2007

Capture and Anaesthesia of the Mongolian Wild Ass (*E. hemionus*)

Chris Walzer
University of Veterinary Medicine, chris.walzer@vu-wien.ac.at

Petra Kaczensky
University of Freiburg, petra.kaczensky@wildlife.uni-freiburg.de

Oogii Ganbaatar
Greater Gobi Strictly Protected Area Part B, takhi@t-online.de

Namtar Enkhsaikhan
International Takhi Group

Davaa Lkhagvasuren
National University of Mongolia, d_lkhagvaa@num.edu.mn

Erforsch. biol. Ress. Mongolei (Halle/Saale) 2007 (**10**): 69-76

Capture and anaesthesia of the Mongolian wild ass (*E. hemionus*)

Ch. Walzer, P. Kaczensky, O. Ganbaatar, N. Enkhsaikhan & D. Lkhagvasuren

Abstract

Science-based conservation efforts in general and wide-ranging equid conservation specifically, often require capture and subsequent handling of the subject animal. Safe and animal-welfare appropriate wild equid capture and anaesthesia is a complex operation necessitating a multitude of skills that require appropriate veterinary training. In order to develop management plans for the Mongolian wild ass (*Equus hemionus*), which range over vast areas the use of radio-telemetry, is an essential tool. Radio-telemetry allows the researchers to better understand the habitat requirements and to delineate the areas of potential wildlife-human conflicts. To date we have successfully captured 16 wild ass in the Gobi regions of Mongolia. The agent of choice for wild ass capture and anaesthesia is the potent opiate ethorphine in combination with specific opiate antagonists that allow for the complete reversal of the anaesthetic effects. The recommended dosage for healthy, adult wild ass procedures anaesthesia is a combination of 4.4 mg ethorphine, 10 mg buthorphanol and 10 mg detomidine. Anaesthesia was reversed with the opioid antagonist-agonist diprenorphine or a combination of 200 mg naltrexone and the alpha$_2$-antagonist 20 mg atipamezole. All wild asses were standing and alert approximately two minutes following administration of the antagonists.

Keywords: anaesthesia, capture, *Equus hemionus*, Gobi, khulan, Mongolia, wild ass

Introduction

Science-based conservation efforts in general and wide-ranging equid conservation specifically, often require capture and subsequent handling of the subject animal. Probably, the two most common research reasons that require the capture of animals are the placement of radio-telemetry devices and the collection of biomedical materials (OSOFSKY & HIRSCH 2000). In order to develop management plans for the Mongolian wild ass (*Equus hemionus*), which ranges over vast areas the use of satellite-based telemetry, is an essential tool. Satellite-telemetry allows the researchers to better understand the habitat requirements and to delineate the areas of potential wildlife-human conflicts.

The Gobi area of Mongolia is home to an estimated 20,000 Asiatic wild asses (*E. hemionus*, khulan or Dziggetai in Mongolian); (READING et al. 2001, FEH et al. 2001, MONGOLIAN MINISTRY OF ENVIRONMENT 2003, KACZENSKY & GANBAATAR unpubl. data). In the IUCN Equid Action Plan the status of *Equus hemionus* is qualified as “insufficiently known” and the species is listed as vulnerable (FEH et al. 2002). Most probably no more than 5,000 individuals remain outside of Mongolia and China and therefore Mongolia is a globally important stronghold of the Asiatic wild ass (FEH et al. 2002). In Mongolia the khulan has been fully protected since 1953. It is listed in appendix I of the Convention on International Trade of Endangered Species (CITES) and in 2002 was included in appendix II of the Convention of Migratory Species (Bonn Convention, CMS 2002). However, due to human population growth in conjunction with severe winters in the past years (UNITED NATIONS DISASTER MANAGEMENT TEAM 2000), the occurrences of herder-khulan conflicts appear on the increase.

Competition for pastures and water and poaching for meat seem increasingly to be becoming a problem in Mongolia. For some parts of the local population, wild ass meat seems to provide a substitute or even a cheap alternative protein source to the increasingly expensive meat from domestic animals (KACZENSKY & GANBAATAR unpubl. data). In 2005, a national survey based on questionnaires, suggested that up to 2,000 wild Asses might be poached each year throughout their distribution range in Mongolia (WINGARD in print). Moreover, political transition in the early 1990’s forced urban populations to return to nomadic land use, resulting in a sharp increase in human- and livestock numbers in many rural areas (FERNANDEZ-GIMENEZ 1999, BEDUNAH & SCHMIDT 2004, MEARNS 2004).

