Przewalski horses, wolves and khulans in Mongolia

Report December 2003, by Petra Kaczensky and Chris Walzer

ITG INTERNATIONAL TAKHI-GROUP

FWF

RESEARCH for CONSERVATION SALZBURG ZOO

ИХ ГОВИЙН ДАРХАН ЦААЗАТ ГАЗАР "Б" NATIONALPARK GOBI B

1 The Przewalski horse population

Status of the population

The summer and autumn months did not see big changes in the takhi population. However, in late August, begining of September we suddenly lost 4 foals and a young adult mare (ORKHON) within 5 days (28. Aug-2. Sept). No carcasses or carcass remains could be recovered. However, on 14 September ORKHON was reported alive 200 km SW of the takhi camp. She was seen together with a group of domestic horses near the Burgastai Myangan river. According to the herder reports, she came to this area 5 days previously (~1 Sept). She was also seen by the border guards along the border fence, was caught by some herders who took her satellite collar off and also saddled her in an attempt to ride her (!) – which failed. Apparently some people almost shot her, assuming she was a khulan (according to reports she was only spared because there is a custom not to kill single animals). In the end, a passing herder from Takhin Tal identified the "lonely khulan" as a takhi and informed the takhi camp.

Together with resisdent veterinarian Jochen Lengger, Sukhee, Ganbaa and the rangers captured ORKHON on 17. Sept, anaesthetized her, put her in a transport box and drove her back on a very bad dirt road to Takhin Tal. After the 9 hr. transport, ORKHON was in better shape than her captors and was released unhurt. The interpretation of what made the young mare cover 200 km in 2 days has still to be found. Speculations range from a wolf attack triggered movement to human interference of some kind. By mid November 2003 there were 59 takhis in 5 groups in Takhin Tal (Table 1). Unfortunately only 7 of the 13 foals (54%) born in spring were still alive in fall.

Fig. 1: Tayan group *in June 2003.*

Table 1: Most recent group composition and fate of the free roaming horses in the Gobi B strictly protected area (10.November 2003).

name	sex	born	age	origin	arrival	own	mother	father
Pas group - 14 adults/subadults + 3 foals								
KHOWCH /PAS	stallion	24.04.89	14	Askania Nova	22.06.93	1818	548	896
CHANADAGA	mare	11.05.91	12	Askania Nova	22.06.93	2130	600	1159
Chanadagas foal	mare	23.06.03	0	Gobi B		?	2130	1818
SHAGAI	mare	15.06.91	12	Askania Nova	22.06.93	2141	966	1008
Shagais foal	mare	02.06.03	0	Gobi B	-	?	2141	1818
UUGAN	mare	02.09.92	11	Tachin Tal	-	2398	1831	?
Uugans foal	stallion	12.06.03	0	Gobi B	-	?	2398	1818
BULGA	mare	07.05.95	8	Langenberg	18.06.96	2787	2018	1374
MICHID	mare	13.05.96	7	Tierpark Berlin	11.06.98	2921	744	2041
TOOT	mare	11.05.97	6	Zoo Berlin	11.06.98	3072	1813	1618
OODON	mare	30.07.99	4	Whipsnade/London	14.06.02	3332	?	?
NOMKHON	mare	07.05.02	1	Gobi B	-	?	2141	1818
TELMEN	mare	15.05.02	1	Gobi B	-	?	3072	1818
JAVKHLAN	mare	20.05.02	1	Gobi B	-	?	2130	1818
BOSOO	stallion	21.05.02	1	Gobi B	-	?	2398	1818
OROO	mare	24.05.02	1	Gobi B	-	?	2787	1818
KHERLEN	mare	26.05.00	3	Tachin Tal	-	T203	3035	2363
***o** lost MICHIDS foals - disappeared*								
***o** lost KHERENs foal - disappeared*								
Mundol group - 10 adults/subadults + 1 foals:								
MONDOL	stallion	10.05.97	6	Tachin Tal	-	3069	2130	1818
ZAGAL	stallion	10.05.02	1	Gobi B	-	?	3035	2866
IMJ	mare	02.08.94	9	Schwerin	04.06.98	2748	1436	1236
TSAGAADAI	mare	06.06.96	7	Tachin Tal	-	2940	1297	1772
MANDAL	mare	26.05.02	1	Gobi B	-	?	2940	2866
SOIR	mare	31.03.97	6	Langenberg	01.06.00	3045	2018	1374
MISHEEL	mare	28.05.97	6	Tachin Tal	-	3084	1977	1159
KHOKHOO	mare	19.11.96	6	Langenberg	01.06.00	2984	1359	1374
DOROTHEE	mare	06.06.99	4	Tachin Tal	-	3230	3035	2503
Dorothees foal	mare	06.06.03	0	Tachin Tal	-	?	3230	3069
ORKHON	mare	15.07.00	3	Tachin Tal	-	T212	2645	2363
***o** lost MISHEELs foal - disappeared*								
***o** lost KHOHOOs foal - disappeared*								
Tuulai group - 6 adults/subadults								
TUULAI	stallion	07.05.96	7	Tachin Tal	-	2911	1825	1159
YYL	mare	17.04.94	9	Oberwil	10.06.97	2712	486	1772
KHEREM	mare	28.07.02	1	Gobi B	-	?	2712	2866
TAGTAA	mare	05.05.98	5	Winterthur	01.06.00	3143	2483	1742
MARAL	mare	23.05.00	3	Tachin Tal	-	T202	3038	2363
ERDENE	mare	19.02.98	5	Rotterdam	14.06.02	3040	?	?
***o** KHERLEN and her foal changed to Pas group*								
***o** ORKHON changed to Mundol group*								

