Expedition report

Surveying snow leopards and other animals in
the mountains of the Altai Republic, central Asia

Expedition dates: 2 July – 11 August 2006

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Abstract

This study was part of an expedition to the Altai mountains in the Kosh Agach region of the Altai Republic, run by Biosphere Expeditions from 2 July to 13 August 2006. The aim was to continue a survey of snow leopard *(Uncia uncia)* in this area, as well as surveying the snow leopard's primary prey species, argali *(Ovis ammon)* and Siberian ibex *(Capra sibirica)*, together with secondary prey species.

Using the Snow Leopard Information Management System (SLIMS) developed by the International Snow Leopard Trust (ISLT), presence/absence surveys (SLIMS form 1) of snow leopard and prey species, as well as relative abundance studies (SLIMS form 2), were conducted throughout the study period across the entire survey area (approximately 200 square kilometers). Interviews with local, semi-nomadic herders also formed an important part of the research procedure. The expedition also collected data for extended mammal, bird and plant inventories.

In 2006 there were no records of snow leopard sign in the core area, but outside of it to the northwest. Presuming an increase in numbers of the primary prey species (particularly the Siberian ibex), it is very likely that other factors (perhaps poaching and other sorts of human disturbance) are gaining an overwhelming impact on snow leopard presence in the study area. Nevertheless, the study area retains its importance as a habitat for snow leopard and as a corridor for snow leopard dispersal. The survey area urgently needs protection, but involving the local community is vital if conservation initiatives are to succeed.

Резюме

Данное исследование проводилось в рамках экспедиции в Кош-Агачском районе Республики Алтай РФ, организованной природоохранным агентством «Biosphere Expeditions» в период с 2 июля по 13 августа 2006 г. Целью работы было изучение присутствия снежного барса в данном регионе, а также животных, являющихся основной его добычей, среди которых, наряду с другими видами животных, следует отметить аргали и сибирского горного козла. Параллельно проводили инвентаризацию птиц, млекопитающих и высших растений.

С помощью Системы Учета Информации о Снежном Барсе (SLIMS), разработанной Международным Обществом Опеки Снежного Барса (ISLT), исследование наличия (форма 1 SLIMS) снежного барса и его видов-жертв, проводилось на протяжении всего периода работы на всей территории, включенной в зону деятельности экспедиции (приблизительно 200 кв. км). Интервью местных скотоводов также стало важной частью исследования.

В 2006 г. констатировали отсутствие следов снежного барса в основном районе исследований (все находки были сделаны в другом районе – на северо-западе от основного района исследований). На фоне некоторого увеличения численности его потенциальных жертв, в первую очередь горного козла, можно предположить, что возрастающее негативное влияние на снежного барса оказывает беспокойство со стороны людей. Вместе с тем имеется положительный потенциал для присутствия здесь снежного барса, чему способствует рельеф, растительность, слабая посещаемость высокогорий скотоводами, пребывание потенциальных жертв (прежде всего, аргали и горного козла). Район исследования крайне нуждается в защите, однако, вовлечение в работу местного населения является необходимым условием для того, чтобы инициативы по созданию заповедника или национального парка могли быть реализованы.

Contents

Please note: Each expedition report is written as a stand-alone document that can be read without having to refer back to previous reports. As such, much of this section, which remains valid and relevant, is a repetition from previous reports, copied here to provide the reader with an uninterrupted flow of argument and rationale.

1. Expedition Review

Matthias Hammer
Biosphere Expeditions

1.1. Background

Biosphere Expeditions runs wildlife conservation research expeditions to all corners of the Earth. Projects are not tours, photographic safaris or excursions, but genuine research expeditions placing ordinary people with no research experience alongside scientists who are at the forefront of conservation work. Expeditions are open to all and there are no special skills (biological or otherwise) required to join. Expedition team members are people from all walks of life and of all ages, looking for an adventure with a conscience and a sense of purpose. More information about Biosphere Expeditions and its research expeditions can be found at www.biosphere-expeditions.org.

This expedition report deals with an expedition to the Altai Republic from 2 July to 11 August 2006. This expedition conducted a survey of snow leopards as well as their prey species like the argali (a mountain sheep with large ram horns and close relative of the Marco Polo sheep) and the Siberian ibex (a relative of the Alpine Steinbock). The expedition also surveyed other animals such as marmots, birds and other small mammals. The area is an important but unprotected corridor of snow leopard movement between Mongolia and Russia and next to nothing is known about these movements. Data collected by this expedition are important for the creation of a protected area, as the current lack of data on these flagship species is delaying any further action.

The Altai Republic sits in the very centre of central Asia between China, Mongolia, Kazakhstan, Russia and the Tuva Republic. The Altai mountains rise from 350 to 4500m and are one of the most beautiful, pristine and remote parts of the world. They were added to the list of natural World Heritage Sites in 1998 as an area of outstanding biodiversity of global importance and providing the habitat for a number of endangered species, including the snow leopard and manul (a small cat predator).

It is, however, also one of the poorest regions of the former Soviet Union whose collapse has increased pressures on exploitation of natural resources and deprived local scientists of precious funds for biodiversity conservation. As a result, the creation of a protected area has been much delayed for lack of data on important flagship species.

Little is known about the status and distribution of the globally endangered snow leopard in the area and its interaction with prey animals like the argali and Siberian ibex, and its reliance on smaller prey like marmots, ground squirrels and game birds. Information gathered by this expedition will provide data that can be used in the formulation of management and protection plans.

1.2. Research Area

The Altai mountains are one of the most beautiful, pristine and remote parts of the world, stretching across the very centre of central Asia between China, Mongolia, Kazakhstan and Russia, and standing at the junction of several natural zones and cultures. Few foreigners get to this corner of the world. Those that do see a variety of high mountain landscapes and immense spaces of open steppe framed by snow covered peaks. Belukha, the region's highest mountain at 4506 m, rises just west of the research area and other mountain peaks, such as Tapduair (3505 m) and Silugiem (3411 m), overshadow base camp.

The mountains are divided by several river valleys and there is a great variety of landscapes. There are hollows with semi-desert landscapes, alpine peaks, narrow river canyons and broad valleys, highland tundra and deep natural limestone gorges, open steppe, permanent snow and glaciers and tracts of forest, as well as 7000 lakes, wild rivers and waterfalls. Forests of larch, cedar, spruce and pine (but very few deciduous trees) cover more than a half of the mountain territory. Base camp itself is set amidst larch forest at the foot of Tapduair mountain and overlooking an area of open steppe.

