on these species, as well as the most active agents working for their management and conservation. Wild equids need this help as there are many challenges facing them in the 21st century. Although we have some bright points of good news, such as the return of Przewalski's horse to the wild, there are many other issues of concern. Feral horse populations are expanding or remain high and present a never-ending sequence of management challenges and controversies, while many other species of wild equids decline and face a diversity of old and new threats to their conservation status. These wild species also often suffer from a lack of public focus.

It is our hope that this conference will provide an update of the status of our knowledge about wild equids and of their various conservation issues around the world. We also hope that the presentations and discussions will raise awareness of the key research and conservation issues for the coming years, and provide inspiration for those who will follow up, turning ideas into action.

We are especially pleased that the conference has attracted delegates from over 30 nations, working across the globe. The presence of both academic researchers and conservation practitioners, of experienced and young researchers, and of researchers from a diversity of disciplines is particularly rewarding. We really hope that there will be time to renew old friendships as well as develop new ones during the next few days. The family of equid researchers and conservationists is small and the magnitude of the tasks that await us are daunting - so only by working together and pooling our collective experience, knowledge and energy can we hope to ensure that these species persist throughout this century and beyond.

Welcome to Vienna.

Petra Kaczensky, PhD

IWEC 2012 Organizer

Jason Ransom, PhD

IWEC 2012 Organizer

International Wild Equid Conference

Research Institute of Wildlife Ecology, University of Veterinary Medicine

Public Event



Vienna 2012

Das Forschungsinstitut für Wildtierkunde und Ökologie der Veterinärmedizinischen Universität Wien lädt Sie ein zur Abendveranstaltung

The Research Institute of Wildlife Ecology, Veterinary University of Vienna invites you to the evening event

20-jähriges Jubiläum der Wiedereinbürgerung der Przewalski Pferde in der Mongolei

20-year anniversary of Przewalski horse reintroductions in Mongolia

Dienstag (Tuesday), 18. September 2012
18:00 Uhr

Festsaal der Veterinärmedizinischen Universität Wien (Conference hall)
Veterinärplatz 1
1210 Wien

Programm

18.00 Uhr **Öffentlicher Vortrag (Presentation for the general public – In German)**

„20 Jahre Wiedereinbürgerung der Przewalski Pferde in der Mongolei“

„20 years of Przewalski horse re-introduction in Mongolia“

Univ.Prof. Dr. Chris Walzer und Dr. Petra Kaczensky,
Veterinärmedizinische Universität Wien

19.00 Uhr **Ausstellungseröffnung (Opening of the exhibit)**

Ausstellung einer landestypischen Jurte (mongolisches Zelt) und Fotoausstellung „Highlights aus der Wüste Gobi“

Traditional Mongolian felt tent (ger/yurt) and photo exhibit “Highlights from the Gobi desert”

Sektempfang (Reception)

Für sämtliche Fragen steht Ihnen (For all questions please contact)
Karin Svadlenak-Gomez, MSc, T +43 1 4890915-104 oder unter E-Mail: karin.svadlenak-gomez@vetmeduni.ac.at, gerne zur Verfügung.

Website der “International Wild Equid Conference”: <http://www.vetmeduni.ac.at/equid-conference-2012>

Mit finanzieller Unterstützung der
(with financial support by)

wirtschafts
agentur
wien

zit

Die Technologieagentur
der Stadt Wien

International Wild Equid Conference

Research Institute of Wildlife Ecology, University of Veterinary Medicine

Acknowledgments



Vienna 2012

A sincere thank you to the sponsors that helped make this conference happen.
Please visit their websites and learn about who they are!



World Association of Zoos
and Aquariums | **WAZA**
United for Conservation®

<http://www.waza.org>



zit

Die Technologieagentur
der Stadt Wien

<http://www.zit.co.at>



ITG INTERNATIONAL TAKHI-GROUP

<http://www.savethewildhorse.org>



CENTER FOR
COLLABORATIVE
conservation

<http://www.collaborativeconservation.org>



VECTRONIC
Aerospace

<http://www.vectronic-aerospace.com>



<http://www.gullivers.at>

Mrs. Mag. Evelyn Haim-Swarovski
(private donation)

Please join us in thanking Joel Berger, Sandra Olsen, and Dan Rubenstein for bringing their vast experience and insights to this conference. Also, thanks to Karin Svadlenak-Gomez, Chris Walzer, Sabine Klima, Maria Leitgeb, Beate Zöchtweiser, Felizitas Steindl, Christian Schwarz, Claudia Seeber and Sandrina Sinko for help with conference organization. Cover photos are courtesy of Petra Kaczensky, Jason Ransom, St. Louis Zoo, Grevy's Zebra Trust, and Zhigang Jiang. The *E. africanus* photo on the back cover is courtesy of Patricia Moehlman (image © P.D. Moehlman).

International Wild Equid Conference

Research Institute of Wildlife Ecology, University of Veterinary Medicine

Schedule



Tuesday, September 18, 2012

start	finish	length	
18:00	20:00	2:00 h	arrival and check in Location: check-in table at the conference hall, parallel with event
18:00	20:00	2:00 h	Special event "20 years Przewalski's horse reintroduction in Mongolia" Location: Anteroom and Conference hall, Veterinary University of Vienna

Wednesday, September 19, 2012

start	finish	length	
7:30	8:30	1:00 h	Check-in and poster set-up Location: Anteroom of the Conference hall, Veterinary University of Vienna
8:30	9:00	30 m	Welcome: Petra Kaczensky and Jason Ransom, IWEK organizers Welcome from University by rector Dr. Sonja Hammerschmid Location: Conference hall, Veterinary University of Vienna Keynote:
9:00	9:45	45 m	<i>Equids and ecological niches: behavioural and life history variations on a common theme:</i> Daniel Rubenstein, Princeton University, USA
Scientific Program: Behavior and Population Ecology			
9:45	10:05	20 m	<i>Juvenile dispersal of Takhi (Equus ferus przewalskii) from their natal harems in Hustai National Park, Mongolia:</i> Lee Boyd*
10:05	10:25	20 m	<i>Vigilance and its links to social cohesion in a reintroduced equid:</i> Sarah R.B. King* and John Gurnell
10:25	10:45	20 m	<i>Foal survival and wolf predation in a population of Galician wild ponies (Equus caballus):</i> Laura Lagos* and Felipe Bárcena
10:45	11:15	30 m	Morning Break
11:15	11:35	20 m	<i>A long-term investigation of social and sexual behavior of endangered Somali wild asses (Equus africanus somalicus) and Grevy's zebras (E. grevyi):</i> Cheryl Asa*, Karen Bauman, Fraser Babbs, Fiona Marshall, and Martha Fischer
11:35	11:55	20 m	<i>Insights from the Pedigree on the Social Structure of Free-Roaming Konik Horses (Equus Caballus) in a Dutch Reserve:</i> Amos Bouskila*, Han de Vries, Zef M. Hermans, and Machteld van Dierendonck
11:55	12:15	20 m	<i>Ecological dynamics of sexual selection in the feral horses of Sable Island, Canada: effects of scale, habitat, and density:</i> Philip D. McLoughlin*, Eric VanderWal, Adrienne L. Contasti, Floris van Beest, Jordan Weisgerber, and Sarah Medill
12:15	12:35	20 m	<i>Feral horse demography and management in Tornquist Park, Argentina:</i> Alberto Scorolli*
12:35	13:35	1:00 h	Lunch

International Wild Equid Conference

Research Institute of Wildlife Ecology, University of Veterinary Medicine

Schedule



Vienna 2012

Wednesday, September 19, 2012 continued

start	finish	length	Scientific Program: Genetics and Veterinary Medicine
13:35	13:55	20 m	<i>Genetic diversity in populations of feral horses on public lands in the Western United States:</i> E. Gus Cothran*, Brian W. Davis, Anas Khanshour, Eleanore Conant, and Rytis Juras
13:55	14:15	20 m	<i>Insights into genetic diversity, population structure and demographic history of the African wild ass (Equus africanus):</i> Sónia Rosenbom*, Fanuel Kebede, Redae Teclai, Hagos Yohannes, Futsum Hagos, Patricia Moehlman, and Albano Beja-Pereira
14:15	14:35	20 m	<i>Different mechanisms contribute to the rapid genome evolution of Equids:</i> Elena Giulotto*, Francesca M Piras, Francesco Vella, Claudia Badiale, Elisa Belloni, Federico Cerutti, Riccardo Gamba, Paola Pellanda, Valerio Vitelli, Oliver A. Ryder, Elena Raimondi, and Solomon G. Nergadze
14:35	14:55	20 m	<i>The decline of the Asiatic wild ass: recording 100,000 years of genetic diversity of the species:</i> E.A. Bennett, S. Champlot, M. Pruvost, M. Gautier, B. Arbuckle, A. Balasescu, V. Eisenmann, P. Kaczensky, R. Kuehn, M. Mashkour, A. Morales Muniz, J. Peters, J.-F. Tournepiche, H.-P. Uerpmann, C. Walzer, T. Grange, and E.-M. Geigl*
14:55	15:40	45 m	Coffee Break & Poster Session
15:40	16:00	20 m	<i>Genetic diversity in a reintroduced population: the Asiatic wild ass in the Negev, Israel:</i> Edith Speyer*, Sharon Renan, Amos Bouskila, and Shirli Bar-David
16:00	16:20	20 m	<i>Successful cryopreservation protocol of Persian wild ass (Equus hemionus onager) spermatozoa:</i> Maria T. Prieto Pablos*, J. Saragusty, J. Stagegaard, T.B. Hildebrandt, F. Göritz, and R. Hermes
16:20	16:40	20 m	<i>Infectious disease concerns in wild equids:</i> Chris Walzer*
16:40	17:00	20 m	<i>Successful semen banking and artificial insemination in the Persian onager (Equus hemionus onager): A tool for sustainable population management:</i> Mandi M. Vick*, David E. Wildt, Rachael A. Weiss, Barbara A. Wolfe, Kate E. Archibald, and Budhan S. Pukazhenthi

Thursday, September 20, 2012

start	finish	length	
8:00	8:15	15 m	Opening and announcements: Petra Kaczensky and Jason Ransom Location: Conference hall, Veterinary University of Vienna
			Keynote
8:15	9:00	45 m	<i>Is there a future for large scale migrations?</i> Joel Berger, University of Montana, USA
			Scientific Program: Abundance estimation, Diet, & Habitat Use
9:00	9:20	20 m	<i>Comparing methods for estimating wild equid population densities: a case study of the endangered Grevy's zebra:</i> Victoria H. Zero, Siva R. Sundaresan*, Timothy G. O'Brien, and Margaret F. Kinnaird
9:20	9:40	20 m	<i>A collaborative approach for estimating Asiatic wild ass abundance in the Mongolian Gobi:</i> Jason I. Ransom*, Petra Kaczensky, Bruce C. Lubow, Oyunsaikhan Ganbaatar, and Nanjid Altansukh

International Wild Equid Conference

Research Institute of Wildlife Ecology, University of Veterinary Medicine

Schedule



Thursday, September 20, 2012 continued

start	finish	length	
9:40	10:00	20 m	<i>Determination of feral horse density in a forest environment of Toolara State Forest:</i> Magdalena A. Zabek*, Dave Berman, and W. Collins
10:00	10:30	30 m	Morning Break
10:30	10:50	20 m	<i>Stable isotope diet reconstruction of feral horses (Equus caballus) on the Sheldon National Wildlife Refuge, Nevada, USA:</i> Megan K. Nordquist*, Steven L. Petersen, Todd F. Robinson, and Gail Collins
10:50	11:10	20 m	<i>Free-roaming horse distribution and habitat use patterns within riparian and upland areas in western North America:</i> Steven L. Petersen*, Craig A. Carr, Gail H. Collins, P.A. Clark, D.E. Johnson, C. Boyd, K. Davies, and Amy J. Gooch
11:10	11:30	20 m	<i>Effects of long-term feral horse grazing on habitat conditions in the western USA:</i> Kate A. Schoenecker*, Jason I. Ransom, and Tracy A. Mask
11:30	11:50	20 m	<i>Seasonal pattern in range use of Asiatic wild asses in Great Gobi B Strictly Protected Area:</i> Dejid Nandintsetseg*, Peter Leimgruber, and Petra Kaczensky
12:00	13:00	1:00 h	Lunch Break
Scientific Program: Habitat			
13:00	13:20	20 m	<i>Making and maintaining connections: fence replacement, removal, and rethinking its necessity along Mongolia's railroad infrastructure:</i> Kirk A. Olson*
13:20	13:40	20 m	<i>Conservation and research needs for Asiatic wild ass in Central Asia:</i> Petra Kaczensky*
13:40	14:00	20 m	<i>Spatial-dynamic modeling of equid ecosystems to support their conservation and management:</i> Michael Coughenour*
14:00	14:20	20 m	<i>Species distribution modeling for the determination of optimum habitat:</i> Fanuel Kebede*, Afework Bekele, Patricia D. Moehlman, Paul H. Evangelista
14:20	15:05	45 m	Coffee Break & Poster Session
15:05	15:25	20 m	<i>Recent insights from movement ecology and their implications for the conservation of wild equids:</i> Navinder Singh*
15:25	15:45	20 m	<i>Using multi-scale resource selection by Asiatic wild ass to predict landscape connectivity:</i> James Forester*
15:45	16:05	20 m	<i>Quantifying intermittent coordination in the movements of simultaneously tracked animals: A case study with khulan in Mongolia:</i> Justin M. Calabrese*, Chris H. Fleming, Petra Kaczensky, Peter Leimgruber, William F. Fagan, and Thomas Mueller
16:05	17:05	1:00 h	Group Discussion: Developing strategies for increasing habitat connectivity Group discussion moderator: Joel Berger
18:30	19:30	1:00 h	Spanish Riding School tour
20:00	22:00	2:00 h	Reception in the Senate Chamber of Vienna City Hall
Location:			meet at: 17:45 in front of Conference hall, or at 18:30 at Spanish Riding School

International Wild Equid Conference

Research Institute of Wildlife Ecology, University of Veterinary Medicine

Schedule



Vienna 2012

Friday, September 21, 2012

start	finish	length	Field trip excursion to Neusiedl Lake National Park
09:45	10:00	15 m	Meet on university campus
10:00	11:30	1.5 h	Bus departure from campus of the Vetmed
11:30	12:00	30 m	Welcome and introduction by National Park director Dr. Kurt Kirchberger in Illmitz
12:00	12:45	45 m	Lunch at the National Park house
12:45	17:00	4.25 h	Departure into the field in separate groups of 25 people to experience: <ul style="list-style-type: none"> -the National Park's habitat management work using traditional domestic animals (grey cattle) and endangered species (Przewalski's horse) on its pasture lands -the challenge of National Park management on private lands in a multi-use landscape -large reed beds and typical steppe species (particularly birds) during two hikes along the edge of Neusiedl lake
17:00	19:15	2.25 h	Dinner in a typical restaurant serving local food specialties
19:15	20:30	1.15 h	Bus departure back to the university campus
20:30			Arrive back at university campus

Saturday, September 22, 2012

start	finish	length	
8:00	8:15	15 m	Opening and announcements: Petra Kaczensky and Jason Ransom Location: Conference hall, Veterinary University of Vienna
			Keynote:
8:15	9:00	45 m	<i>The roles of humans in equine distribution through time:</i> Sandra Olsen, Carnegie Museum of Natural History, USA
			Scientific Program: Human values, Management, and Conflict
9:00	9:20	20 m	<i>Wild, domestic, hybrid, feral, icon and pest: comparing and contrasting the complexity of human relationships with wild ancestors and domestic derivatives for horses and wolves:</i> John D.C. Linnell*, Nicolas Lescureux, and Petra Kaczensky
9:20	9:40	20 m	<i>Habituation potential in wild equids: the influence of coevolutionary history and present-day exposure to benign humans:</i> Alexali S. Brubaker* and Richard G. Cross
9:40	10:00	20 m	<i>Methods for managing overabundant wild horse populations in Australia:</i> Dave Berman*
10:00	10:30	30 m	Coffee Break
10:30	10:50	20 m	<i>A survey of techniques for re-homing of brumbies as a method of controlling the feral population:</i> Frances Dinn*, H. Ip, M. Hernandez-Jover, and P. Buckley
10:50	11:10	20 m	<i>Twenty-four years of managing free-roaming and captive wild equids by means of fertility control:</i> Kimberly M. Frank*, Robin O. Lyda, and Jay F. Kirkpatrick
11:10	11:30	20 m	<i>Immunocontraception in wild horses (Equus caballus) extends reproductive cycling beyond the normal breeding season:</i> Cassandra M.V. Nuñez*, James S. Adelman, and Daniel I. Rubenstein

International Wild Equid Conference

Research Institute of Wildlife Ecology, University of Veterinary Medicine

Schedule



Vienna 2012

Saturday, September 22, 2012 continued

start	finish	length	
11:30	11:50	20 m	<i>Kiang-herder conflicts in eastern Ladakh, India:</i> Yash Veer Bhatnagar*, Navinder J. Singh, Charudutt Mishra, Pranav Trivedi, R. Raghunath, and Karma Sonam
11:50	12:10	20 m	<i>Grevy's zebra water use and their Interaction with livestock and people in Samburu, Kenya:</i> Peter Lalampaa*, Jim Groombridge, Zeke Davidson, Siva Sundaresan, and Belinda Low
12:10	12:30	20 m	<i>Anthropogenic threats to Persian onager (Equus hemionus onager) in Iran:</i> Amir Hossein Khaleghi Hamidi*, Houman Jowkar, and Mehdi Nabiyan
12:30	13:30	1:00 h	Lunch break
Scientific Program: Conservation and Status			
13:30	13:50	20 m	<i>Przewalski's horse reintroduction: a case study of how concepts of wildness and wilderness influence reintroductions as a conservation strategy:</i> Catherine A. Christen*, Peter Leimgruber, and Nigel Rothfels
13:50	14:10	20 m	<i>The ecology and conservation of the African wild ass (Equus africanus):</i> Patricia D. Moehlman*, Hagos Yohannes, Fanuel Kebede, Redae Teclai, and Ann Oakenfull
14:10	14:30	20 m	<i>Przewalski horse re-introduction in the Mongolian Gobi:</i> Oyunsaikhan Ganbaatar*, Nanjid Altansukh, Namtar Enkhsaikhan, Petra Kaczensky, Christian Stauffer, and Chris Walzer
14:30	14:50	20 m	<i>Reproduction and mortality of reintroduced Przewalski's wild horse Equus przewalskii in Hustai National Park, Mongolia:</i> Namkhai Bandi* and Dorj Usukhjargal
14:50	15:10	20 m	Coffee break
15:10	15:30	20 m	<i>The status of Persian wild ass: threats and the conservation needs:</i> Mahmoud-Reza Hemami*, Saeideh Esmaeili, Moslem Momeni, and Mohsen Bagheri
15:30	15:50	20 m	<i>Cape mountain zebra conservation goals – security in numbers?</i> Halszka Hrabar* and Graham Kerley
15:50	16:10	20 m	<i>Resource use and limitations for released Przewalski's horses at Kalamaili Nature Reserve, Xinjiang, China:</i> Qing Cao, Melissa Songer, Y.J. Zhang, D.F. Hu, Daniel I. Rubenstein, and Peter Leimgruber*
16:10	17:10	1:00 h	Group Discussion: Establishing guidelines for translocation and reintroduction of equids Group discussion moderator: Patricia Moehlman
17:10	17:30	20 m	Closing Remarks and Adjournment

International Wild Equid Conference

Research Institute of Wildlife Ecology, University of Veterinary Medicine

Schedule



Vienna 2012

Poster Presentations (alphabetical by presenter surname)

- 1 *Restoration of Persian Onager (Equus hemionus onager) in Iran*: Hasan Akbari*, Mohamamd Sadegh Farhadinia, Azam Habibipour, and Akbar Hamedanian
- 2 *The correlation between breeding behavior and reproduction, hormone in feces of Asiatic Wild Asses (Equus hemionus)*: Junhuai Bi*, He Xiaoping, and Ding Ying
- 3 *Second transport of Przewalski's horses from Czech Republic to Mongolia*: Miroslav Bobek*, Jaroslav Šimek, Lenka Bartůňková, Roman Vodička, Evžen Kůs, and Jan Marek
- 4 *Group size, group composition and behavior of Equus hemionus near a water source in the Negev Desert, Israel*: Amos Bouskila*, A.S. Renan, Edith Speyer, D. Ben-Natan, I. Zaibel, and S. Bar-David
- 5 *Resource use and limitations for released Przewalski's horses at Kalamaili Nature Reserve, Xinjiang, China*: Qing Cao*, Melissa Songer, Y.J. Zhang, D.F. Hu, Daniel I. Rubenstein, and Peter Leimgruber
- 6 *Reintroduction of the Koulan in the Territory of Arganaty Mountains*: Dmitry Cheremnov* and S.V. Sokolov
- 7 *Developing a cooled semen protocol for captive breeding of Somali wild ass (Equus africanus somaliensis)*: Bruce W. Christensen*, Chong Wang, and Linda M. Penfold
- 8 *A new approach to improve DNA extraction from feces of wild equids*: Vânia Costa*, Sónia Rosenbom, and Albano Beja-Pereira
- 9 *Delayed reversibility of PZP (porcine zona pellucida) in free-ranging Przewalski's horse mares*: Claudia Feh*
- 10 *Seed dispersal by Persian wild ass (Equus hemionus onager) in Qatruiyeh National Park, south central Iran*: Amin Ghasemi, Mahmoud-Reza Hemami*, Majid Iravani, and Josef Senn
- 11 *Why do zebras get ulcers? Stress physiology in relation to human land use in Grevy's zebra (Equus grevyi)*: Sara E. Heisel*, Vanessa O. Ezenwa, and Siva Sundaresan
- 12 *A new threat to Cape mountain zebra? – lion interactions in the Karoo National Park*: Craig Tambling, Halszka Hrabar*, and Graham Kerley
- 13 *Development of microsatellite markers for endangered Grevy's zebra (Equus grevyi) by the next generation sequencer*: Hideyuki Ito*, Azusa Hayano, Hidefusa Sakamoto, and Miho Inoue-Murayama
- 14 *Using Markov Chains in ancient equid mobility simulations*: Manuel A. Izquierdo*, Petra Kaczensky, and Ariane Burke
- 15 *Evaluating suitable habitats of Khulan (Equus hemionus) and goitered gazelle (Gazella subgutturosa) in Mt. Kalamaili Ungulate Nature Reserve, Xinjiang, China*: Hongjun Chu, Zhigang Jiang*, Yan Ge, Feng Jiang, Chen Wang, and Yongshan Tao
- 16 *Attitude of rural Mongolians towards wild ass*: Petra Kaczensky*
- 17 *Corral mass capture device for Asiatic wild asses*: Vitaliy Fyodorovich Levanov, Sergey Vladimirovich Sokolov, and Petra Kaczensky*
- 18 *Understanding Asiatic wild ass (Equus hemionus) population size estimates in the Great Gobi B Strictly Protected Area, Mongolia*: Stephanie Kramer-Schadt*, Oyunsaikhan Ganbataar, and Petra Kaczensky
- 19 *Parasitic nematodes of Przewalski horses in Ukraine: biodiversity of strongylid (Nematoda: Strongylida) community in connection with horse-keeping conditions*: Tetiana A. Kuzmina*, Natalia S. Zvegintsova, Tetiana L. Zharkikh, and Vitaliy A. Kharchenko

International Wild Equid Conference

Research Institute of Wildlife Ecology, University of Veterinary Medicine

Schedule



Vienna 2012

Poster Presentations continued

- 20 *Measuring the social structure of a population of Galician Wild Ponies (Equus ferus sp.):* Laura Lagos* and Felipe Bárcena
- 21 *Community-led restoration of Grevy's zebra habitat in Kenya:* Belinda Mackey and Peter Lalampaa*
- 22 *Long-term, individual-based research into the ecology and evolution of the feral horses of Sable Island National Park, Canada:* Philip D. McLoughlin*, Steven Simpson, Jordan Weisgerber, and Sarah Medill
- 23 *Turkmenian kulan (Equus hemionus kulan) captive population status and perspectives:* Anna Mekarksa*
- 24 *Historical distribution of Persian wild ass (Equus hemionus onager) in central Iran:* Maryam Nehrir*, Haniyeh Nowzari, and Mahmoud-Reza Hemami
- 25 *Population parameters of Persian wild ass (Equus hemionus onager) in Qatrouyeh National Park, Iran:* Haniyeh Nowzari*, Mahmoud-Reza Hemami, Mahmoud Karami, Mir Masoud Kheirkhah Zarkesh, Borhan Riazzi, and Daniel I. Rubenstein
- 26 *Immunocontraception, social behavior, and stress in a wild horse population:* Cassandra M.V. Nuñez*, James S. Adelman, and Daniel I. Rubenstein
- 27 *The evolution of brumby management in Australia:* Colleen O'Brien*
- 28 *DNA Microsatellite Analysis of Mongolian Domestic (E. caballus) and Wild (E. przewalskii) Horses :* Tsendsuren Oyunsuren
- 29 *Estimating abundance of equids using aerial applications:* Jason I. Ransom* and Bruce C. Lubow
- 30 *Alternative chemical immobilization protocol in a group of captive feral horses using homemade remote delivery:* Ovidiu Rosu*, L.A. Udrescu, and A. Birtoiu
- 31 *Science support for management of feral horses (Equus caballus) in the Western United States:* Kate A. Schoenecker*, Jason I. Ransom, James E. Roelle, Linda C. Zeigenfuss, Linda Coates-Markle, Albert J. Kane, Steven S. Germaine, and Tracy A. Mask
- 32 *Feral horse body condition: a useful tool for population management?:* Alberto Scorolli*
- 33 *Ethological welfare of the horse populations: evaluation criteria:* Natalia Spasskaya*
- 34 *Intranasal transmission of chronic wasting disease in deer and its implication to wild equids:* Terry R. Spraker*, Tom Gidlewski, Tracy A. Nichols, Mark D. Zabel, Aru Balchandran, Kurt C. VerCauteren, and Katherine I. O'Rourke
- 35 *A tale of the horse's tail - stable isotope analysis of equid tail hair in the Mongolian Gobi:* Martina Burnik Sturm*, Micha Horacek, and Petra Kaczensky
- 36 *Potential Offset Programs for Asiatic Wild Ass in the Southeastern Gobi Desert:* Dorjderem Sukhragchaa* and Batsaikhan Nyamsuren
- 37 *Preliminary research results of epigenetic variability, epigenetic distance and fluctuating asymmetry of the Przewalski's wild horse Equus przewalskii Poljakov, 1881 by non-metric characters of the skulls:* Dorj Usukhjargal*, H. Ansorge, R. Schafberg, Mikhail V. Sablin, and Namkhair Bandi
- 38 *Early Reactive Culling Protocol in the Oostvaardersplassen Nature Reserve, the Netherlands:* Machteld van Dierendonck*
- 39 *One measure-three objectives: Przewalski stallions pasturing a conservation area:* Hermann Will*, V. Fröhlich, C. Gohl, F. Karbe, N. Steidele, and K. Baumgartner



Equids and Ecological Niches: Behavioral and Life History Variations on a Common Theme

Daniel I. Rubenstein

Although equids are evolutionarily closely related and have a common body plan and broadly similar life styles, as a group they exhibit a wide array of ecological, life history and social variations. These differences emerge because different species--and even different populations within species--occupy different realized and fundamental niches. These differences ultimately lead to the broad-scale biogeographic distribution of equids. Typically one edge of each species' range is shaped by physiological and ecological tolerances to extreme climatic conditions. Whereas asses can tolerate extreme heat and water stress better than neighboring horses or Grevy's zebras, horses can tolerate extreme cold better than either of the other species. The other edge, however, tends to be shaped by biotic interactions. How individuals cope with different degrees of predation or intra- and interspecific competition for resources, especially mates as well as overall environmental uncertainty affects the competitive balance among equid and non-equid species and their place on a shared landscape. What makes equids special is that they exhibit a wide array of social structures each built upon different sets of social relationships tuned to coping with different environmental features. As a result, each niche is shaped by a unique set of challenges with respect to foraging and drinking as well as managing risk associated with predation and competition and coping with uncertainty, especially with people and their herds. The aim of this talk is to illustrate how variations in niche characteristics of different equids emerge as responses to specific contexts from a common equid theme.

Corresponding author:

Daniel I. Rubenstein, PhD

Chair Class of 1877 Professor of Zoology
Department of Ecology and Evolutionary Biology
106A Guyot Hall
Princeton University
Princeton, New Jersey 08544-2016
USA
Tel: +1.609.258.5698
E-mail: dir@princeton.edu



Equus spp.



Is There a Future for Large Scale Migrations?