Tayan group - 6 adults:								
TAYAN	stallion	24.04.97	6	Tierpark Berlin	11.06.99	3066	1431	2041
MONDOR	mare	17.06.98	5	Springe	14.06.02	3194	?	?
MONGON	mare	06.05.99	4	Winterthur	14.06.02	3273	?	?
TSAKIR	mare	02.06.99	4	Tierpark Leipzig	14.06.02	3298	?	?
ZOGII	mare	15.05.00	3	Winterthur	14.06.02	?	?	?
ZORGOL	mare	20.05.00	3	Winterthur	14.06.02	?	?	?
Bachlor group - 8 adults/subadults:								
HUBSUGUL	stallion	21.05.97	6	Langenberg	11.06.99	3233	1320	1374
ZANDAN	stallion	28.05.98	5	Gobi B	-	3166	2398	1818
KHUCHIT	stallion	16.06.99	4	Langenberg	14.06.02	3320	?	?
MOOGII	stallion	08.10.99	4	Neusiedl/Wien	14.06.02	3342	?	?
MYANGAN	stallion	01.05.00	3	Tachin Tal	-	T204	1669	2866
MAGNAI	stallion	02.07.00	3	Rotterdam	14.06.02	T154	?	?
SELENGE	stallion	28.08.00	3	Marvel Zoo	14.06.02	T160	?	?
ZUUN	stallion	01.05.01	2	Tachin Tal	-	T214	2786	2363
Jiguur group (captive group) - 8 adults/subadults + 3 foals:								
JIGUUR	stallion	12.06.92	11	Langenberg	18.06.98	2363	486	1772
KHALIUNAA	mare	16.03.88	15	Australien, Monarto	05.06.95	1669	954	982
Khaliunaas foal	stallion	22.05.03	0	Tachin Tal		?	1669	2363
SOGOO	mare	01.12.92	10	Australien, Dubbo	05.06.95	2586	974	787
OSAMA	stallion	11.09.02	1	Tachin Tal	-	?	2586	1772 or 1818
OD	mare	23.04.94	9	Prag	18.06.98	2645	1847	1135
Ods foal	mare	09.04.03	0	Tachin Tal	-	?	2645	2363
GURGUUL	mare	07.05.95	8	Winterthur	10.06.97	2786	1879	1742
Gurguuls foal	stallion	03.04.03	0	Tachin Tal		?	2786	2363
KHONGOROO	mare	10.05.95	8	Tachin Tal	-	3038	1972	1159
SONJA	mare	13.06.00	3	Salzburg	14.06.02	?	?	?

Monitoring of the free-roaming groups with GPS/ARGOS transmitters

At the end of October we re-captured stallion TAYAN to remove the ARGOS collar that had failed by the end of May. He was not re-equipped with a collar due to the risk that frequent fighting of stallions might again result in a destroyed collar. In addition, we changed the collar of the mare UUGAN in *Pas group*. This collar had been silent since mounting in fall 2002. She was a equipped with a new collar. and thus at present we monitor three horses in three groups with ARGOS/GPS technology: UUGAN (*Pas group*), SOIR (*Mundor group*) and MONDOR (*Tayan group*)(Fig. 2). All collars work as expected. UUGAN's collar is being evaluated in the USA in order to possibly retrieve logged GPS data from the on-board storage.

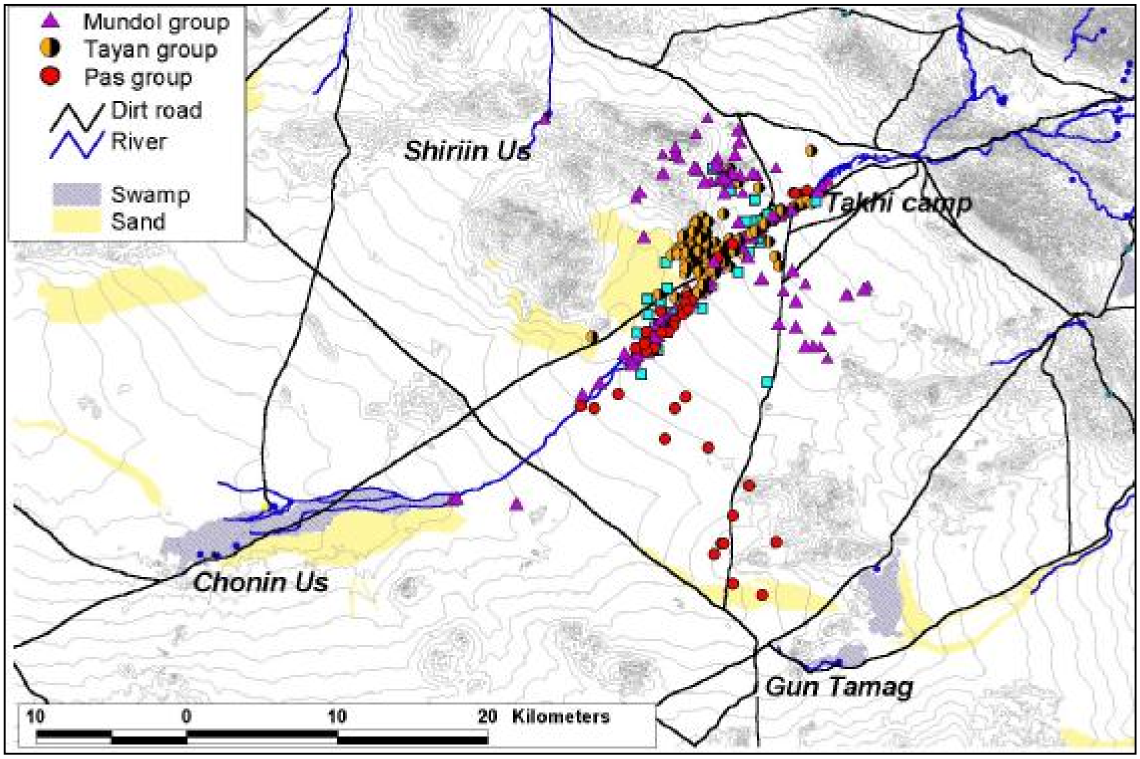

Fig. 2: Takhi locations, based on GPS satellite data, July-November 2003.

2 Wolf population status and feeding ecology

Wolf monitoring

The wolf BOROO is still transmitting locational data on a regular basis. Contrary to the expectation of local herders and the camp staff, she did not leave her usual range during the summer to follow herders and their livestock into the high mountains. The area covered only slightly increased since July to a total of about 480 km^2 by begining of November 2003.

3 Khulan movements and habitat use

Radiotracking of khulans

The collars of all 6 radiocollared khulans still transmit as expected. Movement patterns did not differ much from those observed last year – none of the marked animals ventured out of the strictly protected area (Fig. 3).