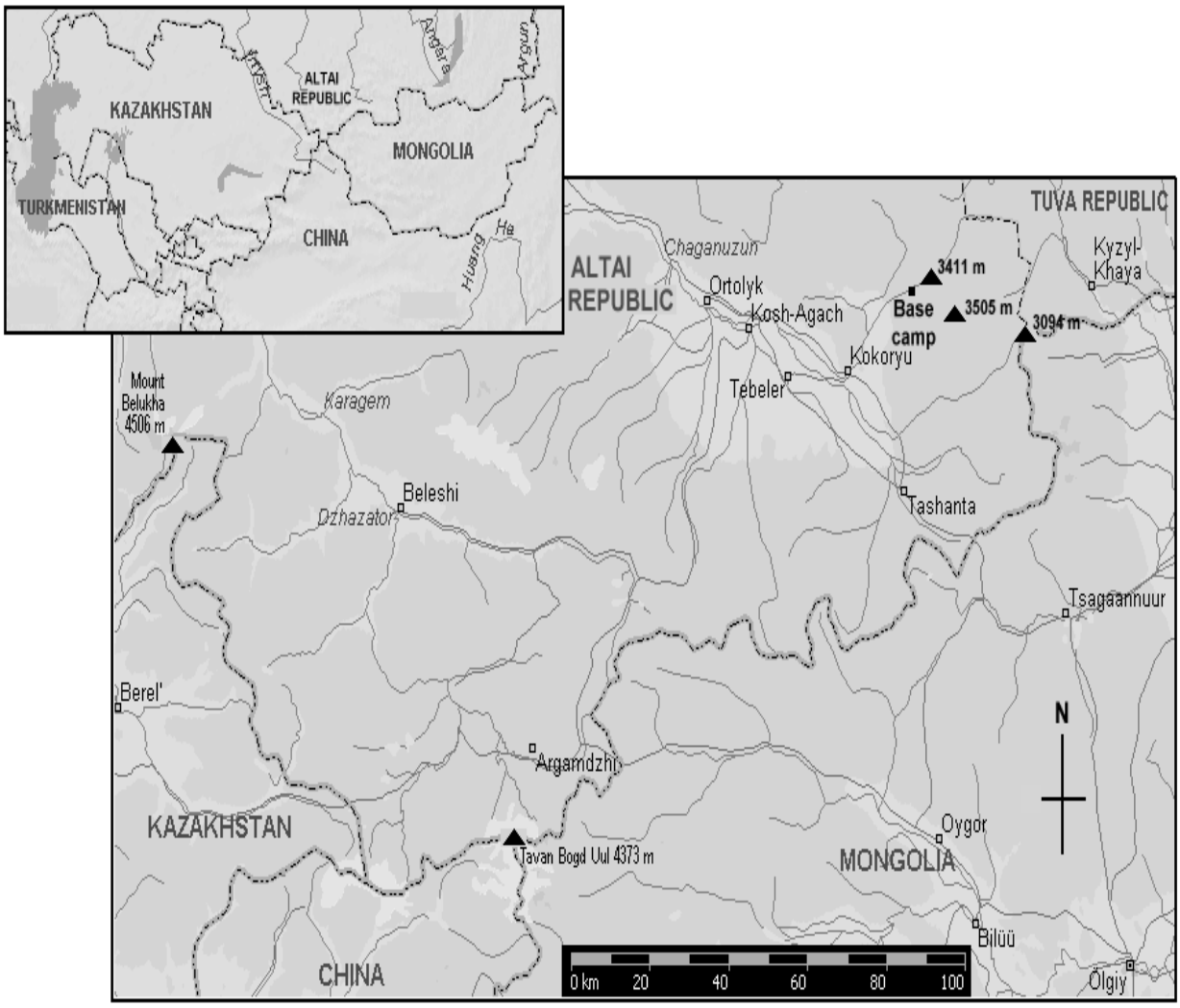

Fig. 1.2a. Map showing the Altai region and base camp.
The research area is within a 30 km radius of base camp.

Many threatened animal and plant species, many of them endemic, are present in the area with a recent count showing at least 73 mammal species, 300 bird species, 44 fish species, 7 reptile species, a large number of invertebrates, and 1270 plant species.

The climate is temperate continental with short, hot summers (during which the expedition will take place) and prolonged, cold winters. January temperatures range from -9°C to -31°C and July temperatures from +11°C to +35°C during the day, dropping to around zero during the night. The weather at base camp was very variable and in extreme cases turned from hot sunshine to a snow shower at temperatures below zero within the space of a few hours.

The Altai Republic is very sparsely populated, with about 200,000 people, 53,000 of whom live in the main city of Gorno Altaisk. About 60% are Russians, 30% are native Altai people, and 5% are Kazakhs. The Altai, a Turkic-speaking people, are mostly village dwellers, but a few are still semi-nomadic, moving with their herds to different pastures, following the seasons and living in yurts in summer. Even today some settled families keep their yurts in their gardens as an extra room or kitchen for summer use. In the remoter areas the horse is still the main means of transport and the yurt the main type of residence.

The history of the Altai is that of a semi-nomadic horseback culture entwined in the power struggles of central Asia between Mongolian and Turkic tribes. In 1756 the Altai became part of the Russian empire and in 1905-1907 they were involved in the Revolution, which ended in the establishment of Soviet power in 1917. During the era of the Soviet Union the Altai people were integrated into the union as an autonomous district (oblast) and most of its semi-nomadic people were collectivised. With the end of the Soviet Union the oblast was transformed into a republic in 1991, adopting the name Altai Republic in 1992. As a semi-independent member of the Russian Federation, the Altai Republic established its current constitution and state symbols, such as its flag and coat of arms, in 1997. Official languages of the Altai Republic are equal Russian and Altaian.

1.3. Dates

The expedition ran over a period of six weeks divided into three two-week slots, each composed of a team of international research assistants, guides, support personnel and an expedition leader. Expedition slot dates were

2 - 14 July
16 - 28 July
30 July - 11 August

1.4. Local Conditions & Support

Expedition base

The expedition team was based in a mountain tent camp of single and double dome, mess and kitchen as well as shower and toilet tents at approximately 2200 m altitude and 60 km from the nearest human habitation. All meals were prepared by the expedition cook and vegetarians were accommodated.

Field communications

There was no mobile or landline telephone connection at base. Instead the expedition used an Iridium Motorola satellite telephone with internet connection. This worked fairly well and e-mail contact was available intermittently. Courtesy of Motorola and their local Novosibirsk dealer, Neman, a radio mast and a GM950 base station were installed at base, and four Motorola GP320 hand-held and three GM340 mobile radios, all courtesy of Motorola, were used for communication. These worked well and, when within range, the expedition research teams could communicate with each other reliably and easily at the press of a button.

Transport & vehicles

Team members made their own way to the Novosibirsk assembly point. From there onwards and back to the assembly point all transport and vehicles were provided for the expedition team, for expedition support and emergency evacuations. Courtesy of Land Rover, and their local dealer Avtoland of Novosibirsk, the expedition had the use of three Defender 110 Station Wagons and one Defender 90 Station Wagon.

Team members wishing to drive the Land Rovers had to be older than 21, have a full clean driving licence and a new style EU or equivalent credit card sized driving licence document. Off-road driving and safety training was part of the expedition.

Medical support & insurance

The expedition leader was a trained first aider, and the expedition carried a comprehensive medical kit. Further medical support was provided by a district hospital in the town of Kosh Agach (60 km from the camp). All team members were required to be in possession of adequate travel insurance covering emergency medical evacuation and repatriation. Emergency evacuation procedures were in place. There were no major medical incidents. There was one bout of gastroenteritis.

1.5. Expedition Scientist

Volodymyr Tytar was born in 1951 and his Master's Degree in Biology is from Kiev State University. At that time he first experienced the Altai mountains and wrote a paper on the ecology of the brown bear in the Altai. He then pursued a career as an invertebrate zoologist before shifting towards large mammals and management planning for nature conservation. He has worked with Biosphere Expeditions on wolves, vipers and jerboas on the Ukraine Black Sea coast and has been involved in surveying and conservation measures all his professional life.

1.6. Expedition Leader & Scientist

Tessa McGregor was born in Paris and educated in England. She read biology at King's College, London and specialised in animal behaviour and ecology. Her life-long passion for wildlife and wild places motivated her personal and professional life. Tessa has worked in remote places as a wildlife biologist, environmentalist and in the media - TV, radio and journalism (including BBC Natural History Unit, Radio 4 and Discovery). She is an expert on tigers. Tessa joined Biosphere Expeditions in 2003 and currently lives in Scotland. Her other interests include horse riding, diving and photography.

1.7. Expedition Team

The expedition team was recruited by Biosphere Expeditions and consisted of a mixture of all ages, nationalities and backgrounds.

2 - 14 July

Toril Andresen (Norway), Iain Buchanan (UK), Tracy Carpenter (UK), James Clements (USA), Helge Eek (Norway), Hugh Faust (USA), James Freedman (UK), Guy March (UK), Kindra McCall (USA), Christine Newell (UK), Peter Pilbeam (UK), Jens Warstat (Germany). Also assistant expedition leader Andy Stronach (UK).

16 - 28 July

Maryse Agil (France), Tracy Carpenter (UK), Gerald Cupper (UK), Hugh Faust (USA), James Freedman (UK), Angela Manthorpe (UK), Guy March (UK), Stefan Ulsenheimer (Germany), Michelle Ward (Australia/UK), Jens Warstat (Germany). Also assistant expedition leader Andy Stronach (UK).