Joel Berger

Migratory animals provide a challenging problem for conservation, as the scale of their seasonal movements transcends any capacity of a protected area network to manage and protect them. Despite growing concern about this urgent and important challenge, there have been few large scale attempts to develop meaningful conservation actions to halt the steady pace of declines, especially for many of the poster children of terrestrial migration – Asian and African ungulates. The causes are as obvious as profound – burgeoning human populations, impoverishment, habitat loss, a lack of conservation incentives. For equids, the challenges parallel those of other large-bodied migrants. Based on lessons learned from both successes and failures, conservation opportunities persist. These involve recognizing the overarching role of human impacts relative to our lack of biological knowledge of a species needs. These vary by continent, by species, and by local region. If we recognize these and adjust our behaviour with voluntary or regulatory actions, rather than just recognition, conservation of migration in equids may be possible.

Corresponding author:

Joel Berger, PhD

John J. Craighead Chair of Wildlife Conservation
Division of Biological Sciences
University of Montana
Missoula, Montana 59812
USA
Tel: +1.406.243.5540
E-mail: jberger@wcs.org
E-mail: joel.berger@umontana.edu



Equus spp.



The Roles of Humans in Equine Distribution through Time

Sandra L. Olsen

The human-horse relationship has been a key factor in the shrinking and expansion of the horse's range, its introduction to new regions and redistribution in areas previously occupied in the Pleistocene. This presentation will provide a brief synopsis of the ways in which the changing roles of the horse in human societies and the movements of people have combined to produce the current geographic coverage of this amazingly adaptable species. For millennia, there were few landmark events in the human-horse relationship, and the connection between hominins and equids was constrained to predator vs. prey as Paleolithic hunters dispatched wild equids with spears for consumption. This early relationship was confined to the Pleistocene ranges of the horse, primarily in Eurasia, but also briefly in the New World after humans entered at the close of the Ice Age. After the end of the Pleistocene, the natural range of the European Wild Horse, aka Tarpan, shrunk considerably due to changes in vegetational zones and climate. It is relatively certain that a more or less continuous belt across Northern Europe and the Eurasian steppe was still populated by Tarpan in the early to middle Holocene. However, the few tiny islets of relict populations sprinkled about at the margins introduce difficulties in reconstructing the entire Holocene range of the Tarpan. Domestication can be viewed as the initial catalyst that eventually enabled humans to greatly expand the geographic distribution of horses well beyond their Pleistocene range and to reintroduce them into areas where they had vanished 10,000 years prior. Horses were comparatively late to be brought fully under human control. Verification for horse domestication dates only to about 5,500 years ago, when the Copper Age Botai people were keeping, breeding, and even milking horses in northern Kazakhstan. Expansion of domestic horses began at a glacial rate, but there is evidence for reintroduction into parts of Western Europe by 3,000 BCE (5,000 BP). It was another millennium plus before domestic herds were dispersed into the Near East and paired with the wheel. The horse by this time served a number of important functions, but its role in warfare molded geopolitics through human history from the 2nd millennium BCE until recent times. Military campaigns have served as a major contributor to the spread of horses. The repopulation of North America with horses brought in by European explorers and colonists was made possible by seafaring. The transport of horses on ships overcame natural barriers, but also led to the creation of many feral populations on islands. This talk will focus on how humans played a major role in expanding the distribution of the horse and indirectly creating feral populations around the world.

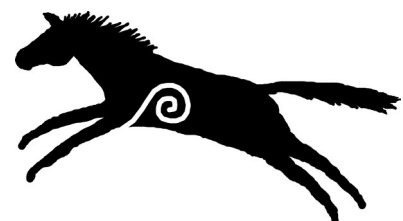
Corresponding author:

Sandra L. Olsen, PhD

Curator & Head of Anthropology Section
Director, Center for World Cultures
Carnegie Museum of National History
Pittsburgh, Pennsylvania 15206-3706
USA

Tel: +1.412.665.2606

E-mail: sandraolsen@gmail.com



Equus spp.



Juvenile Dispersal of Takhi (*Equus ferus przewalskii*) from Their Natal Harems in Hustai National Park, Mongolia

Lee Boyd

The dispersal of maturing takhi from the harems into which they were born was not documented prior to extinction of the species in the wild. It is a phenomenon that we had no opportunity to study in captivity, where human managers made the decision about when to remove young animals and where to send them. This study examined the fate of free-ranging takhi born between 1993 and 2002 in Hustai National Park, Mongolia. The average age at departure for colts surviving to dispersal was 2.2 years ($n=41$, range=1.1–3.6 years). Colts joined bachelor groups for several years before acquiring their own harem. Thirteen of 18 colts born between 1993 and 1998 obtained harems, at the average age of 5.5 years (range=4.4–8.1 years). The average age of 39 fillies that dispersed was also 2.2 years (range=0.6–3.1 years). Several fillies did not disperse from their natal harem when their sire was deposed by another stallion. In early years when horse density was low, the juveniles dispersed widely. One pair of half siblings (brother-sister) dispersed together and remained in the park, but 3 of the 4 other colts born in 1993-1994 and the other 2 fillies born in 1994 presumably did not encounter others of their species and kept moving until they found domestic horses, leaving the reserve at distances of up to 75 km until they were driven back to the vicinity of other takhi. In subsequent years, dispersing juveniles quickly found conspecifics. The colts joined bachelor groups and the fillies were swiftly incorporated into harems. After 1999, all dispersing fillies were snapped up in less than a week, most commonly on the same day they left their natal harem. The age of dispersal and of harem acquisition are comparable to those reported for feral horse populations. Increasing takhi density and the resultant intrasexual competition among stallions appear to affect several parameters of dispersal.

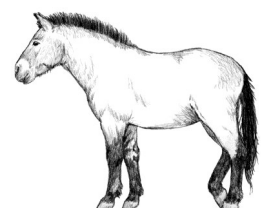
Corresponding author:

Lee Boyd, PhD

Department of Biology
Washburn University
Topeka, Kansas 66621
USA

Tel: +1.785.670.2081

E-mail: lee.boyd@washburn.edu



E. ferus przewalskii

Vigilance and It's Links to Social Cohesion in a Reintroduced Equid

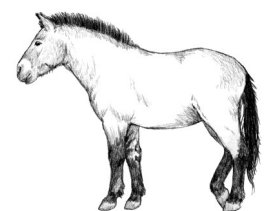
Sarah R. B. King and John Gurnell

Vigilance is a vital aspect of life for all animals, but is particularly important for reintroduced species. Over 800 hours of observations of four Przewalski's horse (*Equus ferus przewalskii*) harems at Hustai National Park, Mongolia between 1998 and 2000 allowed us to examine factors affecting vigilance of the horses. As a secondary factor affecting survival after reintroduction, we also examined social cohesion of the harems. Vigilance occurred at a low rate (median of 0.37 acts horse⁻¹ hour⁻¹ across the harems) and there was no apparent effect of time since release on vigilance behavior. Low-intensity vigilance ("looking") was the most commonly observed behavior, and this was mostly directed at other members of the harem. There was a negative correlation between vigilance and dominance rank, with stallions exhibiting the most vigilance; vigilance of mares with foals, and mares of the same age and similar rank without a foal was not significantly different. There was no difference in synchronization among the harems, which overall had a mean synchronization score of 0.75. Przewalski's horses at Hustai National Park are likely showing basal level of vigilance and synchronization. Although suffering from wolf predation, the horses have proved to be sufficiently vigilant to survive and reproduce, indicating that they have not lost essential skills while in captivity.

Corresponding author:

Sarah R.B. King, PhD

Department of Ecology & Evolution, and Museum of Natural History
University of Colorado
Boulder, Colorado 80309
USA
Tel: +1.303.492.8466
E-mail: king_srb@yahoo.com



E. ferus przewalskii



Foal Survival and Wolf Predation in a Population of Galician Wild Ponies (*Equus ferus* sp.)

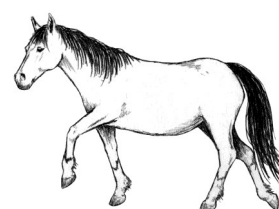
Laura Lagos and Felipe Bárcena

Equids are prey of a range of big predators, which generally cause high mortality of the young. Galician Wild Ponies (*Equus ferus* sp.) share the majority of their distribution area with wolves (*Canis lupus*). The predation impact of wolves on juveniles of several species such as wapiti, red deer or roe deer, has been widely studied. Nevertheless, except for studies on the wolf diet in the northwestern Iberian Peninsula, which show a high consumption of ponies, the predator-prey relationship between wolves and wild ponies is virtually unknown. This situation is probably related to the fact that most of the existing published scientific work has been carried out in regions where these species don't coexist. Our study aims to assess the survival of the foals and determine the predation impact on a Galician Wild Pony population coexisting with wolf. We conducted a three-year (2006-2008) monitoring of 74-86 wild adult ponies belonging to 7 bands inhabiting 3 mountainous areas in the centre of Galicia (NW Spain). Each pony was identified individually using morphological features. Surveys were conducted every two weeks to monitor the birth and survival of foals, and 27 were fitted with ear-tag radio-transmitters to monitor them and facilitate the location of the carcasses in case of death. We analysed the characteristics of the foals that could influence their survival, such as sex, colour or birth date. We evaluated causes of death on the foal carcasses located and we analysed the temporal correlation between mortality and the presence of injured foals (failed wolf attacks). Activity of wolves in the area of study was evaluated using tracking and camera trapping. Our results show a Kaplan-Meier survival of the foals of 0.41 (SE = 0.05; $n = 149$). Chestnut-palomino and black foals had a higher survival, as well as foals born at the start of the foaling season ($P < 0.01$). We also observed a higher survival of females over males, of the peak-born foals, as well as of the foals which had suffered an attack resulting just in injuries, but these last results were not statistically significant. Wolf predation was the main cause of mortality, 76% of the foal carcasses found ($n = 33$) had been killed by wolves and only 3% had died due to other causes. We observed a positive time correlation between the number of injured and the number of killed foals per month ($P < 0.01$). We discuss the influence of the cited characteristics of the foals on their vulnerability to wolf predation.

Corresponding author:

Laura Lagos

Instituto de Investigación y Análisis Alimentarios
Universidad de Santiago de Compostela
15782 Santiago de Compostela
Spain
Tel: +34.657530122
E-mail: laura.lagos@usc.es



E. ferus sp.

A Long-Term Investigation of Social and Sexual Behavior of Endangered Somali Wild Asses (*Equus africanus somalicus*) and Grevy's Zebras (*E. grevyi*)

Cheryl Asa, Karen Bauman, Fraser Babbs, Fiona Marshall, and Martha Fischer

Our long-term comparative study of socio-sexual behavior of Somali wild ass and Grevy's zebra has two primary objectives: 1) to enhance captive breeding of these endangered equids through an increased understanding of their behavioral processes and interactions, and 2) to evaluate their relative sociality, a factor considered important to domestication, since asses were domesticated at several sites whereas attempts to domesticate zebras failed. The animals, maintained at the Saint Louis Zoo, are allowed outside during the day but are housed indoors overnight and during winter (December through February). Animals are observed in outdoor yards between 9 and 11AM, three to six days per week for each species. Focal animal sampling is used to record data on affiliative, aggressive and sexual interactions; scan samples at 5-min intervals record proximity of each animal. Fecal samples are collected three times weekly for hormonal analyses of estrogen and progesterone to monitor onset of puberty, ovulatory cycles and pregnancy; testosterone in males to monitor onset of puberty and annual pattern; and cortisol in both as an indirect measure of stress. Social groups of both species have included only females (for study of female sociality), females with a male (social and sexual behavior), females with infants (mother/infant and foal play behavior). Results also have been compared to the literature on domestic and feral horses and donkeys. Results have revealed higher levels of aggression and lower levels of affiliative behavior among female asses than among female zebras or horses. Female asses regularly displayed behavioral patterns uncommon in horse mares but often seen in young stallions, i.e., biting, kicking, and wrestling at intensities that did not inflict injury. The same individuals also spent considerable time in close proximity, suggesting existence of social bonds. Somali foals also displayed more aggression than zebra or horse foals, beginning when a new mother and foal were introduced back to the herd within a few weeks of birth. Somali foals directed threats, bites and kicks toward adults, not just toward other foals, yet play behavior typical of horse foals was also common. Both asses and zebras showed more aggressive interactions during courtship and mating than do horses, something also reported for domestic donkeys. Courtship, especially in the asses, often included vigorous chases by males despite repeated kicks by females. A prolonged bite (Bite Hold) at the base of the female's mane was common. Males tested female receptivity with chin on the female's back and rump, as seen in horses, but intromission was typically preceded by multiple mounts, more representative of donkeys. Data collection continues as the herd composition changes, due to births and animal imports and exports, to increase the number of subjects and statistical power.

Corresponding author:

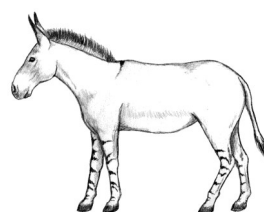
Cheryl Asa, PhD

Research Department, Saint Louis Zoo

1 Government Drive

Saint Louis, Missouri 63110

USA Tel: +1.314-646-4523, E-mail: asa@stlzoo.org



E. africanus



E. grevyi



Insights from the Pedigree on the Social Structure of Free-Roaming Konik Horses (*Equus caballus*) in a Dutch Reserve

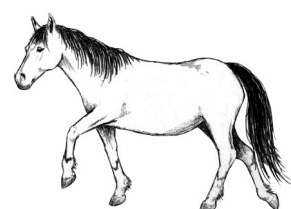
Amos Bouskila, Han de Vries, Zef M. Hermans, and Machteld van Dierendonck

Social interactions in group-living animals are complex and involve diverse aspects of the groups and the individuals that form them. Only in few studies the researchers know the genetic relations among individuals in the group, yet such knowledge may shed light on the social relationship within the group. We observed behavior and movement of 27 Konik horses (*Equus caballus*) that were introduced for habitat management to the Blauwe Kamer Reserve, Netherlands, and are mostly not managed by man. Genetic samples were collected from each horse, the parents of horses that were born on the reserve were determined, and the pedigree was reconstructed. We recorded observations simultaneously on two digital video cameras: one recording the entire groups and the positions of individuals and the other zoomed in on each horse to assist in individual recognition. The social network was analyzed based on positive affiliation and proximity, after aggressive interactions were removed. Not counting foals, the horses clustered in two harem groups with 11 individuals (two of which were adult stallions) and six individuals (one of which was a stallion), respectively. Two bachelor males often moved in the harems' vicinity and three additional young bachelor males roamed elsewhere in the reserve. Degree (number of connections of an individual) and betweenness centrality are measures of centrality and they were not associated with age or rank. However, these measures emphasized connections that were formed during the study period and that eventually led to the move and acceptance of three individuals into the smaller harem. The comparison of harem composition to the pedigree revealed that the large group, which includes the oldest individuals, supplied young females that eventually formed the smaller harem. The small harem did not contribute any individual to the larger group, perhaps because the juveniles that were born and matured in it so far were all males. The genetic analysis revealed that one of the foals whose mother belong to the larger group was not fathered by any of the stallions of the harem, in spite of the efforts of the stallions to keep other males away from the harem's females. The comparison between the social interactions and the pedigree revealed that at least two males attempted to mate with their own daughters. The current study contributes to the understanding of processes that groups of horses undergo when enclosed in a limited area reserve with no options for emigration / immigration. The only human intervention in the Blauwe Kamer Reserve is the occasional transfer of individuals into or out of the reserve. Our results can suggest slight modifications in the management of the horses to reduce the risk of inbreeding.

Corresponding author:

Amos Bouskila, PhD

Department of Life Sciences
Ben-Gurion University of the Negev
84105 Beer-Sheva
Israel
Tel: +972.544969664
E-mail: bouskila@bgu.ac.il



E. caballus

Ecological Dynamics of Sexual Selection in the Feral Horses of Sable Island, Canada: Effects of Scale, Habitat, and Density

Philip D. McLoughlin, Eric VanderWal, Adrienne L. Contasti, Floris van Beest, Jordan Weisgerber, and Sarah Medill

We studied hierarchical scale and habitat effects on factors important to sexual selection for the feral horses of Sable Island National Park, Nova Scotia, Canada. Habitat strongly correlated with local adult density and population growth, which in turn related to spatial variation in the operational sex ratio (OSR) experienced by stallions at larger scales of observation. OSR negatively related to mean harem size and positively predicted instances of multi-stallion bands across multiple scales. Mean harem size positively correlated with variance in harem size (female aggregation) only at small scales. Patterns in sexual dimorphism and heterozygosity matched expectations of long-term effects of habitat on mate competition and choice. Following theory on density-dependent habitat selection, we advance the idea of ‘habitat-dependent sexual selection’, with the corollary that intensity of mate competition among males (in our case) should persist longest in poorest habitat, which reaches local carrying capacity last. Effects of scale and spatial heterogeneity on sexual selection and associated eco-evolutionary dynamics are not likely to be trivial.

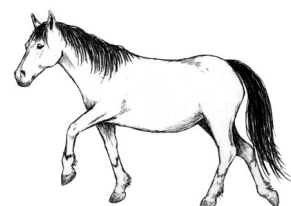
Corresponding author:

Philip D. McLoughlin, PhD

Department of Biology
University of Saskatchewan
112 Science Place
Saskatoon, SK S7N 5E2
Canada

Tel: +1.306.966.4451

E-mail: philip.mcloughlin@usask.ca



E. caballus

Feral Horse Demography and Management in Tornquist Park, Argentina

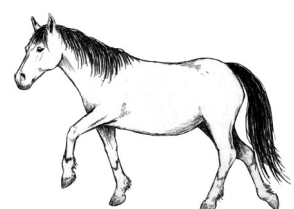
Alberto L. Scorolli

Feral horse (*Equus caballus*) is an invasive alien species worldwide. In Argentina there are many populations, some in Natural Protected Areas are considered a serious threat to biodiversity. Our goals were: to construct demographic models for the Tornquist Park feral horse population and validate them with empirical data to improve their management. The study area is located in Argentina, between 38°00'–38°07'S and 61°52'–62°03'W. It covers 67 km² of hills, the climate is temperate and humid with a mean annual rainfall of 800 mm and the typical vegetation is grassland steppe. The feral horses were observed with binoculars (10 x50), walking a fixed path that covered 20 km² in two consecutive days. Feral horses were individually identified based on coat color, and marks on face and legs. The small area and good visibility permits to obtain total counts. We choose for operational easy to study the female segment of the population. Density was 35 horses/km² in March 2002 and the population was food limited, in November 2002 a mass die-off during a severe rain storm killed 193 feral horses, and in the years 2006–2007, 220 feral horses were live captured with corral-traps, density was then 9 horses/km². In the periods 2003–2005 and 2008–2011 we conduct annual counts of the population. We used the demographic rates estimates (foaling rate, and survival of adult, two-years old, yearlings and foals) obtained during our long-term demographic study (1995–2002) to construct a matrix stage population projection model with the software Unified Life Models (ULM). We built three different models: Model 1, with the average of the eight annual estimates of the parameters, Model 2 with the mean of the highest 3 survival rates values obtained and Model 3 with the 3 lowest survival values. We compared the models projections with the growth rates and trends obtained with the annual counts conducted in the periods 2003–2005 and 2008–2011. We also performed a sensitivity analysis. The Model 3, with the lowest survival fitted well the observed growth in 2003–2005. Population growth rate (λ) value was 1.00 and the obtained from the counts 1.02. Meanwhile the Model 2 fitted better the observed population trend in 2008–2011, (λ) was 1.08 and the value calculated from the counts was 1.09. Adult survival show the highest elasticity (0.57) and sensitivity (0.68). Annual rainfall below or near the mean and density could explain in part the observed trends. A deterministic demographic model for feral horses was validated for the first time in Argentina. Long-term demographic studies, especially of individually identified animals, could contribute to a better understanding of the ecology of feral equids, allow more reliable population modeling and improve their management.

Corresponding author:

Alberto L. Scorolli, PhD

Dto. de Biología, Bioquímica y Farmacia
Universidad Nacional del Sur
San Juan 670
8000 ICN, Bahía Blanca
Argentina
Tel: +54.291.459.5100
E-mail: scorolli@criba.edu.ar



E. caballus

Genetic Diversity in Populations of Feral Horses on Public Lands in the Western United States

E. Gus Cothran, Brian W. Davis, Anas Khanshour, Eleanore Conant, and Rytis Juras

The modern horse, *Equus caballus*, originated in North America in the Pleistocene but was extinct on the continent by about 10,000 BP. The horse was returned to the Americas as domestic horses from Spain beginning with the second voyage of Columbus (1493 AD). Feral horses began to appear in North America soon after the early Spanish explorers and settlers expanded the ranges of domestic horses into North America. By the early 19th century, vast herds of feral herds could be found over much of what is now the Western United States. Today, a large number of feral horses are found on public lands managed by the Bureau of Land Management of the U.S. Dept. of Interior. In this study, we examine microsatellite based genetic variation in 175 populations from 10 states. Some populations were sampled two or more times over the time period covered which is about 12 years. Average sample size per population was about 38 horses with nearly 7,000 total horses tested. Samples were collected by BLM personnel. Standard measures of genetic variation were calculated for each herd. Observed heterozygosity ranged from 0.49 to 0.87 which essentially spans the range of variation for domestic breeds. Variability was weakly associated with population size. Population sizes of the herds have fluctuated over time. When a herd was sampled on more than one occasion, levels of variation at the different time periods were compared. In most cases no change was evident, mainly because sampling periods spanned less than a generation interval. Various measures of genetic distance and genic differentiation among the populations are examined and genetic distance compared to geographic distance based upon GPS coordinates for each herd (supplied by the BLM). In general there is no strong correlation of genetic distance with geographic distance but those herds that are geographically closest to each other average lower genic distances. Visualization of genetic relationships will be done by construction of Neighbor-joining trees and Factorial Correspondence analysis. Estimates of migration rates between populations and effective population size also will be calculated from the data using MIGRATE, as well as other methods. Possible ancestry of the feral herds to domestic breeds was estimated by comparison to 65 domestic horse breeds with a focus on those from the New World. Most herds appeared to be of widely mixed ancestry with no clear, specific breed ancestor. This result is consistent with the history of most of the areas where the feral herds are located. Only a handful of herds show evidence of Iberian ancestry and those that do tend to be more isolated than other herds.

Corresponding author:

Gus Cothran, PhD

Department of Veterinary Integrative Biosciences

Texas A&M University

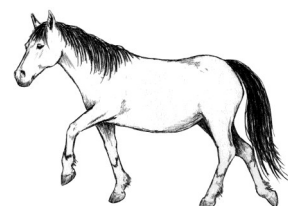
TAMU4458

College Station, Texas 77843

USA

Tel: +1.979.845.0229

E-mail: gcothran@cvm.tamu.edu



E. caballus

Insights Into Genetic Diversity, Population Structure and Demographic History of the African Wild Ass (*Equus africanus*)

Sónia Rosenbom, Fanuel Kebede, Redae Teclai, Hagos Yohannes, Futsum Hagos, Patricia Moehlman, and Albano Beja-Pereira

The African wild ass is an indigenous species to the arid and semi-arid habitats in Northeast Africa. Once distributed across a wider range, north and west into Sudan and Egypt, its distribution range is now believed to be circumscribed to the Danakil Desert of Ethiopia and Eritrea. The African wild ass is considered as critically endangered (CR) by IUCN, but demographic trends in Ethiopian and Eritrean populations are somewhat different. In Ethiopia, there has been a severe population decline since the early 1970s (95%) and the only remaining population is in the north-eastern Afar Region. The number of individuals in this country is now believed to be less than 200 with a density of approximately 0.625 African wild ass per 100 square kilometers. Long-term data are not available in Eritrea, but since the mid-1990's the population appears to be stable and in a limited study area the density is approximately 47 African wild ass per 100 square kilometers. In this study we have used a non-invasive sampling approach. Fecal samples from three extant subpopulations were collected; two from Ethiopia ($n=100$) and one from Eritrea ($n=45$). Genetic diversity, structure and demographic parameters for these subpopulations were inferred using genotyping data from 10 polymorphic microsatellite markers and sequence analysis of a fragment of the hypervariable region of mtDNA. Sequence based analyses revealed the existence of three shared haplotypes between the subpopulations of Ethiopia and Eritrea and the presence of a unique haplotype in the Eritrean subpopulation. Both haplotype (h) and nucleotide (π) diversities were higher in the Eritrean subpopulation ($\pi=0.00767$ and $h=0.707$) than in either Ethiopian subpopulations. Expected heterozygosity (H_e) estimated from microsatellite loci genotypes for the Ethiopian ($H_e=0.492\pm0.068$) and Eritrean ($H_e=0.571\pm0.054$) subpopulations, also point to the Eritrean subpopulations retaining higher diversity. Data analyses in order to infer subpopulation structure and demographic parameters is currently underway.

Corresponding author:

Sónia Rosenbom

CIBIO

Research Centre for Biodiversity and Genetic Resources

University of Porto

Campus Agrário de Vairão

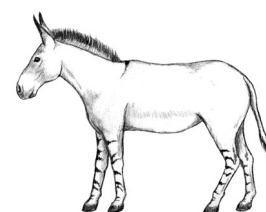
R. Padre Armando Quintas 7

4485-661 Vairão

Portugal

Tel: +35.1252660411

E-mail: sonia.rosenbom@cibio.up.pt



E. africanus

Different Mechanisms Contribute to the Rapid Genome Evolution of Equids

Elena Giulotto, Francesca M Piras, Francesco Vella, Claudia Badiale, Elisa Belloni, Federico Cerutti, Riccardo Gamba, Paola Pellanda, Valerio Vitelli, Oliver A. Ryder, Elena Raimondi, and Solomon G. Nergadze

Speciation events in the genus *Equus* occurred very rapidly in an evolutionary time scale and were accompanied by extensive karyotype modifications, the estimated rate of change being eighty times faster than that observed in Ceratomorpha. By means of molecular cytogenetic analyses, we previously demonstrated that one of the main forces driving the exceptionally rapid evolution of Equid karyotypes was centromere repositioning that is the shift of the centromeric function to a new position without chromosomal rearrangement, giving rise to the so called evolutionary neocentromeres. Although we described 9 evolutionary neocentromeres, this number is probably underestimated. Using fluorescence *in situ* hybridization and DNA sequence analysis, we then showed that the localization of satellite DNA sequences varies widely in different species of the genus *Equus* and observed that several chromosomes, while lacking satellite DNA at their centromeres, contain such sequences at non-centromeric termini, probably corresponding to relics of ancestral, now inactive, centromeres. The observation that *E. asinus* and *E. burchelli* share a neocentromere in the same chromosomal position suggested that these species may be more closely related than previously proposed. Our cytogenetic phylogeny studies demonstrated that the genus *Equus* is a paradigmatic model for the analysis of the molecular events underlying the formation of mammalian centromeres. Here we report on the comparative analysis, by fluorescence in situ hybridization, of the distribution of different classes of satellite DNA and of interstitial telomeric sequences in five *Equus* species: *E. caballus*, *E. asinus*, *E. burchelli*, *E. grevyi* and *E. zebra hartmannae*. Interestingly, in *E. zebra hartmannae* we observed ten very extended blocks of interstitial telomeric repeats all coinciding with evolutionary break points. These results strongly suggest that the involved chromosomes were originated by telomere-telomere fusions pointing to the relevance of these events in the evolution of equids. We further investigated Equid genome plasticity by the analysis of insertion elements such as ERE-1 transposons, mitochondrial DNA insertions and interstitial telomeres. Taking advantage of the complete sequence of the horse genome, we designed primer pairs flanking horse insertion elements and amplified the genomic DNA of the different *Equus* species. This procedure allowed us to date several insertion events in the evolutionary tree of the genus *Equus* and to demonstrate that insertion elements are still playing an important role in the rapid evolution of these genomes.

Corresponding author:

Elena Giulotto, PhD

Dipartimento di Biologia e Biotecnologie "Lazzaro Spallanzani"
Università degli Studi di Pavia
Via Ferrata 1
27100 Pavia
Italy
Tel: +39.0382985541
E-mail: elena.giulotto@unipv.it



Equus spp.