In June 2002 we initiated a khulan project within the frame of the Przewalski's wild horse re-introduction endeavour by the International Takhi Group (ITG) in the Gobi-B Strictly Protected Area (SPA) in SW Mongolia. The Gobi desert of Mongolia is characterized by its remoteness and harsh climate. Hence, equids inhabiting this ecosystem can be expected to cover large ranges in order to meet their dietary and water requirements. In order to monitor movement patterns and habitat use we captured 16 and equipped 14 free-ranging Asiatic wild Asses with ARGOS and GPS-ARGOS satellite collars in the Gobi B strictly protected area (7 animals) and the south Gobi in the Umngovi and Dorngovi aimags (9) (additional project information at www.wildvet.at and http://www.waza.org/conservation/projects/.

Methods

Wild equid capture and anaesthesia is a complex operation requiring a multitude of skills. Prior to capture the purpose and circumstances of the procedure must be considered to be both practical and essential (OSOFSKY & HIRSCH 2000). Every anaesthetic event bears the inherent risk of significant injury and potentially death. Though this risk is for the most part very small it must be ascertained that the procedure is necessary and that the potential gains outweigh the risks (KREEGER et al. 2002). Necessary permits from the Ministry of Nature and Environment must be procured well in advance of the planed event.

Chemical restraint and anaesthesia of wild equids has been markedly refined over the years (WALZER, 2003). The agent of choice for wild equid immobilization and anaesthesia is the potent opiate ethorphine. The opiates interact in the central nervous system (CNS) with stereo-specific and satuarble receptors (KREEGER et al. 2002). Various receptors have been identified. These are classified as kappa, delta, sigma and mu receptors. A major advantage in the use of the opiates, are the specific opiate antagonists that allow for the complete reversal of the anaesthetic effects. Whereas some agents can be classed as sole antagonists (e.g. naltrexone) others have agonist-antagonist properties (e.g. diphrenorphine). The opiate ethorphine is an analogue of thebaine and is in humans 500 times more potent then morphine (JASINSKI et al. 1975, KREEGER et al. 2002). Ethorphine at 2.45 mg / ml is available in Europe and many other parts of the world in combination with acepromazine 10 mg / ml (Large Animal Immobilon, C-Vet Veterinary Products, Leyland, UK). Furthermore ethorphine is available as a mono substance at 4,9 mg / ml and 9,8 mg / ml (M99, Vericore Ltd., Dundee, Scotland). All products are supplied in a container together with the antidote diprenorphine or M5050 in the respective adequate dosages. In North America due to the unavailability of ethorphine a similar even more potent opiate, carfentanil (Wildlife Pharmaceuticals, USA) has been used extensively in equids. However, the effects of carfentanil cannot be equated with those of ethorphine (MORRIS 1992). In the past years several additional non-narcotic immobilization protocols have been developed and used more or less successfully in wild equids (MATTHEWS 1995, MORRIS 1992, VITAUD 1993). For prolonged procedures intubation and inhalation anaesthesia with isoflurane or halothane is recommended.

Ethorphine is reversed either with the opioid antagonist naltrexone (Trexonil, Wildlife Laboratories Inc., Fort Collins, Colorado, USA) or the antagonist-agonist diprenorphine (Revivon, C-Vet Veterinary Products, Lancs, UK). Naltrexone has a longer half-life than diphrenorphine and eliminates renarcotization. Renarcotization is an effect that occurs when using opioids. Several hours after antagonist application the animals once again comes under the influence of the opioid agonist (KREEGER et al. 2002). Especially in equids captured in the wild this effect could be fatal as it potentially makes an individual more prone to predation and injury. The alpha$_2$-agonist detomidine can be reversed with the specific alpha$_2$-antagonist atipamezole (Antisedan, Orion Corp. Farmos Finland).