30 July - 11 August

Katie Bunting (UK), Adrian Dumbleton (New Zealand), Camilla Eriksen (Norway), James Freedman (UK), Robert Kowalewski (UK), Gerald Maier (USA), Angela Manthorpe (UK), Jane Orton (UK), Christian Rakvaag (Norway), Ulf Rakvaag (Norway), Marsha Shmalo (USA), Hannah Simonson (USA). Also assistant expedition leader Peter Schütte (Germany).

Throughout the expedition

Andrei (driver, jerboa whisperer, unofficial archaeological advisor and fount of knowledge about the region). Nastya (translator), Roman (camp helpers and mountain guides), Ivan (camp helper). Nina (cook and heart and soul of kitchen and mess tent).

1.8. Expedition Budget

Each team member paid towards expedition costs a contribution of £1150 per two week slot. The contribution covered accommodation and meals, supervision and induction, a permit to access and work in the area, all maps and special non-personal equipment, all transport from and to the team assembly point. It did not cover excess luggage charges, travel insurance, personal expenses like telephone bills, souvenirs, etc., as well as visa and other travel expenses to and from the assembly point (e.g. international flights). Details on how these contributions were spent are given below.

Income	£
Expedition contributions	43,500
Expenditure	
Base camp and food includes all meals, base camp equipment	3,904
Transport includes fuel, vehicle maintenance	3,003
Equipment and hardware includes research materials, research gear	605
Biosphere Expeditions staff includes salaries, travel and expenses to Novosibirsk	5,843
Local staff includes salaries, travel and expenses, Biosphere Expedition tips, gifts	6,121
Administration includes bribes, registration fees, sundries, etc	1,587
Logistics & co-ordination Payment to Sibalp	4,290
Team recruitment Altai as estimated % of PR costs for Biosphere Expeditions	4,240
Income – Expenditure	13,907
Total percentage spent directly on project	68%

1.9. Acknowledgements

This study was conducted by Biosphere Expeditions which runs wildlife conservation expeditions all over the globe. Without our expedition team members, who are listed above and who provided an expedition contribution and gave up their spare time to work as research assistants, none of this research would have been possible. The support team and staff, also mentioned above, were central to making it all work on the ground. Thank you to all of you and the ones we have not managed to mention by name (you know who you are) for making it all come true. Biosphere Expeditions would also like to thank Land Rover, Motorola, Buff®, Cotswold Outdoor, Globetrotter Ausrüstung and Gerald Arnhold for their sponsorship.

1.10. Further Information & Enquiries

More background information on Biosphere Expeditions in general and on this expedition in particular including pictures, diary excerpts and a copy of this report can be found on the Biosphere Expeditions website www.biosphere-expeditions.org.

Enquires should be addressed to Biosphere Expeditions at the address given below.

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2. Snow Leopard & Prey Survey

Volodymyr Tytar
I.I Schmalhausen Institute of Zoology of the National Academy of Sciences of Ukraine

Tessa McGregor
Biosphere Expeditions

2.1. Introduction

The estimated population of snow leopards *(Uncia uncia)* in the wild today is between 3000 and 7000 animals (unpublished manuscripts and Sunquist & Sunquist 2002). This is the same estimate as for tigers, but whilst tigers have received a lot of publicity and there is wide public awareness of their precarious status, the same cannot be said for the snow leopard. They are still one of the least known big cats. Hardly a surprising fact when one considers their elusive nature and the remote and difficult habitats they occupy in the mountainous regions of central Asia. Their geographical range spans twelve countries, many of which are politically unstable and all of which have sensitive borders. The snow leopard is classified as an endangered species (Category I) by the IUCN and is disappearing from many parts of its formerly vast range.

After China, which it borders, Russia has the second largest potential snow leopard habitat and together with Mongolia and other post-Soviet republics, it accounts for much of snow leopard habitat.

The amount of suitable snow leopard habitat in Russia totals about 131,000 sq km (Koshkarev 1994), with snow leopards being reported from the Altai and Sayan ranges bordering Mongolia. Smirnov et al. (1990) estimates about 80 snow leopards reside in southern Siberia, including those animals that wander into Mongolian territory. Sopin (1977), cited in Fox (1989), estimates 0.75 to 1.5 snow leopards per 100 sq km in parts of the Altai mountains giving a total population of about 40 (Jackson & Hunter 1996).

Rodney Jackson's four year study (Jackson 1996) of radio-collared snow leopards in Nepal provided most of what is known about the species today, but while Nepal contains prime snow leopard habitat and has the highest percentage of protected area (26.7%) after Bhutan (57.4%), it also only accounts for a small proportion of snow leopard range (0.9%). It took another 10 years for a comparable study to be undertaken in a different habitat (Schaller et al. 1994). This study employed radio-collared animals (VHP & satellite transmitter radio-collars) and took place in the Mongolian part of the Altai mountains, to the north of the Great Gobi National Park. Although a stronghold of snow leopards in Mongolia, prey densities were found to be relatively low and probably representative of much of the snow leopard's range in central Asia (McCarthy et al. 2005). Results from this study have also revealed much larger snow leopard home ranges than previously recorded.

However, studies involving radio-collared snow leopards are difficult, time-consuming and expensive. Conducting surveys using the Snow Leopard Information Management System (SLIMS), on the other hand, is a more practical way of assessing snow leopard status and distribution in much of the snow leopard's range. Following this protocol ensures standard procedures are used and enables data gathered across any part of the snow leopard's range to make a valuable contribution to the International Snow Leopard Trust's (ISLT) database and so help further knowledge and conservation efforts. The expedition therefore followed SLIMS methodology.

2.2. Research Area & Timing of Survey

The area surveyed by Biosphere Expeditions was chosen for several reasons including: (1) the area was as yet poorly surveyed for snow leopard; (2) map study suggested that the area may be an important corridor for snow leopard dispersal to and from Mongolia; (3) the habitat is biodiverse, supporting a range of prey species and other carnivores; (4) the area lacks proper protection and is threatened by a proposed road to the Tuva Republic and a proposed gas pipeline.

The study site totaled approximately 200 sq km and was delineated by geographical features (rivers and mountain ranges). The site was divided into two survey blocks. As per SLIMS suggestions, the survey routes followed river valleys and landform edges wherever possible. Research was focused on the core area as it included the most important habitat for snow leopard and prey, and suffered from the lowest levels of human disturbance. The survey sites were accessed by Land Rover Defender (or on foot if near base camp). All surveys were conducted on foot. Base camp was situated in a valley, at the entrance to the core area, below the mountain of Kunduyak. It afforded the necessary shelter and fresh water source from Kunduyak stream needed by the expedition.

Snow leopard surveys are best undertaken when weather permits travel within the proposed survey area, when animals are most actively marking and when sign is most long-lived. These conditions rarely coincide, so trade-offs have to be made between logistical factors and biological ones. In this study, logistics and team recruitment by and large determined the survey period. On the one hand, summer is a difficult time to find snow leopard sign: marking activity is low, human disturbance is high and livestock grazing can soon obliterate sign. Suitability of tracking substrate is also poor (tracking is much easier in snow). Weather conditions also tend to be unpredictable and contribute to sign erosion and eradication. Rain erodes sign rapidly. On the other hand, however, recruiting an expedition for a summer expedition is much more realistic, logistics are not nearly as prohibitive as in winter and, most importantly for this study, human presence can be a valuable source of information, especially in the absence of other baseline data. Summer is also the optimum time for accumulation of sign and availability of "relic" sign (i.e. old sign that is not washed away or otherwise destroyed or removed).

2.3. Methodology

Snow leopard presence-absence survey

Presence-absence surveys of snow leopard and prey (SLIMS Form 1) were conducted throughout the survey area. Designed for ease of use, presence-absence surveys are a scientifically valid approach to determine the general status of snow leopards in broad geographical areas. The surveys rely on the presence of snow leopard sign at strategic search locations. Data analyses use survey block summaries to draw conclusions on: (1) the presence-absence of snow leopards and prey species; (2) major threats; (3) management recommendations.

These are qualitative methods that lead to personal judgments supported by physical evidence documented in the survey forms. Unlike relative abundance surveys, there is no statistical basis for the conclusions. When snow leopard sign is absent, the analyst must rely on all other information on the data forms to reach a judgment. Prey species, habitat and local interview data may point to the presence of snow leopards, even though no sign was found during the survey.