The Decline of the Asiatic Wild Ass: Recording 100,000 Years of Genetic Diversity of the Species

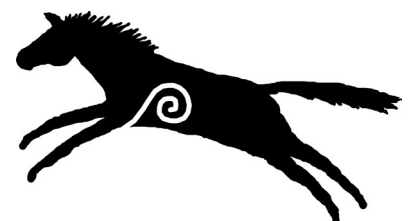
E.A. Bennett, S. Champlot, M. Pruvost, M. Gautier, B. Arbuckle, A. Balasescu, V. Eisenmann, P. Kaczensky, R. Kuehn, M. Mashkour, A. Morales Muniz, J. Peters, J.-F. Tournepiche, H.-P. Uerpmann, C. Walzer, T. Grange, and E.-M. Geigl

Paleogenetics can potentially elucidate past animal population structures, monitor climate- and human-induced fluctuations of the genetic diversity, and advise conservation biologists in the design of conservation strategies. The Asiatic wild asses whose geographical distribution in the Pleistocene and the early Holocene stretched from Northern Africa to Eurasia had to be put on the IUCN Red List of threatened species before they were genetically well studied. Indeed, little is known about their population dynamics, population structure and phylogeography. We undertook a study of the genetic diversity of the Asiatic wild ass during the Middle-Upper Pleistocene and the Holocene, i.e., over 100,000 years, by analysing the mitochondrial hypervariable region and Y chromosomal SNPs in ancient and modern samples from Western Europe and Asia. The genetic data obtained reveal several significantly distinct haplogroups with a clear substructure. This structure becomes only apparent through the ancient DNA data. The extant populations in China and Mongolia encompass three distinct haplogroups, two of which encompass kulans and kiangs questioning the taxonomic position of kiangs as separate species. The third group is related to two haplogroups found among ancient and modern Iranian and Turkmen *E. hemionus*, indicating genetic flux between these populations. Two other haplogroups, found in Syria and in Turkey and the Balkans, respectively, are extinct at present. The data also show that *E. hemionus* lived in the Pleistocene in Europe as far as Western France. Our data do not support clear genetic separations between the various *Equus hemionus* species and/or subspecies defined as *E. h. hemionus*, *luteus*, *kulan*, *onager* and *kiang* for two reasons: (i) individuals of the same subspecies cluster in distinct haplogroups; (ii) several haplogroups encompass individuals from different subspecies. Since the *E. hemionus* populations are presently critically endangered and mostly consist of very few remaining individuals (with the exception of the Mongolian kulans), it is not clear whether enforcing the maintenance of a reproductive barrier between populations that have only recently been separated is a wise strategy, given the concomitant risk of a detrimental reduction of the genetic diversity with its associated genetic diseases. Our study shows how the analysis of the ancient population structure of endangered species can question the concept of subspecies that is based on recently introduced reproductive barriers between populations resulting from recent habitat reductions. Such a historical perspective can be invaluable in assisting definition of more effective strategies of the management of wild life.

Corresponding author:

Eva-Maria Geigl, PhD

Institut Jacques Monod
CNRS-Université Paris Diderot
15, rue Helene Brion
Paris 75013
France
Tel: +33.157278132
E-mail: geigl.eva-maria@ijm.univ-paris-diderot.fr



Equus spp.



Genetic Diversity in a Reintroduced Population: The Asiatic Wild Ass in the Negev, Israel

Edith Speyer, Sharon Renan, Amos Bouskila, and Shirli Bar-David

A reintroduced population is a small population; therefore it is susceptible to loss of genetic diversity, through two main evolutionary processes: Inbreeding and Genetic drift. In addition in the course of colonization, it might be affected by founder effect, since it undergoes a process of spatial expansion resulting in the establishment of small sub-populations that are spatially separated, to some extent, from one another. An additional important parameter, which considerably affects the amount of genetic diversity in a population, is its effective population size (N_e). The size of N_e is influenced by the variance among individuals in their reproductive success (RS). In polygynous mating systems, there is a high variance in RS of males while RS is relatively constant among females. Therefore, the composition of the gene pool is determined by most of the females but only by a few dominant males. The Wild Ass (*Equus hemionus* spp.) was reintroduced into Makhtesh Ramon and wadi Paran (1982-93). Later on the population expanded to Northern Negev Heights ("Negev Heights"). Today, Negev Heights is the most frequented activity center. In a research done by Saltz et al. (2006), until 1999 in Makhtesh Ramon, a relation between RS and amount of annual precipitation was found. The goal of this research is to evaluate females' RS and their contribution to the gene pool of the Wild Ass in the Negev Heights. Two research methods are employed: 1. Direct observations- Individual profiles were created and number of females and juveniles in each group, was recorded. 2. Non-invasive genetics- fecal samples were collected and mitochondrial DNA was amplified. Genetic diversity was compared between: 1. Negev Heights subpopulation and the founders (30 samples from the breeding core) 2. Negev Heights Juveniles (69 samples) and adults (108 samples). Preliminary results, imply that a drought during gestation (i.e. 2011 RS=0.52) had a similar effect on RS as for Makhtesh Ramon (RS=0.51) but when good conditions are present (i.e. 2010 RS=0.61) the RS is higher than that expected for Makhtesh Ramon (RS=0.47). These results suggest that the Negev Heights habitat is more suitable than the Makhtesh Ramon and may explain the naturally expansion of the population. 3 mtDNA haplotypes were defined occurring in all the different sampled groups. One haplotype was found in low frequency in the Negev Heights (Frequencies; 0.13). No significant genetic difference was found between adults and juveniles, but a significant genetic difference was found between Negev Heights and the founders (AMOVA, Φ_{st} =0.092, P =0.01). These results imply that most of the females contribute to the gene pool of the Negev Heights subpopulation. Although, a high RS was found indicating that the population is well established, further research monitoring the long term changes in genetic diversity and RS of the population is essential for the conservation of the Wild Ass.

Corresponding author:

Edith Speyer

Mitrani Department of Desert Ecology
Ben-Gurion University of the Negev
84990 Midreshet Ben-Gurion
Israel
Tel: +972.523339493
E-mail: edith.speyer@gmail.com



E. hemionus



Successful Cryopreservation Protocol of Persian Wild Ass (*Equus hemionus onager*) Spermatozoa

Maria T. Prieto Pablos, J. Saragusty, J. Stagegaard, T.B. Hildebrandt, F. Göritz, and R. Hermes

During the last century, many species have become endangered and conservation in terms of captive breeding has been crucial for their survival. Genetic variation is a primary component of adaptive evolution, and its loss or reduction will decrease the long-term survival probability of populations. Maintaining genetic variation has been a major goal in captive breeding programs. Sperm cryopreservation may be considered as a perfect tool to improve genetic diversity, reduce inbreeding, and avoid animals' translocation. The present study aimed at finding a reliable semen freezing protocol to preserve epididymal sperm of the critically endangered Persian wild ass, *Equus hemionus onager*. Six testicles from three animals were processed post-mortem. We tested the effect of two testicles' transportation temperatures (22°C and 4°C; submerged in saline), two cryopreservation techniques – conventional liquid nitrogen vapor freezing in straws (CF) and directional freezing (DF), and two post-thaw incubation temperatures (22°C and 37°C; 30 min, 1h, 2h, and 3h) in a 2×2×2 experimental design. Sperm samples were evaluated for total motility, viability, acrosome integrity, and sperm morphology (percent of normal sperm and percent of different morphological defects excluding defects due to the epididymal origin of the sperm). The total number of spermatozoa obtained from the epididymis was $13.85 \pm 0.72 \times 10^9$ cells. The resulting optimal freezing protocol include transportation of testicles at 4°C, cryopreservation by DF, and if needed – post-thaw incubate at 22°C. With this combination of transportation temperature and cryopreservation technique, we obtained the following post-thaw values: $43.33 \pm 6.67\%$ motility, $52.33 \pm 11.46\%$ viability, $69.67 \pm 8.51\%$ acrosome integrity, and $70.54 \pm 8.10\%$ normal morphology normalized to pre-freezing values. After the incubation period at 22°C, the motility values for the previous combination were $40 \pm 5.77\%$, $30.33 \pm 5.17\%$, $28.33 \pm 4.41\%$, and $16.67 \pm 4.41\%$ for 30 min, 1h, 2h, and 3h, respectively. In conclusion, with this protocol, good quality semen can be stored for future use in artificial inseminations when and where needed.

Corresponding author:

Maria T. Prieto Pablos, PhD

Research Group Reproductive Management
Leibniz Institute for Zoo and Wildlife Research
Alfred-Kowalke Strasse 17
10315 Berlin
Germany
Tel: +49.305168441
E-mail: prieto@izw-berlin.de



E. hemionus

Infectious Disease Concerns in Wild Equids

Chris Walzer

In today's increasingly human-dominated landscapes and in the face of global climate change small remnant or reintroduced equid populations are inherently at risk from epizootic disease incidents. Continuous encroachment of the last remaining wilderness areas by humans and their livestock has significantly increased the human-livestock-wildlife interface in the past decades and consequently the potential for disease transmission. Similar to the devastating effects of stochastic events, predation, competition and habitat degradation on small populations, disease will influence individual fitness, population dynamics and is therefore an important natural selective force. Generally most diseases of domestic equids can be transmitted to wild equids and vice versa. A clear understanding of potential infectious agents, their vectors and the underlying epidemiological processes is essential when developing and implementing conservation measures. When moving wild equids from one population (e.g. captive population in Europe) to another (e.g. in-situ in central Asia) it is important to appreciate that the animals moved, are at the same time a vessel for numerous infectious agents that could adversely affect the receiving population. On the other hand, naïve animals when faced with a novel infectious agent in a new and often demanding environment are similarly at risk due to the lack of an adequate co-evolutionary pathogen-adapted immune response. Beyond the transmission of diseases between wild equid populations, the transmission of a disease from a wild equid source to a domestic horse population can have serious health consequences and more often than not, significant economic implications. This was clearly demonstrated with the introduction of the highly infectious and deadly African Horse Sickness (Orbivirus) with zebras to Spain in 1987. The increasing pressure from grazing livestock on wild equids in remnant ecological islands is of serious concern in many parts of the world. Recent and repeated outbreaks of equine influenza A in Mongolia and the Xinjiang Autonomous Region of China have directly threatened Przewalski's horses in the south-west of Mongolia (Greater Gobi SPA "B") and the Kalamaili Nature Reserve in Xinjiang. Disease must be firmly integrated in equid conservation management measures to ensure that these risks are adequately recognized and subsequently addressed. Management must be based on a thorough understanding of disease epidemiology including inter-alia disease distribution, hosts, vectors, modes of transmission and pathogenicity. Furthermore, national and international regulations concerning equid diseases and their management must be adhered to. In conclusion it is important to understand that pathogens are an important feature of a species' environment and as such all interventional measures must be carefully considered in an evolutionary context.

Corresponding author:

Chris Walzer, DVM

Research Institute of Wildlife Ecology
University of Veterinary Medicine
Savoyenstrasse 1
A-1160 Vienna
Austria
Tel: +43.14890915180
E-mail: chris.walzer@fiwi.at



Equus spp.

Successful Semen Banking and Artificial Insemination in the Persian Onager (*Equus hemionus onager*): A Tool for Sustainable Population Management

Mandi M. Vick, David E. Wildt, Rachael A. Weiss, Barbara A. Wolfe, Kate E. Archibald, and Budhan S. Pukazhenth

Current populations of the endangered Persian onager (*Equus hemionus onager*) are regionally isolated in the wild (< 1,000 individuals in nature) and in managed *ex situ* populations (< 200 animals worldwide). This species breeds well in captivity, and natural breeding is essential to maintaining social structure and long-term viability. However, semen banking and artificial insemination could aid in preserving genetic diversity and minimizing the need for live transport. The objectives of this study were to (1) understand the basic reproductive biology of the Persian onager and (2) develop methods for semen collection, sperm cryopreservation and artificial insemination. To understand seasonality and the impact of lactation, urine samples were collected non-invasively for 3 months to 2 years in 11 females (including four lactating females) and analyzed by enzyme immunoassay to assess progesterone and estrogen metabolite concentrations. Ultrasonography was performed three times weekly for 2 months to monitor ovarian follicular development and ovulation ($n=7$ females). Electroejaculation was performed in seven sedated males, and spermic ejaculates were cryopreserved in EQ medium with or without L-glutamine. Artificial insemination with frozen ($n=2$) or fresh/chilled ($n=1$) sperm was conducted in three females 24 h after detecting a dominant follicle and administering deslorelin (1.5 mg, IM) to induce ovulation. Females were seasonally polyestrous, exhibiting five to seven estrous cycles during summer months with an estrous cycle of ~25 days. Lactational suppression of estrus was pronounced in four females housed without a male and nursing foals up to 1.5 y after parturition. Sperm collection was successful in five of seven males, and there was no effect of cryodiluent on post-thaw sperm motility (60–70%) or acrosomal integrity (54–91% intact). Artificial insemination was successful in two of three females, resulting one healthy male and one female foal using frozen-thawed and fresh/chilled sperm, respectively. These data demonstrate that Persian onager sperm can be frozen and stored to preserve genetic diversity, and that artificial insemination (even using thawed sperm) is a successful way of producing offspring in managed populations.

Corresponding author:

Mandi M. Vick, PhD

Cleveland Metroparks Zoo

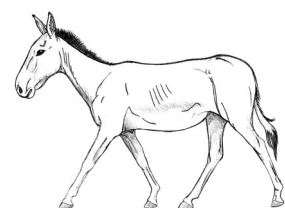
Wildlife Way

Cleveland, Ohio 44109

USA

Tel: +1.216.635.2522

E-mail: mmv@clevelandmetroparks.com



E. hemionus

Comparing Methods for Estimating Wild Equid Population Densities: A Case Study of the Endangered Grevy's Zebra

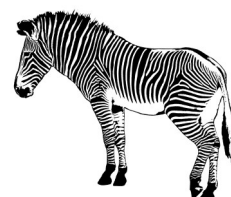
Victoria H. Zero, Siva R. Sundaresan, Timothy G. O'Brien, and Margaret F. Kinnaird

Accurately estimating animal abundance or density is crucial for wildlife management and conservation. While numerous techniques are available to assess abundance and density, comparisons of precision and cost-effectiveness among these approaches are few. In this study, we assess the precision and cost of three sampling methods for estimating densities of the endangered Grevy's zebra (*Equus grevyi*). The methods used here are widely applicable to other equids. We compare line-transect distance sampling and photographic capture-recapture, and a third newly proposed technique (random encounter model, REM) that uses camera trap encounter rates to estimate animal density. We carried out our study on the 200 sq km Mpala Conservancy in Laikipia, Kenya. In line transect sampling, observers traverse randomly or systematically placed lines in a study area. Observers count animals in clusters, or groups, detected from the line. Count data is gathered in association with perpendicular distances between clusters and the transect. Because not all animal clusters may be detected, count data are adjusted according to the probability of detection, which can be estimated from the observed distribution of perpendicular sighting distances. We carried out line transect sampling in June 2008 and June 2010. In photographic capture-recapture methods, we repeatedly survey the study area photographing all encountered Grevy's zebras. Using their unique stripe patterns, we can develop capture histories for each individual. This data can then be analyzed using closed population capture-recapture models to estimate population size. We performed the photographic survey in June 2010. The random encounter model (REM) estimates density by modelling the underlying process by which animals encounter camera traps. By incorporating average group size and average speed of movement, encounter rates can be modelled and unbiased density estimates can be derived. The REM method was carried out in June 2008. All three methods provide comparable density estimates for Grevy's zebra and are preferable to the common practice of raw counts, which are less accurate because they do not account for detection probability. Photographic capture-recapture is most precise while line-transect distance sampling is least precise. Over the long-term, photographic capture-recapture also allows estimation of population parameters such as survival. Line transects and photographic capture-recapture surveys are cost-effective in the first year and REM is most cost-effective over the long-term. We suggest that for single species monitoring programs in which animals can be uniquely identified, photographic capture-recapture may be preferred. When encounter rates are low, distance sampling although lacking the precision of the other methods, can be used cost-effectively for long-term or multi-species monitoring programs. The REM is an efficient and precise method of estimating densities but has high initial equipment costs. Overall, these simple methods provide a useful set of tools to accurately monitor wild equid populations.

Corresponding author:

Siva R. Sundaresan, PhD

Denver Zoological Foundation
2300 Steele Street
Denver, Colorado 80205
USA
Tel: +1.303.376.4800
E-mail: ssundare@princeton.edu



E. grevyi



A Collaborative Approach for Estimating Asiatic Wild Ass Abundance in the Mongolian Gobi

Jason I. Ransom, Petra Kaczensky, Bruce C. Lubow, Oyunsaikhan Ganbaatar, and Nanjid Altansukh

Accurately estimating abundance of wildlife is critical for effective conservation and management strategies. Aerial methodologies for estimating abundance are common in developed countries, but they are often impractical for remote areas of developing countries where many of the world's endangered and threatened fauna exist. The alternative terrestrial methodologies can be constrained by limitations on access, technology, and human resources and have rarely been comprehensively conducted for large mammals across large areas. We attempted to overcome these problems by incorporating local peoples into a simultaneous point count of Asiatic wild ass (*Equus hemionus*) across the Great Gobi B Strictly Protected Area, Mongolia. We developed an inexpensive rangefinder to help consistently measure distances from observer to animals and then used paired observers to collect abundance and covariate metrics at 50 observation points. We estimated population sizes using distance sampling theory, but also assessed individual observer error to examine potential bias introduced by the large number of minimally trained observers. We estimated 5,671 (95% CI = 3,611–8,907) wild asses inhabited the 11,027 km² study area at the time of our survey and found that the methodology developed was robust at absorbing the logistical challenges and wide range of observer abilities. Group size was important in estimating detection probability, but behavior, sun angle, vegetation type, and professional experience of the observer were not. An important improvement over many previous attempts at terrestrial distance sampling for this species is that the point count design resulted in little, if any, evasive behavior from wild asses. This created the opportunity for accurate measures of distance without the negative biases that arise when animals flee from observers. Attempts to increase precision of the estimate by stratifying analyses based on habitat selection failed, which is likely a common problem for estimating abundance of gregarious species. Stratifying based on *a priori* habitat selection models using past seasonal locations might improve precision of future estimates. This initiative serves as a functional model estimating wildlife abundance using a terrestrial application while integrating local people into scientific and conservation projects. This, in turn, creates vested interest in conservation by the people who are most influential in, and most affected by, the outcomes.

Corresponding author:

Jason I. Ransom, PhD

National Park Service
Biological Resource Management Division
1201 Oakridge Drive, Suite 200
Fort Collins, Colorado 80525
USA
Tel: +1.970.225.3584
E-mail: jason_i_ransom@nps.gov



E. hemionus

Determination of Feral Horse Density in a Forest Environment of Toolara State Forest

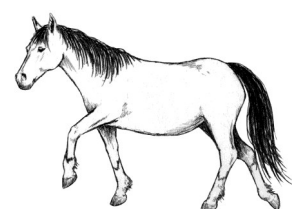
Magdalena A. Zabek, Dave Berman, and W. Collins

Toolara State Forest is the largest exotic commercial pine plantation of a size of 880 km², located in Queensland, Australia. Due to an abundant supply of resources, there has been a considerable increase in the population of feral horses (*Equus caballus*), which is facing an increased risk of overpopulation. In other areas of Australia, significant increases in feral horse numbers can often lead to welfare issues when the population exceeds existing food resources. A previous survey, conducted in 2009, estimated a total of 812 horses in a survey area of 400 km². Assuming equal density of horses in the entire forest, the total population totaled 1,786 horses. Management of this population is important due to possible welfare issues if the population exceeds available resources. Therefore, determination of the total numbers of horses is crucial for determining the best method of population management. However, Toolara is a dense pine forest, so is difficult to assess horse numbers using visual assessment. Therefore, the aim of this study was to estimate the number of feral horses in Toolara State Forest, using dung detection rates. This study included a vehicle strip transect survey, which covered 582 km of forest roads and a ground survey, which applied the distance (DISTANCE 6.0) sampling method. The study was conducted across four habitats of pine forest: mature forest, young forest, recently planted, and recently harvested forest. Dung counts were performed on total of 111 transect lines, totaling a distance of 43.9 km. Density of horses/km² was estimated with two additional parameters; individual defecation frequency of 7.97 ± 0.83 (Mean \pm SEM; range 5.69–12.24) defecations a day, and a daily dung disappearance rate of 424 days. Total number of horses in the forest was estimated by multiplying horse density/km² by the total forest size. From encountered dung ($n=1,619$ and $n=1,735$ for strip and distance transect survey respectively), mean density of dung per km² was 463.63 for strip transects and $7,341 \pm 1,686$ SE/km² for distance transect survey, respectively. Based on these parameters; the average density of horses for the whole Toolara forest was estimated to be 2.24 ± 0.48 horses/km². The total number of horses occupying an area of 880 km² was estimated to be $1,978 \pm 128$ horses, and indicated 11% increase in number of horses compared to the previous estimate in 2009. The accuracy of distance sampling estimates will be compared with horse estimates derived from the mark-resight method, which will be completed by the end of 2012 to test for the method practicality.

Corresponding author:

Magdalena A. Zabek

University of Queensland
School of Veterinary Science
Gatton, Queensland 4343
Australia
Tel: +61.402.766.053
E-mail: m.zabek@uq.edu.au



E. caballus



Stable Isotope Diet Reconstruction of Feral Horses (*Equus caballus*) on the Sheldon National Wildlife Refuge, Nevada, USA

Megan K. Nordquist, Steven L. Petersen, Todd F. Robinson, and Gail Collins

Feral horse management has become a subject of significant controversy in the United States. This is because of differing opinions and minimal recent empirical data on feral horses. In recent years, numbers of feral horses have increased due to governmental horse removal restrictions (specifically the Wild Horse and Burro Act of 1971). With increasing numbers of feral horses on rangelands, land managers are challenged with identifying the appropriate course of action for satisfying groups with differing opinions. The purpose of this study is to characterize diet consumption through the use of stable isotope dietary analysis ($\delta^{15}\text{N}$ and $\delta^{13}\text{C}$). We did this in order to measure the impact of feral horse forage consumption on rangelands and to propose strategies for improving habitat management and conservation. We obtained tail hair isotopic values from tail hair removed while horses that were held in squeeze chutes following a roundup. Resulting isotopic values were compared to plant isotopic values using plant samples obtained from the geographical areas as the horses in order to characterize diet. Contribution of the various plant species to the tail hair mixture values was determined using the EPA program IsoSource©. Initial analysis of tail hair isotopes demonstrated seasonal variation. During summer months, shrubs (mostly *Artemisia* spp. and *Purshia tridentate*), *Elymus elymoides*, *Juncus balticus*, and *Festuca idahoensis* were the predominantly consumed vegetative species. During fall months, *Leymus cinereus* and *Juncus balticus* played a more significant role in feral horse diet. In the winter, shrubs were more heavily consumed along with *Poa secunda*. Springtime showed a shift towards forb consumption. Changes in seasonal consumption of forages are most likely linked to forage availability as well as equine preference. We analyzed plant metrics (specifically biomass, abundance, and cover) to compare a site with horses present to a site where horses had been removed the previous year and found relatively few differences between the two sites. With nearly all differences we found higher plant production (forage availability) on the site where horses were still present. In riparian areas however, there was more vegetation (specifically *Carex rossii*, *Juncus balticus*, and *Poa secunda*) on the site where horses had been removed. Within riparian areas, only *Bromus tectorum* (a plant not typically found in riparian areas but characteristic of degraded areas) showed significantly greater amounts of biomass on the site with horses present. Knowledge of plant species consumption will allow land managers greater ability to make scientifically based decisions regarding feral horse population control which is important in determining appropriate management levels of populations.

Corresponding author:

Megan K. Nordquist

Brigham Young University

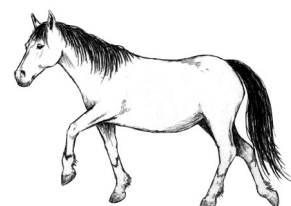
346 WIDB

Provo, Utah 84602

USA

Tel: +1.801.850.8211

E-mail: megankw47@gmail.com



E. caballus

Free-Roaming Horse Distribution and Habitat Use Patterns within Riparian and Upland Areas in Western North America

Steven L. Petersen, Craig A. Carr, Gail H. Collins, P.A. Clark, D.E. Johnson, C. Boyd, K. Davies, and Amy J. Gooch

Effective management of free-roaming horses on western North American rangelands requires an understanding of their influence on habitat structure and resilience. Of particular interest to managers is the influence that horses have on critical or sensitive environments such as riparian and sagebrush ecosystems. To effectively characterize this influence, methods are needed that detect horse occurrence and habitat use patterns temporally. The purpose of this study is to quantify horse riparian habitat use patterns by measuring the distribution of free-roaming horses in northwestern USA. To accomplish this, GPS collars were placed on free-roaming horses to collect coordinate positions of horse location. These data could then be used to track movement patterns and to calculate travel rates and distances. Additionally, five motion sensitive digital infrared cameras were placed along five riparian areas, programmed to take photographs of horses between April to October when habitat use is high. These images were collected either at 15 minute timed intervals or from motion triggered events. Preliminary results indicate that GPS collars can be used effectively and safely to track horse movement patterns. Additionally, more frequent logging rates provided spatially explicit data in relation to horse location, direction, and rate of movement during day and night periods. Photographs from remote cameras suggest that the amount of time horses spend in riparian areas increases as the summer progresses, likely associated with water availability. Understanding movement patterns and the frequency and duration of free-roaming horse use in sensitive habitats can help managers predict where impacts may occur and to identify sites that require protection.

Corresponding author:

Steven L. Petersen, PhD

Brigham Young University

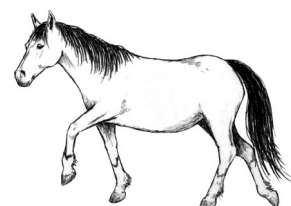
487 WIDB

Provo, Utah 84602

USA

Tel: +1.801.422.4885

E-mail: steven_petersen@byu.edu



E. caballus



Effects of Long-Term Feral Horse Grazing on Habitat Conditions in the Western USA

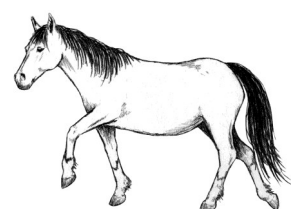
Kate A. Schoenecker, Jason I. Ransom, and Tracy A. Mask

Feral horses (*Equus caballus*) can have significant direct and indirect effects on vegetation dynamics and ecosystem processes. Managing feral horses is an ongoing challenge for public land managers due to population growth rates of horses that exceed 20%, a lack of native predators, regulatory and political constraints on management seeking to reduce numbers, and intense public scrutiny of management and policies. Understanding the relationships between wild horse herd management and habitat conditions is important for managers of rangelands in the USA, and other countries with replicate situations, such as Australia and Canada. To determine feral horse effects on habitat conditions, we used Normalized Difference Vegetation Index (NDVI) data to assess biomass in areas with and without feral horse grazing from 2000 to 2011. We used multivariate modeling to incorporate ecological covariates such as precipitation, density of horses, and presence of other grazers (bison, elk, domestic cattle, and sheep). Model results will be presented with discussion of implications.

Corresponding author:

Kate A. Schoenecker, PhD

US Geological Survey
2150 Centre Avenue, Bldg C
Fort Collins, Colorado 80526-8118
USA
Tel: +1.970.226.9329
E-mail: schoeneckerk@usgs.gov



E. caballus

Seasonal Patterns of Range Use of Asiatic Wild Asses in Great Gobi B Strictly Protected Area

Dejid Nandintsetseg, Peter Leimgruber, and Petra Kaczensky

Home range sizes of Asiatic wild asses (*Equus hemionus*, called khulan in Mongolian) in the Mongolian Gobi are huge, and year-round selection for specific habitat types seems weak. Although khulan do not follow pre-defined migrations, some seasonal movement patterns seem to exist, but have not been explored in detail. In July 2009 we equipped 10 khulan (6 mares & 4 stallions) with GPS-store-on-board transmitters that collected a GPS position every 15min over a 12 month period in the Great Gobi B Strictly Protected Area in SW Mongolia. The collars collected a total of 347,808 locations. We applied local convex hull (LoCoH) nonparametric kernel methods to construct individual 28-day 75% isopleth home ranges to check for seasonal trends in size and spatial distribution of home ranges. Contrary to our expectation khulan home ranges did not follow the assumed climate driven spring (March-May), summer (June-August), fall (September-November) and winter (December-February) pattern, but seemed rather be driven by the 2009/2010 weather extreme (a very snow rich and cold catastrophic “dzud” winter) and the mating season. During both periods, 28-day range sizes were greatly reduced and spatially restricted. However, ranges during the mating season were located in the east and strongly overlapped, whereas ranges during the “dzud” period were located in the west and showed less overlap. Our data suggests a strong influence of social- and extreme climatic factors on khulan movements patterns. The extreme weather event may have masked any underlying seasonal effect potentially driven by the climatic variation in normal years. Consequently more and longer term data is necessary to understand and predict khulan movements and come up with conservation strategies incorporating temporal variation in resource availability as well as social constraints.

