

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

Erforschung biologischer Ressourcen der Mongolei
/ Exploration into the Biological Resources of
Mongolia, ISSN 0440-1298

Institut für Biologie der Martin-Luther-Universität
Halle-Wittenberg

2005

Wild Bactrian Camel Conservation

Richard P. Reading

Denver Zoological Foundation, rreading@denverzoo.org

Evan S. Blumer

The Wilds, eblumer@thewilds.org

Henry Mix

Nature Conservation International

Jadamsuren Adiya

Mongolian Academy of Sciences, adiyaj@yahoo.com

Follow this and additional works at: <http://digitalcommons.unl.edu/biolmongol>



Part of the [Asian Studies Commons](#), [Biodiversity Commons](#), [Desert Ecology Commons](#), [Environmental Sciences Commons](#), [Nature and Society Relations Commons](#), [Other Animal Sciences Commons](#), [Terrestrial and Aquatic Ecology Commons](#), and the [Zoology Commons](#)

Reading, Richard P.; Blumer, Evan S.; Mix, Henry; and Adiya, Jadamsuren, "Wild Bactrian Camel Conservation" (2005). *Erforschung biologischer Ressourcen der Mongolei / Exploration into the Biological Resources of Mongolia, ISSN 0440-1298*. 124.
<http://digitalcommons.unl.edu/biolmongol/124>

This Article is brought to you for free and open access by the Institut für Biologie der Martin-Luther-Universität Halle-Wittenberg at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in *Erforschung biologischer Ressourcen der Mongolei / Exploration into the Biological Resources of Mongolia, ISSN 0440-1298* by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

Erforsch. biol. Ress. Mongolei (Halle/Saale) 2005 (9): 91–100

Wild Bactrian camel conservation

R.P. Reading, E.S. Blumer, H. Mix & J. Adiya

Abstract

The wild Bactrian camel (*Camelus bactrianus ferus*) is critically endangered throughout its range in China and Mongolia. Yet, wild camels remain poorly understood, with knowledge derived primarily from a few short studies and anecdotal information. We initiated a wild camel conservation project to determine the reasons for camel decline and to develop a program to address those problems.

We are employing satellite telemetry to gather data on wild camel movement patterns, home ranges, habitat use, and sources of mortality. We are also collecting faeces from camels and wolves to determine important forage plants and to begin to assess predation levels, respectively. In addition, steroid fecal analysis may help us evaluate wild camel reproductive physiology. Finally, we are directly observing wild camels to study their behavior.

Thus far, we successfully collared two wild camels (1 male, 1 female). We received one year's data on the cow before her Doppler satellite collar failed and are receiving only sporadic data from the GPS satellite collar on the bull.

Over one year, the cow covered a minimum distance of 4,527 km and her 100 % minimum convex polygon (MCP) home range was 17,232 km². Her kernel home range sizes covered 8,696 km² for 95 %, 4,031 km² for 75 %, 2,284 km² for 55 %, and 612 km² for 25 % kernels. We received only 20 GPS locations on our bull from October 10, 2003 to March 22, 2004. During that time, he travelled a minimum of 683 km and his 100 % MCP home range extended over 9,191 km². His kernel home ranges covered 7,255 km² for the 95 %, 3,741 km² for the 75 %, 1,346 km² for the 50 %, 585 km² for the 25 %, and 115 km² for the 5 % kernel. Over the past few autumns, mean group size was 10.07 ± 1.82 wild camels/group.

We are currently analyzing the behavioral data and plan to evaluate the fecal samples once we have sufficient samples. We hope to use the knowledge derived from our work to develop a proactive conservation program working in close cooperation with the Mongolian government and other scientists and conservationists.

Keywords wild Bactrian camel, *Camelus bactrianus ferus*, conservation, endangered species, Mongolia, home range, Great Gobi A Strictly Protected Area

Introduction

Conserving wild Bactrian camels (*Camelus bactrianus ferus*) is a crucial, international effort to recover a species that was listed as critically endangered by the World Conservation Union (or IUCN) in 2002. The multi-organizational effort includes the Denver Zoological Foundation, the Mongolian Conservation Cooperative, (a Mongolian non-profit organization), the Mongolian Academy of Sciences, the Great Gobi Strictly Protected Area Administration, the Wilds, Nature Conservation International (a German non-profit organization), and the United Nations Development Programme (UNDP).