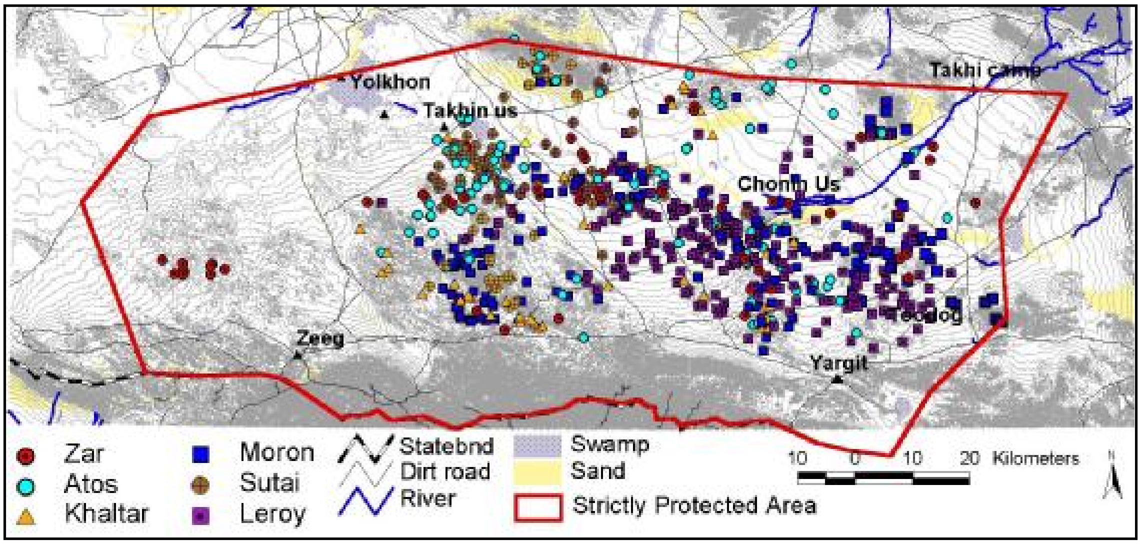

Fig. 3: Locations of 7 khulans monitored in the Gobi B National Park from July-November 2003.

4 Wildlife monitoring

Wildlife counts in the eastern part of the SPA are now conducted early each month. In addition, one test-survey covering the whole park was conducted in mid October (Fig. 4). The total transect route was about 750 km, but three additional areas need to be sampled in the future.

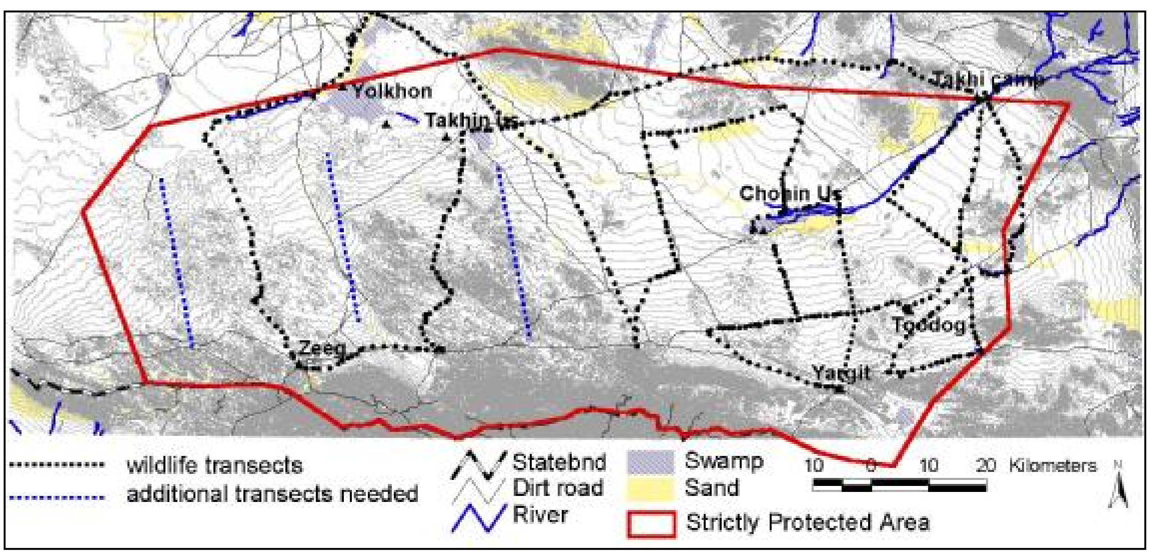

Fig. 4: Wildlife transects driven in October 2003 in a first attempt to cover the whole park. In the western part some additional sampling is necessary.

The wildlife transects covering the whole park not only give a better estimate of ungulate numbers and distribution, they also allow for a better control of human activities in the park. During the survey all 3 military stations were visited and checked for illegal saxaul consumption. It turned out that all stations use saxaul almost exclusively for firewood due to inadequate stoves for burning dung. We agreed to provide one dung stove per military station and to organize training courses to build dung stoves to replace the old, inefficient ones (about 8-10 stoves per military base). In addition, several trucks were checked and people were informed that collecting saxaul in the park is illegal and what fines would be issued in case of rule violations.

Lights criss-crossing the gobi at night, fresh off-road car tracks and the remains of two freshly killed khulans were obvious signs of ongoing poaching activities. Therefore we also stopped at all herder camps and questioned people about signs of wildlife and explained the protected status of all wildlife – except wolves – in the park. From two herders that were encountered with loaded guns, the locks of their guns were confiscated by the rangers to make sure they would obey the regulations.

5 Veterinary Research

5.1. Feeding ecology of reintroduced Przewalski's Horses

(Report Jochen Lenger Dec. 2003)

Since the early 1990´s the Przewalski's Horses or Takhis have been reintroduced into the desert-steppe ecosystem of the Gobi B strictly protected area. These captive-borne animals have to adapt to their new environment as well as to predation, harsh climate, diseases, water and food shortage. The Przewalski's Horses potentially compete with other wild life (wild ass and black tailed gazelle) and domestic livestock (sheep, goat, cattle, horse, and camel) for limited nutritional resources (Walzer 2003). In September 2003 a project funded by the Austrian National Banks "Jubiläumsfonds" Nr. 10301 started which concentrates on the plant utilisation of the reintroduced Przewalski´s Horses.