Corresponding author:

Dejid Nandintsetseg

Department of Ecology, School of Biology and Biotechnology
National University of Mongolia
University Street 1
Ulaanbaatar 210646
Mongolia
Tel: +976.99891512
E-mail: dnandintsetseg@gmail.com



E. hemionus

Making and Maintaining Connections: Fence Replacement, Removal, and Rethinking Its Necessity Along Mongolia's Railroad Infrastructure

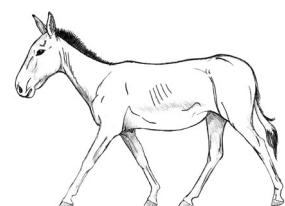
Kirk A. Olson

The double fenced Trans Mongolian Railroad is currently the only continuous anthropogenic barrier that khulan (*Equus hemionus*) and Mongolian gazelle (*Procapra gutturosa*) encounter in the southern gobi and steppe ecosystems. Within 10 years after completion, its existence defined the easternmost range of khulan and Mongolian gazelles are found perpetually entangled within its fenced corridor. To accommodate the mining industry, Mongolia has initiated construction of a 1,100 km long east-west railroad which will bisect critical khulan and Mongolian gazelle habitat. If the rail corridor is constructed to existing standards, this will have devastating consequences for these populations. Along one segment of the TMR with no bridges, Khulan were observed walking >70 km's alongside the tracks before turning away. Of 5 GPS collared Mongolian gazelles that approached the TMR, only one successfully crossed. Marked gazelles crossed over the planned route and average of 3 ± 2 times with one individual crossing on 8 separate occasions. In the summer of 2011 I sought solutions for the existing barrier effect of the TMR in hopes that these can be transferred over to the planned railroad before it has the opportunity to become a barrier to animal movements. Using data obtained from discussions with railroad professionals and herders living in close proximity to the existing and planned railroads, and collecting locations of carcass and crossing point dimensions along the TMR, I offer a series of recommendations for reconnecting these two contiguous habitats and will minimize the impact to khulan and gazelles ability to undertake long distance movements along the planned route. The purpose of the fenced corridor is to minimize livestock collisions and discourage vehicles from crossing the tracks at non-designated locations. Rail operators in other countries typically do not maintain a fenced corridor preferring to compensate for damage incurred as it is more economical policy. Despite the presence of unfenced underpasses along the railroad, they do not appear to be utilized by Mongolian gazelles as the number of observed carcasses could not be predicted by the number of large unfenced underpasses. The one-sided barrier effect observed previously was not observable as carcass numbers on either side of the fence were not significantly different, highlighting the variability in animal movements in this arid region. Herding households also lamented the lack of crossing opportunities along the TMR and are highly concerned about their ability to access pastures along the planned route. There was agreement amongst herding households that fence free zones in areas where there are no families living near the tracks would be acceptable in order to help wildlife. In areas where khulan do not occur, antelope friendly fence design was preferred over woven barbed wire fencing. To maintain rail safety, erecting animal tight fencing 2.5 km's on either direction of railroad stations and increase the number of posted at-grade vehicle crossings.

Corresponding author:

Kirk A. Olson, PhD

Smithsonian Conservation Biology Institute
1500 Remount Road
Front Royal, Virginia 22630
USA
Tel: +1.413.695.6935
E-mail: kirkaolson@hotmail.com



E. hemionus

Conservation and Research Needs for Asiatic Wild Ass in Central Asia

Petra Kaczensky

The steppes, desert steppes, and deserts of Central Asia are still home to several globally threatened migratory or nomadic large herbivores. However, a growing human population, changes in land management, exploitation of natural resources, and the development of infrastructure place increasing pressure on these species and their habitats. Among these species is the Asiatic wild ass (*Equus hemionus*). Anecdotal evidence suggests that the Asiatic wild ass may have lost as much as 70% of its range since the 19th century because of direct persecution and competition with humans and their livestock over water and pasture use. The Mongolian Gobi and adjacent areas in northern China provide the last refuge for a large and more or less continuous population of Asiatic wild ass. However, connectivity is increasingly threatened by linear infrastructure development, large scale natural resource extraction and/or land conversion. Opportunities for restoration exist, but have been poorly explored. The wild ass population in Turkmenistan seems to have recovered and stabilized, but research activities seem to have largely ceased. Connection to the declining population in Touran in northern Iran likely existed in the past, but is now blocked by a solid border fence. The decline of the Touran population is poorly understood, but is believed to suffer from poaching and competition with livestock. The second Iranian population in Bahrame-e Goor seems to increase, but only in numbers and not in range. In Kazakhstan the wild ass became extinct at the end of the 1930s. However, reintroductions already began in 1953 and have been most successful to Altyn Emel National Park. With the breakdown of the Soviet system large regions within the former wild ass range of central Kazakhstan became depopulated and presently have a very low human population density with little agricultural production. Interest in saiga (*Saiga tatarica*) and steppe ecosystem conservation is presently high and provides a window of opportunity to also promote the re-establishment of the formerly native wild equid species.

Corresponding author:

Petra Kaczensky, PhD

Research Institute of Wildlife Ecology
University of Veterinary Medicine
Savoyenstrasse 1
A-1160 Vienna
Austria
Tel: +43.1.4890915.181
E-mail: petra.kaczensky@fiwi.at



E. hemionus

Spatial-dynamic Modeling of Equid Ecosystems to Support their Conservation and Management

Michael Coughenour

There is a pressing need for an assessment methodology that explicitly considers the role of horses in ecosystems and the ecological processes which are necessary for ecosystem viability. Sustainable equid ecosystems are comprised of interacting processes involving soils, plants, herbivores, and often, predators and humans. Spatial-dynamic ecosystem modeling can be used to assess these interactions and guide equid and natural resources management and conservation. I provide an overview of the ecosystem modeling approach, its utility for assessing the Pryor Mountain wild horse population and its habitat, and its utility for conducting integrated assessments of equid, equid-livestock, and equid-wildlife ecosystems elsewhere. The approach goes beyond traditional carrying capacity methodologies and instead, predicts outcomes for equids, rangelands, and other ecosystem components. Vegetation responses to herbivory were predicted under the alternate scenarios. Model-based assessments provide information that is useful for a variety of stakeholders, including equid and wildlife managers, conservationists, rangeland managers, livestock producers, and pastoralists.

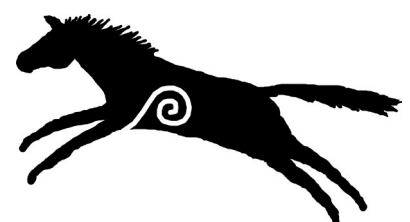
Corresponding author:

Michael Coughenour, PhD

Natural Resource Ecology Laboratory
Colorado State University
Fort Collins, Colorado 80523
USA

Tel: +1.970.491.5572

E-mail: mikec@nrel.colostate.edu



Equus spp.

Endangered Grevy's Zebra in the Alledoghi Wildlife Reserve, Ethiopia: Species Distribution Modeling for the Determination of Optimum Habitat

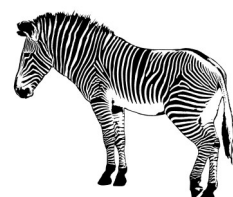
Fanuel Kebede, Afework Bekele, Patricia D. Moehlman, and Paul H. Evangelista

Habitat loss due to human-induced factors is intensifying and is a critical threat to most endangered species. Grevy's zebra *Equus grevyi* is one of the most endangered mammals in the world. Human encroachment on its natural habitat and poaching are the greatest threats to this species' survival in the wild. Grevy's zebra only occur within a few isolated areas in Ethiopia and Kenya. Effective conservation interventions based on scientific information are needed to safeguard this species from extinction. Wildlife managers need to identify the extent of the remaining suitable habitat and achieve a better understanding of human and wildlife interactions if they are to facilitate appropriate conservation strategies. The present study employed the maximum entropy model (Maxent), a species distribution modeling approach, to determine the geographic extent of habitat and seasonal distribution of Grevy's zebra in the Alledoghi Wildlife Reserve, Ethiopia, and to use this information to determine the optimum demarcation of conservation boundaries. Field surveys were conducted 4 times annually, twice during the wet season and twice during the dry season, for two years. Field data and predictor variables were separated into two seasons, and models were generated for each season independently. Seasonal maximum temperatures, distance to human settlements and slope were the best predictors for both the dry and wet seasons. Evaluations of model performances were high, with AUC (area under the receiver operating curve) values of 0.96 and 0.97 for the dry and wet seasons, respectively. The results will be critical for modifying the existing boundaries of the Alledoghi Wildlife Reserve and directing conservation strategies for the Grevy's zebra.

Corresponding author:

Fanuel Kebede

Ethiopian Wildlife Conservation Authority
Box 817
Bishoftu
Ethiopia
Tel: +251.911374816
E-mail: fanuel.kebede@gmail.com



E. grevyi

Recent Insights from Movement Ecology and Their Implications for the Conservation of Wild Equids

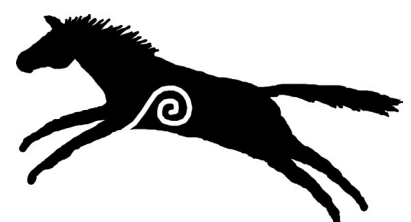
Navinder J. Singh

Conservation of large mammal populations requires extensive information on their movement and life history. The field of movement ecology has exploded in the last decade, with developments in tracking technology, data handling, analyses and visualization. As a result of these developments a vast amount of knowledge can be generated by purely looking at the movement paths of the animals. Using examples of the work on moose movements in Scandinavia, I will show the importance of such studies and their implications on the conservation and management of wild equids. Novel methods have revealed that animals can follow multiple movement modes such as migration, nomadism, dispersal and home range behaviour at spatio-temporal scales. Life history affects movement and these effects can be seen in the movement patterns of individuals using such methods. Populations of the same species can vary their movement in response to changing climatic conditions and risk; and movement paths can also reveal crucial demographic information. In addition, new technologies also allow us to estimate metabolic rates simultaneous to movement, hence estimating the costs of movement. All such developments have great potential to provide insights into equid ecology and conservation.

Corresponding author:

Navinder J. Singh, PhD

Department of Wildlife, Fish, and Environmental Studies
Swedish University of Agricultural Sciences
SE-901 Umea
Sweden
Tel: +46.907868538
E-mail: navinder.singh@slu.se



Equus spp.

Using Multi-scale Resource Selection by Asiatic Wild Ass to Predict Landscape Connectivity

James D. Forester

General patterns of resource selection by animal populations emerge from an interaction between landscape context and individual-level behavior. Statistical models that describe these broad-scale patterns may miss important fine-scale interactions between individual animals and features of their local environment. To predict how spatial and temporal patterns of resources and risk will shape future movement patterns, either within or between seasonal ranges, more mechanistic models of behavior are needed. Here I use a combination of step selection functions (SSF) and landscape connectivity models to explore how temporally variable resource selection by Asiatic wild ass (*Equus hemionus*) can affect the realized connectivity of the Great Gobi B Strictly Protected Area in SW Mongolia. This approach to modeling resource selection and connectivity is easily implemented using open-source statistical tools and promises to provide deeper insight into the movement ecology and conservation of wild equids.

Corresponding author:

James D. Forester, PhD

Department of Fisheries, Wildlife, and Conservation Biology
University of Minnesota
1980 Folwell Avenue
Saint Paul, Minnesota 55108
USA
Tel: +1.612.626.6721
E-mail: jdforest@umn.edu



E. hemionus



Quantifying Intermittent Coordination in the Movements of Simultaneously Tracked Animals: A Case Study with Khulan in Mongolia

Justin M. Calabrese, Chris H. Fleming, Petra Kaczensky, Peter Leimgruber, William F. Fagan, and Thomas Mueller

From migrations of wildebeest to the collective movements of fish schools and bird flocks, spectacular examples of highly coordinated movement among animals abound in nature. To date, quantitative approaches to studying movement behavior have tended to two extremes: they either focus on strikingly coordinated examples like those above or they assume that individuals move independently of one another. While these two endpoints of the coordination spectrum have been well studied both theoretically and empirically, little work has been done in the vast middle ground in-between. Many animal species likely feature periods of coordination interspersed with bouts of uncoordinated movement. Identifying when, how, and why animals chose to coordinate is thus a critical component in understanding their basic biology, social structure, and habitat needs, but tools to do so have been lacking. Here, we develop a new approach to understanding movement coordination in wild, free-ranging animals and apply it to khulan (*Equus hemionus*) in the Gobi desert. Starting with a general and flexible biased random walk model that accounts for both socially- and environmentally-driven coordination in movement among individuals, we develop a suite of tools that can be readily applied to multi-individual relocation data. We show that khulan exhibit several pronounced periods of coordinated movement during the year, including an expected peak around the breeding season, and a previously unexpected peak in April. Decomposing these peaks into components due to environmental and social factors, we demonstrate that while the breeding season peak has a stronger social component, the April peak is dominated by environmental factors, suggesting that coordination then is mediated by mutual attraction to resources. We conclude by discussing the potential of our approach to address a broader range of questions and species.

Corresponding author:

Justin M. Calabrese, PhD

Conservation Ecology Center
Smithsonian Conservation Biology Institute
National Zoological Park
1500 Remount Road
Front Royal, Virginia 22630
USA
Tel: +1.540.635.6582
E-mail: calabresej@si.edu



E. hemionus

Wild, Domestic, Hybrid, Feral, Icon and Pest: Comparing and Contrasting the Complexity of Human Relationships with Wild Ancestors and Domestic Derivatives for Horses and Wolves

John D.C. Linnell, Nicolas Lescureux, and Petra Kaczensky

Among the mammal species that have been domesticated there are few, if any, that have managed to penetrate so deeply into human culture and society as the dog and the horse. For both species humans also have very deep relationships with their nearest extant wild ancestors, e.g. the wolf and Przewalski's horse (recognizing that the exact taxonomic relationships between domestic and extant wild ancestors is unclear and subject to much debate for both species). Our relationships with these species (both domestic derivatives and wild ancestors) are highly complex. In this talk we explore the similarities between the human relationship with dogs/horses and their nearest living ancestors. We see a wide range of cultural and situation specific variations in our relationships with the domestic derivatives (dog and horse). Both dogs and horses helped humans to dominate other species as hunting partners and to increase the range of their activities, being the main means of terrestrial transportation until the invention of the engine. Both species also underwent dramatic changes in their status, especially in the modern occidental world, shifting from essential working animals to pets and emotional partners, and from a source of food to a culinary taboo. For both species we also see management challenges associated with feral populations, with responses ranging from strict protection to sterilization and lethal control. We also find conservation challenges associated with wild-domestic hybridization in both species, as well as reintroduction programs having been initiated to restore wild populations. The conservation context for the wild ancestors of both is complex and highly challenging, associated with significant conflicts, both of economic and socio-political types. However, there are also many differences with respect to both the global conservation status of the wild ancestors and the nature of the conflicts between the wild ancestors and human interests. Drawing on an interdisciplinary survey of the literature on the topic and our own field research we will compare and contrast the horse and the wolf-dog domestic-wild pairs, and speculate about how our relationship with the wild ancestors is influenced by our relationship with their domestic derivatives and vice versa. We shall finally identify areas where research conducted on one taxonomic group may be able to shed light on some knowledge gaps in the other group.

Corresponding author:

John D.C. Linnell, PhD

Norwegian Institute for Nature Research

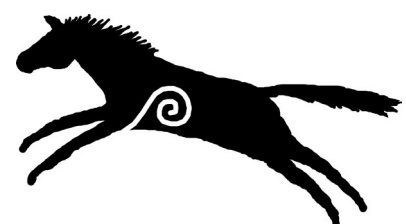
P.O. Box 5685 Sluppen

NO-7485 Trondheim

Norway

Tel: +47.73801442

E-mail: john.linnell@nina.no



Equus spp.

Habituation Potential in Wild Equids: the Influence of Coevolutionary History and Present-day Exposure to Benign Humans

Alexali S. Brubaker and Richard G. Cross

It is not fully understood why horses and donkeys, but not zebras, were domesticated. Among other traits, the capacity to habituate to humans is necessary for domestication; insufficient habituation potential was possibly a limiting factor in the case of zebras. Hominins have hunted equids for at least 400,000 years, thus recognition of a bipedal shape and flight are coevolutionary responses. However, humans today are a unique predator. Unlike lions, with short-term fluctuations in threat level, humans in certain protected areas permanently ceased hunting. Discerning that these humans are harmless would be adaptive. Behavior of free-living wild (feral) horses towards humans is highly plastic - in settings with harassment or poaching, horses flee, or with frequent exposure to benign humans, horses habituate. Regardless of whether horses were domesticated because their ancestors had high behavioral plasticity, or if much of the plasticity of modern horses derives from domestication, feral horses provide a comparison species with known domesticability. If zebras habituate to the same degree as horses do under equivalent situations, this suggests that habituation potential alone cannot account for different domestication outcomes. The hunting hypothesis (HH) posits that because zebras co-evolved with hunting hominins in Africa longer than horses did in Eurasia, their enduring wariness towards humans hinders habituation. In contrast, the exposure primacy (EP) hypothesis suggests that exposure to benign humans may override evolved behavior, facilitating habituation. We investigated whether contextual flight responses of horses and zebras differed by conducting standardized Flight Initiation Distance (FID) approach tests ($n=86$) on foot towards horses and zebras in the United States and Africa at sites with low and high exposure to humans (mean humans/acre = 0.004 and 0.209, respectively). Mean FID's in meters (with SD) for each combination: horse, low=146 (96.19); horse, high=16.58 (13.57); zebra, low=104.42 (42.52); zebra, high=37 (27). We developed an ANCOVA model (on log-transformed data) with start distance as the covariate. It yielded main effects of human exposure $F_{1,81}=31.15$, $P<0.0001$, species $F_{1,81}=13.32$, $P=0.0005$, and an interaction effect of species and human exposure: $F_{1,81}=8.25$, $P=0.005$. Effect sizes of predictors as proportion of variance uniquely attributable to each: exposure, $\eta^2=0.09$; species, $\eta^2=0.04$; interaction of exposure and species, $\eta^2=0.02$. We interpret the larger effect size of exposure as stronger evidence for EP, and limited habituation potential of zebras as an unlikely viable explanation for their non-domestication. However, the wider range of FID's in horses across exposure levels may support HH. Anecdotally, zebras are considered aggressive, so we suggest future research into aggression, defensive and/or social, as a candidate factor to possibly explain their non-domestication.

Corresponding author:

Alexali S. Brubaker

University of California-Davis

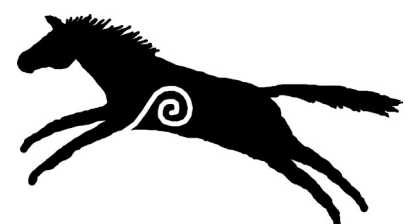
Shields Avenue

Davis, California 95616

USA

Tel: +1.415.385.4563

E-mail: asbrubaker@ucdavis.edu



Equus spp.

Methods for Managing Overabundant Wild Horse Populations in Australia

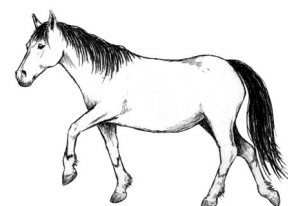
David Berman

There are somewhere between 350,000 and one million wild horses living in Australia. At a conservative rate of increase there could be 35,000 to 100,000 new foals born each year. During good seasons populations increase rapidly and then during drought many horses die of starvation or thirst. Overabundant horses have a negative impact on the economy and the environment. Management is required to reduce this damage. In this paper I describe three scientifically monitored wild horse management programs that have achieved a reduction in damage. Each program required specific strategies and methods suitable for the site. In central Australia all horses were removed from Finke Gorge National Park by helicopter mustering then shooting from helicopter. This national park has been free of the impact of feral horses for 15 years. All horses were removed from a military training area situated within 24 km of the centre of a capital city. Individual horse social groups were trapped using feed and all those suitable were re-homed. In an exotic pine plantation within two hours of a capital city horses are being captured and re-homed. Feed trapping does not work in this forest so other mustering methods have been developed. Only horses near to busy roads are to be removed. The remaining population is to be left in the forest. Ongoing management will be required probably using both rehoming and fertility control. These three sites are very different in size of the horse population, distance from human populations centers, landscape and vegetation and horse behaviour. They therefore require different strategies and methods. However, all programs required a measure of home range size, an understanding of movement patterns and determination of density and distribution. Science contributed significantly to the success of these wild horse management programs. While the programs described here appear to have achieved a reduction in damage caused by horses there are still many places where nothing is done or where lack of science means management actions are inadequate.

Corresponding author:

David Berman, PhD

Australian Wild Horse Management Services
Wellcamp-Westbrook Road
Wellcamp 4350
Australia
Tel: +61.746306646
E-mail: sunsetdowns@hotmail.com



E. caballus



A Survey of Techniques for Re-homing of Brumbies as a Method of Controlling the Feral Population

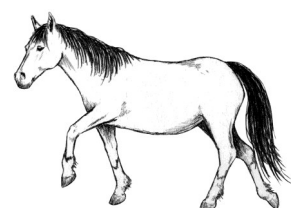
Frances Dinn, H. Ip, M. Hernandez-Jover, and P. Buckley

Feral brumby populations are increasingly problematic, damaging native vegetation and soils, and posing a risk to native animals and road traffic. Numerous methods of population control have been attempted, including aerial culling, trapping for slaughter and trapping for re-homing. Brumbies are the subject of much folklore in Australia and their fate triggers strong emotional responses from the public. Trapping for re-homing is regarded as a humane and socially acceptable means of control and is currently carried out by various organisations Australia-wide. However, no document exists that outlines the most efficient and humane method for the capture, training and re-homing of these animals. This study aims to survey the methods used to re-home brumbies in different areas of Australia. Seven trainers associated with Brumby Rescue organisations completed a survey via email that covered several aspects of their re-homing programs, with three of these organisations hosting visits to observe the employment of facilities and methods in depth. These organisations assisted with the distribution of surveys via email, post and online to owners of the purchased brumbies. These participants completed questions with limited response options about their experiences of the re-homing process, and asked for their general opinion about whether they perceived the process to have been successful. Data collection is currently occurring, with the final round of surveys expected to be returned in August 2012. Qualitative analysis will occur in relation to the trainer survey data, and providing that a sufficient number of participating owners is obtained, univariable and multivariable logistic regression will be utilised. Initial univariable logistic regressions will be performed and those variables associated with the outcome with a P -value of 0.10 will be included for the multivariable logistic regression analysis. Additionally, a backward method will probably be used for selection of significant variables and building the model. An investigation of potential confounding effects and interactions will also be performed. It is anticipated that the data analysis will identify 'risk factors' that may contribute to the success or failure of re-homing programs. It is hoped that this will lead to the production of a document that provides information for rescue organisations about the criteria for successful re-homing of brumbies and will assist in maximising the value of this technique as part of the brumby population reduction program.

Corresponding author:

Frances Dinn

School of Animal and Veterinary Science
Charles Sturt University
Wagga Wagga, New South Wales 2678
Australia
Tel: +61.435187855
E-mail: frances_1406@hotmail.com



E. caballus

Twenty-Four Years of Managing Free-Roaming and Captive Wild Equids by Means of Fertility Control

Kimberly M. Frank, Robin O. Lyda, and Jay F. Kirkpatrick

The management of free-roaming and captive wild equids takes many forms, and is not without political and social overtones. One approach, that has proven successful, safe and effective, at both the individual animal and the population level is immunocontraception. Porcine zona pellucida (PZP) vaccine has been applied to thousands of free-ranging wild horses (*E. caballus*), feral burros (*E. asinus*), and captive and semi-captive Przewalski's horses (*E. przewalskii*), Grevy's zebra (*E. grevyi*), Plains zebra (*E. burchelli*) and mountain zebra (*E. zebra*). The PZP vaccine, registered by the Environmental Protection Agency in the U.S. under the name ZonaStat-H, elicits antibodies against the ovarian sperm receptor, thereby blocking fertilization, and is the only non-barrier contraceptive that does not interfere with the cascade of reproductive endocrine events. The vaccine can be delivered remotely, by means of 1.0 cc darts, avoiding handling of animals; the contraceptive effects are reversible; there are no debilitating health side effects; behavioral changes are limited to those associated with the absence of foals, improved body condition or age; used properly, effectiveness is 90–95%, the vaccine cannot pass through the food chain, it is safe to administer to pregnant females; and the cost is relatively low. These characteristics provide a great deal of flexibility and lend themselves to effective management plans for differing populations. A shortcoming of the vaccine when used in large herds is that annual booster inoculations are required, at least for the first three years. In the case of donkeys and zebras, booster inoculations must be given more frequently (every 8 months) than in horses or Przewalski's horses (annually), because of the non-seasonal nature of the breeding season. The vaccine's use at the population level has either slowed growth significantly, or achieved zero population growth, or significantly reduced population numbers, depending on the management goals. Among chronically treated populations, foal mortality decreases, body condition scores increase and longevity increases significantly. Because of the non-intrusive and humane nature of this approach to population management, social acceptability has been greater than with removal of animals, and it surely has been more economical. Some models for fertility control of American wild horses have projected savings of millions of dollars over roundups and removals. This approach also bridges the gap – at least to some degree – between conservationists whose primary perspective is the population, and animal welfare interests, where the perspective is the individual animal. Despite impressive advances in management of equids by fertility control, agency inertia impedes progress.

Corresponding author:

Kimberly M. Frank

The Science and Conservation Center
Zoo Montana
2100 South Shiloh Road
Billings, Montana 59106
USA
Tel: +1.406.652.9718
E-mail: sccpzp@hotmail.com



Equus spp.



Immunocontraception in Wild Horses (*Equus caballus*) Extends Reproductive Cycling Beyond the Normal Breeding Season

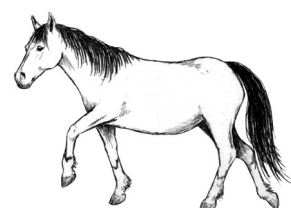
Cassandra M.V. Nuñez, James S. Adelman, and Daniel I. Rubenstein

Although the physiological effects of immunocontraceptive treatment with porcine zona pellucida (PZP) have been well studied, little is known about PZP's effects on the scheduling of reproductive cycling. Recent behavioral research has suggested that recipients of PZP extend the receptive breeding period into the non-breeding season. To determine if this is the case, we compiled foaling data from wild horses (*Equus caballus*) living on Shackleford Banks, North Carolina for 4 years pre- and 8 years post-contraception management with PZP (pre-contraception, $n=65$ births from 45 mares; post-contraception, $n=97$ births from 46 mares). Gestation lasts approximately 11-12 months in wild horses, placing conception at approximately 11.5 months prior to birth. Since the contraception program began in January 2000, foaling has occurred over a significantly broader range than it had before the contraception program. Foaling in PZP recipients ($n=45$ births from 27 mares) has occurred over a broader range and later in the year than has foaling in non-recipients ($n=52$ births from 19 mares). Females receiving more consecutive PZP applications gave birth later in the season than did females receiving fewer applications. For a gregarious species like the horse, the extension of reproductive cycling into the fall months has important social consequences, including decreased group stability, and the extension of male reproductive behavior. In addition, reproductive cycling into the fall months could have long-term effects on foal survivorship. Managers should consider these factors before enacting immunocontraceptive programs in new populations.

Corresponding author:

Cassandra M.V. Nuñez, PhD

National Aeronautics and Space Administration
1827 Summit Place, NW
Washington D.C. 20009
USA
Tel: +1.973.820.5655
E-mail: nunezcmv@gmail.com



E. caballus

Kiang-Herder Conflicts in Eastern Ladakh, India

Yash Veer Bhatnagar, Navinder J. Singh, Charudutt Mishra, Pranav Trivedi, R. Raghunath, and Karma Sonam

In the western extreme of its range, kiang (*Equus kiang*) are distributed over c. 7,500 km² of eastern Ladakh in flat valleys and rolling mountains mostly above an elevation of 4,200 m. Native nomadic communities rearing cashmere goats and sheep inhabit the region, which has seen an over threefold increase in its population since the 1960's owing to market forces and addition of population of large number of Tibetan refugees. While other wild ungulates of the region such as Tibetan argali and Tibetan gazelle have decimated, kiang continue to survive in numerous areas. Although they persist, an increasing perception that they deplete pastures, thus competing for scarce resources with livestock is gaining strength among a section of nomads, officials and politicians, leading to negative perceptions towards conservation in general. Our earlier work suggested that although the conflicts are often seen to exist in the entire landscape, they are primarily confined to specific areas such as moist meadows along riverbeds that have higher plant biomass and are important pastures for livestock too. This study was designed to obtain more accurate occurrences of kiang in the landscape and identify such conflict hotspots through targeted interview surveys in the Hanle Valley. We used presence-only information of over a decade of our work in the tract to generate the best possible distribution maps, used MODIS NDVI maps to identify the moist sedge meadows and held interview surveys to confirm presence of conflicts in the Hanle Valley and adjacent areas. Preliminary results suggest that the moist meadows are the primary 'hotspots' of conflicts since nomads also use these areas intensively. Nomads allege that kiang consume substantial biomass in such areas, especially during end-of-growing season (autumn) when they aggregate in large groups. Since no forage grows back, it results in scarcity of forage for livestock, especially during late winter and spring. We suggest that such areas should be systematically identified in the entire range and conflict mitigation should be undertaken so that the generally tolerant local community remains so.