The wild Bactrian camel is critically endangered throughout its range in China and Mongolia, where it receives full legal protection (IUCN, 1996; Shiirevdamba et al., 1997; Wingard, 2001; Reading et al., 2002). Wild camels are restricted to 3 small, remnant populations in China and Mongolia: in the Taklimakan Desert, the deserts around Lop Nuur, and the area in and around Region A of Mongolia's Great Gobi Strict Protected Area (Yongzu, 1991; Hare, 1997, 1998;

Schaller, 1998; Reading et al., 2002). There is a small semi-captive herd being maintained and bred outside Great Gobi Park near Bayantoori, Gobi-Altay Aymag (UNDP, 1994).

Wild Bactrian camels are poorly understood. Knowledge of the species is derived from only a few short studies and anecdotal information (Anonymous, 1988; Tolgat & Schaller, 1992; Tolgat, 1995; Xiaoming & Schaller, 1996; Hare, 1997; Reading et al., 2002). Recent global population estimates suggest that only a few thousand individuals survive in small portions of Mongolia and China (Tolgat & Schaller, 1992; Tolgat, 1995; Xiaoming & Schaller, 1996; Hare, 1997, 1998; Reading et al., 1999), and appear to be declining. We initiated a wild camel conservation project to determine the reasons for camel decline and to develop a program to address the causes of decline (Blumer et al., 1999a,b; Reading et al., 1999). In 2003 and 2004, we continued progressing toward these goals with cooperative field work, the development of a co-funded project with the UNDP and Mongolian Academy of Sciences, and initial data analysis of collected data to date.

Study area

Region A of the Great Gobi Strict Protected Area (SPA) is characterized as a high upland (on average 1300 m) with dry stream beds and hills, rocky outcrops, and mountain massifs rising to 2,695 m. Springs and other water sources are rare. Climate is strongly continental and arid, characterized by cold winters (to -35°C), dry, windy springs (to 80 km/h), and hot summers (to 40°C). Precipitation is low, averaging less than 60 mm/yr, with most precipitation falling in the summer months and some areas going years without any precipitation. Vegetation is sparse. Xerophytic and hyperxerophytic semi-shrubs, shrubs, scrub vegetation, and bunch grasses dominate. Other plant communities can be found around oases, on mountain massifs, and other localized areas. Other significant wildlife species in the Great Gobi that will likely benefit from our work include Gobi bears (*Ursus arctos pruinosus*), snow leopards (*Uncia uncia*), grey wolves (*Canis lupus*), argali sheep (*Ovis ammon*), Asian wild asses (*Equus hemionus*), goitered gazelles (*Gazella subgutturosa*), cinereous vultures (*Aegypius monachus*), and lammergeiers (*Gypaetus barbatus*). Many of these species are locally or globally threatened or endangered.

Methods

We captured wild camels using a remote delivery system developed by Pneu-Dart, Inc. We utilized Pneu-Dart© rifles with a red dot scope and Pneu-Dart darts with barbed needles. We used a cocktail of drugs previously determined to work well with the species (Blumer et al., 1999b). Although we evaluated several methods of darting animals, we were only successful using a motorized vehicle to approach animals in open terrain for darting on the run. This method worked 3 times over 3 years, although on one occasion we removed the collar from the animal after determining that it was in poor physical condition. In addition, in 2002 we got close enough to dart a fourth animal, but the dart bounced off. In this technique, the driver rapidly closes distance on the wild camels, while the shooter sits in the door opening (with the door removed) of the vehicle (with nylon webbing across the opening as a safety precaution), and attempts to dart the camel while on the run. Once the immobilized animal is fitted with a satellite telemetry collar, measurements made, biological samples collected, and the animal is given addition drugs to reverse the immobilization (Blumer et al., 1999b). Unsuccessful methods attempted included using blinds near oases, approaching wild camels while hiding behind domestic animals, and using leg snares to capture animals at oases.

We deployed two different styles of satellite telemetry collars on captured animals. In 2002 we deployed an Argos, doppler-based collar on an adult female and in 2003 we deployed a GPS-satellite collar. Data from the Argos collar are collected automatically and continuously while turned on and downloaded to central facility. The collar operates on an 8 hours on and 24 hours

off cycle. Every four days we receive the data from Service Argos that the company corrects for atmospheric alterations. In contrast to the Argos collar, we set the GPS collar to record locations twice per day. Unfortunately, the GPS collar has only been working intermittently (i.e., we have received 20 total locations since October and none since March). In addition, the Argos collar ceased functioning altogether on 27 October 2003; exactly one year to the date after it was put in service. These equipment failures have compromised our research.