The analyst uses the survey data to support qualitative judgments on snow leopards, prey species, threats and management recommendations for the survey area. The survey forms are the critical analytical unit and are stored for future reference. Over time, as survey conclusions are mapped out, trends will emerge. It is estimated that it will take at least three years for these trends to become clear for the Biosphere Expeditions Altai survey area.

Snow leopard presence can be detected by sign, i.e. pugmarks (tracks), scrapes, faeces (scat), urination and rock scent spray. These signs tend to be left in relatively predictable places. For example, scrapes tend to be left at the base of cliffs, beside large boulders, on knolls and promontories, at bends in trails, or along other well-defined landform edges (Schaller 1977; Koshkarev 1984; Mallon 1988; Schaller et al. 1987; Jackson & Ahlborn 1988; Fox 1989). These factors are important when deciding where to survey.

Snow leopard relative abundance survey

Relative abundance surveys of snow leopard and prey (SLIMS Form 2) were conducted as well for purposes of identifying parts of the survey area that potentially support snow leopard numbers so that targeted prey species and habitat evaluations can be undertaken, which may lead to creating a new protected area.

Prey base survey

Surveying prey base is another, essential component of the present SLIMS presence/absence survey. Argali and ibex are the main prey species. Their range closely parallels that of snow leopard. Siberian red deer *(Cervus elaphus maral),* roe deer *(Capreolus capreolus)* and wild boar *(Sus scrofa)* are also taken by snow leopard in Russia (Jackson & Hunter 1996).

Prey species were surveyed by recording sign and by observation. Prey sign included tracks, faeces, hair/wool, and carcasses/bones. Prey species were divided into 'primary' (ibex and argali) and 'secondary' (maral, marmot, pika, hare and game birds). The same search sites were used for snow leopard and for prey.

Additional surveys

Evidence of other carnivores sharing snow leopard habitat was also recorded as part of the SLIMS survey.

In the end an attempt is made to build a predictive model of the distribution of the snow leopard in the Altai based on ecological niche modeling and using Biosphere Expedition records together with published data summarized in the Red Data Book of the Republic of the Altai. DIVA-GIS software (www.diva-gis.org) was applied to process georeferenced primary occurrence data for the species, in combination with digital maps representing environmental parameters (namely, altitude and 19 bioclimatic parameters). The simplest BIOCLIM model (Nix 1986) was chosen, which itself involves tallying species' occurrences in categories for each environmental dimension, trimming the extreme 5% of the distribution along each ecological dimension, and taking the niche as the conjunction of the trimmed ranges to produce a decision rule.

2.4. Results

Snow leopard presence-absence survey

From 6 July to 8 August 2006 a total of 22 snow leopard presence-absence surveys were carried out. The average length of one survey route was 12.1 km, and an average of 6.8 hours was needed for making an inspection. Elevations ranged from 1993 m (in the Buguzun floodplain) to 3505 m (top of Tapduair). The dominant landscape surveyed in the area consisted of narrow valleys (NVAL), broken terrain (BTER), and steeply rolling slopes (SROL) met, respectively, in 26, 24 and 19% of cases; other landforms included grass plateau, ridges, glacial lake areas, and even woodland consisting of Siberian larch and sporadic pine stands.

Snow leopard sign searched for during this study included: pugmarks (tracks), scrapes, faeces (scat), urination and rock scent spray.

Scrapes: These can be found in sandy sites (short-lived) and gravel (more long-lived). Unfortunately suitable substrates were not present in most of the survey area favoured by snow leopard, where the majority of substrate was vegetation and broken terrain. Potentially suitable substrate was subject to livestock grazing. Rainfall and frequent snowfall throughout much of the survey period also reduced the possibility of finding scrapes. One relic scrape was discovered (50º05.758' N, 89º03.122' E, 2363 m) this year on 3 August about 100 m from the fresh pugmark found on the same day (see below).

Tracks (pugmarks): These are more easily found in sandy rather than gravelly places, but sandy areas were only present at lower elevations, away from preferred snow leopard terrain. Most of the area surveyed was unsuitable for tracking (scree, boulders, vegetation, etc), but the wet weather and occasional snowfall made finding tracks "easier" than had been anticipated.

This year the expedition was fortunate in one of the surveys (4.5% of the total) to encounter two sets of pugmarks left behind by the snow leopard; these findings were made in the third slot during an overnight stay (3 and 4 August) in the Tabajoc area (located to the NW of the base camp). On 3 August one fresh pugmark was found (50°05.776' N, 89°03.125' E, 2380 m) on a very steep path dropping from ridge to valley with sign of ibex tracks and trails (well used, some fresh); on the same day a relic scrape was found nearby. Both snow leopard sign were found on an incline of more than 45°.

On the next day (4 August) one doubtful pugmark was found at 50°08.302' N, 88°58.821' E, 3084 m) that could have been left behind by a juvenile snow leopard, but also an adult lynx.

Faeces: Faeces can be long-lived in areas with little rainfall and minimal insect activity - the survey area was subject to high rainfall and intense insect activity. Grasshoppers were found at all but the highest elevations and were voracious consumers of faecal, plant and other matter. Faeces can be deposited solitarily or with other scats of varying ages (Jackson & Hunter 1996). Faeces are most often found in association with scrapes. No samples of faeces were discovered this year.

Urination: Urine can be deposited on scrape piles and is commonly deposited along regular paths or trails. No signs of urination were found during the survey period. Lack of trails and difficulty in finding scrapes were a contributing factor.

Scent spray: Snow leopards spray-mark the faces of upright or overhanging boulders and the base of cliffs. Some sites are periodically revisited and re-sprayed (mainly along trails). The majority of spray sites will have one or more scrapes within a distance of a few meters. No scent-spray was found inside the survey area this year, but one scent-spray was discovered on a reconnaissance visit north-west of Tabajoc, two days ride from base camp.

Claw rakes: These are occasionally left on a rock face, log or upright tree trunk. No claw rakes were found during the survey period.

Summary of sign found 2003-2006

A summary of all the sign found over four years of survey work, 2003-2006, is given below.

Table 2.4a. Summary of all snow leopard sign found during the surveys 2003-2006. *PUG = pugmark (track), SC = scrape, FE = scat or faeces, UR = urination, RC = rock scent spray.

Type of sign (with SLIMS code*)	Date	GPS coordinates	Altitude (m)	Comments
		2003		
OBS	21/08/03	49°57.770'N 89°19.050'E	3305	1 adult seen resting in broken terrain below ridgeline at distance of approx. 50 m at 14:00. Animal retracted lips & bared teeth at observer & moved off immediately. Sighting lasted only a few seconds.
PUG	10/07/03	49°59.821'N 89°1 3.334'E	~ 2600	Pugmarks > 6 days, found in crystalline snow. Track ≤ 5 m.
PUG	23/07/03	49°59.594'N 89°20.888'E	2864	Track approx. 70 m on fine gravel plateau - followed landform edge closely before crossing open ground (20 m) to grassy plateau used by argali.
PUG	28/07/03	49°55.971'N 89°13.330'E	2923	Both set of tracks > 6 days & found on snow patches. Although tracks hard to measure, one set slightly smaller (possible indication of mother and cub?).
PUG	28/07/03	49°56.231'N 89°13.989'E	2965	Tracks ≥ 10 days
PUG	11/08/03	50°00.650'N 89°17.965'E	3330	Track ≤ 5 days
PUG	11/08/03	50°00.274'N 89°17.987'E	3373	Both sets of pugmarks found in snow made by adult and had been made fewer than 12 days apart - either made by same individual (likely) or two different animals (less likely).
SC	23/07/03	49°59.578'N 89°21.050'E	2795	Non relic scrape found in lee of large boulder approx 1.5 m wide & 1.8 m high with flat face angling back at approx 60° to the horizontal, the upper edge overhanging. Possible scrape, but very old.
SC	21/08/03	49°56.322'N 89°19.817'E	2565	Possible old, non-relic scrape in gravelly sand.
FE	14/07/03	50°01.492'N 89°18.770'E	2786	Large cat scat, quite fresh - awaiting results of DNA analysis for positive ID.
FE	13/08/03	N/R (Ridge 'Manul Rock')	≥ 2580	Large cat scat, old - awaiting results of DNA analysis for positive ID.