Corresponding author:

Yash Veer Bhatnagar PhD

Nature Conservation Foundation & Snow Leopard Trust

3076/5 IV Cross

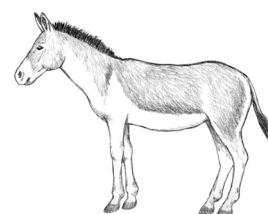
Gokulam Park

Mysore, Karnataka, Pin 570 001

India

Tel: +91.821.2515601

E-mail: yash@ncf-india.org



E. kiang



Grevy's Zebra Water Use and their Interaction with Livestock and People in Samburu, Kenya

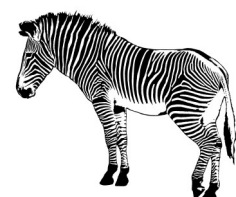
Peter Lalampaa, Jim Groombridge, Zeke Davidson, Siva Sundaresan, and Belinda Mackey

In arid African savannahs, water point interactions between pastoralists and wild ungulates are rarely witnessed because pastoralists exclude wild ungulates or they partition resource use in terms of drinking time. We studied interactions between endangered Grevy's zebra and livestock over water use in two community wildlife conservancies in Samburu, Kenya. My study took place in the dry season, between May and July 2011. I used camera traps and field observation methods to collect data from eight water points within two areas. Eight water points were categorised into wildlife and livestock water points depending on their location to core conservation areas which excluded livestock use. The results showed that Grevy's zebra make significantly more visits to water points that are within core conservation areas than to communal water points that are highly utilized by livestock. The time for drinking of water was varied but contrary to expectation, Grevy's zebra drank late in the evening after dusk and in the early morning before day break both at conservancy and community water points. Habitat around water points also influences Grevy's zebra. The study found that Grevy's zebra showed preference to medium bush habitat water points compared to dense bush habitat water points. However, dominant habitat type around the study area may have influenced results for habitat choice of each water point. During the study period, livestock water points were found to be heavily occupied throughout the day. Historically, pastoralists completed water resource utilization by midday but with the increase of livestock species such as goats, sheep and camels, the duration of water use by people has increased leading to a resource use overlap with Grevy's zebra. Furthermore, grazing resources in communal areas are patchy due to heavy grazing by livestock, forcing Grevy's zebra to seek sufficient pasture far from water. However in Kalama Conservancy where sufficient grazing and water are situated in the core conservation area, Grevy's zebra do not have to travel this long distance. Water resources play a significant role in determining the stability of Grevy's zebra populations within pastoral areas. My study revealed that community conservancy core conservation areas that contain both Grevy's zebra habitat and provide diurnal access to water for Grevy's zebra are critical refuges. Kalama Community Wildlife Conservancy is a real working example of where provision of artificial water points within the core area has had a positive response from Grevy's zebra. The study recommended that effective planning of water use by wildlife and livestock should be integrated with conservancies' rangeland management objectives in order to minimize land degradation and maximize resource availability especially for endangered species like Grevy's zebra.

Corresponding author:

Peter Lalampaa, MS

Grevy's Zebra Trust
PO Box 15351 00509
Nairobi
Kenya
Tel: +254.722.975.122
E-mail: peter@grevyszebratrust.org



E. grevyi

Anthropogenic Threats to Persian Onager (*Equus hemionus onager*) in Iran

Amir hossein Khaleghi Hamidi, Houman Jowkar, and Mehdi Nabiyan

Persian onager *Equus hemionus onager*, is one of the critically endangered subspecies which its natural distribution has been limited in two different populations in two Protected Areas in Iran. The first population is in Bahram-e-Goor Protected Area, which is significantly increasing and the second population is in Touran National Park and Protected Area, which has dramatically declined in recent years. Anthropogenic threats are the most important factors in general decline of this species, so identifying these threats are quiet useful to address population decline in Touran. From 2004 to 2006 a constant survey in Bahram-e-Goor, from 2007 to 2011, 5 surveys in Bahram-e-Goor and 8 surveys in Toruan have been conducted. The present study was based on interview surveys and field observations. Results of this study have shown that in order of priority, the threats to Persian Onager in Touran, are poaching, lack of law enforcement, livestock grazing, roadkill, migrations, resource competition and mining. In Bahram-e-Goor Protected Area, the threats are respectively size, roadkill, livestock grazing, natural resources utilizations, human disturbance, mining, migrations and poaching. It is obvious that poaching as the major threat has been mitigated in Bahram-e-Goor, while in Touran, is still the most important threat to Persian onager's population. In Bahram -e-Goor most of the population is concentrated in the core zone (National Park), to escape human disturbance. Although Touran is almost 4 times bigger than Bahram-e-Goor but population cannot avoid the human disturbance even in the core zone, since in Touran in 6 months of the year livestock is grazing even in the core zone, while Bahram-e-Goor core zone is completely out of livestock. Further studies, which focus on ecological limitations of the Persian onager, are recommended and needed. As information on ecological threats gathered from such studies along with the information on anthropogenic problems can lead to better management and thus conservation of Persian onager in Iran.

Corresponding author:

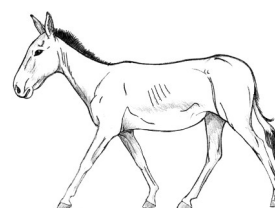
Amir hossein Khaleghi Hamidi

Plan for the Land Society
No. 1-33 Alley—Alvand Street
1516666611 Tehran

Iran

Tel: +98.912.1270945

E-mail: a.h.khaleghi@gmail.com



E. hemionus

Przewalski's Horse Reintroduction: A Case Study of How Concepts of Wildness and Wilderness Influence Reintroductions as a Conservation Strategy

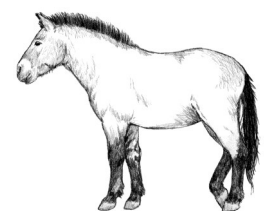
Catherine A. Christen, Peter Leimgruber, and Nigel Rothfels

Reintroduction has long served as a major conservation strategy to reestablish once-extinct populations in the wild. Frequently involving zoo breeding of remnant captive populations for release to the wild, reintroductions also often are held to provide significant justification for the continued existence of zoos. Perhaps one of the most visible reintroductions has been the restoration of Przewalski's horses to parts of their historical ranges in Asia, specifically to Mongolia and China. To regard fully the importance of these reintroductions, both past and present, we must look beyond the animal itself to the history of human concepts about it, specifically about its wildness and about the wilderness that is regarded as its natural habitat. Part of that history is an anthropological story about cultural identities, local to Mongolia and China. Another portion is firmly anchored in the West, where the horse we see today was largely created out of a unique confluence of ideas about horses, primitivity, and untouched wilderness as this species' former home. Perhaps more than any other reintroduced species, the 21st century *Equus przewalski* is a product of a kind of non-natural, indeed "cultural," selection. The original stock of the Przewalski's horses which arrived in Europe in the late 19th and early 20th centuries exhibited great phenotypic variability. At the time, zoologists, breeders and aficionados argued that these were not all "pure" Przewalski, and carefully bred these animals to conform to their imagined preconceptions about wild, primitive horses. When reintroduction efforts were initiated in the late 20th century, these too reflected concepts of wilderness and horse ecology that had been largely inferred by expert opinion. Controversy over what represented best reintroduction areas led to sometimes disconnected strategies for restoring this species to the wild. Our paper examines this history and points to critical questions regarding the biology, conservation, management, and restoration of this species and its habitat.

Corresponding author:

Catherine A. Christen, PhD

Smithsonian Conservation Biology Institute
1500 Remount Road
Front Royal, Virginia 22630
USA
Tel: +1.540.635.0040
E-mail: christenc@si.edu



E. ferus przewalskii

The Ecology and Conservation of the African Wild Ass (*Equus africanus*)

Patricia D. Moehlman, Hagos Yohannes, Fanuel Kebede, Redae Teclai, and Ann Oakenfull

African Wild Ass (*Equus africanus*) is the world's most endangered equid. It persists in one of the harshest climates and terrains in the world, the Horn of Africa. In the deserts of Eritrea and Ethiopia, African wild ass live in temporary groups that are small and typically are composed of fewer than five individuals. The only stable groups are composed of a female and her offspring. The African wild ass exhibits the mating system and social organization that is typical of wild equids that live in arid habitats. The African wild ass is polyestrous and foals are usually born from October to April. Females typically have a surviving foal every other year and natality correlates with the rainfall that occurred during the period of gestation. Forty-five fecal samples were collected from African wild ass in Eritrea and Ethiopia. DNA was extracted from the dried fecal samples and five mitochondrial DNA haplotypes were identified. These haplotypes indicate that that there is and/or has been gene flow between the populations in Ethiopia and Eritrea. The most likely avenue of gene flow is via the Dalool Depression. The major threat to the African Wild Ass is hunting for food and medicinal purposes, particularly in Ethiopia and Somalia. The most viable population of African wild ass is in Eritrea, where the Afar pastoralists share resources with wildlife and do them no harm.

Corresponding author:

Patricia D. Moehlman, PhD

IUCN/SCC Equid Specialist Group

Box 2301

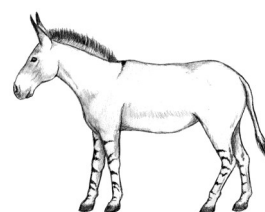
Arusha

Tanzania

Tel: +255.784.870776

E-mail: tan.guides@habari.co.tz

E-mail: pdmhbf@aol.com



E. africanus

Przewalski Horse Reintroduction in the Mongolian Gobi

Oyunsaikhan Ganbataar, Nanjid Altansukh, Namtar Enkhsaikhan, Petra Kaczensky, Christian Stauffer, and Chris Walzer

The last record of the Przewalski's horse (*Equus ferus przewalskii*) in the wild occurred in the late 1960s in south-western Mongolia. Thereafter, no more wild horses were observed and in 1996 the species was classified as Extinct in the Wild on the IUCN Red List of Threatened Species. With Mongolian independence in 1990, the "Takhin Tal" project began in the Great Gobi B Strictly Protected Area in SW Mongolia. In 1992 the first captive born animals arrived at the adaptation enclosures and in 1997 the first harem group was released into the wild. In total 89 Przewalski's horses on 10 transports were airlifted from Europe to Takhin Tal and 3 horses were transported from central Mongolia. The initial phase of the reintroduction program in the Dzungaria Gobi was plagued with various problems, and population growth could only be achieved by introducing additional captive animals. Management changes were implemented in 1999/2000, but in 2000/2001 the area was hit by a "dzud" winter. The population suffered a net loss of 21% and almost no foals were produced in the spring of 2001. Since 2001 the population development was positive and the population numbered 137 free-ranging individuals, by the end of December 2009. However, the winter 2009/2010 was to become one of the worst winters in the memory of Dzungaria Gobi local people. Very cold temperatures and frequent snow storms resulted in a massive die-off of all domestic livestock, with local herders losing between 50-100% of their animals. The small re-introduced Przewalski's horse population was also almost eradicated, and after the severe "dzud" conditions in late winter only 49 wild horses were left by the first of May in 2010. The winter 2010-2011 was normal, but social stability of the newly formed Przewalski's horse groups was still low and apparently resulted in poor foal survival. Although the spring of 2012 has been exceptionally dry, by the end of June foals had been born. To speed up population growth and distribution and strengthen cross-country cooperation, 4 stallions from the breeding center in Jimsar, Xinjiang province, China and 4 mares from European zoos were transported to Takhin Tal in 2012 raising the present population to 77 individuals.

Corresponding author:

Oyunsaikhan Ganbaatar

Great Gobi B Strictly Protected Area Administration

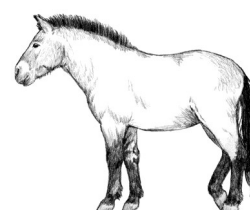
Takhin Tal

Gobi-Altai Province

Mongolia

Tel: +976.99068929

E-mail: ganbaatar_o@yahoo.com



E. ferus przewalskii

Reproduction and Mortality of Reintroduced Przewalski's Wild Horse *Equus przewalskii* in Hustai National Park, Mongolia

Namkhai Bandi and Dorj Usukhjargal

Eminent explorer and Russian army colonel N.M. Przewalski discovered a new species of wild horse from the Mongolian and Chinese frontier region in the year 1878, subsequently named *Equus przewalskii* Poljakov, 1881. Between 1898 and 1903, 88 foals were caught in the Mongolian gobi, but only 53 foals survived the transport to Europe. Because of competition with livestock, illegal hunting and harsh climate conditions the wild horse "takhi" probably became extinct in the wild in 1960s. However, the reintroduction started only in 1992 with the import of 16 Przewalski's horses from the Netherlands to Hustai National Park in Mongolia in association with the Foundation for the Preservation and Protection of the Przewalski horse and the Mongolian Association for Conservation of Nature and Environment. During 1992-2000, over five occasions, 84 wild horses from European countries were reintroduced to Hustai National Park. At present 260 individuals of Przewalski's horses exist in Hustai with 30 breeding harems and more than 50 bachelors compete for the mares. The reproduction rate increased from year to year showing that the wild horses have already felt comfortable in the new environment and became acclimatized successfully. The growth rate of the Przewalski's horse population during the period of active transportation from 1992 to 2000 was 32% and during the period without new transportation from 2001 up to 2011 was 7.7%. Of the mares which were born in Hustai and successfully reached reproductive age, 24.7% of them first gave birth at age 3, 55.6% of them first gave birth at age 4. The most effective age range within the breeding population was 4 to 15, 60-80% of them giving birth and an average during 2002-2011 of 72.9%. Of the takhi's which died, 65% of them were foals, 9.4% subadult male, 7.7% subadult female, 7.2% adult male and 10.6% were adult females. Causes of mortality differed by age and sex. The predominant causes of mortality in foals and yearlings were wolf attacks. Stallions usually died of bad condition and injuries, but parturition problems are common cause for death among mares. The mortality rate of foals (40% in 1993-2011) is a matter of great concern since foals born in Hustai National Park are the only gain component now after the active reintroduction period came to an end. A total of 109 foals were killed by wolves in 1993-2011 but 52% of them were younger than one month.

Corresponding author:

Namkhai Bandi, PhD

Hustai National Park Trust

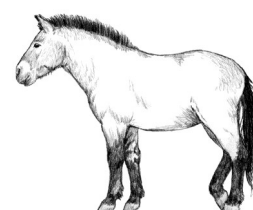
II Khoroo

Ulaanbaatar 210628

Mongolia

Tel: +976.99188884

E-mail: takhi@hustai.mn



E. ferus przewalskii

The Status of Persian Wild Ass: Threats and the Conservation Needs

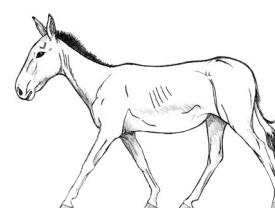
Mahmoud-Reza Hemami, Saeideh Esmaeili, Moslem Momeni, and Mohsen Bagheri

Persian wild ass or onager (*Equus hemionus onager*), was historically widespread in steppes and deserts of central Iran, but now is recognised as the most threatened (CR, C1) among the four extant subspecies of the Asiatic wild ass. The last populations of the subspecies occur in Bahram-e-Goor Reserve (including Qatruiyeh National Park and Bahram-e-Goor Protected Area) and Touran Protected Complex (comprised of a national park, wildlife refuge and protected area). The abundances of onager populations were estimated in 2009 in Bahram-e Goor (229 with 95% CI of 140–347) and in 2010 in Touran (134 with 95% CI of 76–238) using distance sampling line transects. Comparing these estimates with those reported previously, suggested an expanding population for Bahram-e-Goor ($r = 0.09$) and a critically declining one for Touran ($r = -0.05$). Habitat degradation, illegal hunting, insufficient protection, grazing competition with livestock, harassment by herd dogs, and severe drought have been the main causes of onager decline in Touran. Urgent conservation activities are required to prevent extinction of the last population of onagers.

Corresponding author:

Mahmoud-Reza Hemami, PhD

Department of Natural Resources
Isfahan University of Technology
Daneshgah Avenue
8415683111 Isfahan
Iran
Tel: +98.311.3913576
E-mail: mrhemami@cc.iut.ac.ir



E. hemionus

Cape Mountain Zebra Conservation Goals – Security in Numbers?

Halszka Hrabar and Graham Kerley

Excessive hunting and habitat loss to agriculture left Cape mountain zebra *Equus zebra zebra* numbers in a critical status by the 1950's, with fewer than 80 individuals remaining. Active conservation programmes, however, resulted in the subspecies making a gradual recovery to 1,600 animals by 2002. An IUCN conservation target was then set for the population to reach 2,500 animals, but the population was subsequently not well monitored. The aim of this study was therefore to review the conservation status of the sub-species and to assess the validity of the target. The prospect of achieving larger populations was also investigated and the contribution of private land-owners towards Cape mountain zebra conservation was determined. All sub-populations were identified and data on each was collected by means of a questionnaire survey. Detailed population demographic data (age and sex composition, herd composition, foals sex ratios etc.) was then collected from 10 sub-populations to gain a better understanding of factors influencing population performance and demographics. The total extant Cape mountain zebra population was found to consist of no less than 2,790 individuals in 2009, in 52 sub-populations. The average annual rate of increase in population size between 2002 and 2009 was 10.6%, which is comparable to earlier years. The target size of 2,500 zebra has therefore been exceeded and this success is due to two key factors, namely the metapopulation approach to the management of the sub-species and the increase in available habitat - largely attributable to the private sector. There are double the number of privately owned sub-populations compared to formally-protected sub-populations at present and the proportion of the population on privately-owned land has risen from 14% in 1998 to 32% in 2009. The total existing area available to Cape mountain zebra is now more than 935,200 ha and could potentially support a significantly larger population than at present. The IUCN target therefore appears to be substantially below the opportunity for Cape mountain zebra conservation on the landscape and we recommend this target be revised in the light of these findings. Even though numbers might show a positive trend, the security of the subspecies is still of concern, as the growing proportion of the metapopulation on private land is more vulnerable to threats associated with small populations and management actions. Furthermore, most of the metapopulation is at risk of inbreeding, as two thirds of the entire genotype is located in just two populations, both of which are at risk due to limited habitat availability. New conservation challenges are also emerging as a result of the increased population size e.g. management of saturated populations; increased pressure to legalise hunting and predation pressure due to lion reintroductions.

Corresponding author:

Halszka Hrabar, PhD

Centre for African Conservation Ecology
Nelson Mandela Metropolitan University
University Way
Port Elizabeth 77000
South Africa
Tel: +27.0.445336194
E-mail: halszka.hrabar@live.nmmu.ac.za



E. zebra



Distribution Range Shift of Kiang (*Equus kiang*) under Climate Change Scenarios

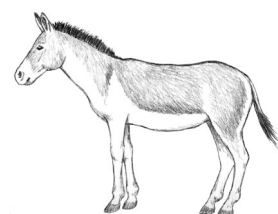
Zhigang Jiang and Zhenhua Luo

Kiangs (*Equus kiang*) are endemic to the Tibetan plateau, which inhabits alpine meadows and steppe between 2,700 and 5,300 m. The habitat of kiang is relatively flat open terrain with wide valleys and low hills on the plateau, where kiang live small group of 5-10 individuals. Kiang grazes grasses, sedges and forbs. Main predator of kiang is wolf, kiang form circles to defend themselves when attacked by wolves. During rut in summer, kiangs gather together in large herds of several hundred individuals. Climate change has significant impacts on species' distributions and diversity patterns. Understanding species' range shifts and richness gradients under climate change is crucial for conservation. The Tibetan Plateau, home to kiang, contains a unique biome with many endemic and flagship ungulates, and is very sensitive to climate change and a region deserves particular attention in study the impacts of global change on biome. To account for uncertainties of modeling and climate prediction, we integrated various climatic models, scenarios of IPCC (2007) and eco-geographic variables to predict the current distributions of kiang and examine its modifications under climate change and to provide suggestions for kiang management and biodiversity conservation. We used the maximum entropy approach to predict the current ranges and the potential distributions in 2020, 2050 and 2080 of kiang on the Tibetan Plateau. We used 14 eco-geographic variables across four groups, all of which were processed on 1 km × 1 km equal-area grids: (1) Climate: annual mean temperature (ANMT, °C), temperature seasonality (TS, °C), maximum temperature of the warmest month (MTWM, °C), minimum temperature of the coldest month (MTCM, °C), temperature annual range (TEMR, °C), annual precipitation (ANPR, mm), precipitation of the wettest month (PRWM, mm), precipitation of the driest month (PRDM, mm) and precipitation seasonality (PRS, mm). These bioclimatic variables represent important energy and water constraint on species' distributions. We used three general circulation models, three emissions scenarios and two dispersal hypotheses were included in the ensemble modeling framework. Our study indicates that kiang on the Tibetan Plateau will face severe distributional reductions and the distribution pattern of kiang will be dramatically changed under the climate change. For conserving the unique wild ungulates on the plateau, we suggest that (i) securing existing protected areas and (ii) establishing new nature reserves to counterbalance the impacts of climate change for conservation of kiang.

Corresponding author:

Zhigang Jiang, PhD

Institute of Zoology
Chinese Academy of Sciences
Beichen Xilu, Chaoyang District
Beijing 100101
China
Tel: +86.13501370683
E-mail: jiangzg@ioz.ac.cn



E. kiang

Restoration of Persian Onager *Equus hemionus onager* in Iran

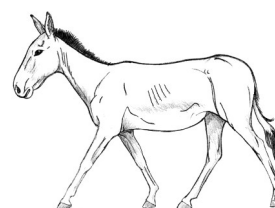
Hasan Akbari, Mohamamd Sadegh Farhadinia, Azam Habibipour, and Akbar Hamedanian

As the only wild equid of west Asian steppes, the Persian wild ass (onager) (*Equus hemionus onager*) once roamed across vast areas of region. However, presently the species occurs only within two reserves around central desert in Iran, namely as Turan Biosphere Reserve and Bahram-Gour Protected Area as well as several reintroduction centers across its historical range. The present paper outlines efforts to restore the onager in Iran during the past two decades. Established in 1997 in Gourab near central city of Yazd, the main breeding center of onager has been launched based on three individuals captured in Turan. During a course of twelve years, the Gourab population reached 40 individuals until 2008 when the founder population was split into six other breeding centers, located from 19 to 533 kilometer far from Gourab within former distribution of the species. It was aimed to decrease potential adverse impact of stochasticity through creating several breeding populations. Also, re-introducing increased numbers has been sought. The first reintroduction effort took place in 2010 when a basic population of 10 individuals was released softly into the wild in Tange-Hanna within Kalmand Protected Area, near Gourab station. According to the latest census program, conducted by Department of Environment (DoE), presently Iran has two main natural populations not exceeding 500 to 600 onagers as well as a 10 individuals re-introduced population in Kalmand. Moreover, 33 onagers live within six breeding centers. Our data indicate that highly skewed sex bias toward females within centers (10:33) plus lack of security within target habitats to secure initiation reintroduction process are the main challenges of onager restoring program in Iran.

Corresponding author:

Hasan Akbari

Yazd Provincial Office of Department of Environment
Daneshjoo Street
Yazd 89165-311
Iran
Tel: +98.09133536911
E-mail: haenv@yahoo.com



E. hemionus

The Correlation Between Breeding Behavior and Reproduction Hormone in Feces of Asiatic Wild Asses (*Equus hemionus*)

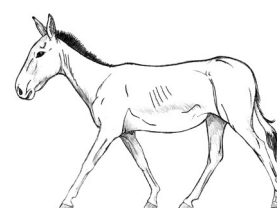
Junhuai Bi, He Xiaoping, and Ding Ying

We observed the wild reproduction behavior and studied reproduction hormone in feces of *Equus hemionus* in Inner Mongolia (North latitude 44°36'~46°00', latitude 88°30'~90°03' and North latitude 41°50'~42°27', latitude 106°15'~108°00') for four straight years in 2004–2008. This study mainly aimed at three Mongolian wild ass family groups (a total of 33) which lived in a relatively fixed region for a long time. The research of reproduction hormone in feces was carried out on the basis of behavioral research. So, there was no problem of individual identification and difference between individual feces samples. The measurement for two consecutive years indicated that progesterone level in female ass feces appeared 1 peak in May and August, the peak was 21890.59835ng/g, that means the levels in dry feces was 21890.59835ng per gram. The peak was obviously higher than others (t -test, $P<0.05$). There were large changes in other months and the contents remained a low level. For testosterone, there was a significant difference between male asses in Spring and Summer (t -test, $P<0.05$). The peak of testosterone concentration of male asses all appeared in June and was significantly higher than other months (t -test, $P<0.05$). Estradiol levels in female ass had significant difference per month and showed obviously seasonal changes (t -test, $P<0.05$). Estradiol level in female ass feces appeared 1 peak in June every year and the peak was significantly higher than other months (t -test, $P<0.05$). Difference of estradiol levels wasn't significant between individuals and was significant between months. Among many reproductive behaviors in male asses, frequency of driving out other males, sniffing vulva, urine marking, manure tagging, mounting and mating behavior all had a significant correlation with testosterone level in feces ($P<0.01$); behaviors of biting, smelling urine, urine covering, and chasing the female all had a significant correlation with testosterone level in feces too ($P<0.05$). Only behaviors of olfactory bulb and rooting had no significant correlation with testosterone level in feces ($P>0.05$). Among oestrus behavior in female asses, sending hip and accepted mounting had a significant correlation with estradiol level in feces ($P<0.05$), frequent urination had no significant correlation with estradiol level in feces ($P>0.05$). Child-care behavior had no significant correlation with progesterone level in feces ($P>0.05$).

Corresponding author:

Junhuai Bi, PhD

College of Life Science and Technology
Inner Mongolia Normal University
No. 71, Zhaowuda Road
Huhhot, Inner Mongolia 010022
China
Tel: +86.471.4392102
E-mail: bjunhuai@yahoo.com



E. hemionus

Second Transport of Przewalski's Horses from Czech Republic to Mongolia

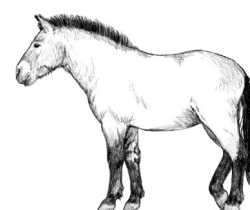
Miroslav Bobek, Jaroslav Šimek, Lenka Bartůňková, Roman Vodička, Evžen Kůs, and Jan Marek

In mid-July 2012 Prague Zoo successfully carried out a combined air and ground transport of four Przewalski's Horses to Gobi B Strictly Protected Area in southwestern Mongolia. Profiting from a unique offer of the Czech Army, Prague Zoo succeeded in bringing new horses to Gobi B seven years after the last transport from Europe took place; three years after the harsh winter reduced the local population by two thirds. In 2011 Prague Zoo organized a transport of three mares and one stallion to the Khomiin Tal reserve (western Mongolia). Wishing that the next transport would support the fragile population of Gobi B, Prague Zoo started to explore the possibility of using an airport in Bulgan town located some 200 km from Gobi B's headquarters. As the airport in Bulgan is basic and has only one unpaved runway, the number of permits needed to land on such an airport is unimaginable and the skills needed to land with a heavy aircraft on such a runway are exceptional. Nevertheless the joint efforts of Prague Zoo, the Czech Army and International Takhi Group resulted in the fact that – on July 17th 2012 – four animals landed at Bulgan airport. Based on recommendations of EEP coordinator several horses were pre-selected for the transport. From these four were chosen to go to Mongolia: Anežka – Born 16. 6. 2009 in Zoo Košice (donated by Zoo Košice); Greta – Born 7. 6. 2008 in Han-sur-Lesse (donated by Döberitzer Heide); Xara – Born 3. 5. 2009 in Karlsruhe (donated by Döberitzer Heide); Spela – Born 5. 5. 2007 in Springe (donated by Springe). The transport began on 16th July morning, when the four mares were loaded to transport crates in Dolní Dobřejov (Southern Bohemia), and transported on board a truck to military airport at Prague–Kbely. At 15:30 the aircraft with horses on board took off. The inside temperature during the flight was kept at 15-18°C to suit the need of the horses. 17 hours later, after stopovers in Kazan and Novosibirsk, the plane landed in Bulgan airport. The horses were immediately reloaded to prepared trucks and started their journey to Takhin Tal, headquarters of Gobi B, where they arrived 10 hours later at 2 am. The horses were released from their crates to car-lights lit enclosure. All four mares were in good condition, only tired due to the long transport. The mares were successfully transported from Czech Republic to Mongolia and will hopefully strengthen the fragile yet crucial population of Przewalski's Horses in Gobi B. Special thanks to: Czech Army, International Takhi Group, The Great Gobi B administration, Czech Development Agency, BIDVEST Czech Republic, Heinz Sielman Stiftung, Waltraut Zimmermann, Lydia Kolter and many others.