We analyzed telemetry data using ArcView© Geographic Information System (GIS) software. We employed both minimum convex polygon (MCP) and kernel estimators for home range evaluations, using at most one location per day to avoid problems of autocorrelation.

We are collecting scat from wolves and wild camels for future analysis of diet. The wolf scats will provide an estimate of the importance of wild camel in their diet (although not predation rates, as wolves scavenge as well as kill wild camels). Wild camel faeces may also provide us with an indirect method of assessing wild camel reproductive status (Lyda et al., 2002).

To gather data on wild Bactrian camels, we observe animals from vehicles or on foot using binoculars and spotting scopes. We filmed some behavior for future analysis. We only collect data up until the animals react to the presence of people, they leave our field of view, or our observation time ends. We have particularly focused on gathering data on behavior during the winter rut.

Finally, we are training our Mongolian colleagues and helping to develop a long-term wild camel conservation program. Training to date consisted of 'on the job' fieldwork and workshops designed to impart knowledge on field methods and scientific grant and paper writing. We worked with the United Nations Development Programme to set up the research and monitoring aspect of a Global Environment Facility (GEF) funded project, titled: The Conservation of the Great Gobi Ecosystem and Its Umbrella Species. We drafted the original concept paper and early proposal for this project and will be working with the Academy of Sciences to implement the research and monitoring components.

Results & discussion

Animal capture & immobilization

We successfully darted and satellite collared 3 wild camels. In spring 2001, we captured a cow camel, but she was in poor physical condition, so we decided to remove the collar the next day after the animal failed to move from the capture site. Care, in form of medical attention, food, and water were provided. Although the camel eventually moved from the capture site, it is unclear if she survived the procedure. Thereafter, we shifted to trying to capture animals in autumn. In autumn 2002, we captured a 3-year-old female and in autumn 2003 a 7-year-old male wild camel (age determined by teeth). We shot at a 4th camel in 2002, but the dart bounced off the animal's hip, likely because it hit the ileum bone. We fit the female with an Argos, Doppler collar and the male with a GPS collar.

All animals were darted after a short (maximum 2 km) chase. Successfully immobilized camels went down less than 18 minutes after darting and after travelling about 5 km. There were no problems with the anesthesia for the two successfully collared animals, and after approximately 45 minutes, the anesthesia was 'reversed'. These two camels were in good condition (stable heart and respiratory rates, and good tissue oxygenation) and were adequately tranquilized throughout the procedures. Other attempts to capture wild camels failed, as described above. We decided that this technique has merit, but is not optimal. In the future, we hope to complement this technique with other efforts, such as darting from ultra-light aircraft, and will continue to explore the use of foot snares in the vicinity of oases.