..continued

Type of sign (with SLIMS code*)	Date	GPS coordinates	Altitude (m)	Comments
			2004	
FE	24/07/04	49°57.599'N 89°19.039'E	3202	Dry, well preserved, though, perhaps, few months old; found in rock-dominated habitat; awaiting results of DNA analysis for positive ID.
			2005	
OBS	09/08/05	49°56.942'N 89°18.522'E	2632	Seen through binoculars at 11:40 on ridge (3168 m) above valley at a distance of approx. 1 km from GPS location given. Overcast, cool day – cloud cover 100%.
PUG	18/08/05	49°57.877'N 89°18.136'E	3168	Track seen from an observation location.
PUG	20/08/05	50°00.468'N 89°17.469'E	3294	Old, found on ridge; one animal.
PUG	20/08/05	50°00.605'N 89°17.172'E	3176	Fresh, found on ridge; one animal.
SC?	26/07/05	50°00.452'N 89°19.898'E	2837	Dubious scrape (may have been created by an ibex).
RC	17/08/05	49°57.877'N, 89°18.136'E	2940	On the east-face of a 3-meter high boulder (of a 10% incline).
			2006	
PUG	03/08/06	50°05.776'N 89°03.125'E	2380	Fresh pugmark found on a very steep path dropping from ridge to valley with sign of ibex tracks and trails (well used, some fresh); on incline >45°.
PUG?	04/08/06	50°08.302'N 88°58.821'E	3084	Dubious pugmark sign; could be one left behind by a juvenile snow leopard, but could also have been left behind by a lynx.
SC	03/08/06	50°05.758'N 89°03.122'E	2363	Relic sign; on incline >45°.
RC	22/07/06	50°17.975'N 88°50.293'E	2509	On overhanging rock next to track in broken terrain above the Kalbaka River - ibex tracks and resting depressions close by. Remote area – no sign of livestock/human disturbance.

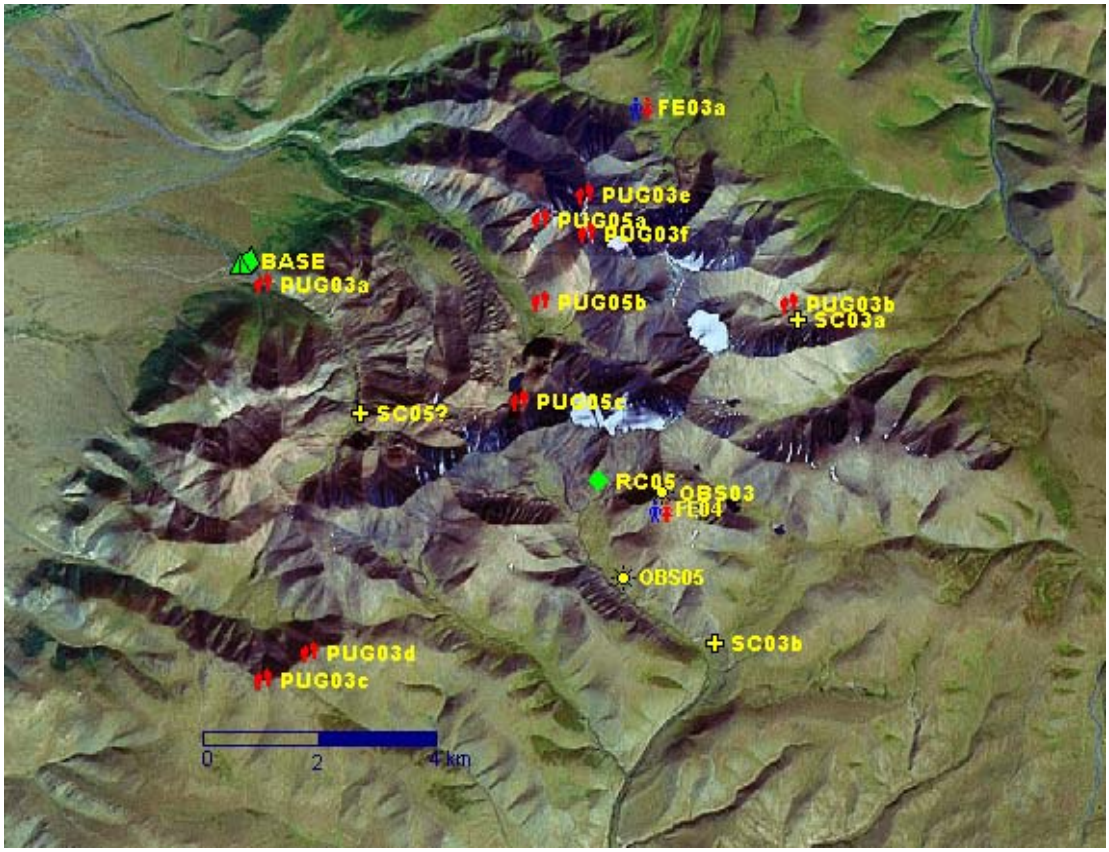

Figure 2.4a. Map showing snow leopard sign found 2003 – 2005. PUG = pugmark = track. SC = scrape. RC = scent spray. FE = faeces. OBS = observation. Figures indicate years and question marks tentative signs. The location of base camp is also shown.

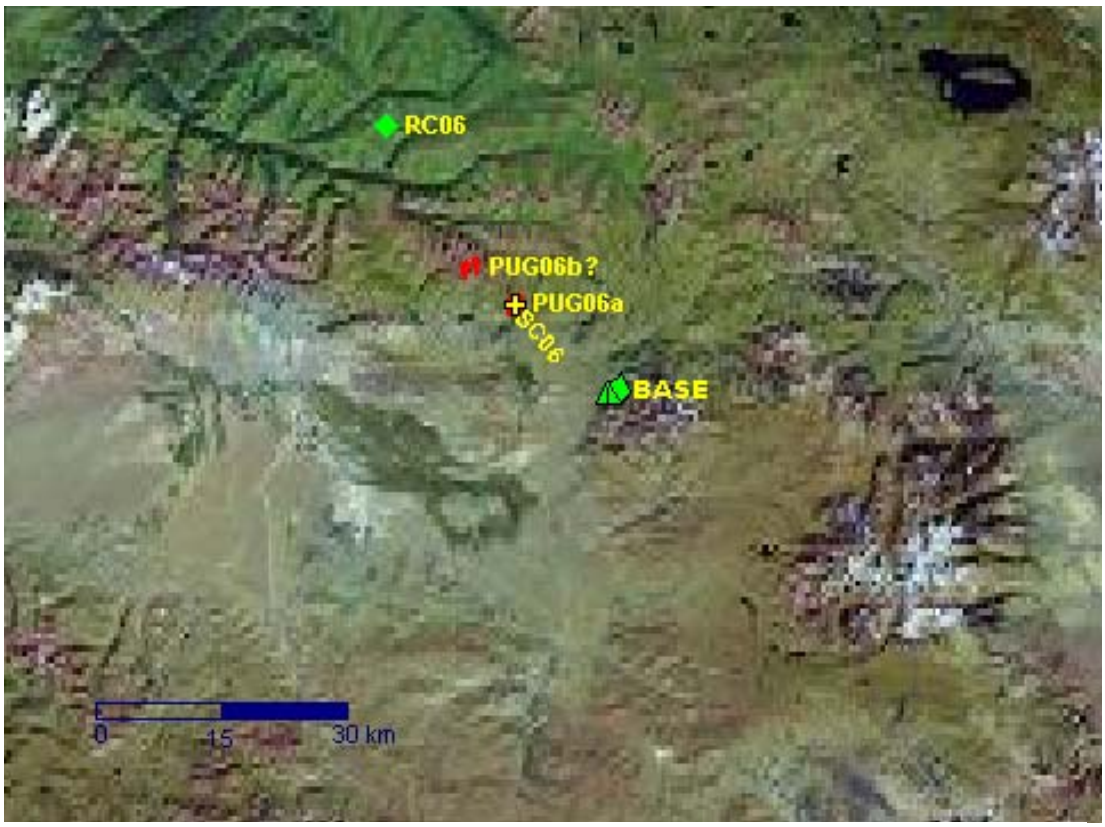

Figure 2.4b. Map showing snow leopard sign found 2006. The location of base camp is shown as a refrence point relative to the 2003 – 2005 findings.