Corresponding author:

Miroslav Bobek, MS

Prague Zoo
U Trojského zámku 3/120
171 00 Praha 7
Czech Republic
Tel: +420.296.112.109
E-mail: bobek@zoopraha.cz



E. ferus przewalskii

Group Size, Group Composition and Behavior of *Equus hemionus* Near a Water Source in the Negev Desert, Israel

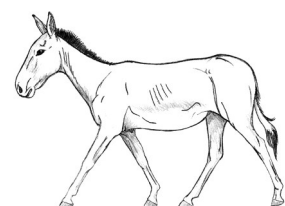
Amos Bouskila, A.S. Renan, Edith Speyer, D. Ben-Natan, I. Zaibel, and S. Bar-David

The Asiatic Wild Ass, *Equus hemionus*, was once abundant in western Asia. The species declined due to hunting and habitat loss. Between 1982-93 38 *E. hemionus* (21♀ 17♂) that originated from Iran and Turkmenistan were reintroduced to the Negev Desert, Israel. Saltz, Rubinstein and co-workers studied the released population till 1999. The current population in the Negev is estimated at more than 200 individuals, yet, their social and genetic structures are not known. Here we report group composition and behavior of *E. hemionus* near a water source from the 2010 field season, which is part of a wider study of the mating system and genetic diversity. We recorded and videotaped group composition and social interactions from a shelter, 150m from the water source. We recorded 140 observations of females, 120 of juveniles and 230 of males. Not all wild asses were individually identified, but so far, we created 97 individual profiles (27♀ 70♂) based on photos, and recorded in which groups were they videotaped. Individuals were recognized with certainty up to 9 times, but 73 individuals were identified only once. Before reaching the water source, wild asses often aggregate in large groups and wait for the first few individuals to approach cautiously the water, and only then the rest of the individuals make a swift final approach. We did not consider these aggregations as social groups. We defined a group when individuals approached or left together the valley in which the water source is located. Female groups (including those with a male) were larger than male-only groups (9.8 and 5.1 individuals, range 2–49 and 1–34, respectively; $P=0.019$). From records of individuals observed more than once, individuals appear on different days in groups of various sizes and compositions, suggesting a fission-fusion social structure. Except for September, fewer adult females were observed compared to males ($P=0.028$). Different daily activity patterns of the two sexes may explain this observation. These results will be combined in the future with the genetic work and will contribute to the assessment of population viability.

Corresponding author:

Amos Bouskila, PhD

Department of Life Sciences
Ben-Gurion University of the Negev
84105 Beer-Sheva
Israel
Tel: +972.544969664
E-mail: bouskila@bgu.ac.il



E. hemionus

Resource Use and Limitations for Released Przewalski's Horses at Kalamaili Nature Reserve, Xinjiang, China

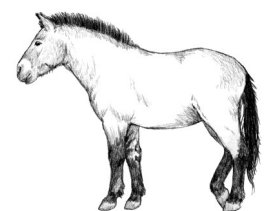
Qing Cao, Melissa Songer, Y.J. Zhang, D.F. Hu, Daniel I. Rubenstein, and Peter Leimgruber

Przewalski's horses (*Equus ferus przewalskii*) have been in semi-release in the Kalamaili Nature Reserve (KNR) for more than 10 years. The KNR consists of arid steppe and semi-desert landscapes with few open water sources. Przewalski's horses have shown strong preferences to areas in proximity to water sources. Using GPS satellite-telemetry data on horse movement and generalized linear modeling we analyzed the environmental characteristics of the horse's home range preferences in a Geographic Information System. Przewalski's horses selected high vegetation freshness and areas with shorter distance to permanent water, shorter distance to patches with higher herbaceous biomass and topographical variation. Water was the most important factor in home range characteristics, indicating that Przewalski's horses may not be adapted to desert environments and cannot use large portions of the reserve that are far from open water sources. Since 2009, we have been using camera traps to record the water use patterns for wildlife at the release site. Horses are mostly diurnal at the water, with their active peak around the noon. In contrast another wild equid species, the Asiatic wild asses (*E. hemionus*), are mostly nocturnal. The two species are not only making different temporal use of the water, but also tend to use water at different spatial locations, presumably to avoid competition. Photo capture rates for both species were negatively correlated with rainfall. Increased rain may reduce the reliance on open water sources temporarily for both species. Our movement data also shows that longer movements are often triggered by rainfall events. Our work confirms that water is a limiting factor for Przewalski's horse populations released in desert environments. Providing access to open water sources is one of most important considerations for developing strategies to enhance the chance for establishing a stable, free-ranging population.

Corresponding author:

Qing Cao

Department of Ecology and Evolutionary Biology
Princeton University
106A Guyot Hall
Princeton, New Jersey 08544
USA
E-mail: qcao@princeton.edu



E. ferus przewalskii

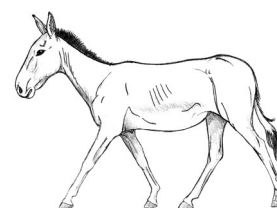
Reintroduction of the Koulan in the Territory of Arganaty Mountains

Dmitry Cheremnov and S.V. Sokolov

With fast development of civilization and the development of technology, industry, agriculture, animal husbandry and new lands development at the end of 19th and especially in the 20th century, the influence of human society on fauna has grown markedly. Man, occupying natural areas of animal habitat with pastures, ploughed fields, and development of mineral deposits, blocking seasonal migration routes with roads and other resources of communication, using weed and pest-killer chemicals, and directly killing animals, has caused irreparable disappearance of many wildlife species that have inhabited the planet for millions of years. One of these animals is the koulan that was a usual inhabitant of deserts and semideserts of Kazakhstan in the middle of 19th century and at the present time is almost completely destroyed. Only a small population of Turkmen koulan subspecies (*Equus hemionus onager* Boddaert, 1785) has remained. This population in the past occupied Turkmenia, Uzbekistan, Iran, Afghanistan, and the western part of Kazakhstan and survived in reserve Badkhyz (Turkmenia). Proceeding from the presented evidences of contemporaries regarding the fact that the territory in the past was a dwelling area of koulans, now there are favorable conditions for koulans, which include a favorable landscape and its structure, presence of water sources, big stocks of mineral salt, a considerable quantity of forage for koulans, and a neighbourhood with reliable protection. All presented factors suggest optimality of territory choice for koulan reintroduction in the east region of Kazakhstan. Koulan extinction is a huge loss both for Kazakhstan and for the world as a whole, but efforts made for this kind of restoration were not in vain, the population of koulan is increasing and reservation creation in the territory of the Arganaty mountains will contribute to koulan restoration in eastern Kazakhstan to help compensate extinction in the 20th century. Thus, as a result of the first stage of reintroduction in Kazakhstan it was possible to form four groupings of koulans: Barsakemel, Altynemel, Andasay and Aktau-buzachi. At the same time, poor protection of Andasay and especially Aktau-buzachi groupings has brought to nothing all efforts of the state on koulans restoration in Zhambyl and Mangistau Regions. The solution of this urgent problem is believed to be relocation of survived animals and their reproduction on a new territory - reintroduction.

Corresponding author:

Dmitry Cheremnov
Ohotproekt
Manas
Almaty 50008
Kazakhstan
E-mail: dimon_karab@mail.ru



E. hemionus

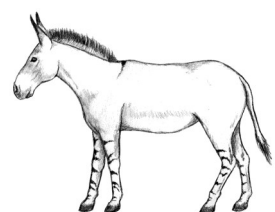
Developing a Cooled Semen Protocol for Captive Breeding of Somali Wild Ass (*Equus africanus somaliensis*)

Bruce W. Christensen, Chong Wang, and Linda M. Penfold

Somali wild asses are among the most endangered wild equids. Assisted captive breeding between institutions is vital to maintaining genetic diversity. Shipping semen is cost effective and less stressful than animal transport. Our objective is to develop short-term semen cryopreservation techniques. In a preliminary experiment, semen obtained from electroejaculation of a male wild ass was extended in one of three commercial equine semen extenders (EquiPro®, Minitube of America, Verona, WI, USA; INRA 96TM, IMV Technologies, L'Aigle, France; VMD-ZTM, VMD-Inc, Arendonk, Belgium) and compared with a neat sample. Each treatment was divided into two aliquots, one maintained at 25°C and one cooled gradually and maintained at 5°C. Motility was evaluated with a computer assisted semen analysis program (SpermVision, Minitube of America, Verona, WI, USA) at times 0, 24, and 48 hours. Progressive motility at time 0 was 37% in the neat sample and 67% in any of the extenders. At 24 hours, all three extenders at both temperatures maintained progressive motility better (range of 37–61%) than the neat sample (0%). At 48 hours, only EquiPro® maintained any progressive motility at 25°C (4%), but all three extended samples maintained progressive motility at 5°C (22–28%). Sperm motility parameters indicative of hyperactivity (velocity of the average path (VAP), velocity of the curved line (VCL), beat cross frequency (BCF), and amplitude of lateral head displacement (ALH)) were not different between extenders. In concurrence with domestic equid sperm, maintenance of progressive sperm motility in the Somali wild ass is improved by adding commercially developed semen extenders and cooling samples to 5°C. Evaluating more males will refine short-term preservation and shipping protocols. Estrous timing and artificial insemination techniques must be developed, but initial results indicate that shipment of semen between institutions is a possibility.

Corresponding author:

Bruce W. Christensen, DVM, MS, Dipl. ACT
University of California-Davis
Tupper Hall
Davis, California 95616
USA
Tel: +1.530.752.4432
E-mail: drbruce@ucdavis.edu



E. africanus



A New Approach to Improve DNA Extraction from Feces of Wild Equids

Vânia Costa, Sónia Rosenbom, and Albano Beja-Pereira

Wild Equid species are threatened by drastic territory decrease and fragmentation of their habitat, hence it is crucial to investigate the genetic background of these populations. The elusive nature of wild Equids makes sampling and even observation challenging and since most of these populations are considered endangered they should ideally be sampled noninvasively. The fact that the animals are not captured or handled eliminates the risk of injuries and minimizes the risk of disturbing the behavior of the group. When using noninvasively sampled scats researchers are able to obtain information from behavioral biology, population size, home range, effective population size, genetic variation, phylogeography, diet and diseases. The DNA present on fecal samples is limited to the intestine epithelial cells; therefore it is usually degraded, in very low amount and with a high prevalence of inhibitors which causes the limitations associated to this methodology. Noninvasive sampling is indeed a promise on conservation genetics but there is an urgent need to solve the problems of low quantity and quality DNA. The method presented in the current study was developed for herbivores, namely endangered wild Equids. Scat samples from African wild ass (*Equus africanus*), kiang (*Equus kiang*), onager (*Equus hemionus*) and Grevy's zebra (*Equus grevyi*) were collected in Ethiopia, Eritrea, Iran and China. The DNA extraction method was developed specifically for these species. This method yielded an average of total DNA of 3.375 µg (22.5ng/µl) and, for some of the samples the total DNA extracted exceeded 5.6 µg; the samples are currently being amplified for mitochondrial fragments and microsatellites. This is the first method to report such high DNA amount in noninvasive samples and will greatly contribute for a better knowledge of wild Equid genetic diversity, since the constraints regarding DNA amount are considerably decreased. The application of this method on wild Equids may also have considerable potential for conservation genomics studies since it allows the recovery of a high DNA amount from noninvasive sources.

Corresponding author:

Vânia Costa

CIBIO-UP

Campus Agrário de Vairão

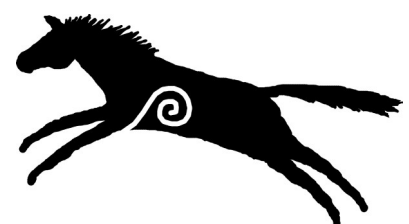
Rua Padre Armando Quintas

4485-661 Vairão

Portugal

Tel: +35.1252660411

E-mail: vaniacosta@cibio.up.pt



Equus spp.

Delayed Reversibility of PZP (Porcine Zona Pellucida) in Free-Ranging Przewalski's Horse Mares

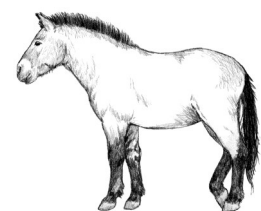
Claudia Feh

Contraception can be important for endangered species management, both in captivity and for reintroductions, reversibility being essential for planned breeding. PZP (porcine zona pellucida) has been successfully employed as a contraceptive in 80 species, in both captive and wild populations. Studies on its efficiency, safety and reversibility show no major detrimental effects. Following 3 years of treatment, feral mares returned to fertility 3.7 years later on average. PZP has been used in Przewalski's horses in zoos, but published data on reversibility is missing. We contracepted 20 Przewalski's mares belonging to two free-ranging subpopulations from the same origin, 8 mares at Le Villaret (France) and 12 re-introduced mares in Khomiin Tal (Mongolia). We administered 65 µg doses of PZP remotely, the primo-injection mixed with Freund's Complete adjuvant, subsequent injections with Freund's Incomplete adjuvant. We treated 9 mares for one year, 7 mares for two years and 4 mares for 3 years. Eight mares were 2 years old at the start of treatment, 1 mare 3, 9 mares between 4 and 8, two mares 11 and 18. All mares were in good to excellent body condition throughout and after treatment. Eleven out of the 20 mares have still not produced a foal after an average time span of 6.7 years following contraception, regardless whether PZP was administered for one, two or three years. The other 9 mares gave birth after an average of 3.2 years. All 12 mares aged 3 years or more at the start of contraception had foaled at least once beforehand. Only 4 of these reversed. The 8 remaining 2 year old mares obviously had no previous foals. All mares were mated regularly throughout the breeding season. All 10 stallions associating with the 20 mares sired foals with other mares. The inbreeding coefficient of mares not producing foals was slightly lower (mean 0.174) compared to mares having foals (mean 0.183). Foaling rate of untreated mares in the same population over 9 years was 0.64 for adults, similar to the 0.72 observed prior to the start of contraception over the same time span. The reaction of Przewalski's mares to PZP seems to differ compared with feral domestic mares, reversibility being delayed and probably compromised in a high percentage of individuals even after a short administration time. Although our study is not experimental and other factors may influence conception, we were able to control for population and previous mare fecundity, mare inbreeding coefficient and stallion fertility. A soft-release approach to reintroductions, including releasing preformed family groups, proved beneficial to survival in many projects. This implies applying contraceptives before shipping to avoid the risk of transporting pregnant females, but PZP seems not ideally suited for Przewalski's mares.

Corresponding author:

Claudia Feh, PhD

Association pour le cheval de Przewalski
Station biologique de la Tour du Valat
Le Sambuc, 13200 Arles
France
Tel: +33.490.972313
E-mail: feh@takh.org



E. ferus przewalskii



Why Do Zebras Get Ulcers? Stress Physiology in Relation to Human Land Use in Grevy's Zebra (*Equus grevyi*)

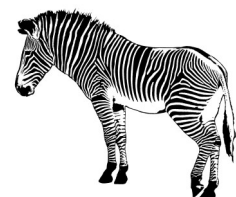
Sara E. Heisel, Siva Sundaresan, and Vanessa O. Ezenwa

As recently as 1970 an estimated population of 15,000 Grevy's zebra (*Equus grevyi*) spread across the entire horn of Africa. Due in part to pressures from increasing human populations, the population has declined to ~2,500 individuals and is now restricted to isolated populations in regions of Kenya and small numbers of animals in pockets of Ethiopia. Within the Grevy's zebra range in Kenya, livestock husbandry is the main economic activity and is the basis for subsistence. The area is comprised of private ranches, communal areas and community conservancies, which represent a mosaic of land management types. The commonality across all of these areas is that wildlife, pastoralists and their livestock share the same grazing and water resources. As these regions face an increasing level of resource degradation it is critical to understand how differences in human land use will influence wildlife health and conservation. Our proposed study uses a conservation physiology approach to examine the effects of different land use practices on the health of Grevy's zebra. Specifically, we will evaluate levels of nutritional and non-nutritional stress in relation to management practices, including livestock stocking densities and grazing regimes. To measure stress, we will quantify levels of two hormones, glucocorticoids (GCs) and triiodothyronine (T3), from non-invasively collected fecal samples. These two hormones will be used as indicators of non-nutritional and nutritional stress, respectively. We will also explore the potential consequences of varying stress levels by testing for associations between stress and parasite infection. Finally, we will investigate the link between genetic diversity and stress. Overall, we predict that: 1) Grevy's zebra in areas of higher intensity land use will have higher levels of stress hormones; 2) animals experiencing higher stress levels, of either or both types, will have higher parasite loads because stress may depress their immunological defenses; and 3) individuals with lower levels of genetic diversity will have higher stress levels. The practical implications of this work are the ability to adopt new management practices or modify existing ones based on those found to be most conducive to Grevy's zebra health. Additionally, genetic diversity information will provide the ability to translocate individuals if populations are found to be isolated in pockets of low genetic diversity.

Corresponding author:

Sara E. Heisel

University of Georgia
140 E. Green Street
Athens, Georgia 30602
USA
Tel: +1.314.952.3873
E-mail: seheisel@uga.edu



E. grevyi

Seed Dispersal by Persian Wild Ass (*Equus hemionus onager*) in Qatruiyeh National Park, South Central Iran

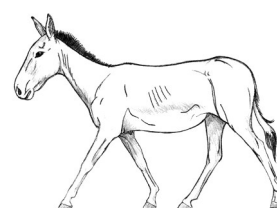
Amin Ghasemi, Mahmoud-Reza Hemami, Majid Iravani, and Josef Senn

Mammals may disperse seeds through different mechanisms with endozoochory being the most important in large herbivores. Having wide home ranges, large herbivores play a key role in long-distance dispersal of plant seeds between and within habitats. The aim of this study has been to investigate seasonal and spatial variation in dung seed content of the threatened Persian wild ass or onager (*Equus hemionus onager*) as the only extant and originally largest ungulate species in Qatruiyeh National Park, Iran. Fresh pellet groups ($n=186$) were collected from three different plains separated by mountain chains in July and October 2011 and were cultivated in a green house. Totally, 51 plant species (27 and 49 species from July and October samples, respectively) from 41 genus and 20 families germinated from dung samples. Species richness and relative frequency of seedlings varied not only between the seasons but also between the three plains. *Lepidium vesicarium* (Brassicaceae) and *Astragalus podolobus* (Fabaceae) were the most abundant plant species germinated from July and October samples, respectively. Simpson's index of diversity had a range of 0.20 to 0.81 between the three plains in July samples, but was almost the same in all three plains for October samples. These findings suggest that Persian wild ass play an important role in plant biodiversity protection and vegetation dynamics of arid regions in central Iran.

Corresponding author:

Mahmoud-Reza Hemami, PhD

Department of Natural Resources
Isfahan University of Technology
Daneshgah Avenue
8415683111 Isfahan
Iran
E-mail: mrhemami@cc.iut.ac.ir



E. hemionus



A New Threat to Cape Mountain Zebra? – Lion Interactions in the Karoo National Park

Craig Tambling, Halszka Hrabar, and Graham Kerley

The predation environment for Cape mountain zebra (CMZ) has changed in the last decade as three populations are now exposed to lions. Most notable is the second largest population, in the Karoo National Park (KNP), where eight lions were re-introduced in November 2010. The effect that lions will have on the population dynamics and numbers of this Vulnerable (under the IUCN red-list) sub-species is, however, unknown as there is currently no information available on co-occurring CMZ and lion populations. The aim of this study was therefore to determine 1) to what degree do lions prey upon CMZ and 2) what effect do lions have on this CMZ population? An estimate of the diet of lions in the KNP for the first 13 months of co-habitation was determined through 1) records of observed lion kills and 2) following up lion GPS point clusters. Obtaining diet estimates in this manner biases kill observations to large prey items. As such, estimated kill frequencies of each species were corrected to account for the under-detection of small kills. We used the 2010 aerial census information and the corrected lion diet estimates to calculate Jacobs' indices of preference for each prey species. Spatial utilization of KNP was determined for CMZ (from aerial census') and lions (continually from GPS collars) to assess whether lions were spending a disproportionate amount of time in areas with higher CMZ occupancy. Lastly, CMZ demographic data was collected prior to the reintroduction of lions and twice since the reintroduction. Group size and the age and sex of individuals were recorded for all groups encountered along the public access road network. Fifty-nine lion kills were found, 13 of which were CMZ. Eland, gemsbok and CMZ were preyed upon more than expected based on their abundance and CMZ was the most selected species (Jacobs' index=0.61). The high use area for the female lions has been within the 50% range use area of CMZ. Average CMZ group size has not changed significantly since the reintroduction of lions (3.7 ± 0.6 in September 2010 versus 5.1 ± 0.6 and 4.3 ± 0.3 in March 2011 and September 2011, respectively). The average number of CMZ juveniles (< 2 years) had also not changed significantly by March 2011 (September 2010=20.5 %, March 2011=21.9%). Despite their preference for CMZ, lion numbers appear to still be too low to have an effect at the population level, as CMZ numbers have continued to increase (546 in 2010 versus 716 in 2012). Based on these findings, the potential threat of lions as predators remains inconclusive and careful monitoring of these CMZ populations is warranted.

Corresponding author:

Halszka Hrabar, PhD

Centre for African Conservation Ecology
Nelson Mandela Metropolitan University
University Way
Port Elizabeth 77000
South Africa
Tel: +27.0.445336194
E-mail: halszka.hrabar@live.nmmu.ac.za



E. zebra

Development of Microsatellite Markers for Endangered Grevy's Zebra (*Equus grevyi*) by the Next Generation Sequencer

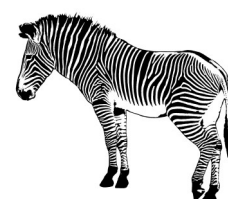
Hideyuki Ito, Azusa Hayano, Hidefusa Sakamoto, and Miho Inoue-Murayama

The Grevy's zebra (*Equus grevyi*) inhabits from arid to semi-arid region in northern Kenya and Ethiopia. During few decades, the species has suffered a strict decline due to destruction of a habitat, overhunting and competition with livestock. And this equid, with estimated 1,838–2,319 individuals in total, is one of the most endangered wild equids in the world. In Japan, individuals have decreased from 50 individuals in 1982 to 20 individuals at the end of 2011. So, to establish the stable populations, not only increasing of the number of individuals but also breeding program with genetic information is necessary. Although an immediate conservation program including genetic management is required, there is almost no information about the genetic diversity of the Grevy's zebra until now. Microsatellite markers are one of the most popular genetic markers for population/conservation genetic studies. However, its application to endangered species with no/little genetic information has difficulties, such as high development costs, a lack of available sequences, laborious work and time-consuming. Recently, due to low costs, reducing time and laborsaving, the use of next-generation sequencing techniques for development of microsatellite markers has become a powerful tool for genetic studies in non-model/endangered species. In our research, microsatellite marker was developed with the next-generation sequencer to understand the genetic information that contributes to suitable management of the Grevy's zebra. We adopted next-generation sequencing to develop the microsatellite markers of Grevy's zebra. We performed genotyping to determine the efficiency of this method as applied to population/conservation genetics for Grevy's zebra. We obtained 32 Mbp of nucleotide information from 92,254 sequence reads (average length 355.6bp). The number of reads including 2–6 nucleotide repeats was 2,516, and reads that could design primer was 1,174. We developed 66 primer pairs, analyzed genetic polymorphism in 12 Grevy's zebra and detected polymorphism in 16 loci. The ranges of allele number, H_e , H_o of the 16 loci were 2 to 6, 0.28 to 0.81, and 0.00 to 0.83, respectively. Probability of identity (P_{id}) and P_{id} -sibling (P_{id-sib}) using 16 locus were 1.99×10^{-10} and 4.88×10^{-5} , respectively. This means that new developed microsatellite markers can identify 20,491 individuals and are sufficient to identify all living Grevy's zebra. Development of microsatellite markers with next generation sequencer was a rapid, low-cost and saving-labor method. And this method was applicable to species with no/little genetic information, so was effective tool to investigate the population/conservation genetics of endangered species. It was thought that the information obtained in this study was useful to understand genetic information of Grevy's zebra and to plan a suitable breeding plan in the future.

Corresponding author:

Hideyuki Ito

Kyoto University
Wildlife Research Center
2-24 Tanaka-Sekiden-Cho
Kyoto 6068203
Japan
Tel: +81.75.7714393
E-mail: itohide7@gmail.com



E. grevyi



Using Markov Chains in Ancient Equid Mobility Simulations

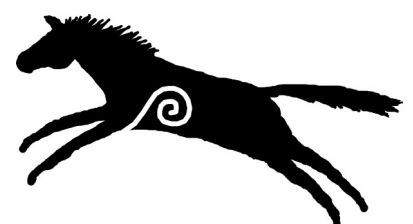
Manuel A. Izquierdo, Petra Kaczensky, and Ariane Burke

Agent Based Models (ABM) are a computational tool that provide a way to build in silico virtual environments where archaeological hypotheses can be tested. Our ultimate aim is to gain a better understanding of the ecology of ancient Neanderthals. For this we simulated the spatial behaviour of *Equus hydruntinus*, an extinct species of Hemione and one of the most important prey species during the Late Pleistocene in many places in Europe. We used the ethology of a contemporary species, the Asiatic wild ass (*E. hemionus*) as a proxy to build ABMs of *E. hydruntinus*. We used Markov Chains to derive the statistical properties from GPS locational data obtained from *E. hemionus* from the Great Gobi B Strictly Protected Area in SW Mongolia. The ABMs are used to simulate the spatial behaviour of *E. hydruntinus* in Western and Central Europe in order to investigate predator-prey relationships during the Middle Palaeolithic.

Corresponding author:

Manuel A. Izquierdo

Hominid Dispersals Research Group
Département d'anthropologie
Université de Montréal
3150, rue Jean-Brillant local C3014
Montréal, Quebec, H3T 1N8
Canada
Tel: +1.514.677.2686
E-mail: ma.izquierdo@umontreal.ca



Equus spp.

Evaluating Suitable Habitats of Khulan *Equus hemionus* and Goitered Gazelle *Gazella subgutturosa* in Mt. Kalamaili Ungulate Nature Reserve, Xinjiang, China

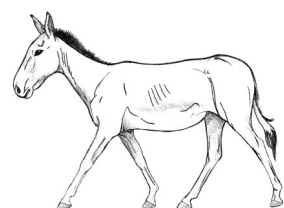
Hongjun Chu, Zhigang Jiang, Yan Ge, Feng Jiang, Chen Wang, and Yongshan Tao

Mt. Kalamaili Ungulate Nature Reserve (MKUNR) is one of the largest habitats for khulan and goitered gazelle. We recorded the GPS positions of khulans and goitered gazelles in MKUNR during the field surveys from 2006 to 2007. We mapped the species and number, as well as permanent water points, vegetation types and human activity characteristics such as roads, nomad settlements, and mines on maps created with ArcView3.2a. Through the distance query and overlapping analysis of the layers in ArcView3.2a, we used Vanderploeg and Scavia's Selection Index (E_i^*) to identify habitat selection by khulans and goitered gazelles during four seasons in MKUNR. We then calculated the seasonal potential habitats of khulans and goitered gazelles. We set up the evaluating criteria for the influences of water points, vegetation types and human activity characteristics on the seasonal potential habitats of khulans and goitered gazelles with the Buffer Analysis function of ArcView3.2a. Finally, we studied the compound influences of permanent water points, vegetation types, roads, nomad settlements, and mines on the seasonal habitats of khulans and goitered gazelles through the map query analysis of ArcView3.2a. After the analyses, we found that suitable habitat areas were 6,163 km², 6,558 km², 6,834 km² and 7,099 km² for khulans whereas were 12,569 km², 6,970 km², 7,703 km² and 12,761 km² for goitered gazelles during the four seasons of the year. In order to effectively protect khulan and goitered gazelle, we suggest that MKUNR start to carry out long term khulan and goitered gazelle monitoring programs; to maintain permanent water sources; to use airplane seeding program to reforest the area and to restrict the number of livestock which entering and grazing in winter and early spring; to established strict permission system for mining and ban illegal mining; to strengthen the construction of across the grassland fences; to cooperate with Mongolia government to establish a trans-boundaries international nature reserve; to set up compensational mechanisms for using natural resources.