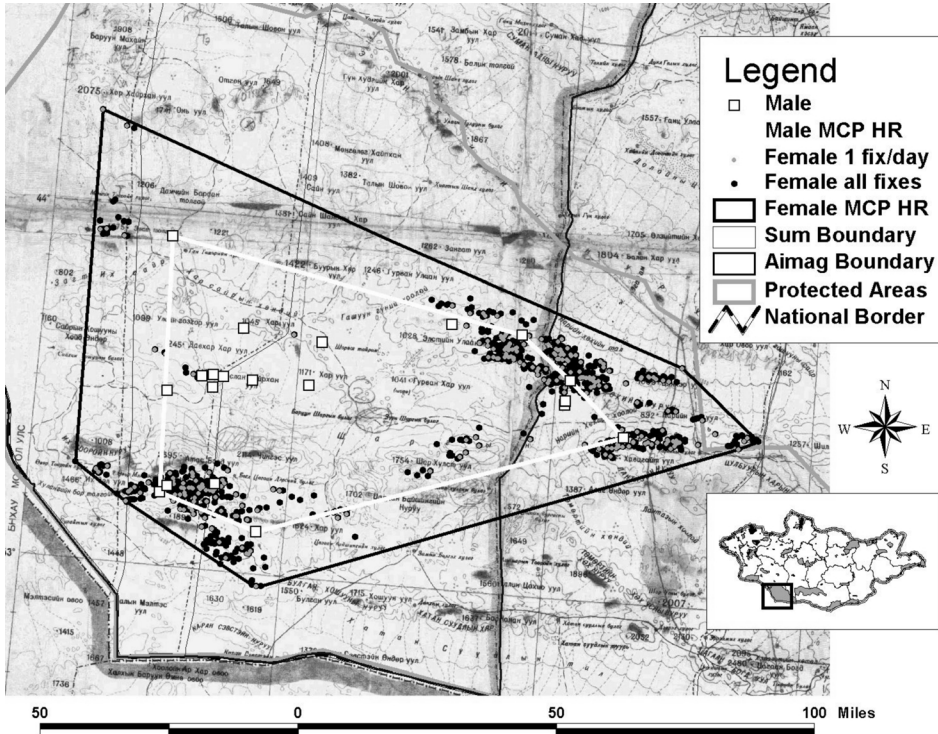


Figure 1: Wild Bactrian camel locations and 100 % minimum convex polygon (MCP) home ranges. Date for Female: October 27, 2002–October 27, 2003. Data for Male: October 10, 2003–March 23, 2004.

Camel movement & home ranges

Unfortunately, we have experienced problems with both satellite telemetry collars we deployed. The Argos collar on the female camel appeared to function well and provide substantial data until it ceased functioning on October 27, 2003 for unknown reasons (one year to the day after being deployed) (figure 1). We suspect technical problems in the collar’s design or from high levels of solar activity that may have disrupted the collar’s circuitry (D. Mattson, pers. comm.). The GPS collar on the male camel has been working only intermittently since deployment, possibly due to the sensitivity of the collar to its position on the animal relative to the satellite (M. Haupt, pers. comm.). That collar has only provided 20 locations since October 2003 and none since March 23, 2004 .

Despite collar problems, we have received valuable data from the two collared animals. It is apparent that we require satellite or GPS collars for wild camels (as opposed to more traditional collars), as the large movements will likely make it impossible to follow these animals on the ground. For example, both animals have displayed long, rapid (i.e., travelling several hundred kilometers in just a few days) movements periodically (figures 2 and 3).

From October 27, 2002 to October 27, 2003 we received 1,139 usable locations (i.e., error smaller than $\pm 1\text{km}$) from our satellite collar on the cow camel for 256 different days (i.e., 4.45 locations/day for days on which we received data, see figure 1). During this time she covered a minimum distance of 4,527.34km (straight line distance between consecutive points, see figure 2). She moved further during winter months (November–March; mean = $497.72 \pm 36.07\text{km}$) than summer months (mean = $291.25 \pm 19.38\text{km}$; April–October, figure 4). This difference was