Threats to snow leopard presence

In the course of the presence-absence survey an account was taken of human-induced factors considered to be threatening to snow leopard presence in the area. Grazing activities turn out to be common and widespread and were recorded in 14 out of the 22 accomplished snow leopard presence-absence surveys (around 64%) and are primarily confined to foothills and valley floor.

In general, the grazing pressure in the area remains stable, and records taken during the presence-absence surveys range between 54 (in 2005) and 70% (in 2004), however the variations are statistically insignificant (all *t*-tests less than 1.96). Localised grazing, however, appears to be on the increase due to growing herd sizes.

Occasional horse droppings and car tracks found in higher places indicate sporadic human presence all over the area. Other signs of human presence and disturbance included findings of bullet cases, hides, campfires and various pieces of rubbish left behind by visitors; tree felling has been recorded as well. In previous years these were supplemented by findings of trenches dug by hunters (for shooting ibex), steel leg-traps and snares.

Short-term disturbance is created by harvesters coming in for pine cones, mushrooms, wild onions etc.

Snow leopard relative abundance survey

All together 21 such surveys were carried out since 2004 (17 in 2004, 3 in 2005, and 1 in 2006). The length of the survey routes varied between 37 and 3449 m (average of 757.2 m), and altitudes varied between 2134 and 3280 m. Transect summaries for 2004-2006 are presented in Table 2.4a and Fig. 2.4a, allowing habitat evaluations to be undertaken.

Table 2.4b. Transect summary (in %) for the relative abundance survey (terrain features & grazing status).

	Cliff base	Ridgeline	Hillside	Valley bottom	Terrace	Streambed	Barren	Grass	Shrub	Forest	Flat	Rolling	Slightly broken	Moderately broken	Very broken	Year-round	Seasonal	Non-grazing
Dominant topographic feature	15	**26**	**26**	4	4	**26**												
Primary habitat type							**65**	**19**	13	3								
Rugged-ness											9	0	4	**39**	**48**			
Grazing status																0	23	**77**

As is evident from the table, habitat surveyed for snow leopard relative abundance is characterized by a diverse topography consisting of a mosaic of hillsides and ridges cut across by numerous streambeds, often blocked by large boulders and piles of rock debris. Much of the landscape is very broken and barren, patches of grass appear where areas are less broken and a soil layer may develop. The relative inaccessibility and poor vegetation make the area uninteresting to herders, so livestock grazing, if any, is fairly sporadic and limited to seasonal.

Fig.2.4a shows the records of the potential prey species. 49% are records (signs and observations) of the 'primary' prey species, Argali and Siberian ibex. Game birds (Altai snowcock, grouse etc.), Northern pika, Mountain hare and the Grey or Altai marmot make up together another 45% of the records. Single records (grouped in the 'other' category and totaling 6%) have been made of maral, wild boar and the Arctic ground squirrel.

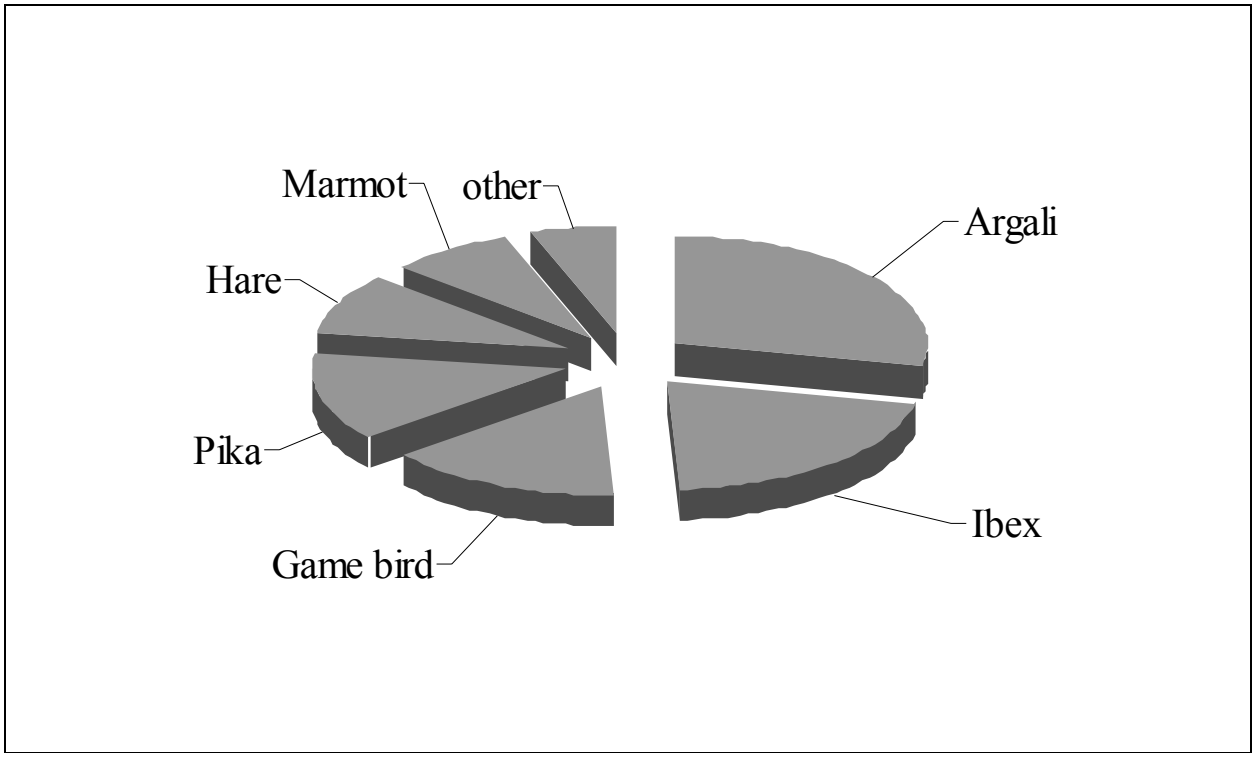

Figure 2.4c. Transect summary for the relative abundance survey (potential prey species).

Prey base survey

Signs of prey species in both presence/absence and relative abundance surveys were fairly abundant and widespread because they are usually met in a much greater variety of terrain.

In 2006 a total of 75 signs of argali were recorded. These included faeces (39 cases), footprints (18), pieces of wool (1), skulls, horns etc. (3), resting depressions ('beds') found in 7 places. The animals themselves were spotted in places between altitudes of 2221 and 3257 m seven times singly and in groups numbering up to 18 animals.

A total of 65 signs of Siberian ibex were recorded. These included faeces records (25), footprints (14), 'beds' (7), skulls (3), tufts of hair (3). In 13 documented cases animals were seen between altitudes of 2623 and 3130 m in numbers between 1 and 31 (average 12). The pool of records was made over the altitudes of 2344 and 3305 m.

In pooled samples average elevations for both argali and ibex records are in fact the same, 2768.4±31.3 and 2838.0±36.4 m, respectively (t = 1.46<1.96).

Signs indicating the altitudes at which the animals are met, highlight the area as a potential habitat for the snow leopard. These (pooled encounters of argali and ibex) occurred between 2221 and 3305 m (a vertical range of 1084 m, very similar to the ranges recorded previously).

Evidence from surveys and interviews indicates that the numbers of animals using the survey area are perhaps relatively low and are subjected to fluctuations from year to year. For instance, fewer records (73 against 54) had been made of one of the 'primary' prey species, the argali, in 2005, however once again more have been made in 2006 (reaching the number of 75). On the other hand numbers of records involving the Siberian ibex have been increasing steadily from 23 in 2004 to 38 (in 2005), and 65 (in 2006).