Main study objectives:

- Evaluate the use of different plant species by reintroduced Przewalski Horses in the desert-steppe environment.
- Evaluate the competition with other equids.
- Evaluate differences in the feeding strategies of newly released versus established Przewalski horse groups.
- Compare these data to the data of other equids within the study area.
- Estimate the total uptake of various nutrients.

Technique: Most plant species have a characteristic pattern of long chain n-alkanes in their cuticular wax. This permits the estimation of diet composition from the pattern of alkanes in the faeces and in the plants available (Dove and Mayes 1996). This method allows to differentiate about 7 different plant species per faecal sample (Tataruch pers. comm. 2003).
To get an overview on which plants to concentrate in the chemical analyses a microhistological evaluation of faeces should be done. This technique would allow to relate faecal particles to reference samples of certain plant species. Due to this procedure we will be able to focus on major foraging plants.

Working program: Plant and faecal samples are collected simultaneously. Additionally GPS data, Takhi group identity, weight and dry weight are noted for each sample. A solar oven and the dry Mongolian climate allow to dry all samples within 24 to 48 hours. After this procedure the samples are packed into plastic bags and are ready for shipment.
In the time from mid September to mid November 2003, 60 plant samples of 22 different species were collected within the home range of all 5 reintroduced Takhi groups. Simultaneously 21 faecal samples of *Equus przewalskii*, 10 of *Equus hemionus* and 4 of *Equus caballus* (in total 35 samples) were collected. After homogenisation the alkane concentrations will be determined by gas chromatography in all samples. The alkan profile of plant species and faecal samples will allow us to qualitatively assess the proportions of plant species in the diet. In addition the Weender analysis will enable us to estimate the total uptake of various nutrients.

List of collected plants: *Ceratocarpus arenarius, Cargana leucophloca, Convolvulus Gortschakovii, Artemisia gobica, Ajania Fruticulosa, Nanophyton erinaceum, Reaumuria soongarica, Elymus secalinus, Alluim mongolicum, Ephedra Przewalskii, Iris tenuifolia, Zygophyllum pterocarpum, Carex duriuscula, Stipa gobica, Anabasis brevifolia, Artemisia xanthochroa, Achnatherum splendens, Agropyron desertorum, Eurotia ceratoides.*

Acknowledgements: These investigations are financed by the fund of Austrian National Bank (Jubiläumsfond Nr.10301).

Reference list

Dove, H. and R.W. Mayes (1996), Plant Wax Components: A New Approach to Estimation Intake an Diet Composition in Herbivores. The Journal of Nutrition 126 (13-26)
Walzer, C. (2003), Grant-Proposal to the "Jubiläumsfonds" der Österreichische Nationalbank: the Utilization of different plant species by reintroduced Przewalski´s horses and other ungulates in the Bobi-B national Park in Mongolia.

5.2. Piroplasmosis Project

Beginning on the 9th of March 2003, Dr. Simon Ruegg started working at the Institute of Parasitology at the University of Zürich. The first task was to find financial sources for the piroplasmosis project. A research focus and corresponding grant applications were developed during the following three months. Applications were submitted to the "Froschungskredit 2003" of the University of Zürich and to the Roche Research foundation. Further applications to the "Stiftung für das Pferd", the Karl-Enigk-Stiftung and the "Nachwuchsförderungskredit" of the University of Zürich were planned, but abandoned when the grant from the "Froschungskredit 2003" was received. The reports from this fund can be viewed at http://www.unizh.ch/forschung/dienste/forschungskredit03.html.
Simultaneously the mathematical model for equine pirplasmoses was further developed. Simon modified the output from a point estimate for the parameters to confidence intervals. This was done by altering the model design from a single function to a series of ordinary differential equations (ODEs), which describe the change of different categories (details can be viewed in the publication). The model was then confronted with the data with the most-likelyhood method. With the new results from the model and major modifications the original paper was rewritten and will be submitted to the Journal of Wildlife Diseases in the spring.
In August, contact was established with Prof. Hiepe from the Institute of molecular parasitology at the Humbold-University in Berlin. He previously worked in Mongolia specifically with ticks and gave valuable advice as well as possible contacts in Mongolia. Also, some useful literature could be copied

from his library. With this new data the project plan was developed throughout the year and finally submitted to the PhD-commission of the VETSUISSE faculties on December 18th.
The project was presented at different occasions. The results of his thesis were presented at the IZW congress in Rome in May. In November a short report was published in the magazine of the University of Zürich (http://www.unipublic.unizh.ch/magazin/gesundheit/2003/1069/index.html). In December the thesis was honoured with the faculty prize of the veterinary faculty of Berne for the best scientific thesis.

Outlook 2004
The first six weeks of 2004 will be occupied with a course in vector biology and identification at the London School for Hygiene and Tropical Medicine. Then Simon will leave for a field trip to Takhin Tal in the middle of March. In Ulaanbaator a meeting with Dr. Theinert is planned, who is the contact person and tick expert of Prof. Hiepe. The field trip will last for the entire activity period of adult ticks, i.e. until middle of June. In Zürich the collected samples will be further processed and analysed.

Acknowledgements: This project is run under the auspices of the Institute of Parasitology of the University of Zurich. PD Dr. A. Mathis and Dr. P. Torgerson will supervise the underlying project with equal responsibility. Prof. A. Barbour from the Institute of Mathematics of the University of Zürich will act as external supervisor and provide advice in mathematical matters. Prof. P. Deplazes will supervise the tick culture in captivity and the infrastructure involved. PD Dr. C. Walzer will provide the infrastructure in the field as well as the necessary contacts in Mongolia.

The Forschungskredit 2003 of the University of Zürich supports the project with CHF 110'000.- for two years. Further expenses are covered by the Institute of Parasitology of the University of Zürich and ITG.

6 Other activities

Congresses

Petra Kaczensky, Chris Walzer and Nadia Robert attended the 3rd International Wildlife Management Congress in Christchurch, New Zealand from 1-5 December 2003. They each gave talks on:
Chris Walzer: *Reintroduction of Przewalski's horses to the Dzungurian Gobi in SW Mongolia*
Petra Kaczensky: *Movement patterns of Asiatic Wild Ass in SW Mongolia*
Nadia Robert: *Pathological investigations of reintroduced Przewalski's horses in Mongolia – what can be learnt*? (see abstracts in appendix)

In addition, two posters were presented, one on our experiences with GPS / ARGOS telemetry and one on management issues concerning the wolf in the Gobi B Strictly Protected Area (see posters in appendix).