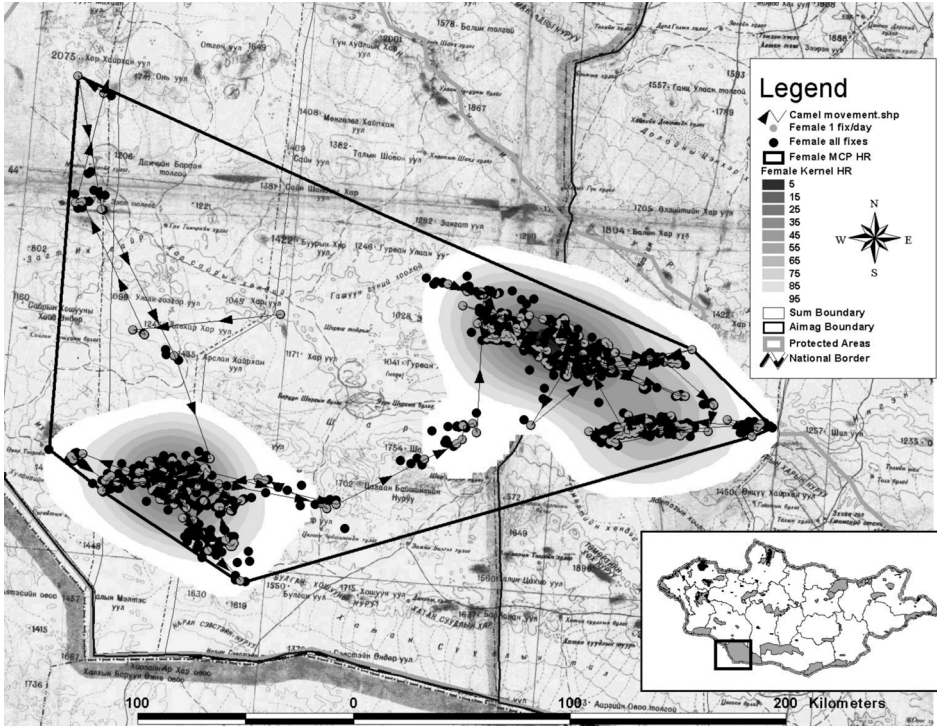


Figure 2: Female wild Bactrian camel movement and home ranges (100 % MCP and 5 %, 15 %, 25 %, 35 %, 45 %, 55 %, 65 %, 75 %, 85 %, and 95 % Kernel).

significant ($t=5.04$, $df=6.3$; $p < 0.01$). During all of this travel, she only left the Great Gobi SPA once for a few days.

Analysis of the telemetry data for the cow indicate that she used a 100 % minimum convex polygon (MCP) home range of 17,232.29 km². Obviously, much of this area was not used and other portions of her range only little used. Her kernel home range sizes (which estimate probability of occurrence) were much smaller, 8,695.74 km² for 95 %, 4,031.12 km² for 75 %, 2,284.42 km² for 55 %, and 611.91 km² for 25 %, and 60.50 km² for 5 % kernel ranges. She seemed to utilize two main areas; one area just south of Atas Mountain in the south-center of the park and the other in the northeastern part of the park in a hilly area.

We have received only 20 GPS locations on our bull camel from October 10, 2003 until March 22, 2004 (figure 1). Most locations were recorded on different days (only twice have we received two locations on one day). During that time, he travelled a total, minimum distance of 683.42km (straight line distance between consecutive points). Although we have few data points, thus far his 100 % MCP home range covers 8,190.60 km², while his kernel home range sizes extend over 7,254.77 km² for the 95 % kernel, 3,741.29 km² for the 75 % kernel, 1,345.78 km² for the 50 % kernel, 585.43 km² for the 25 % kernel, and 115.35 km² for the 5 % kernel home ranges (figure 3).

Plotting kernel home ranges allows us to begin to identify areas of important wild camel habitat by illustrating areas of high use, especially where there are overlaps between animals. While we have only limited data on two wild camels, we are beginning to identify important habitat areas (figure 5). Two areas of importance are evident thus far; 1) the area to the north

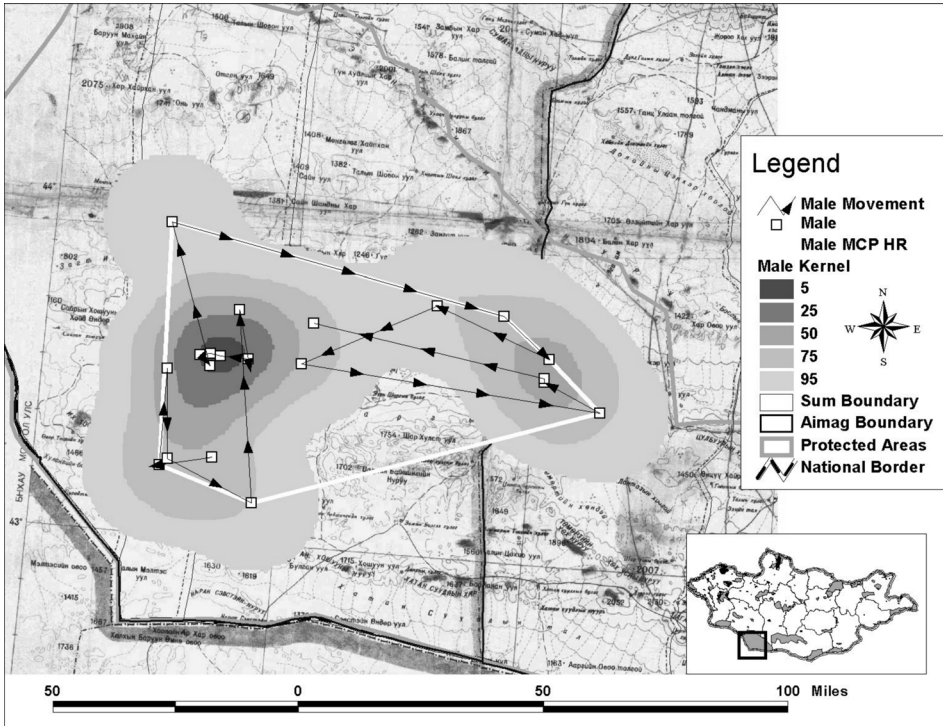


Figure 3: Male wild Bactrian camel movement and home ranges (5%, 25%, 50%, 75%, and 95% Kernel).