It is quite difficult to give any statistical interpretation of these estimates, however, in general, the pool of the 'primary' prey species seems to have increased. A contributing factor may be the regular presence of Biosphere Expeditions in the core area during the summer months (since 2003), as this has curtailed poaching activity enabling both predator and prey species to make the most of the summer months to raise young and prepare for winter.

As far as total count methods are difficult to apply in the area, a prudent option is to focus, for the current study at least, on relative abundance methods which produce indices reflecting the density of the prey species population. For example, given a standard technique, such as counting signs along a transect, it is possible to say that if area *A* has a higher frequency of signs than area *B*, then there must be more animals in area *A*, even if we do not know the exact numbers in either area. Similar logic is used to compare relative abundance in the same area over time.

One such approach is to analyse how fast are we gaining our data, assuming that more animals in the area will be producing more signs. This can be assessed by plotting cumulated numbers of signs against the dates from the beginning of the survey up to its end, and estimating the corresponding regression values. For this purpose dates have to be transformed into a continuous sequence of numbers, so, in 2006, for instance, 5 July (the starting day of the survey) has the number 127, and 8 August (the final day of the survey) has the number 161 (see, for example, Table 24 in Zaitsev, 1984). Regression lines and equations are summarized in Figs. 2.4b and 2.4c.

Interestingly, the cumulated number of signs versus the dates fits well into the linear regression model (R, the correlation coefficient, ranges between 0.956 and 0.990), meaning that during each particular survey the number of animals in the study area remains at a fairly constant level, so, perhaps, in the summer time there is no movement of the animals in or out of the area and mortalities too, perhaps, are very low.

Regression coefficient values for argali (*2004*: 1.454±0.062, n=21; *2005*: 1.055±0.067, n=17; *2006*: 2.208±0.073, n=21) indicate a possible drop in the numbers of animals in 2005 compared to 2004 ($t_{2004/2005}$=4.48>1.96, *d.f.*=34); the population, however, seems to have recovered in 2006 ($t_{2005/2006}$=12.53>1.96, *d.f.*=34).

Regression coefficient values for the Siberian ibex (*2004*: 0.386±0.030, n=14; *2005*: 0.663±0.049, n=19; *2006*: 1.809±0.058, n=24) indicate a growing population ($t_{2004/2005}$=2.43>1.96, *d.f.*=29; $t_{2005/2006}$=14.56>1.96, *d.f.*=39) that since 2004 may have undergone a fivefold increase in numbers (1.809/0.663≈5).

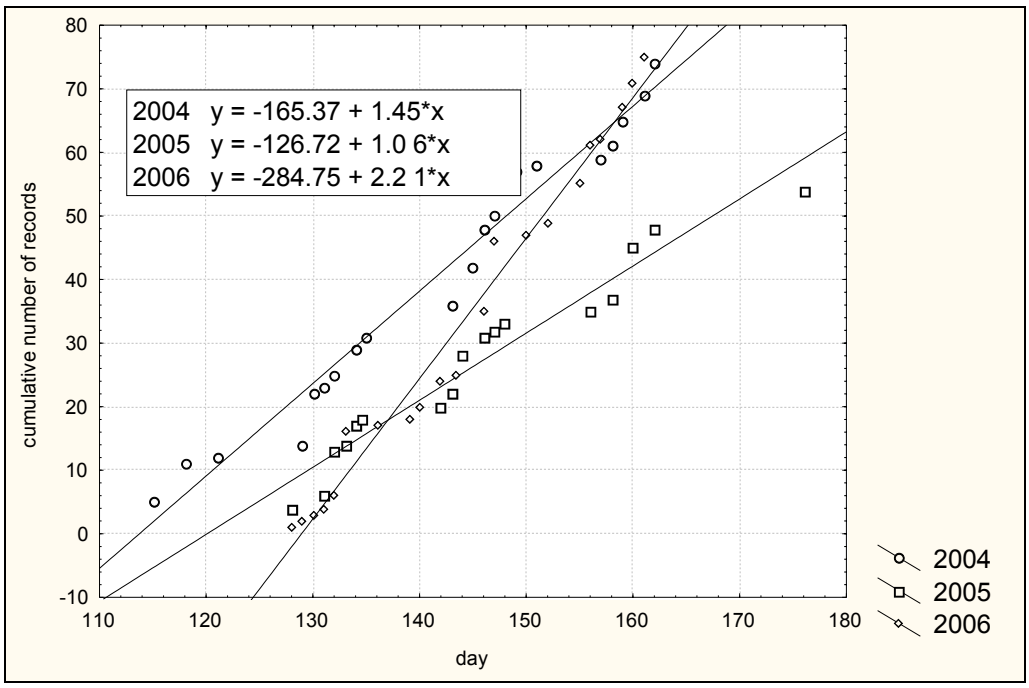

Figure 2.4d. Increase in the cumulative number of recorded signs of argali (2004-2006).

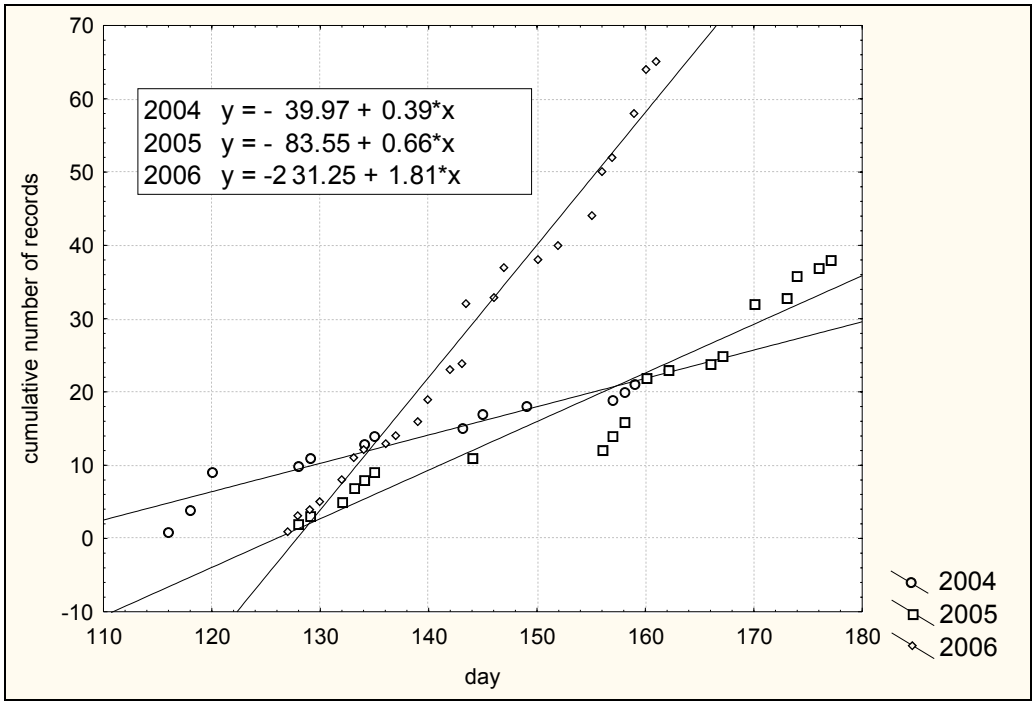

Figure 2.4e. Increase in the cumulative number of recorded signs of Siberian ibex (2004-2006).

Additional surveys

Evidence of other carnivores sharing snow leopard habitat was also recorded. These were wolf, wolverine, fox, lynx and manul. Wolf and wolverine sign (each in 9% of snow leopard presence/absence surveys of 2006) were found at various elevations. Since 2004 wolf sign has been recorded in 10% of cases, fox in 9, manul in 8, wolverine in 4, and lynx sign in 2% of the cases.

Wolf is the only predator currently preying on domestic livestock in the area. Unfortunately, eradication measures for the wolf include poisoning and the use of traps, a potential hazard for the snow leopard as well.

Video camera trapping equipment was carried by the expedition in 2004 and 2005. Possible locations were identified and tested, but without success. Indeed, the chances of remote video capture (particularly if only one camera is in use) of snow leopard are slim until a trail or 'relic' scrape is found.