Vegetation mapping

Henrik van Werden, University of Marburg came back from Takhin Tal bringing with him a good collection of plants. Quite a few surprises and many species that had not been described for the area previously (see short progress report in appendix).

7 Acknowledgements and Funding

The project is conducted within the framework of the Przewalski horse reintroduction project of the International Takhi Group (ITG), in cooperation with the Mongolian Ministry of Nature and Environment and the National University in Ulaan Baatar, Mongolia. Funding for the research part on takhis, wolves and khulans is provided by the Austrian Science Foundation (FWF project P14992) and the Austrian National Bank (Jubiläusfondprojekt Nr. 10301) through the Zoo Salzburg (Research for Conservation). Funding for the piroplasmosis project is provided by the Forschungskredit 2003 of the University of Zürich. In Mongolia work would not have been possible without the help of the rangers ("takhi men") and local people from Tachin Tal – many thanks for their help, patience and their incredible hospitality.

abstracts for talks:

Monday 1 December 1710 Managing wildlife and ecosystems

WALZER, Chris, Petra KACZENSKY, Christian STAUFFER, and Zedensodnom SUCHEBAATAR.

ITG – Research, Zoo Salzburg, A-5081 Anif, Austria (CW, PK); ITG, c/o Waldamt der Stadt Zürich, Amtshaus V, Werdmühleplatz 3, 8023 Zürich, Switzerland (CS); ITG field station Takhin Tal, Bugat Sum, Mongolia (ZS).

REINTRODUCTION OF PRZEWALSKI'S HORSES TO THE DZUNGURIAN GOBI IN SW MONGOLIA.

The Przewalski's horse (*Equus caballus przewalskii*), or takhi in Mongolian, became extinct in the wild by the mid 1960's. The last recorded sightings of Przewalski's horses occurred in the Dzungarian Gobi desert in SW Mongolia. The species has only survived due to captive breeding based on 13 founder animals. The private Christian Oswald Fund (COS) and the Mongolian Society for the Conservation of rare animals (MSCRA) of the Ministry of Environment initiated the Takhin Tal Project with the support of various international sponsors. In 1999 the International Takhi Group (ITG) was established to continue and extend this project in accordance with the IUCN reintroduction guidelines. In 1992 the first group of captive born Przewalski's horses were airlifted to the Takhin Tal site (45.53.80 N, 93.65.22 E) at the edge of the 9000 km^2 Gobi-B National Park and International Biosphere Reserve. Subsequent transports were carried out in the following years and to date a total of 73 horses have been transported. In 1997 the first harem group was released into the wild from the adaptation enclosures and 1999 the first foals were successfully raised in the wild. At present 62 Przewalski's horses live at the Takhin Tal site. Today 38 horses belonging to 3 harems and 1-bachelor group range freely in the Gobi-B national park. Comprehensive interdisciplinary monitoring and research are the foundation for management decisions. Due to it's important symbolic value in Mongolian culture the Przewalski's horse has become an important vehicle for national park development.

13. **KACZENSKY, Petra and Chris WALZER**

International Takhi Group – Research, Zoo Salzburg, A-5081 Anif, Austria.

EVALUATION OF ARGOS AND GPS / ARGOS TELEMETRY FOR MONITORING PRZEWALSKI'S HORSES AND ASIATIC WILD ASS IN MONGOLIA

The Gobi desert of Mongolia is characterized by its remoteness and harsh climate. Hence large ungulates 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 equipped three free-ranging Asiatic wild asses (*Equus hemionus*) and one Przewalski's horse (*Equus przewalski*) with ARGOS satellite collars and an additional six Przewalski's horses with GPS / ARGOS satellite collars. ARGOS collars were programmed to transmit continuously during 7 hours every day. GPS / ARGOS collars were programmed to attempt to acquire 6 GPS locations (battery life 1 year) and 3 GPS locations (battery life 1 year) every day, respectively. These locations were stored on board and transmitted every third day via ARGOS uplink during a 7-hour transmission period. On average ARGOS collars managed to acquire between 0.63 and 2.21 locations per 7-hour transmission period (location error ≤ 1,000 m – reliable locations). Reliable locations only made up for 22% (15-35%) of all locations for the ARGOS collars. GPS / ARGOS collars were much more successful and on average acquired 39% (30-50%) reliable locations per transmission period, plus an additional 1.9 and 3.4 to 3.9 GPS locations per day. However, while all ARGOS collars are still functioning after a 7 month monitoring period, three GPS / ARGOS collars failed prematurely. During one year we received GPS and ARGOS locations simultaneously for three Przewalski's horses. ARGOS data proved to be sufficient to describe general movement patterns and spatial requirements in the coarse grained Gobi habitat.

ROBERT, Nadia, Christian WALZER, Simon R. RÜEGG and Christian STAUFFER

Center for Fish and Wildlife Health, Länggass-Strasse 122, 3001 Berne, Switzerland (NR, SRR); the Zoo Salzburg, 5081 Anif, Austria (CW); International Takhi Group, c/o Waldamt der Stadt Zürich, Werdmühleplatz 3, 8023 Zürich, Switzerland (CW, CS).

PATHOLOGICAL INVESTIGATIONS OF REINTRODUCED PRZEWALSKI'S HORSES IN MONGOLIA – WHAT CAN WE LEARN?

The Przewalski's horse (*Equus caballus przewalskii*) became extinct in the wild by the mid 1960's, and the species has survived only due to captive breeding. Since 1999 the International Takhi Group (ITG) has run the Takhin Tal reintroduction project, including a disease-monitoring program. All dead horses have been examined since then, and samples submitted for further investigations. Equine piroplasmosis, a tick-transmitted disease caused by *Babesia caballi* and *Theileria equi*, is endemic in Takhin Tal and has been identified as cause of death of three stallions and one stillborn foal. In December 2000, wolf predation had been reported to be the cause of loss of several free-ranging Przewalski's horses, but thorough clinical examination, pathological and bacteriological investigations showed that the horses were weakened by a strangles infection, making them easy prey for wolves. Other identified occasional causes of death were exhaustion, wasting, urolithiasis and pneumonia. The pathological examinations of the dead Przewalski's horses in Takhin Tal did not permit a definitive diagnosis in each case, but they revealed the importance of several disease factors during the initial phase of the project, which could potentially jeopardize the establishment of a self-sustaining population. Pathological and other investigations in remote field projects often represent a challenging task, but this study shows that in spite of the difficult circumstances, such as extreme weather conditions and remoteness, important information can be gained from examination of the collected samples.