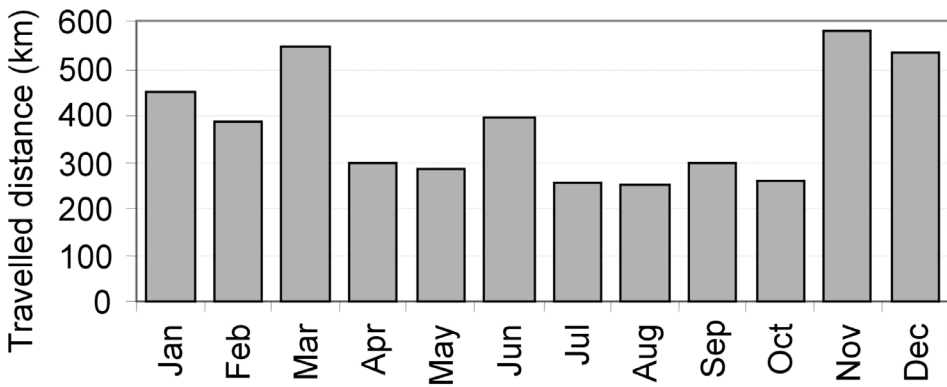


Figure 4: Distance travelled each month by a wild Bactrian camel (*Camelus bactrianus ferus*) cow in Mongolia's Great Gobi, October 27, 2002 until October 27, 2003.

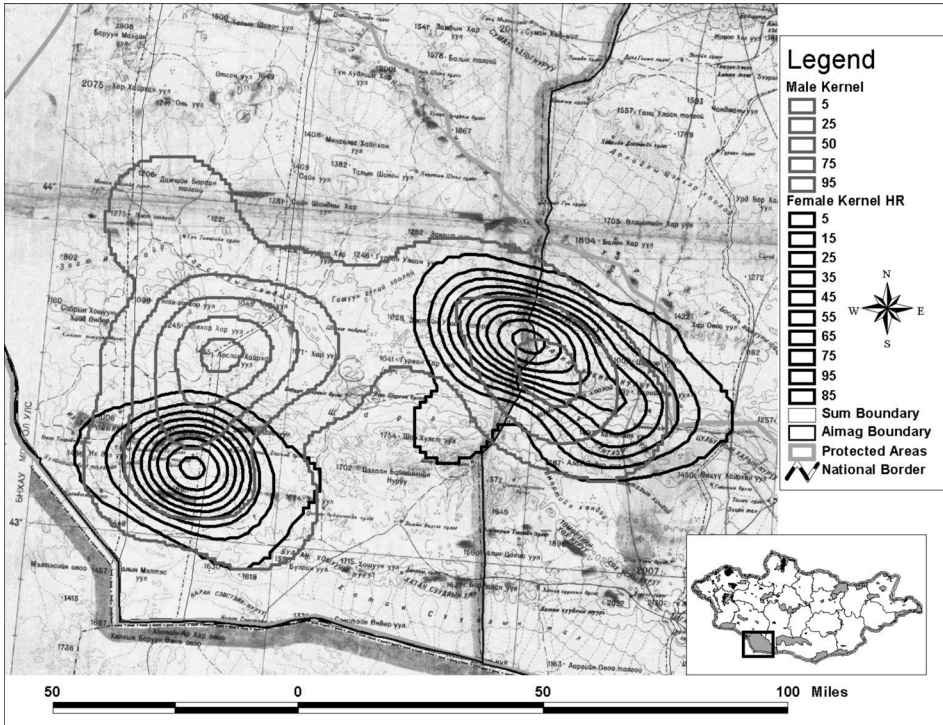


Figure 5: Habitat use by wild Bactrian camels (contours = kernel home ranges as described in figures 2 and 4).

and south of Atas Mountain and 2) the region to the northeast of Khavtsgait (Wild Camel) Mountain, near the Nariin Khokhiin Range. As we gather more data we will hope to correlate home range use with habitat features to determine what makes good camel habitat.