Corresponding author:

Zhigang Jiang, PhD

Institute of Zoology
Chinese Academy of Sciences
Beichen Xilu, Chaoyang District
Beijing 100101
China
Tel: +86.13501370683
E-mail: jiangzg@ioz.ac.cn



E. hemionus



Attitude of Rural Mongolians Towards Wild Ass

Petra Kaczensky

Although feral horses and their management are probably among the most heatedly and emotionally discussed topics in wildlife management, very little human dimension research has been conducted concerning feral or wild equids. The main conflicts with feral or wild equids concern competition with livestock for pastureland, alteration or destruction of pastureland and crop raiding. The Mongolian Gobi is one of the last refuges for the Asiatic wild ass (*Equus hemionus*; called khulan in Mongolian). A growing human population, changes in land management, exploitation of natural resources, and the development of infrastructure place increasing pressure on wild asses and their habitats. Consequently, conserving the continuity of the wild ass population will need a landscape level approach, also including multi-use landscapes outside of protected areas, particularly in the southeast Gobi. To assess attitudes of local people towards khulans and their conservation we interviewed 327 families in 13 districts in the south-eastern and south-western Gobi. Local people ranked khulans higher than wolves, but lower than ibex, black-tailed gazelles, marmots or takhi. Average attitude is more positive and knowledge level higher than in local people in the south-western Gobi as compared to those in the south-eastern Gobi. The reasons for disliking khulans were the perception that they destroy pastures, while reasons for liking khulans were the fact that they are rare, beautiful and have a right to exist. Despite the perceived conflict over pastures, local people generally scored high on conservation issues. This indicates there is a high potential to foster local stewardship of wildlife in Mongolia.

Corresponding author:

Petra Kaczensky, PhD

Research Institute of Wildlife Ecology
University of Veterinary Medicine
Savoyenstrasse 1
A-1160 Vienna
Austria
Tel: +43.1.4890915.181
E-mail: petra.kaczensky@fiwi.at



E. hemionus

Corral Mass Capture Device for Asiatic Wild Asses

Vitaliy Fyodorovich Levanov, Sergey Vladimirovich Sokolov, and Petra Kaczensky

The live capture of Asiatic wild asses is a challenge. Most populations are subject to poaching and are thus extremely vary. Wild asses run fast and groups tend to split up when chased. Furthermore, anaesthesia of wild equids requires the use of the potent opiate ethorphine which is highly toxic for humans and subject to special purchase and import regulations. Consequently, alternative safe and efficient capture methods that do not necessitate the anaesthesia of wild asses are of high interest. Furthermore, capture methods which allow the simultaneous marking of entire groups could benefit studies on the social organization of wild asses. In the following we describe a corral mass capture device developed in Altyn Emel National Park in south-eastern Kazakhstan for live capture of Asiatic wild asses for translocation. The final corral trap design is from 2010 and used a bow shaped asymmetric funnel design for a guiding structure. Wild asses are pushed to the trap with vehicles at night profiting from their impeded ability to see the surrounding landscape and the possibility to hedge them with powerful searchlights. In total 105 wild asses were captured with this method in 2006, 2010 and 2011.

Corresponding author:

Petra Kaczensky, PhD

Research Institute of Wildlife Ecology
University of Veterinary Medicine
Savoyenstrasse 1
A-1160 Vienna
Austria
Tel: +43.1.4890915.181
E-mail: petra.kaczensky@fiwi.at



E. hemionus

Understanding Asiatic Wild Ass (*Equus hemionus*) Population Size Estimates in the Great Gobi B Strictly Protected Area, Mongolia

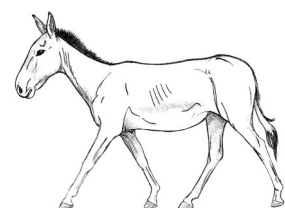
Stephanie Kramer-Schadt, Oyunsaikhan Ganbataar, and Petra Kaczensky

Little is known about the population size of the endangered Asiatic wild ass (*Equus hemionus*), and the reliability of population estimates is hindered by confounding factors like flight distances or group size variation on the animal side and topography or plant community cover on the terrain side. We have been conducting systematic ground based wildlife transects using a DISTANCE sampling approach in the 9,000 km² Great Gobi B SPA since 2003. The density estimates of the individual surveys vary tremendously (low accuracy) and have huge confidence intervals (low precision). We first fitted a Bayesian state-space model to better handle process variation and observation error and to estimate population trends over time. Second, to understand the reasons behind our survey limitations we developed a simulation program reflecting the entire survey process based on actual landscape and biological features. The results can be directly fed into DISTANCE to assess what factors have the highest influence on the population estimates by comparing model scenarios with real survey data from the last 8 years. This critical analysis of our survey methods provides a significant step forward in designing future and interpreting past wildlife surveys in Great Gobi B SPA, SW Mongolia.

Corresponding author:

Stephanie Kramer-Schadt, PhD

Leibniz Institute for Zoo & Wildlife Research
Alfred-Kowalke Strasse 17
D-10315 Berlin
Germany
Tel: +49.30.5168.714
E-mail: kramer@izw-berlin.de



E. hemionus



Parasitic Nematodes of Przewalski's Horse in Ukraine: Biodiversity of the Strongylid (Nematoda: Strongylida) Community

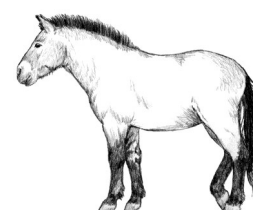
Tetiana A. Kuzmina, Natalia S. Zvegintsova, Tetiana L. Zharkikh, and Vitaliy A. Kharchenko

Strongylid nematodes are the main and the most pathogenic group of parasites of wild and domestic equids worldwide. Strongylid community in wild Przewalski's horses (*Equus ferus przewalskii* Poljakov, 1881) in Ukraine consists of 37 species; more than 20 species parasitize per one horse. Horse-keeping conditions, especially availability of pasture grazing, play the key role in transmission of parasites and influence the biodiversity of strongylid community. The aim of our study was to investigate level of Przewalski's horse infection by strongylids and examine the structure of strongylid community in wild Przewalski's horses kept under different types of horse-keeping conditions in Ukraine. During 2007–2011 we examined 31 wild Przewalski's horses kept under semi-free conditions in large enclosures (24 horses) and in zoo (4 horses) at the "Askania-Nova" Biosphere reserve and 5 horses from the Kyiv zoo. Level of infection by strongylids (EPG) was studied by the McMaster method (Herd, 1992). Strongylids were collected by the in vivo method of diagnostic deworming. Horses were treated with the anthelmintic "Univerm" (0.2% aversectin, Russia). Faecal samples (200 g each) were collected 24, 36, 48 and 60 hours after treatment; all nematodes expelled (>26,000 specimens) were collected and identified. Level of strongylid infection in wild Przewalski's horses kept in semi-free conditions was much higher than in horses from zoos (1016.7 EPG comparing with 128.3 EPG and 75 EPG). However, visually estimated body conditions in more infected horses of semi-free horse keeping conditions were better than in horses from zoos. Totally, 31 strongylid species from 12 genera were found in wild Przewalski's horses from the "Askania-Nova" reserve; from 8 to 18 species (aver. 14.5 ± 2.5) parasitized per horse. Nine species dominated in the strongylid community; they were found in 80–100% of horses and amounted 94.1% of the total strongylid number. General structure of strongylid community was multimodal with dominant, subdominant, background and rare species. Fourteen strongylid species from 6 genera were found in Przewalski's horses from the Kyiv and Askania-Nova zoos; from 4 to 14 species (average 6.6 ± 4.7) parasitized per horse. Six species dominated in the strongylid community; they were found in 80–100% of horses and amounted 90.5% of the total strongylid number. Structure of strongylid community was bimodal with dominant and rare species. The results obtained showed decreasing of biodiversity of strongylid community in Przewalski's horses kept in zoos comparing with semi-free conditions. We suppose that pathogenesis of dominant strongylid species that survive influence of deworming and successfully transmitted in zoo conditions, is much higher than in background and rare strongylid species. Further studies of strongylid communities in wild Przewalski's horses kept in captivity and natural reserves are necessary to clear up the influence of these parasites on horses.

Corresponding author:

Tetiana Kuzmina, PhD

Department of Parasitology
Schmalhausen Institute of Zoology NAS of Ukraine
vul. B. Khmel'nitskogo, 15
Kyiv, 01601
Ukraine
E-mail: taniak@izan.kiev.ua



E. ferus przewalskii

Measuring the Social Structure of a Population of Galician Wild Ponies (*Equus ferus* sp.)

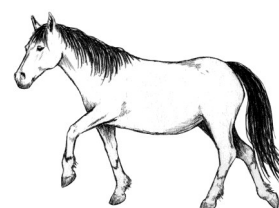
Laura Lagos and Felipe Bárcena

The social organization of feral or wild horses has been described as permanent groups called bands, usually composed of several mares with their foals and a stallion. The use of recent analysis techniques of animal associations provides measures of the social attributes for each individual as well as for a entire population. Thus, it allows for quantitative descriptions, comparison between populations, and even more complex analysis of the relationship between social attributes and components of fitness as foaling rates or foal survival. Our study analyses the social structure of Galician Wild Ponies (*Equus ferus* sp.) in a mountainous area in the centre of Galicia (NW Spain). The population analysed comprised 51–53 >2 year old ponies. These ponies belong to the primitive population of some 20,000 Galician Wild Ponies, which still live free in the mountains and are subject to a traditional exploitation regime. Annually they are rounded up and herded into enclosures built ad hoc, where most of the foals are removed and the remaining ponies, generally mares, are branded or earmarked and then released again. The number of stallions is controlled. Foals suffer a high predation pressure from wolves (*Canis lupus*). Field observations were carried out between May 2006 and October 2008, in 60 surveys done every 15 days. During this period foals in the area of study were not removed. Each pony was identified individually using morphological features. Individuals were considered associated if they were in the same group. We measured relationship using associations and the Simple Ratio Index as a measure of the proportion of time each dyad spent associated. Using SOCPROC, we computed social attributes for each adult pony, network and cluster analysis, as well as an analysis of the temporal pattern of associations using Lagged Association Rate. A qualitative description of the observed social structure of the ponies is of bands formed by a stallion, between 11–27 adult mares and their foals; this can be considered a primary level of social organization. Dendrograms and sociograms suggested a secondary level of social organization inside the bands: strong associations between mares, alone or with foals, sometimes including the stallion. Each mare had another pony with which she spent as a mean 59% of the time, although we observed some association indices >75%. Gregariousness of the adult ponies was characterized by a mean typical group size of 9.35 (range = 3.29–12.07). Mean association index of the mares with their stallion was 43% (range=8–83%). The bands exhibited some degree of dynamism, since several mares changed from one band to another, and some associations inside the bands also changed over time.

Corresponding author:

Laura Lagos

Instituto de Investigación y Análisis Alimentarios
Universidad de Santiago de Compostela
15782 Santiago de Compostela
Spain
Tel: +34.657530122
E-mail: laura.lagos@usc.es



E. ferus sp.

Community-Led Restoration of Grevy's Zebra Habitat in Kenya

Belinda Mackey and Peter Lalampaa

Land use across the majority of Grevy's zebra range in Kenya is communal with pastoralism as the main livelihood. The Grevy's Zebra Trust (GZT) started in January 2007 to conserve Grevy's zebra and its fragile habitat in partnership with communities. The current most large-scale and serious threat to Grevy's zebra in Kenya is loss of habitat, including grazing and water resources. In recognition of the critical role played by communities in Grevy's zebra conservation and the fact that pastoral livelihoods depend on the same, increasingly impoverished ecosystem, GZT has pioneered a new community-led habitat restoration initiative. Holistic planned grazing takes the crucial role of wild animals in maintaining grassland health and replicates it using livestock. Livestock is used as a tool with two functions: animals follow a plan where time for plant recovery is the main focus; and, animals herded tightly together break up bare, capped soil to allow precious rainfall to be captured instead of running off. On bare ground livestock is corralled overnight and the corrals moved weekly to nourish as large an area as possible. Planning is done seasonally: in the wet season the aim is to grow as much forage as possible by avoiding overgrazing; in the dry season it is to ration forage and maintain wild and domestic animal health. Estimates of forage available for livestock are done at the beginning of each seasonal plan ensuring that 50% is left for wildlife needs and soil cover. GZT pioneered its habitat restoration work in partnership with Westgate Community Conservancy. In addition to holistic planned grazing there is also intensive clearing by hand of the widespread and undesirable *Acacia reficiens* tree. In the bare ground underneath these trees, perennial grass seed is planted. The combination of clearing and holistic planned grazing has seen an overall increase in plant cover and the re-establishment of indigenous grasses. There has also been a positive response from wildlife, with sightings of Grevy's zebra, giraffe, elephant, cheetah and lion. The health of the cattle used in the holistic grazing plans also dramatically improved. This innovative habitat restoration model is now being used to scale up holistic planned grazing in four other conservancies that contain critical Grevy's zebra habitat.

Corresponding author:

Peter Lalampaa, MS

Grevy's Zebra Trust
PO Box 15351 00509
Nairobi
Kenya

Tel: +254.722.975.122

E-mail: peter@grevyszebratrust.org



E. grevyi



Long-Term, Individual-Based Research into the Ecology and Evolution of the Feral Horses of Sable Island National Park, Canada

Philip D. McLoughlin, Steven Simpson, Jordan Weisgerber, and Sarah Medill

In 2008, we initiated a long-term, 30+ year individual-based research program on the ecology and evolution of the feral horses of Sable Island National Park, Nova Scotia, Canada. Our research is directed at explaining variation in single-generational proxies of fitness (e.g., lifetime reproductive success) from additive and interactive effects of behaviour, morphology, and a horse's unique experience of the biotic and abiotic environment. Long-term study of the life histories of most or all individuals of a closed demographic unit allows for the construction of population-wide pedigrees, prompting fundamental questions like why do some lineages grow and flourish while others decline or go extinct, and why might some strategies be selected for at one time but against at another. The core field component of our program on Sable Island, which enters its fifth year in 2012, is an intensive, individual-based regime of sampling the horse population: each summer we obtain weekly observations of every individual on the island ($n=451$ horses in September, 2011). Collected data provides the basis for student projects requiring knowledge of movements and habitat, life history, known relationships and band dynamics, morphology, and calculations such as individual exposure to local density. We also collect hair for analyses of genetics, stress (corticosterone), and diet from stable isotope analysis. We are now looking to expand our program on the Sable Island horses to include collaborators through data-sharing agreements.

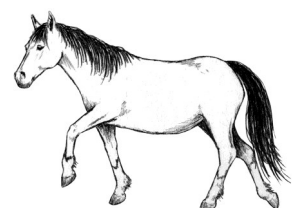
Corresponding author:

Philip D. McLoughlin, PhD

Department of Biology
University of Saskatchewan
112 Science Place
Saskatoon, SK S7N 5E2
Canada

Tel: +1.306.966.4451

E-mail: philip.mcloughlin@usask.ca



E. caballus

Turkmenian Kulan (*Equus hemionus kulan*) Captive Population Status and Perspectives

Anna Mekarska

The Turkmenian kulan (*Equus hemionus kulan*) is critically endangered in the wild, but also the future of this species in captive population is in danger. In 2011, there were only 314 Turkmenian kulans living in Euro-Asian zoos (138) and in Askania Nova Reserve (176). There are no more Turkmenian kulans in USA, Canyon Colorado Equid Sanctuary doesn't exist anymore. Population size in Euro-Asian zoos is decreasing both in terms of demographic and genetic parameters. This situation is caused by difficulties in keeping this species in mixed exhibits and competence with other more charismatic Equid species. Also very restricted veterinary law is prohibiting international transfers. Contrary, population of Turkmenian kulans living in Askania Nova is developing. There is also interest in this species within Spanish and Portuguese grazing projects. Captive population of Turkmenian kulan needs more interest in European zoos. Molecular research has been proposed to evaluate genetics and to compare captive and wild populations of kulans and onagers.

Corresponding author:

Anna Mekarska

Local Park and Zoological Garden Foundation in Krakow
Krakow Zoo
Kasy Oszczednosci Miasta Krakowa 14
30-232 Krakow
Poland
Tel: +48-126254010
E-mail: fennek@zoo-krakow.pl



E. hemionus

Historical Distribution of Persian Wild Ass (*Equus hemionus onager*) in Central Iran

Maryam Nehrir, Haniyeh Nowzari, and Mahmoud-Reza Hemami

Persian wild ass or onager *Equus hemionus onager* is a Critically Endangered taxon whose populations have continued to decline during the last decades. This species used to have a widespread distribution in Fars, Yazd, Isfahan, Kerman, Khorasan, and Semnan provinces. However, the remaining populations are currently restricted to Bahram-e-Goor Protected Area buffering the Qatrouyeh National Park in Fars Province and Touran Protected Complex in Semnan province. We studied the historical distribution of the species in Fars, Yazd, Isfahan and Kerman provinces of Iran. The data on onager historical range and the main reasons for the local extinctions of its populations were collected through reviewing the literature as well as interviewing with local people and hunters of this species. Analysis of the collected data indicated that onager had historically distributed in the following locations: Herat, Marvast, Bafgh, Mehriz, Taft, and Abarkouh in Yazd Province, Shahrehabak in Kerman Province, Shahreza and Koor-o-Biabanak in Isfahan Province, and Izadkhast, Abadeh, Bavanat, Shiraz, Sepidan and Neyriz in Fars Province. Competition with livestock, poaching, land conversion, draughts, isolation of the populations by transportation infrastructure and urban development, and lack of security in the migration routes of the species were recognized as the most important factors contributed to extinction of the onager populations in the studied provinces. The obtained results have implication for conservation of the species e.g. through reintroduction programs.

Corresponding author:

Maryam Nehrir

Department of Foreign Languages

Shiraz Branch

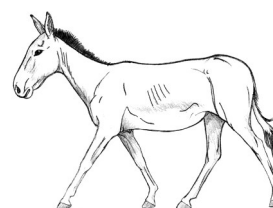
Islamic Azad University

7173914315 Shiraz

Iran

Tel: +98.7118303049

E-mail: marynehrir@gmail.com



E. hemionus



Population Parameters of Persian Wild Ass (*Equus hemionus onager*) in Qatrouyeh National Park, Iran

Haniyeh Nowzari, Mahmoud-Reza Hemami, Mahmoud Karami, Mir Masoud Kheirkhah Zarkesh, Borhan Riazi, and Daniel I. Rubenstein

Persian onager is an endangered species whose populations in semi-arid ecosystems of Iran have continued to decline during the last few decades. Unfortunately, the basic ecology of onagers in Iran is poorly understood and there is a need to understand the dynamics of the remained populations. Age and sex composition of the largest remaining population of onager (occurring in Qatrouyeh National Park) were characterized by direct observation of the groups over two consecutive years (July 2009, February and July 2010) and the abundance of the population was estimated by distance sampling method during December 2009 and August 2010. The population size was estimated at 302 with 95% confidence interval of 213–429 onagers. The survival rate of foals and yearlings estimated at 40% and 86% respectively indicating that the most critical part of onager's life is the first year. Fecundity rate of females varied from 0.23 to 0.33 over two consecutive breeding years suggesting that females do not get pregnant every year. The sex ratio was close to 1 (48:52). Our population model projected an increasing population over the next 30 years incorporating a maximum survival rate for adult age class. Nevertheless, if for any reason the survival rate of matures drops then sustainability of the population will be challenged.

Corresponding author:

Haniyeh Nowzari, PhD

Department of Environment

Abadeh Branch

Islamic Azad University

No. 475, 90 Alley

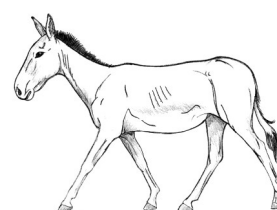
Ghasrodasht Ave.

71957-45343 Shiraz, Fars

Iran

Tel: +98.7116318298

E-mail: hnowzari@princeton.edu



E. hemionus

Immunocontraception, Social Behavior, and Stress in a Wild Horse Population

Cassandra M.V. Nuñez, James S. Adelman, and Daniel I. Rubenstein

The extirpation of natural predators has led to an expansion of wild ungulates across North America, resulting in a variety of conflicts with humans, and the subsequent management of these species. Given the options afforded managers, contraception appears the most humane, especially when compared to more invasive measures such as culls or gathers. While porcine zona pellucida (PZP) has been shown to effectively inhibit conception in several wild species, less is known about its effects on recipient behavior and subsequent physiology. Such studies are crucial if we are to most effectively and humanely utilize this contraceptive. Research on the wild horses (*Equus caballus*) of Shackleford Banks, North Carolina, shows that compared to non-recipient mares, recipients of PZP are up to 10 times as likely to switch harem groups, and visit up to 5 times as many harems. Such group changes frequently result in increased rates of aggression and harassment, both by harem males and resident females. Here, we combine non-invasive behavioral and endocrine sampling to determine how these group changes influence mares' stress physiology. We show that mares changing groups during the breeding season experience a spike in fecal cortisol levels, suggesting increased stress. In contrast, mares changing groups during the non-breeding season do not exhibit increases in cortisol. We propose application schedules that will help minimize such unintended consequences of PZP application. Finally, our methods provide a framework with which managers can assess both behavioral and physiological effects of management strategies, enabling them to reduce animal numbers while maintaining healthy, functional herds.

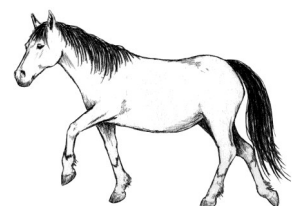
Corresponding author:

Cassandra M.V. Nuñez, PhD

National Aeronautics and Space Administration
1827 Summit Place, NW
Washington D.C. 20009
USA

Tel: +1.973.820.5655

E-mail: nunezcmv@gmail.com



E. caballus

The Evolution of Brumby Management in Australia

Colleen O'Brien

Across Australia, there are an estimated 400,000 wild horses, also known as Brumbies. Their forebears began arriving with the First Fleet in 1788, with the first record of horses escaping or being abandoned occurring in 1804 a mixture of Clydesdale, Thoroughbred, Caper and Timor pony (Department of Sustainability, Environment, Water, Population and Communities, 2011). Brumbies thrived and many of the horses sent overseas with the Australian Lighthorse between 1860 and 1920 were wild caught. By 1930, mechanisation had devalued horses and thousands were released to fend for themselves. In the 1950s, the first of the large scale culling had commenced, with more than a million Brumbies to be culled over the next half century. Unlike the USA, where Mustangs achieved protected status in 1971, Australian Brumbies are a classified pest animal. Responsibility for control lies with various state government bodies and control efforts to date have concentrated on dealing with numbers once they peak, rather than management to avoid this. Control has been scattered and primarily lethal, such as aerial culling and mustering to send Brumbies to abattoirs for slaughter. It wasn't until a publically botched aerial cull of more than 600 Brumbies in Guy Fawkes NP in NSW in 2000 that the public was galvanised. In response, Brumby rescue groups were formed by private citizens in Western Australia, New South Wales and Victoria. These groups both rescued local Brumbies and worked their way into meetings with government to improve the lot of the Brumby in Australia. Brumby rescue groups are fully self funded as there is no government funding available for the rescue, promotion and rehoming of Brumbies in Australia. In this poster, available literature has been used to briefly describe the events that have lead to the current situation. A variety of publications were used to show populations of Brumbies across Australia. Through interviews, the effect of Brumby rescue groups has been shown in terms of achieving programs focusing on passive trapping and removal for rehoming, as well as raising the profile of Brumbies as a horse that is deserving of preservation. This poster is aimed at introducing people to the current situation as regards Brumbies in Australia as well as the challenges faced by individual groups in terms of funding and working towards humane and positive Brumby management in Australia.

Corresponding author:

Colleen O'Brien

Victorian Brumby Association

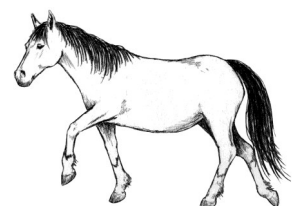
213 Lexton Road

Beaufort, Victoria 3373

Australia

Tel: +61.408.201.107

E-mail: info@victorianbrumbyassociation.org



E. caballus

DNA Microsatellite Analysis of Mongolian Domestic (*E. caballus*) and Wild (*E. przewalskii*) Horses

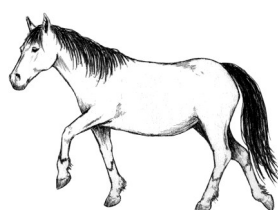
Tsendsuren Oyunsuren

Mongolia at the present accommodates 2.9 million native horses. A molecular genetics study of Mongolian horses has recently started to characterize their natural population and phylogenetic relationships. It is proposed that the close ancestor of Mongolian native horse (*Equus caballus*) could be the Mongolian wild horse named Takhi (*Equus ferus przewalskii*). By comparison of Equine hemoglobin amino acid sequences and serum protein studies a close relationship between domestic horses and Takhi has been shown. Genetically they are so close that their hybrids are fertile. At present for study of genetic variations or polymorphism the eukaryotic genome highly polymorphic sequences called microsatellites or short tandem repeats (STR) are used. Twenty nine unrelated individuals of the Mongolian domestic horses and five wild horses were screened for 2 loci of TG dinucleotide microsatellites of nuclear DNA. Multiplex amplification was used due to non-overlapping of sequences of HTG4 and HTG5 loci. As regards of allele numbers detected in TG dinucleotide repeats locus, 7 and 3 different alleles in HTG4 and 8 and 2 alleles in HTG5 locus were found in domestic and wild horses respectively. No contradiction and no mutations were observed. The comparative data of TG microsatellite analysis in *E. caballus* and *E. przewalskii* showed that Mongolian native horses are more polymorphic comparing to the wild horse (*E. przewalskii*).

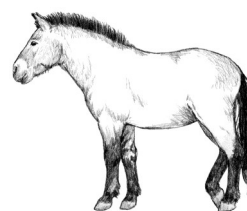
Corresponding author:

Tsendsuren Oyunsuren

Laboratory of Molecular Biology
Institute of Biology
Mongolian Academy of Sciences
Ulaanbaatar-51
13343
Mongolia
Tel: +976.11.458851
E-mail: tsosuren@yahoo.com



E. caballus



E. ferus przewalskii

Estimating Abundance of Equids using Aerial Applications

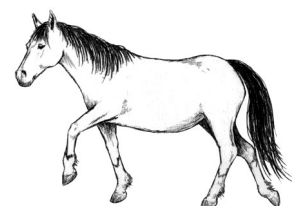
Jason I. Ransom and Bruce C. Lubow

Accurately estimating wild equid populations is a difficult challenge because animals often occupy vast areas and exhibit low and heterogeneous visibility. Population estimation techniques using aerial surveys and statistical design and analysis methods provide a means for meeting this challenge, yet they have seldom been validated because wild populations of known size suitable for field tests are rare. Our study presents field validations of a photographic aerial mark-recapture technique and a simultaneous double-count technique conducted on feral horse (*Equus caballus*) populations in the Western United States. The photographic technique appears to be the most promising method for estimating populations in areas of dense vegetation and rough terrain, and the best tests resulted in estimates falling within –6.7 percent, 2.6%, and –8.6 percent of known truth. Tests of a simultaneous double-count technique using sightability bias correction resulted in best estimates falling within –0.1%, –2.9%, and 0.1% of known truth. However, while the simultaneous double-count performed well in open grassland and shrubland, there is evidence that it may lead to more negatively biased estimates when used in habitat characterized by dense trees or rough terrain. This is because residual unmodeled heterogeneity cannot be completely compensated for using the double-count model. We found undercount bias as large as 32% before any statistical corrections. The necessary corrections varied both temporally and spatially, in response to previous sighting history (behavioral response), and by the number of horses in a group. Group size and sun effect (angle of the sun in relation to the observer) were the most influential effects in fixed-wing surveys, and sun effect, vegetation type, group size, topography, and observer fatigue generated biases during helicopter surveys. Observer skill also had strong influence on horse group detection from either type of aircraft. Some of these factors can be mitigated with thoughtful survey design while others can only be addressed using statistical sampling methods. We are currently developing a low cost aerial survey tool for conducting distance sampling that may be supplemented using the simultaneous double-count technique to improve accuracy of estimates in all survey conditions.