abstracts for posters:

KACZENSKY, Petra and Chris WALZER:

Evaluation of ARGOS and GPS / ARGOS telemetry for monitoring Przewalski's horses and Asiatic Wild Ass in Mongolia

International Takhi Group – Research, Zoo Salzburg, A-5081 Anif, Austria

The Gobi desert of Mongolia is characterized by its remoteness and harsh climate. Hence large ungulates 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 equipped three free-ranging Asiatic wild asses (*Equus hemionus*) and one Przewalski's horse (*Equus przewalski*) with ARGOS satellite collars and an additional six Przewalski's horses with GPS / ARGOS satellite collars. ARGOS collars were programmed to transmit continuously during 7 hours every day. GPS / ARGOS collars were programmed to attempt to acquire 6 GPS locations (battery life 1 year) and 3 GPS locations (battery life 1 year) every day, respectively. These locations were stored on board and transmitted every third day via ARGOS uplink during a 7-hour transmission period. On average ARGOS collars managed to acquire between 0.63 and 2.21 locations per 7-hour transmission period (location error ≤ 1,000 m – reliable locations). Reliable locations only made up for 22% (15-35%) of all locations for the ARGOS collars. GPS / ARGOS collars were much more successful and on

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KACZENSKY, Petra, Namtar ENKHSAIHAN, R. SAMJAA, and Chris WALZER

Wolf damages and wolf management in the Gobi B Strictly Protected Area in SW Mongolia

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Mongolian rural economy is largely based on livestock. Hence the gray wolf (*Canis lupus*) is generally regarded a pest species and is the only animal in Mongolia which can be hunted any time and anywhere, including protected areas. The Gobi B Strictly Protected Area (9,000 km²) in SW Mongolia is and has always been a traditional livestock grazing area, despite its protected status. With the help of interviews we assessed herder- and livestock presence, livestock losses due to wolves and hunting pressure on wolves within and adjacent to the park. In total, 104 families with more than 70,000 heads of livestock use the park predominantly in winter and additionally during spring and fall migration. Yearly loss of livestock varies considerably between individual herders and years, but on average 2% of livestock are lost to wolf predation. Relatively, the larger, unguarded stock (horses, cattle and camels) suffers higher wolf mortality than the small, guarded stock (sheep and goats). Local herders persecute wolves opportunistically with most wolves being killed from motorized vehicles. Hunting pressure appears high, averaging roughly 1 wolf killed per 100 km². Despite this high death toll, wolf numbers are generally believed to increase, while hunting pressure is perceived to have decreased. The Gobi B SPA might act as a sink habitat for wolves dispersing from the more inaccessible mountain ranges surrounding the park. With motorized vehicles becoming more accessible and affordable wolf hunting might well threaten the population in the future. In addition, uncontrolled, but legal wolf hunting in the park facilitates poaching of protected species like black tailed gazelle (*Procapra subguturosa*) and Asiatic wild ass (*Equus hemionus*).

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Interim Report:

Mapping of vegetation units of the Great Gobi B Strictly Protected Area

Summary

We worked from the mid of July to early September 2003 in the Great Gobi B Strictly Protected Area. Sample sites were selected with the aid of an unsupervised classification and a Red-Green-Blue image mosaic. 210 sample points were taken with a Braun Blanquet approach based on a standard work sheet. 300 additional points were recorded as "fast plots", records were kept on a dictaphone and included plant cover of dominating and important character species. Every unknown plant species was collected and will be determined within the next months in Mongolia and Germany.
Afterwards, samples will be classified into plant communities providing a classification system for the study area. The plots will be used as training areas for an supervised classification of the Landsat images. In a final step, based on a digital elevation model of the GGB Strictly protected area, the raster data classification will be refined.

Introduction

One of the primary goal in the Great Gobi B strictly protected area is to establish a stable population of "Takhi", e.g. the Przewalski-Horse. Other mammals are also in the focus of the protection, for example khulan, gazelles, wolves, ibex, snow leopard and foxes. Several species of small mammals occur, some of which are listed of the "Red species list" (www.redlist.org). More than 110 Bird species have been recorded for the park, of which several are also on the "Red Species List".
With an area of approximately 9,000 square kilometres, the GGB-strictly protected area is smaller than Gobi A strictly protected area and Gobi Gurvan Saikhaan national park (GGS NP) in southern Mongolian, but is still much larger than most European national parks. Covering mainly semi-desert and steppe habitats, even high mountain ecosystems (up to 2,900 m above sea-level) are included in the park. Thus the vegetation is widely dominated by deserts with Chenopodiaceae, such as Saxaul (*Haloxylon ammodendron*) and *Anabasis brevifolia*. Asteraceae such as *Artemisia* ssp. and Poaceae like *Stipa* and *Ptilagrostris* cover huge areas in the steppe habitats, while alpine genera such as *Festuca*, *Juniperus*, *Lonicera*, and *Gentiana* species are restricted to the high mountain ecosystems in the southernmost part of the park.
Several species grow only close to the oases in the park, which are characterised by halophytic genera such as *Triglochin*, *Puccinellia* and *Halerpestes*, but also halo-tolerant genera like *Tamarix* and *Achnatherum*. Trees (*Salix* ssp. and *Populus diversifolia*) were only found in the buffer zone of the strictly protected area.
Other surveys of the vegetation of the Dzungarian Gobi (to which the strictly protected area belongs, Grubov 2001) are rare. Hilbig (1995, 2000) published a few impressions of the vegetation, especially concerning the northern part of the strictly protected area and the buffer zone towards the Altay mountain range. Several floristic specialities explain the floristic uniqueness of the area (most recent compilation Gubanov 1996).

The Atlas of Mongolia describes the vegetation of the strictly protected area as rather homogenous desert *Haloxylon* vegetation, whereas the highest mountain ranges are classified as *Festuca* Steppe. This seems to be surprising, because the flora (Grubov 2001) did not even mention *Festuca* or *Juniperus* for the Dzungarian Gobi.
A vegetation map based on dominating cover plants was recently made for the "project area" of the strictly protected area around Takhin Tal (this data is so far unpublished).