Behavior

From December, 2003 to February, 2004 we collected data on wild camel rutting behavior. During 52 observation days we encountered 78 groups of camels and recorded about 90 hours of observation time from distances as close as 100 m to several kilometers; of this, we recorded twenty hours on video for future analysis. During this time we recorded 13 agonistic encounters between bulls or between females and juvenile camels. Our detailed analysis provide some of the only material (and certainly the most extensive) of wild camel behavior, including agonistic behaviors (e.g., dominance displays, fighting, territorial behavior), play (among young bulls), courtship between cows and bulls, anti-predator behavior (e.g., escape tactics, alarm signals), and other social behaviors (e.g., vocalizations, long distance visual communication). We hope to more fully analyze these behavioral data in the next few months.

Group size, population, & interspecific interactions

Over the past few autumns, mean group size of wild camels we observed was 10.07 ± 1.82 camels ($N=56$, Range = 1–55). During the winter rut, we recorded 78 groups of camels that ranged in size from 1 to 75 individuals (mean = 5 animals/group). From our most rigorous aerial survey,

we estimated a population of $1,985 \pm 802$ camels (95 % confidence levels = 909–4,335) in March 1997 (Reading et al., 1999). Based on past work, we think the true number lies at the lower half of that range, but the population could have changed greatly since that time and another survey is required.

In addition to wild camels, we collected information on domestic Bactrian camel prevalence and locations within Great Gobi SPA and on their interactions with wild camels. It is crucial that the Great Gobi staff begin monitoring and managing domestic camels in the Great Gobi to keep them as segregated as possible from the wild camels. We will share our data on domestic camels with park staff to assist in this process. Because wild and domestic camels can interbreed, segregation is crucial to maintaining the genetic integrity of the wild population. Finally, we collected 23 wolf fecal samples, which we will analyze later to determine the contribution of wild camel to the diet of wolves.

Training

We complemented our field conservation and research with a number of activities that will likely strengthen the capacity of our Mongolian counterparts. This work has included field and workshop training for Mongolian field biologists, professional conservationists, professors, and students. During this training, we imparted a number of field research techniques, as well as data analysis methods and scientific proposal and report writing. In return, our Mongolian colleagues taught the foreign biologists a great deal about the natural history and human culture of Mongolia. This two-way exchange of information and ideas undoubtedly served to greatly strengthen our program.

We helped to develop the Global Environment Facility (GEF)/United Nations Development Programme's (UNDP) project 'Conservation of the Great Gobi Ecosystem and Its Umbrella Species', a project finally funded in late 2002 from a proposal we initiated. We have begun implementing the research and monitoring components of this project, working in close cooperation with the Mongolian Academy of Sciences. As part of this project, we hope to establish a more permanent research station in the Great Gobi SPA to facilitate this work. Throughout this process our ultimate goal is to enable our Mongolian counterparts to initiate and implement these activities on their own in the future.

Acknowledgements

Several people helped make this work possible. Special thanks go to S. Amgalanbaatar, Batorshrikh, Choijin, Dr. T. Galbaatar, B. Lhagvasuren, B. Mijiddorj, and Dr. B. Miller. Funding was provided by the Denver Zoological Foundation, the Trust for Mutual Understanding, Nature Conservation International, the Wilds, the Mongolian Academy of Sciences, Great Gobi Strictly Protected Area, the Argali Wildlife Research Center, Wildlife Reserves Singapore that manages the Singapore Zoo, and the Folsom Children's Zoo and Botanical Gardens.