Specifically for the chemical capture of the khulan these authors presently recommend a combination of the opiate (4.4 mg) ethorphine (M99, Vericore Ltd., Dundee, Scotland), the sedative alpha$_2$ agonist (10 mg) detomidine-HCl (Domosedan, Orion Corp. Farmos Finland) and the mixed antagonist-agonist opioid (10mg) buthorphanol (Torbugesic, Fort Dodge Animal Health, Iowa, USA). Detomidine is a potent alpha$_2$-agonist and acts on the alpha$_2$-adrenergic receptors where it inhibits the release of norephinephrine. Butorphanol is a mu-opioid receptor antagonist and through its action alleviates the marked respiratory depression induced by the ethorphine at the mu-receptor and potentiates the sedative effect at the kappa and sigma receptors. This combination has significantly limited the ethorphine specific pacing which greatly reduces the distance a khulan travels after darting. This is particularly important in the open steppe habitat where khulans darted without the addition of butorphanol could cover several kilometres before becoming recumbent (see table 1).

Table 1: Recommended drug combination for the chemical capture of the Mongolian wild ass (*Equus hemionus*)

drug (generic)	amount (mg/adult)	product name
Ethorphine	4,4	M99, Vericore Ltd., Dundee, Scotland
Butorphanol	10	Torbugesic, Fort Dodge Animal Health, Iowa, USA
Detomidine	10	Domosedan, Orion Corp. Farmos Finland
antagonists		
Diprenorphine	12	Revivon, C-Vet Veterinary Products, Lancs, UK
Atipamezole	20	Antisedan, Orion Corp. Farmos Finland
Naltrexone*	200	Trexonil Wildlife Lab. Inc., Fort Collins, Colorado, USA

*Naltrexone can be used as an alternative to diprenorphine or in combination (100 mg SQ)

When drugs need to be applied over a greater distance specific remote delivery systems are needed. For an excellent review of the various available systems the reader is referred to previous publications (KREEGER et al. 2002). For the capture of the Mongolian wild ass these authors recommend the use of a CO_2 propelled dart gun such as the Daninject JM model (Daninject JM™, Wildlife Pharmaceuticals, Fort Collins, CO 80524, USA). This type of gun is safer and far more versatile when compared to models that use gas generated from .22 cal blank cartridges. When working in the wild these authors prefer to use new 3 ml darts discharged by expanding compressed air (Daninject, Wildlife Pharmaceuticals, Fort Collins, CO 80524, USA). Old darts are not used, as these are never as accurate. In numerous procedures this model of dart allows the shooter to visualise correct drug expulsion by observing forward plunger movement. By shortening the dart stabilizers to 3 cm the effective range is 80 meters under ideal conditions (LENGGER et al. 2002). However, this distance is significantly reduced in the windy conditions often encountered in the Gobi region. A sufficiently long dart needle of 55 mm is required to successfully dart a wild ass during the summer and fall seasons due to significant layers of fat in the rump region. The use of wire barbs or collars on the needle to securely retain the dart in the animal is strongly recommended in order to enable complete drug expulsion.

Once an animal is successfully darted one should attempt to keep it in sight. However, it is very important at this stage too not disturb the animal any further by chasing it or approaching closely before the drugs have taken full effect. Once the animal has become laterally recumbent, an approach on foot from behind and immediate fixation of the head and covering the eyes with a towel is recommended (see fig. 1). Be aware that in the first few minutes of recumbency the animal may become aroused by voices or loud noises and attempt to rise and flee further.

Anaesthesia monitoring should be implemented as soon as the animal is fixed. Sequential rectal temperature measurements, thorax excursion to determine breathes per minute and auscultation for heart rate is the absolute bare minimum in anaesthesia monitoring. Relative percent oxyhemoglobin saturation measured with a battery-powered pulse oximeter (e.g. Nellcor NP-20, Nellcor Incorporated, Pleasanton, California, USA) is an extremely useful tool to determine anaesthesia depth and progression and should constitute.

Fig. 1: A lateral recumbent wild ass is best approached from behind. It is important that the head is immediately fixed and the eyes covered (photo: P. Kaczensky).

Using potent capture drugs bears the inherent risk of human injury. Though prevention is the mainstay in avoiding capture drug related accidents it is important to establish a protocol to deal with eventual problems. Accidental capture drug injection is always to be considered an emergency that will require calm, prompt and organized action. Be aware that the legal implications of administrating medical treatment to accident victims by persons that are not qualified vary from country to country (MORKEL 1993). As a bare minimum in the field the following precautions should be adhered to: use capture drugs only with a second, trained person present; respect the potency of the drugs and do not take chances and under estimate a dangerous situation; never work with opioid drugs without having the human antidote (**NB! never use diprenorphine in humans**) in the emergency kit (see table 2); limit personnel present when working with the drugs. For an excellent review dealing with drug related accidents in the field see previous publications (MORKEL 1993).