Methodology

Any mapping project has to be based on a classification of the units to be mapped. In terms of vegetation science several approaches have been suggested, but few received truly worldwide appreciation. The most widely used method is the phytosociological approach after Braun Blanquet (described in Dierschke 1994, Kent & Coker 1992). Previously published classifications of the Mongolian vegetation are also based on this approach (Hilbig 1995, 2000). Other maps concerning the vegetation (e.g. Atlas of Mongolia) are based on a different "Russian" approach, which classifies the vegetation units according to the dominating cover plants.
The method of Braun-Blanquet involves deliberate selection of sample plots or squares of suitable size, which are supposed to be representative of any given vegetation type. All vascular plants are recorded together with a measure of their abundance or cover. The resulting data are than compiled in large tables (rows as species, columns as samples). These are in a second step visually inspected for sample groups, which are characterized by the presence of some diagnostic or "character" species. Afterwards the groups are designated as plant communities and eventually named.
We followed the slightly modified Braun-Blanquet approach used by S. Miehe in the GGS NP (Miehe 1996, 1998). Sample plots had a size of 10 x 10 m (=100 m²) and were marked temporarily by a squares made from string. All vascular plant species were recorded according to the stratum they live in (i.e. shrubs, herb layer etc.) and assigned a cover value. Since the generally used cover abundance scales are too coarse for low-cover situations, as they are found in semiarid environments, we estimated percentage cover directly. All sample sites were additionally photographed to ease up classification in Germany.
Plant species received a preliminary identification in the field (using Grubov 2001), critical specimens were dried and are currently being identified by HVW and various specialists in Germany as well as by R Thungalak in Mongolia. Some important species were photographed and will be designed along with pictures of vegetation units as an ecological field guide that may help scientists working in the strictly protected area.
After complete identification of the plant specimens, phytosociological tables will be compiled. Classification will additionally be cross-checked by means of multivariate analysis (Jongman *et al.* 1995, Kent & Coker 1992). This tables will be compared with other classifications of the vegetation of the southern Gobi compiled for the Gobi Gurvan Sayhan national park, which has a vegetation that it is many respects similar to the Great-Gobi B strictly protected area. In a final step the classification will be compared to countrywide schemes that became recently available (Hilbig 1995, 2000).
The Landsat sensor provides a high-resolution scanner which is suitable for a wide range of applications thanks to its wide spectral ranges. Several channels focus on vegetation parameters such as vegetation vitality and differentiation of plant communities. Due to the resolution of 30 meters, it is highly suitable for desert and steppe vegetation, making large areas of this rather homogenous landscapes mapable without creating an impractically large amount of data.
The park area is covered by four Landsat scenes. Though every quarter of the park is covered by one scene, the classification is less complicated due to the overlapping of the scenes. In the overlapping areas sampling was made more intense to enhance the number of training plots relatively for each scene.

Tab. 1: Ground resolution and spectral range of Landsat 7 ETM
(after http://earthobservatory.nasa.gov/Library/Landsat/)

Band Number	**Spectral Range**(microns)	**Ground Resolution**(m)	**Description**
1	.45 to .515	30	Mapping of vegetation
2	.525 to .605	30	Vegetation vitality
3	.63 to .690	30	Chlorophyll absorption channel
4	.75 to .90	30	Vegetation/chlorophyll
5	1.55 to 1.75	30	Moisture in vegetation/soils
6	10.40 to 12.5	60	Temperature of surfaces
7	2.09 to 2.35	30	Moisture in vegetation/soils,
Pan	.52 to .90	15	Very High resolution visible scan

An RGB Mosaic and two NDVI pictures provided by the DLR were used to identify suitable sample sites. Oases and higher mountains had a different spectral signature and thus were sampled individually. Every major landscape compartment was sampled several times wherever possible to assure coverage of the spectrally more heterogeneous landscape.
Transects were made at every high hill/mountain. A special focus was put on isolated summit areas and higher peaks in order to cover the unique flora of this areas compared to the homogenous matrix they are situated in. This was important due to the unique vegetation but also for covering the flora of the entire strictly protected area. The oases were sampled also by using transects starting at the homogenous surrounding vegetation and covering all vegetation belts towards the depression.
After the field campaign all vegetation samples were integrated into a GIS showing the position on a topographical map overlaid by the provided satellite pictures (Fig. 1).
After the classification of the vegetation plots every Braun-Blanquet sample as well as every point sampled with the dictaphone will be assigned to the plant physiological system and thus be used as training plots for a supervised classification of the Landsat data.
A similar survey made by the author in the Gobi Gurvan Saikhaan (Wesche & von Wehrden 2002) proved that a maximum likelihood algorithm is the best solution to classify the Landsat pictures. To check the individual training points and every group against each other spectral ranges will be checked using scattergrams of emission at relevant wave lengths. Further checks will be performed using the NDVI, principal component analysis and the Tasseled Cap algorithm. Due to the poor vegetation cover in the desert and steppe habitats, the Tasseled Cap transformations are useful to assess soil parameters within the satellite scenes. Unsupervised classifications with different combinations help to identify individual groups of pictures within the scenes.
The classification of the raster data (e.g. the Landsat scenes) will be refined by using a digital elevation model. Using this method altitude and exposition will be used to exclude vegetation units from places where the could no occur based on field impression and general ecological considerations. High altitude meadows, for example, sometimes have a similar spectral value as salt meadows in

depressions. Due to their widely different altitudinal distribution, these two groups can be easily differentiated using the GIS-based stratification of the data. In order to make the result of the classification smother, a nearest neighbour filter will be used with a 7 to 7 pixel range.
Working on this scale (and with a limited time budget) it is impossible to collect detailed data on site conditions. Thus ecological interpretation will largely be based on impressions we got while working. However, we tried to record as much site parameters as possible during our survey. This included sedimentology, geology and soil data as well as data about mammals and birds. Especially burrowing small mammals seem to influence plant community differentiation.