References

- Anonymous (1988): Great Gobi National Park Management Plan. United Nations Environment Programme, Ulaanbaatar, Mongolia.
- Blumer, E.S., Reading, R.P., Mix, H., Lhagvasuren, B. & Mijiddorj B. (1999a): Development of a Conservation Program for Wild Bactrian Camels in Mongolia. In: *Proceedings of the 7th World Conference on Breeding Endangered Species: Linking Zoo and Field Research to Advance Conservation, May 22–26, 1999*. Edited by: Roth, T. Cincinnati Zoo, Cincinnati, OH, USA. (Abstract)
- Blumer, E.S., Namshir, Z., Tuya, T., Mijiddorj, B., Reading, R.P. & Mix, H. (1999b): Field Studies of Wild Bactrian Camels (*Camelus bactrianus feras*) in Mongolia. In: *Proceedings of the Annual Conference of the American Association of Zoo Veterinarians, Columbus Ohio*,

- October 1999. Edited by: Kirk, C. American Association of Zoo Veterinarians, Media, PA. (Abstract).
- Hare, J. (1997): The wild Bactrian camel *Camelus bactrianus ferus* in China: the need for urgent action. *Oryx* 31: 45–48.
- Hare, J. (1998): *The Lost Camels of Tartary: A Quest into Forbidden China*. Little, Brown and Company, London.
- IUCN (1996): *IUCN Red List of Threatened Animals*. IUCN, Gland, Switzerland.
- Lyda, R., Kirkpatrick, J., Reading, R.P. & Blumer, E.S. (2002): Bactrian camel fecal steroid analysis. In: *Ecology and Conservation of Wild Bactrian Camels, Camelus bactrianus ferus*. Edited by: Reading, R.P., Enkhbileg, D. & Galbaatar, T. Mongolian Academy of Sciences & Denver Zoological Foundation, Ulaanbaatar, Mongolia: 79–84.
- Reading, R.P., Mix, H., Lhagvasuren, B. & Blumer, E. (1999): Status of wild Bactrian camels and other large ungulates in south-western Mongolia. *Oryx* 33(3): 247–255.
- Reading, R.P., Enkhbileg, D. & Galbaatar, T. (2002, Editors): *Ecology and Conservation of Wild Bactrian Camels, Camelus bactrianus ferus*. Mongolian Academy of Sciences and Denver Zoological Foundation, Ulaanbaatar, Mongolia.
- Schaller, G.B. (1998): *Wildlife of the Tibetan steppe*. University of Chicago Press, Chicago, IL, USA.
- Shiirevdamba, Ts., Shagdarsuren, O., Erdenjav, G., Amgalan, Ts. & Tsetsegma, Ts. (1997, Editors): *Mongolian Red Book, Ministry for Nature and the Environment of Mongolia, Ulaanbaatar, Mongolia*. [In Mongolian, with English summaries]
- Tolgat, R. (1995): Results of wild Bactrian camel (*Camelus ferus* Prz.) surveys and their biological meaning. In: *Proceedings from a Conference on the Biology and Nature of Great Gobi Strict Protected Area, 12 June 1995*. Edited by: Badamkhand, J. Ministry for Nature and the Environment, Ulaanbaatar, Mongolia: 87–90. [In Mongolian]
- Tolgat, R. & Schaller, G.B. (1992): Status and distribution of wild Bactrian camels. *Biological Conservation* 62: 11–19.
- UNDP Mongolia (1994): *Biodiversity Project, Implementation Phase Document*. UNDP, Ulaanbaatar, Mongolia.
- Wingard, J.R. (2001): *Compendium of Environmental Law and Practice in Mongolia*. GTZ Commercial & Civil Law Reform and GTZ Nature Conservation & Buffer Zone Development Project, Ulaanbaatar, Mongolia.
- Xiaoming, W. & Schaller, G.B. (1996): Status of large mammals in western Inner Mongolia, China. *Journal of East China Normal University (Natural Science)* 12: 93–104.
- Yongzu, Z. (1991): Mammalian zoogeography and conservation of the endangered species in arid areas of China. In: *Mammals of the Palearctic Desert: Status and Trends in the Saharan-Gobi Region*. Edited by: McNeely, J.A. & Neronov, V.M. The Russian Academy of Sciences & The Russian Committee for the UNESCO Programme on Man and the Biosphere, Moscow: 269–284.

Richard P. Reading

Denver Zoological Foundation
 2900 East 23rd Ave.
 Denver, CO 80205, USA
 rreading@denverzoo.org

Evan S. Blumer

the Wilds
14000 International Road
Cumberland, OH 43732, USA
eblumer@thewilds.org

Henry Mix

Nature Conservation International
Schulzenweg 1
15345 Möllensee, Post Kagel, Germany
international@wildlife-conservation.de

Jadamsuren Adiya

Mongolian Academy of Sciences
Institute of Biology
Ulaanbaatar 51, Mongolia
adiyaj@yahoo.com