Table 2: Capture drug related human emergency kit (adapted from Morkel 1993). The * denote the bare minimum to be carried at all times when using potent opioids such as ethorphine

product	**quantity / size**
Naltrexone (Trexonil)*	20 mg
Naltrexone tablets (Revia)	
Sterile syringes*	2 x 5 ml
Hypodermic needles*	5 x 0.8 mm (21G) 38 mm
Rubber tourniquet and clamp*	
Ambu® bag with face masks	
Hydrocortisone	1000 mg
Adrenaline	20 mg
Intravenous saline 0.9 % solution	
IV drip set	2 x
Sterile peripheral venous catheters	4 x (21G) 0.8 mm

Results

The Mongolian khulan is extremely skittish – most probably due to poaching activities – and in some areas flees human presence at several kilometres distance (e.g. Gobi B SPA). We have employed three distinct techniques to capture this species in the wild. In the summers 2002 and 2005 we used a modified high pressure CO_2 dart gun (Daninject JM™, Wildlife Pharmaceuticals, Fort Collins, CO 80524, USA) from a pre-placed hide, 60-80 meters distant from water points. This method was especially useful in the south Gobi as the khulan are readily approached in the area. Some water points additionally offer good cover which allows for a shooting distance of 40-55 meters. If possible, it is a distinct advantage to take a position high above the water point, as the animals never appear to look up. As open water is lacking in large parts of the distribution range in the south Gobi the khulan must dig to a depth of approximately 45 cm. to access ground water. At this time it is very difficult for animal to see movements in its vicinity. Furthermore the use of ground water greatly increases the amount of time the animals have to remain stationary which additionally greatly facilitates darting. Using this method we have captured 10 wild asses.

In 2003 and 2005 we also employed a chase method where the khulan is darted from a moving jeep. This method has also been used to collar wild Bactrian camels (*Camelus bactrianus ferus*) and is traditionally employed by khulan poachers with 12 gauge shotguns (BLUMER et al. 2002, WALZER & KACZENSKY, unpubl. UNDP report 2005). When using the local UAZ jeeps it is important to remove the window from the passenger side and to provide seatbelts for the driver and shooter. If using the Daninject JM CO_2 dart gun, a short 4 cm barrel can be used instead of the standard barrel as this greatly facilitates movement in the jeep. Once an animal is identified, it is chased till the jeep is able to approach within approximately 10-15 meters on a parallel track (see fig. 2). It is then easily darted in the rump musculature using standard pressure settings. It is essential to define a chase cut off time before the procedure is started. Our experience has shown that a cut off time of 15 minutes is adequate. To date we have captured 6 male khulans with this very time-efficient method. The shortest chase time was 2 minutes and the longest 13 minutes. In no all cases induction was extremely rapid and smooth (4-8 minutes) and body temperature was below 40^0 C. A severe limitation to this method is that one is only able to capture males or juveniles without foals. A chase of a female with a foal would result in (permanent) separation of the young from the mare and is therefore unacceptable.

Fig. 2: A khulan is chased until the jeep is able to approach within approximately 10-15 m on a parallel track. It is then easily darted in the rump musculature using standard pressure settings.

Finally we have used a video-enabled remote controlled CO_2 gun (WALZER & BOEGEL 2003) at several water points in attempts to capture khulan in 2003 and 2005. To date this method has not been successful in khulans mainly due to the abundance of water in the areas it was employed. In the authors view this method has great potential in areas with small waterholes that the animals have to visit (e.g. Gobi A SPA).

In all khulan procedures anaesthesia was induced with a single 3 ml dart containing a combination of 4.4 mg Ethorphine (M99, C-Vet Veterinary Products, Lancs, UK), 10 mg Detomidine–HCl (Domosedan, Orion Corp. Farmos Finland) and 10 mg Buthorphanol (Torbugesic, Fort Dodge Animal Health, Iowa, USA). Anaesthesia was reversed in the first seven cases with an i.v. combination of 200 mg Naltrexone (Trexonil Wildlife Laboratories Inc., Fort Collins, Colorado, USA) and the $alpha_2$-antagonist 20 mg Atipamezole (Antisedan, Orion Corp. Farmos Finland). Reversal was rapid and generally smooth but some signs of excitation related to the collar - head shaking - were noted. In the south Gobi 12 mg of the opioid antagonist-agonist diprenorphine (Revivon, C-Vet Veterinary Products, Lancs, UK) was used. This eliminated head shaking and provided a smoother reversal. We recommend that 100 mg naltrexone be given SQ in combination with the IV diphrenorphine to prevent renarcotization. All animals were standing and alert approximately two minutes following administration of the antagonists (see fig. 3). Presently we have captured 16 and out-fitted 14 khulans in Mongolia. The jeep-chase method proved the most efficient in our primary study area. However, this method is not necessarily applicable to all areas.