Results

Flora and Fauna

Little information about the vegetation of the Great-Gobi B strictly protected area were available. Available vegetation maps as well as plant community classifications are rather coarse. The floristic inventory according to Grubov (2001, original Russian edition 1982) is incomplete, and even the Gubanov (2001) lacks some species that were found during fieldwork. The identification of the species is complicated because of this unreliable biogeographical information. Maybe because of the fact that the strictly protected area is situated near the border, information about the Dzungarian Gobi is so poor. The floristic situation is further complicated by the fact, that in the area of the strictly protected area the flora of the Central-Asian subregion is mixed with the flora of the Turanic subregion. During fieldwork, some genera were found with several species, while the whole genus is not even recorded for the area by Grubov (2001), e.g. *Juniperus* and *Festuca*. Several of the records made in this survey will be probably knew for the area, so specimens from difficult groups were sent to specialist to get reliable identifications. All collected species were collected several times to make sure and sets where deposited with specialists both from Mongolia as well as Germany. However, it is already certain that several species were recorded first for the area.
This is refers mainly to some of the species growing at the oases, but is especially true for the high mountain alpine species found in the southern part of the strictly protected area near the Chinese border. These mountains do not just support most or the rare and newly recorded species for the area, but they also have the highest species richness of all habitats in the whole strictly protected area. Thanks to the wet climate in the year of the survey nearly all the plants were flowering and/or fruiting, which made the identifications of the species much easier. Results from the Gobi Gurvan Sayhan national park indicate that in wetter years especially systematically difficult groups such as *Astragalus* and *Oxytropis* are not only more easily identified but occur also with a higher species richness.
Because the main focus in the Great Gobi B strictly protected area is aimed on the mammals, some distribution records will be included with the final report. Because every larger hill was checked for its floristic inventory it was also recorded how many cliffs were found with nests and droppings from birds, including not only from falcons and hawks but also owls and shrikes. Some bird species were also recorded as new for the strictly protected area.

Vegetation map

More than 200 vegetation samples were collected plus an additional ~300 "fast checks". This will finally result in a classification of the plant communities of the strictly protected area. Based on the field work four communities groups can be considered so far:
Oases vegetation, semi-deserts, steppes and mountain steppes.
The oases are all dominated by similar vegetation belts which are sometimes modified by local geomorphological factors. Salt meadows are common, as well as several halophytic or at least halo-tolerant vegetation communities, mainly with Chenopodiaceae and other species.

The semi-desert vegetation ("desert steppes") can be divided in Saxaul-communities, an *Anabasis brevifolia* community, and communities dominated by other shrubs such as *Eurotia ceratoides* and *Reaumuria soongorica*.
The steppes are dominated by *Artemisia*-species, but *Stipa* ssp. indicate links to wetter communities. *Anabasis brevifolia* is confined to the driest steppes. In the northern part, *Nanophyton erinaceum* plays a significant role but could also be considered as a desert community.
The northern part is also widely covered with sand, which influences the vegetation even in the hill areas and affects the species richness as well as the general community composition.
The mountain communities are the most complicated, and must be regarded as special within the vegetation of the strictly protected area in terms of cover and composition. A *Juniperus* community is mixed with other shrubs such as *Lonicera* and *Ribes*, while two types of alpine meadows occur. The lower one (according to the altitude above the sea level) seems to be linked to the higher pediment steppes and shows a low vegetation cover whereas the higher alpine meadow community has a significant higher amount of herbals and grasses that are absent from the lower areas. There, the vegetation is also more dense but seems to be more influenced by snow, wind and other direct or indirect forms of erosion. The soils have a much higher content of organic material and the vegetation composition is more heterogeneous compared to other communities considered so far.
Altogether some 12 communities can be preliminarily identified by now, but a final statement will not be possible until the herbarium work has finished and records were properly analysed. The final number of communities classified is expected to be higher than 12, but some are not widespread enough to be used in the creation of the vegetation map, which will inevitably be on a coarse scale.
Finally, plant communities can be linked with recorded species richness values, and using a GIS a first simple biodiversity map of the strictly protected area for higher plants could be considered. With the same approach the distribution of interesting plant taxa could be plotted on a map.

Itinerary

The sample sites are plotted on a map to give an impression where records were taken. We drove several times through the strictly protected area. Together with another research team led by Dr. Karsten Wesche we drove cross the park to the south-western mountain range, which we inspected briefly. Afterwards one route was leading through the northern part of the strictly protected area towards the oases south of Bulgan. The westernmost parts were inspected on the way back.
A second trip lead to all mountain ranges in the south of the strictly protected area, including the hilly areas situated north of the higher peak ranges. Another journey lead us to all the important oases situated inside the park, taking a wide route through the middle and north-western parts of the park. Some smaller hills situated in the semi-deserts were visited as well. During the last eleven days the main focus was taken on the area of “Takhin Tal”. During this time the fieldwork was sometimes interrupted due to heavy rainfalls.

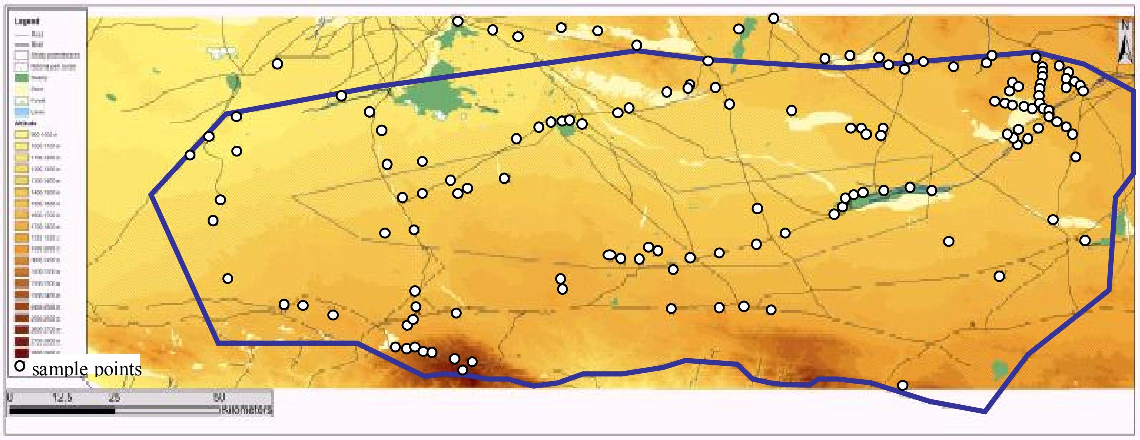

Fig 1: Itinery of the Gobi B strictly protected area.

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