Corresponding author:

Jason I. Ransom, PhD

National Park Service
Biological Resource Management Division
1201 Oakridge Drive, Suite 200
Fort Collins, Colorado 80525
USA
Tel: +1.970.225.3584
E-mail: jason_i_ransom@nps.gov



E. caballus

Alternative Chemical Immobilization Protocol in a Group of Captive Feral Horses using Homemade Remote Delivery

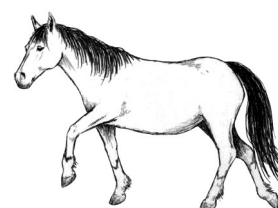
Ovidiu Rosu, L.A. Udrescu, and A. Birtoiu

During a 6 months period, we managed to safely perform 102 remote chemical immobilizations on a group of 50 recently captured Danube Delta feral horses. For all the procedures we used a standard combination of 25 mg detomidine, 62.5 mg tiletamine, 62.5 mg zolazepam and 10 mg butorphanol in 3.5 ml handmade darts delivered by a 11mm improvised blowpipe. Because of the unavailability of etorphine, the feral horse immobilization procedure had to be addressed resorting to other potent available drugs, such as: the sedative $\alpha 2$ -agonist detomidine, the mixed antagonist-agonist opioid butorphanol and the combination of dissociative agent tiletamine with the benzodiazepine zolazepam. Horses' weight was assessed to be around 300 kg (± 50 kg) per animal. The darts were handmade from 3ml luer lock normal resulting a 14.5 cm long, 11 mm thick dart syringe with a maximum liquid chamber capacity of 3.5 ml. Initial effects of the anesthetics were seen after 6-8 minutes when the horses started to exhibit stiff, high-stepping gait and became ataxic. In 28 cases (27.4%) one fully discharged dart syringe induced each horse to lateral recumbency in less than 15 minutes. In 37 (36.2%) of the cases another dart needed to be administered for the horse to become recumbent. There were also 29 (28.4%) procedures that required a total of three delivered darts and 8 (7.8 %) procedures that required 4 darts for the animal to become recumbent. Restricting the enclosure and minimizing the eye contact and noise helped achieve better darting and anesthesia results: 40.5% were induced with one dart in less than 12 minute; 46% required two darts and 15 minutes for lateral recumbency; 13.5% required three darts. In 78.4% of the cases the horses had a smooth awakening comparing with the other 19.6% who had a rougher awakening. In average the anesthetic effect of the combined drugs lasted around 35 to 45 min, offering a good anesthetic depth with proper muscle relaxation, suitable for short soft tissue surgery. An average of 20 breaths per minute and around 35 heartbeats per minute were recorded. Theoretically, the quantity of drugs contained by one dart should have easily covered the sedation of two adult 300 kg horses if given intravenous, but intra-muscular injections take longer for the effect to install (5-15 min). Anesthesia-related complications are significantly more common in horses than in small animals, with reported fatality rates reaching on average 1% for elective equine surgeries; consequently every time a chemical immobilization on equids is made, complication should be expected and prepared for. The cocktail we used for immobilization proved to be a reliable and relatively safe drug mixture that was able to induce and maintain a good anesthesia depth for a minimum of 35 minutes. The homemade darts and blowpipe had shown to be as efficient as the commercial ones, providing a cheap and easy way to remote deliver the anesthetic agents.

Corresponding author:

Ovidiu Rosu, DVM

Vier Pfoten Romania
Str. Maica Alexandra 24
11243 Bucharest
Romania
Tel: +40.730.583512
E-mail: ovidiu.rosu@vier-pfoten.org



E. caballus

Science Support for Management of Feral Horses (*Equus caballus*) in the Western United States

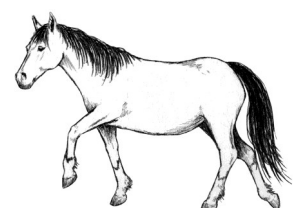
Kate A. Schoenecker, James E. Roelle, Jason I. Ransom, Linda C. Zeigenfuss, Linda Coates-Markle, Albert J. Kane, Steven S. Germaine, and Tracy A. Mask

Since 1971, when wild horses were first granted protection under the Wild Free-Roaming Horses and Burros Act, the Bureau of Land Management has been tasked with the daunting challenge of managing these horses as “an integral part of the natural system of the public lands.” This includes protection from capture, branding, harassment, and death, as well as the responsibility to manage wild horses, wherever they occur, “in a manner that is designed to achieve a thriving natural ecological balance.” While laudable as general management goals, the conditions implied by this act have proven difficult to achieve, largely due to opposing interest groups, growing horse populations, finite resources, and strong public interest and involvement. As of February 2012, an estimated 31,500 wild horses were roaming BLM-managed rangelands while nearly 47,000 wild horses and burros were fed and cared for in short-term corrals and long-term pastures. Given the contentious nature of the issues involved, as well as the potential of wild horse populations to double every four years, BLM has a continual need for the best scientific information available on the ecology and demography of wild horse herds. This information can then be applied to research on population control tools, such as fertility control, in order to assess their efficacy, potential impacts on behavior and social structure, and overall success. Since 1993, USGS has provided science support for the management of wild horse and burro populations in the western United States. Our research has focused on understanding population demographics of free-roaming wild horses, behavior and social interactions, development of population estimation techniques, and various studies of fertility control. We present several examples of our science, including long term population demographics and new studies of contraception efficacy, mechanism, physiology, and safety. An on-going synopsis of our projects and links to our publications can be found at <http://www.fort.usgs.gov/wildhorsepopulations>.

Corresponding author:

Kate A. Schoenecker, PhD

US Geological Survey
2150 Centre Avenue, Bldg C
Fort Collins, Colorado 80526-8118
USA
Tel: +1.970.226.9329
E-mail: schoeneckerk@usgs.gov



E. caballus



Feral Horse Body Condition: a Useful Tool for Population Management?

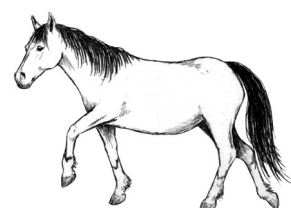
Alberto L. Scorolli

Feral horse (*Equus caballus*) is an invasive alien species worldwide. In Argentina there are many populations, some in Natural Protected Areas are considered a serious threat to biodiversity. The body condition of individuals in a population reflects their general nutrition, health, and their potential growth rate. Our goals were: to study the body condition of the feral horse population in Tornquist Park and explore the potential use as a tool for their management. The study area is located in Argentina, between 38°00'–38°07'S and 61°52'–62°03'W. It covers 67 km² of hills, the climate is temperate and humid with a mean annual rainfall of 800 mm and the typical vegetation is grassland steppe. The feral horses were observed with binoculars (10x50), walking a fixed path that covered 20 km² in two consecutive days. Density was 35 horses/ km² in March 2002 and the population was considered food limited. During the years 2001 and 2002 we estimate monthly the body condition of feral horses using the visual Body Condition Score (BCS), with a scale from 0= very thin, 3=good to 5=obese. The mean of different months, age-sex groups and years were compared using non parametric U Mann-Whitney test ($P<0.05$). The body condition of the population show an annual cycle, with a peak in late summer and begin of autumn. Adult males, stallions, were in good condition (mean BCS ≥ 3) and had higher values than adult females in all months of both years. Adult female higher mean values were observed in May 2001 (BCS=2.5) and March 2002 (BCS=2) and their lower mean values in September (BCS=1.5-1.7). Juvenile females (2 years old) and yearling females presented an annual pattern very similar to adult females. In September 2001, 45% adult females had poor condition (BCS ≤ 1.5) and only 23% showed good condition (BCS ≥ 2.5); whereas in 2002, 83% had poor condition and none had good condition. The observed body condition annual cycle, adult males higher, and relatively constant BCS is known for other feral horse populations. The lower values of adult females probably reflect the higher cost of gestation and lactation assumed by them. High percent of adult females with poor condition during the study is similar to the observed in other food limited populations. We propose to use the frequency (%) of adult females with poor or good BCS as a tool for evaluation of the health, its potential growth rate and the proximity of the population size to carrying capacity. We think that body condition score (BCS) could be useful for the management of feral equid populations and also monitoring of reintroduced populations of threatened equids.

Corresponding author:

Alberto L. Scorolli, PhD

Dto. de Biología, Bioquímica y Farmacia
Universidad Nacional del Sur
San Juan 670
8000 ICN, Bahía Blanca
Argentina
Tel: +54.291.459.5100
E-mail: scorolli@criba.edu.ar



E. caballus



Ethological Welfare of the Horse Populations: Evaluation Criteria

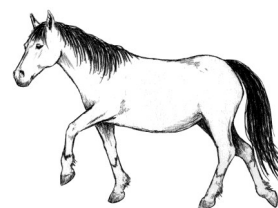
Natalia Spasskaya

Feral and wild horses, and particularly domestic horses, are highly social. They live in social groups of different composition with complex behavior pattern. The viability of such groups, the success of their adaptation to different environmental conditions is largely dependent on their structure and behavior. Stressful conditions are known to disorder behavior and significantly reduce survival and adaptability of the animals. Stress can be caused by influence of two principal groups of factors. Among external factors, changes in the environmental conditions and the anthropogenic impact are most significant. Internal factors are usually associated with changes in the group composition, size and density. Studies in behavior of both free-raiding domestic horse and herds of feral horse, along with that of the Przewalskii's horse living in captivity and under semi-reserve conditions, revealed a number of ethological parameters that are important in evaluation of status of different groups and populations. 1) The formation of natural social structure of the population, including first of all the harem and bachelor groups. Presence of solitary animals, social groups or associations of mixed composition of several types is possible. 2) The low level of intra- and inter-group aggression; the number of aggressive interactions is much smaller than that of peaceful interactions. 3) In the aggressive interactions, weak forms (threat demonstrations) dominate over strong ones (real aggressions). 4) The presence of a stable intra-group hierarchy, i.e. number of aggressive interactions directed upward along the hierarchy, is less than 15% of the total number of aggressions registered. 5) The presence of a significant amount of game forms of interactions, in particular games among sexually mature animals, is especially indicative. 6) The formation of the natural rhythms of the animal activity (daily, seasonal). Negative impact of certain external and/or internal factors, as a rule, causes changes in one or, more frequently, several of the above parameters, with a kind of "chain reaction". For example, the human impact (poaching) leads to violation of 1st and 6th parameters, while restructuring of social groups leads to violation of 2nd, 3rd and 4th parameters. Disturbance of external conditions (drought, fodder) leads to changes in the 6th parameter, which in turn can affect the 5th and 3rd ones. The internal reorganization in the structure of social groups affects directly the 2nd, 3rd and 4th parameters. Changes in demography of the population appeared to be delayed outcomes of the changes of ethological parameters, namely of age structure, fertility, mortality, and respectively of the growth and survival of the population. In such a case, early detection of the hidden stress effects by ethological indicators becomes of particular importance.

Corresponding author:

Natalia N. Spasskaya, PhD

Zoological Museum of Moscow, Lomonosow State University
Bolshaya Nikitskaya Str., 6
Moscow 125009
Russia
Tel: +7.495.629.49.12
E-mail: equusnns@mail.ru



E. caballus



Intranasal Transmission of Chronic Wasting Disease in Deer and its Implication to Wild Equids

Terry R. Spraker, Tom Gidlewski, Tracy A. Nichols, Mark D. Zabel, Aru Balchandran, Kurt C. VerCauteren, and Katherine I. O'Rourke

Chronic Wasting Disease (CWD) is a transmissible spongiform encephalopathy that persistent in both wild and captive North American cervid populations. CWD has been documented in thirteen states in the continual United States, two provinces in Canada and South Korea. This disease continues to spread and cases are found in new areas each year. Indirect transmission can occur naturally via the environment and has been documented to occur by the oral route. Prions have been shown to strongly adsorb to clay particles and upon oral inoculation the prion/clay combination exhibits increased infectivity in rodent models. Cervids and wild equid undoubtedly inhale dust while foraging and normal behavior activities. We therefore hypothesized that dust particles may be a viable mode of intranasal CWD exposure. To test this hypothesis, CWD-positive brain homogenate was mixed with montmorillonite clay, dried, re-powdered and intranasally inoculated into white tailed deer once a week for 6 weeks. Our results demonstrate that CWD can be efficiently intranasally transmitted utilizing montmorillonite dust particles as a carrier and that the intranasal route is a quick and viable route of exposure. How does this research relate to wild equid? To date there has been no documented cases of any transmissible spongiform encephalopathy (bovine spongiform encephalopathy, transmissible mink encephalopathy, scrapie and chronic wasting disease) in equid. Horses are said to possess a species barrier that prevents the prion protein to be transformed to the non-digestible abnormal isoform which is the hall mark of prion diseases. Because of this when equid are examined at necropsy the brains are rarely examined for spongiform encephalopathy. However, it has been documented in experimental animals that are at first resistant to a specific prion disease such as CWD or scrapie following a second or third passage in the same species the previously resistant species of animal will develop the disease. Since prion has been documented to be expelled in the feces and therefore contaminate the ground/dust and intranasal transmission especially bound to dust has recently been documented in a natural host, this suggests that in areas where there are deer and elk with chronic wasting disease or sheep with scrapie; equid are being exposed to the abnormal isoform of prion. So the possibility of a prion disease developing in wild equid is plausible and wild equid that demonstrate any evidence of emaciation should be examined carefully for evidence of a spongiform encephalopathy. Emaciation/poor body condition is commonly observed in wild equid and seems to always be diagnosed as malnutrition or heavy parasite burdens; however spongiform encephalopathy could easily be over looked and should be considered as a possible diagnosis.

Corresponding author:

Terry R. Spraker, DVM, PhD

Colorado State University Diagnostic Laboratory
College of Veterinary Medicine and Biomedical Sciences
Fort Collins, Colorado 80523
USA

Tel: +1.970.297.4155

E-mail: terry.spraker@colostate.edu



Equus spp.

The Tale of the Horse's Tail – Stable Isotope Analysis of Equid Tail Hair in the Mongolian Gobi

Martina Burnik Sturm, Micha Horacek, and Petra Kaczensky

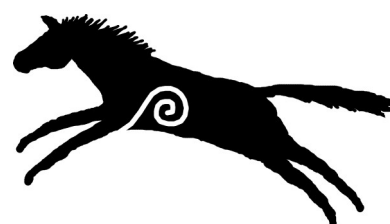
In the Dzungarian Gobi of Mongolia, three equid species, Asiatic wild ass (*Equus hemionus*), domestic horse (*Equus caballus*), and re-introduced Przewalski's horse (*Equus ferus przewalskii*) share the same habitat and thus provide a unique opportunity for comparative ecological studies. However, continuous observations of free-ranging equid species in the harsh environment and over the large expanse of their ranges are impossible to conduct, whereas physiological measurements either require highly invasive techniques and/or the confinement to a captive or semi-captive environment. This requires the adoption of novel approaches. Stable isotope analysis has become a powerful tool to study feeding ecology, water use or movement pattern in contemporary, historic and ancient species. C-isotopes are controlled by the animal feed and depend on the amount of ingested C4- or C3-plants. In the cold-tempered grasslands of Asia, grasses primarily use the C3 pathway, while a multitude of annuals and perennials, use the C4 pathway. H-isotopes reflect the isotopic composition of the water the animal utilizes, e.g. winter precipitation has depleted isotope values as compared to summer precipitation. N-isotopes reflect both the composition of the feed and the physiological status of the animal; e.g. food shortage leads to increased N-isotopes values due to metabolism of body reserves. Here we present first preliminary results supporting our assumption that the isotope signature of wild equid tail hair follows a clear seasonal pattern. We analyzed the tail hair of a 4-year old Asiatic wild ass mare captured in July 2009. The tail hairs were up to 38 cm long and were cut into 38 individual samples. Isotope values revealed an oscillating pattern and varied between -122 and -80‰ V-SMOW for hydrogen, 7.5 and 9.7‰ N_{Air} for nitrogen, and -22.6 and -18.6‰ V-PDB for carbon, whereas sulfur isotopes were rather constant around 9 and 10‰ V-CDT. Whereas hydrogen and carbon isotopes seemed to show negatively correlated oscillation pattern, nitrogen isotopes seemed to follow a different pattern. Further analysis of tails from additional khulan individuals as well as from the other two species are expected to reveal species specific differences strengthening our understanding of the ecological adaptations of the three species.

Corresponding author:

Martina Burnik Sturm, PhD

Research Institute of Wildlife Ecology
University of Veterinary Medicine
Savoyenstrasse 1
A-1160 Vienna
Austria
Tel: +43.6508339230
E-mail: sturm.martina@gmail.com

BLT Wieselburg
Secondary College and
Research Institute
Rottenhauser Strasse 1
A-3250 Wieselburg
Austria



Equus spp.



Potential Offset Programs for Asiatic Wild Ass in the Southeastern Gobi Desert

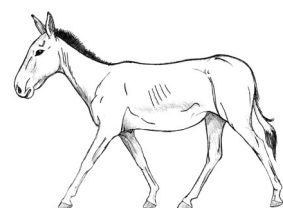
Dorjderem Sukhragchaa and Batsaikhan Nyamsuren

Oyu Tolgoi is the largest developing copper and gold mine in the South Gobi region of Mongolia. As a company, Oyu Tolgoi aims to have a Net Positive Impact (NPI) both economically and environmentally across Mongolia and in specific the South Gobi region throughout the life of the mine. A notable environmental feature of the Southeastern Gobi Desert is the presence of the Asiatic Wild Ass (*Equus hemionus hemionus*) for which 80% of the country's population resides. Unfortunately results of national assessment and survey studies indicate that the Asiatic Wild Ass population in the Little Gobi Protected Area have declined by 39.6% and that distribution areas have decreased by a ratio of 2.8 (Mongolian Academy of Sciences, 2003 and 2009). The key areas of threat for the Asiatic Wild Ass as identified from independent studies by Non-Government Agencies (NGO's) and Oyu Tolgoi's environmental research are, direct loss and fragmentation of habitat, forage quality degradation and competition for pastureland. As part of Oyu Tolgoi's strive to achieve NPI on biodiversity it will incorporate a mitigation hierarchy to avoid, minimize and rehabilitate project-related impacts to the environment as well as develop a biodiversity offset plan that over time will help compensate for residual impacts left by the mine. As an example Oyu Tolgoi has taken action and committed to build wildlife passes under project roads as part of its mitigation actions. However further studies, consultation with biodiversity stakeholders and cross section partnerships with local communities, various government and non-government institutions and academic organizations is an essential milestone to the effective implementation of nationwide anti-poaching, regional pastureland management, expansion of SPA and mitigation measures at infrastructures other than the Oyu Tolgoi project.

Corresponding author:

Dorjderem Sukhragchaa

Oyu Tolgoi LLC
11th floor Monnis Tower
Chinggis Avenue 15
Sukhbaatar District, Ulaanbaatar 14240
Mongolia
Tel: +976.99081475; +976.11.331880 ext. 6311
Email: dorjderems@ot.mn
Email: deremee_in@yahoo.com



E. hemionus



Preliminary Research Results of Epigenetic Variability, Epigenetic Distance and Fluctuating Asymmetry of the Przewalski's Wild Horse by Non-Metric Characters of the Skulls

Dorj Usukhjargal, H. Ansorge, R. Schafberg, Mikhail V. Sablin, and Namkhai Bandi

Przewalski's wild horse (Takhi in Mongolian) are considered to be the one and last remaining truly wild horse species in the world today. Russian army colonel N.M. Przewalski discovered it in 1878 and I.S. Poljakov named the species *Equus przewalskii* Poljakov in 1881. Because of competition with livestock, illegal hunting and harsh climate conditions the wild horse "takhi" probably became extinct in the wild in 1960s. Between 1898 and 1903, 88 foals were caught in the Mongolian gobi with the aim of transporting to zoos in Europe, but only 53 foals survived the journey. Transported takhi's lived and died in zoos. Skulls and other materials were then kept in museum archives. In 2010 and 2011, we studied 27 original and 44 captive bred takhi skulls from the University of Halle, Zoological Society of Munchen, Paleo-Anatomy Institution of Munchen, Natural History Museum of Berlin and the Zoological Institute of the Russian Academy of Science in Saint Petersburg. The studies were based on 76 non-metric traits, 70 of them bilateral, 6 of them unilateral. The analysis of the chosen non-metric characters of homogeneity in age and sex supported age dependence in 15 characters and sex specific expression in 4 characters. The epigenetic variability (Iev) of all takhi samples pooled together was 0.33, original takhi was 0.32, captive bred takhi was 0.33 and hybrid takhi was 0.38. Because, to date, no study on non-metric skull characters on the Equine species have been carried out, it is difficult to determine the degree of variability throughout the takhi. But, if compared to other studies such as the raccoon dog in Europe, epigenetic variability of the raccoon dog (Iev=0.30) and takhi were relatively similar. Of course, a comparison between a small predator and large ungulate is lopsided. But an interesting point is that the epigenetic variability of captive takhi is similar to wild predator epigenetic variability indicating takhi's are less sensitive in inbreeding. It is suggested that non-metric skull character analysis is needed in future studies of Przewalski's wild horse to monitor the genetic situation of the species in the wild.

Corresponding author:

Dorj Usukhjargal

Hustai National Park Trust

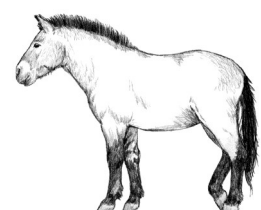
II Khoroo

Ulaanbaatar 210628

Mongolia

Tel: +976.99068399

E-mail: usukhjargal2001@yahoo.com



E. ferus przewalskii



Early Reactive Culling Protocol in the Oostvaardersplassen Nature Reserve, the Netherlands

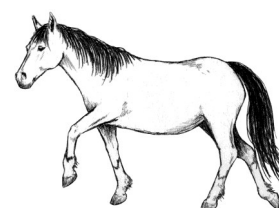
Machteld van Dierendonck

All successful natural reserves with (visible) populations of large feral populations of (domestic) species experience dying animals when conditions are unfavourable. Despite in several of these areas active prevention of suffering is practiced, often the public opinion is very negative. Unfortunately these steps are often not in favour of the optimal 'evolutionary' development of the populations in a reserve. It is a challenge to develop a strategy in which the goals of the stakeholders are balanced: the population gets a maximal chance to adapt to an equilibrium with the ecosystem allowing stochastic processes; the natural processes and welfare of the individuals are optimised; potential suffering is minimal and the support from the public opinion increases concerning the management. In the Dutch Oostvaardersplassen (OVP) reserve, a protocol was developed and practiced for some years, which fulfills these requirements. The Oostvaardersplassen in the Netherlands is of international importance as wetland and has a unique richness in biodiversity. Large herbivores were introduced to maintain short grassland for a wide spectrum of birdlife: Heck cattle (1983), Koniks (1984) and Red Deer (1992). All three herbivores soon came to be recognized as an important component of the ecosystem. In the summer of 2010, 3,910 large herbivores of which 914 adult Koniks were counted in the OVP. Since the start of the project, a policy of minimal intervention was adapted, which included culling of the dying animals ("predator model"). Currently the carrying capacity of the area is most likely reached at the end of winter period. Two international committees (2006, 2010) have been assessing the management in the OVP. In 2010 a set of management actions in order to increase welfare (by creation of corridors and opening of some forested areas; creation of shelter ridges) and minimizing potential suffering by the development of a new Early Reactive Culling Protocol. Central in the new protocol is a matrix based on I) an individual animal behaviour and condition score (AC); II) a long-term expectation of the prevailing environmental conditions score (EC), including population density, information about the food availability, time of the year (per species, gender and age). This guideline helps to take the most optimal decisions. Periodically population scores for AC and EC are collected for monitoring, which is communicated with the general public. The results of working with the guideline are promising. This approach allows the evolutionary processes to optimally develop, while safe guarding the welfare and prevent unnecessary suffering of the large herbivores as much as possible. This protocol provides a very good option for the long-term development of a balanced ecosystem within a stochastic environment, surrounded by a critical general public.

Corresponding author:

Machteld van Dierendonck, PhD

Veterinary Sciences
Ghent University
Salisburylaan 133
9820 Merelbeke
Belgium
Tel: +31.621282985
E-mail: machteld@equusresearch.nl



E. caballus

One Measure - Three Objectives: Przewalski Stallions Pasturing a Conservation Area

Hermann Will, V. Fröhlich, C. Gohl, F. Karbe, N. Steidele, and K. Baumgartner

In the “Tennenloher Forst”, a former military training ground, the typical fauna and flora of a rare habitat called “Sandmagerrasen” (open sandy grassland) has been established. We started a project with a bachelor group of Przewalski horses in 2003. The individuals came from the Munich and Nuremberg Zoo. The main objectives of this project are: 1) to prevent this biotope of the open sandy grasslands from ecological succession, 2) to keep a bachelor group as a genetic pool for reproduction in zoos and for reintroduction projects, and 3) to carry out research on local fauna and flora and on semiferal living Przewalski horses.

Objective 1: After the army left the area, the Tennenloher Forst was quickly pronounced a nature conservation area, and later on became part of the “Natura2000“-programme of the European Union and the German, “DBU Nationales Naturerbe”. The area includes 934 hectares of woodlands (mainly *Pinus sylvestris*) and open sandy grounds, which offers habitats for endangered species like *Sphingonotus caeruleus*, *Bombina variegata*, *Caprimulgus europaeus* or *Coronella austriaca*. Since the end of military usage, the open grasslands were quickly succumbing to succession. After 10 years, the sparsely sandy vegetation was getting more and more overgrown with shrubs and dominant grasses (especially *Calamagrostis epigejus* and the neophyte *Prunus serotina*). Exposed sandy areas were hardly existent. Therefore in 2003 the horses were introduced to a space of 52 hectares to reduce the coverage ratio of the vegetation by grazing. In 2011 the area was enlarged to 87 hectares and goats were added in 2012 to fight *Prunus serotina* which is ignored by the horses. *Objective 2:* Since the project started, the structure of the group was changed several times. Surplus male offspring from zoos were introduced and adult stallions were taken out for breeding reasons. We follow a management plan considering the social structure of the herd and the genetic value of the individuals. Health aspects and feeding regimes are also part of the management. *Objective 3:* Up to now 24 scientific studies have been carried out in this area, among them the dissertation “Monitoring a bachelor group of Przewalski horses throughout the course of the year with particular attention paid to sleep behavior and rank order” (Natalie Steidele, 2011) and – to mention only some of them - diploma thesis on Whitish hair-grass (*Corynephorus canescens*), coprophagous beetles and nutritional value of the pasture of the horses.

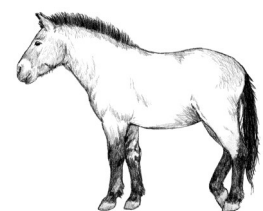
Corresponding author:

Hermann Will, PhD

Nuremberg Zoo
Am Tiergarten 30
90480 Nuremberg
Germany

Tel: +49.176.80065515

E-mail: hermann.will@stadt.nuernberg.de



E. ferus przewalskii

Index of Presenters

A		L	
Akbari, Hasan	61	Lagos, Laura	18, 80
Asa, Cheryl	19	Lalampaa, Peter	52, 81
B		Linnell, John	45
Bandi, Namkhai	57	M	
Berger, Joel	14	McLoughlin, Philip	21, 82
Berman, Dave	47	Mekarska, Anna	83
Bhatnagar, Yash Veer	51	Moehlman, Patricia	55
Bi, Junhuai	62	N	
Bobek, Miroslav	63	Nandintsetseg, Dejid	37
Bouskila, Amos	20, 64	Nehrir, Maryam	84
Boyd, Lee	16	Nordquist, Megan	34
Brubaker, Alexali	46	Nowzari, Haniyeh	85
C		Nuñez, Cassandra	50, 86
Calabrese, Justin	44	O	
Cao, Qing	65	O'Brien, Colleen	87
Cheremnov, Dmitry	66	Olsen, Sandra	15
Christen, Catherine	54	Olson, Kirk	38
Christensen, Bruce	67	Oyunsuren, Tsendsuren	88
Costa, Vânia	68	P	
Cothran, Gus	23	Petersen, Steven	35
Coughenour, Mike	40	Prieto Pablos, Maria	28
D		R	
Dinn, Frances	48	Ransom, Jason	32, 89
F		Rosenbom, Sónia	24
Feh, Claudia	69	Rosu, Ovidiu	90
Forester, James	43	Rubenstein, Daniel	13
Frank, Kim	49	S	
G		Schoenecker, Kate	36, 91
Ganbaatar, Oyunsaikhan	56	Scorolli, Alberto	22, 92
Geigl, Eva-Maria	26	Singh, Navinder	42
Giulotto, Elena	25	Spasskaya, Natalia	93
H		Speyer, Edith	27
Hamidi, Amir Hossein Kh.	53	Spraker, Terry	94
Heisel, Sara	70	Sturm, Martina	95
Hemami, Mahmoud-Reza	58, 71	Sukhragchaa, Dorjderem	96
Hrabar, Halszka	59, 72	Sundaresan, Siva	31
I		U	
Ito, Hideyuki	73	Usukhjargal, Dorj	97
Izquierdo, Manuel Arturo	74	V	
J		van Dierendonck, Machteld	98
Jiang, Zhigang	60, 75	Vick, Mandi	30
K		W	
Kaczensky, Petra	39, 76, 77	Walzer, Chris	29
Kebede, Fanuel	41	Will, Hermann	99
King, Sarah	17	Z	
Kramer-Schadt, Stephanie	78	Zabek, Magdalena	33
Kuzmina, Tetiana	79		