Fig. 3: GPS-Argos collared khulan, standing and alert approximately two minutes after the i.v. administration of the opioid antagonist-agonist diphrenorphine (M5050), (photo: P. Kaczensky).

Conclusions

The capture and anaesthesia of the khulan in Mongolia, with the subsequent placement of radio-telemetry equipment and the collection of biomedical samples can make a substantial contribution to the knowledge and conservation of this threatened species. In order for procedures to be safe for both the wild ass and humans involved, a significant amount of veterinary knowledge and training is required. Capture and general anaesthesia can only be as safe as the acquired skills and knowledge of the person performing the procedure allow. These in combination with an adequate anaesthetic protocol and monitoring determine the outcome. The described protocols using a species-specific combination of the potent opiate ethorphine in combination with the $alpha_2$-agonist detomidine and the opioid agonist-anatgonist butorphanol provides rapid and safe anaesthesia for the Asiatic wild ass. The use of the specific opioid antagonists provides a smooth and rapid reversal of the anaesthetic effects.

Acknowledgements

This work has been supported in part by a grant from the Austrian Science Foundation (P14992) and grant 10301 from the Jubiläumsfonds of the Austrian National Bank. The khulan work in the South Gobi was possible due to a grant by the World Bank through the Sustainable Livelihoods project in Mongolia. We gratefully acknowledge the support of the ITG staff, students and rangers in Ulaanbaatar and the Gobi.

References

BEDUNAH, D.J.; SCHMIDT, S.M. (2004): Pastoralism and protected area management in Mongolia's Gobi Gurvansaikhan National Park. - Development and Change **35**:167-191.

BLUMER, E.S.; NAMSHIR, Z.; TSERENBATAAGIIN, T.; MIJIDDORJ, B.; READING, R.P.; MIX H. (2002): Veterinary aspects of wild Bactrian camel (*Camelus bactrianus ferus*) conservation in Mongolia. - In: READING, R.P.; ENKHBILEG, D.; GALBAATAR, T. (eds.): Ecology and conservation of wild bactrian camels. - Ser. conserv. biol. - Ulaanbaatar, Mongolia, pp. 115-122.

CMS (2002): Convention on Migratory Species. Appendix II. - [available from internet: http://www.cms.int/documents/appendix/cms_app2.htm].

EBEDES, H. (1992): Long acting neuroleptics in wildlife. - In: EBEDES, H. (ed.): The use of tranquillizers in wildlife. - Sinoville Printers, Pretoria, Republic of South Africa, pp. 31-37.

FEH, C.; SHAH, N.; ROWEN, M.; READING, R.P.; GOYAL, S.P. (2002): Status and action plan for the Asiatic wild ass (*Equus hemionus*). In: MOEHLMAN, P.D. (ed.): IUCN Equid action plan. - Publication Services Unit, Cambridge, United Kingdom, pp. 62-71. [Available from: http://iucn.org; accessed 10.12.2005].

FERNANDEZ-GIMENEZ, M.E. (1999): Sustaining the Steppes: A Geographical History of Pastoral Land Use in Mongolia. - Geographical Revue **89**: 315-342.

INTERNATIONAL UNION FOR THE CONSERVATION OF NATURE (1998): Species Survival Commission Re-Introduction Specialist Group, IUCN/SSC Guidelines for Re-introductions. - Gland, Switzerland. [Available from: http://iucn.org; accessed 10.12.2005].

JASINSKI, D.H.; GRIFFITH, J.D.; CARR C.B. (1975): Ethorphine in man 1 - Subjective effects and suppression of morphine abstinence. - Clin. Pharmacol. Ther. **17**: 267-272.

KREEGER, J.T.; ARNEMO, J.M.; RAATH, J.P. (2002): Handbook of wildlife chemical immobilization (international edition). - Wildlife pharmaceuticals, Inc., Fort Collins, Colorado, USA, pp. 36-81.

LENGGER, J.; WALZER, C.; SILINSKI, S. (2002): A simple method of range extension in remote injection systems. - In: ERKEN, A. (ed.): Proc. Europ. Assoc. Zoo- and Wildlife Veterinarians (EAZWV). - Heidelberg, Germany, pp. 467-470.

MATTHEWS, N.S.; PETRINI, K.R.; WOLFF, P.L. (1995): Anesthesia of Przewalksi's horses (*Equus przewalskii*) with medetomidine / ketamine and antagonism with atipamezole. - J. Zoo Wildl. Med. **2**: 231-6.

MEARNS, R.; SHOMBODON, D.; NARANGEREL, G.; TUUL, U.; ENKHAMGALAN, A.; MYAGMARZHAV, B.; BAYANJARGAL, A.; BEKHSUREN, B. (1994): Natural resource mapping and seasonal variations and stresses in Mongolia. - RRA Notes **20**: 95-105.

MONGOLIAN MINISTRY OF NATURE AND ENVIRONMENT (2003): Status and distribution of the khulan in Mongolia in 2003. - Unpubl. report, Mong. Min.. Nat. Environm, Ulaanbaatar.

MORKEL, P. (1993): Prevention and management of capture drug accidents. - In: McKENZIE, A.A. (ed.): The capture and care manual. - Wildlife Decision Support and the South African Veterinary Foundation, Pretoria, South Africa, pp. 100-113.

MORRIS, P.J. (1992): Evaluation of potential adjuncts for equine chemical immobilization. - In: KIRK BAER, C. (ed.) Proceedings Joint Meeting of the AAZV-AAWV. San Diego, CA., USA, pp. 235-50.

OSOFSKY, S.A.; HIRSCH, K.J. (2000): Chemical restraint of endangered mammals for conservation purposes: a practical primer. - Oryx **34**: 27-33.

READING, R.P.; MIX, H.M.; LHAGVASUREN, B.; FEH, C.; KANE, D.P.; DULAMTSEREN S.; ENKHBOLD, S. (2001): Status and distribution of khulan (*Equus hemionus*) in Mongolia. – J. Zool. London **254**: 381-389.

UNITED NATIONS DISASTER MANAGEMENT TEAM (2000): DZUD 2000-Mongolia: An evolving ecological, social and economic disaster: A rapid needs assessment report. - United Nations Disaster Management Team (UNDMT): National Civil Defence and State Emergency Commission Ulaanbaatar, Mongolia.

VITAUD, C. (1993): Utilisation de la combinaison anesthesique tiletamine/zolazepam et detomidine chez les zebres de Grant (*Equus burchelli boehmi*) premiers resultats. - Proc. 35th Int. Symp. Diseases of Zoo and Wild Animals, pp. 277-80.

WALZER, C.; BOEGEL, R. (2003): A video-enabled, radio-controlled remote telinjection system for field applications. - In: KIRK BAER, C. (ed.): Proceedings of the American Association of Zoo Veterinarians. - Minneapolis, Mn, USA, pp. 228-229.

WALZER, C. (2003): Equids. - In: FOWLER, M.E.; MILLER, R.E. (eds.): Zoo and Wild Animal Medicine. 5th ed. - WB Saunders Company, Philadelphia, USA, pp. 578-86.

Addresses

Univ. Prof. Dr. Chris Walzer
Research Institute of Wildlife Ecology
University of Veterinary Medicine Vienna
Savoyen Strasse 1
A-1060 Vienna
Austria
e-mail: chwalzer@eunet.at
chris.walzer@vu-wien.ac.at
Tel. + 436641054967
Fax + 4314890915333

Dr. Petra Kaczensky
Department of Wildlife Ecology
and Management
Institute of Forest Zoology
University Freiburg
Tennenbacher Strasse 4
D - 79085 Freiburg
Germany
petra.kaczensky@wildlife.uni-freiburg.de

Oogii Ganbaatar
Greater Gobi Strictly Protected Area Part B
Takhin Tal
Gobi Altai
Mongolia
e-mail: takhi@t-online.de

Dava Lkhagvasuren
National University of Mongolia
Department of Zoology
P.O. Box 46A-537
Ulaanbaatar, Mongolia
e-mail: d_lkhagvaa@num.edu.mn

Namtar Enkhsaikhan
International Takhi Group
Haus der Industriellen Betriebe
Beatenplatz 2
CH-8023 Zurich
Switzerland
e-mail: www.takhi.org

This address is working for all other authors also !!