2.5. Conclusions (Заключение)

On an expedition such as this, covering a large area of remote, rough and broken terrain, it is difficult to find signs of snow leopard and 'primary' prey species, especially during the summer absence of prolonged, continuous snow cover. Ungulates and carnivores favour higher ground and are more dispersed during this season and snow leopard sign is harder to find.

The field evidence from the first year (2003) indicated that snow leopard is present in the area surveyed. This, together with evidence from local people, confirmed the importance of the study area as a habitat for snow leopard and as a corridor for snow leopard dispersal between Russia and Mongolia. Sign of snow leopard was found in the core area implying a resident animal and/or or more than one snow leopard in the research area. However, in the following year (2004) no other sign was found, besides one fairly old (perhaps a few months) scat presumably belonging to the species, showing that snow leopards may have left the area or are visiting it on an occasional basis. Although at that time sign of prey species was found throughout the survey area, observations were made, and sign found of, 'primary' prey species in the core area (survey block 1) and in the corridor area (survey block 2), there still remains a question of how adequate is the 'primary' prey base to sustain a healthy snow leopard population as Siberian ibex and argali seemed to be present in relatively small numbers.

Many older herders (as well as other people interviewed) had seen snow leopards (adults and cubs) and/or signs of their activity within survey blocks 1 and 2 and in the surrounding area. Sightings were most frequent adjacent to, or in, the core area. Sightings have decreased significantly since 1998, even after taking into account the change in winter herding practices. Snow leopard predation of domestic livestock had occurred in the past, but there were no records of any incidents after 1993. The evidence from interviews suggests the study area once held a healthy, breeding snow leopard population, which is now in steep decline, along with the prey species on which it depends. The studies presented strongly suggest that the main cause for this is likely to be increased poaching of snow leopard and ungulates exacerbated by seriously diminished facilities to combat these problems.

On the other hand, repeated surveys have shown the habitat in the Talduair massif to be sufficiently varied and capable of sustaining a healthy prey base for the snow leopard. Fresh signs of snow leopard presence recorded in 2005 are an indication that the core area once again has been visited and used, due, perhaps, to the tentative increase in the pool numbers of the 'primary' prey species. The developing relationship between the predator and prey species seems to be very fragile, so any decline (perhaps, even slight) in the prey species (namely argali and Siberian ibex) may drive the snow leopard out of the core area, but presuming an increase in numbers of the 'primary' prey species (particularly the Siberian ibex) it is very likely that other factors (instead of just food availability) are gaining an overwhelming impact on snow leopard presence in the study area as in 2006 there have been no records of snow leopard sign in the core area, but outside of it to the northwest.

In this respect the corridor area located to the northwest beyond the Buguzun-Karagai-Tekelu boundary is of vital importance for animals recolonising the core area of this study. In some way the relationship between these two areas resembles the 'continent' and 'island' relationships in biogeography (MacArthur & Wilson 1967), a notion arising from the digital modeling exercise (Fig. 2.5a). Indeed, mountain ranges located north of the Talduair massif together with the Kurayskiy range form an extensive cluster of 'excellent' habitat area interconnected with similar areas in the northern Chuyskiy range favouring snow leopard presence. So, given a sufficient 'primary' prey population and reduction of human disturbance (especially illegal hunting), the core area in mind can be repopulated at any time from this neighbouring large 'corridor' area. Unfortunately, the worrying decline in snow leopard and prey species numbers is affecting these areas as well, so, unless action is taken soon, chances for restoring the snow leopard may be thinning out.

Overgrazing by livestock and erosion caused by vehicles is also a problem, particularly at lower altitudes. Improved anti-poaching control together with a temporary ban on hunting could have an immediate impact on halting the decline of prey species and, by inference, snow leopards. The survey area urgently needs proper protection. Involving the local community and helping them to benefit as well as wildlife is vital for any conservation initiative to succeed.

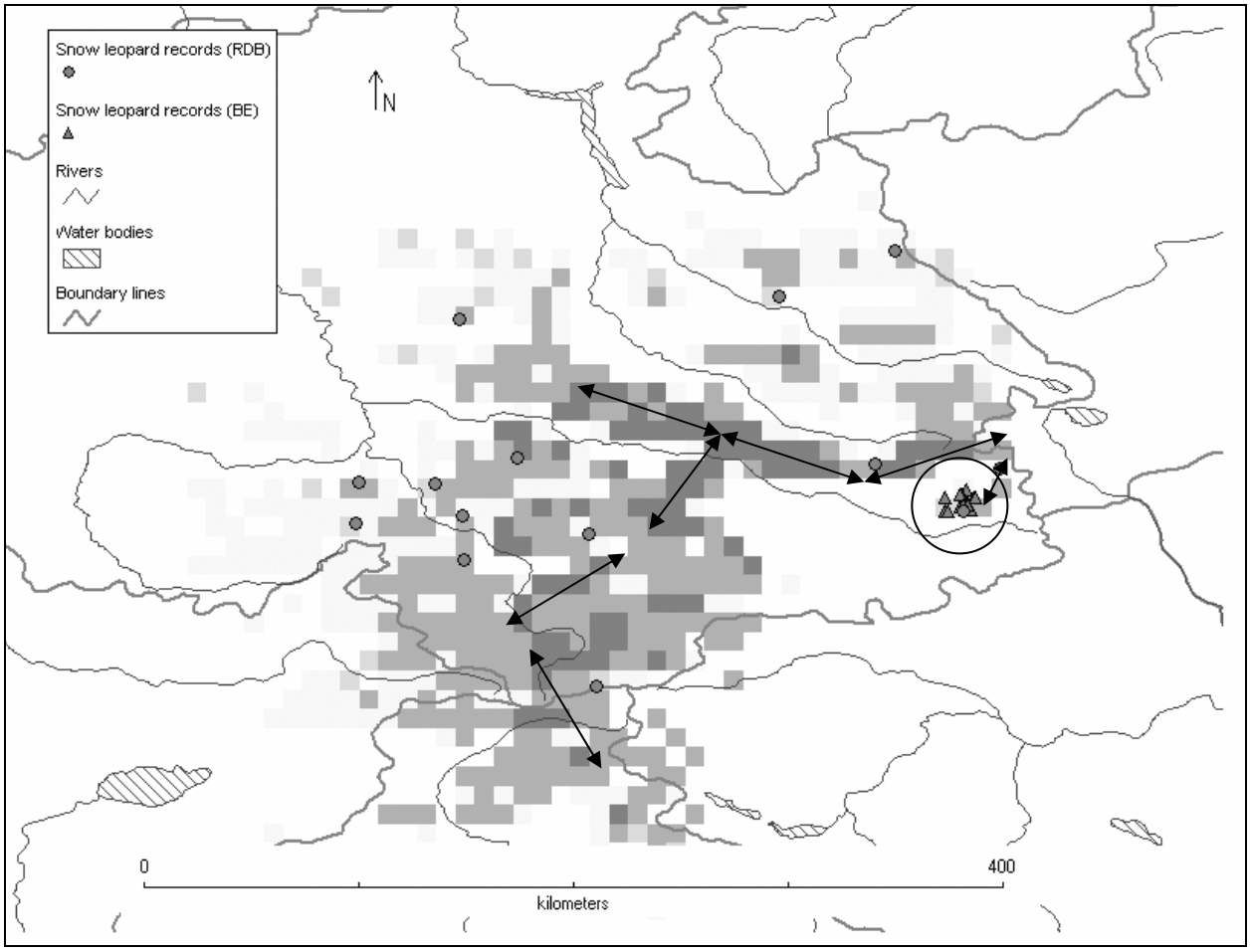

Figure 2.5a. Digital distribution model of the snow leopard in the Republic of Altai (and some adjacent areas); areas within the darkest grey-shaded cells present the most favourable ('excellent') combination of ecological conditions required by the species; arrows indicate potential migration routes and corridors between areas of 'excellent' habitat; the circle encloses the Biosphere Expeditions survey area.

In summary:

- Results from SLIMS data sheets confirm the fragility of the area for sustaining a viable snow leopard population and its temporary status as a snow leopard habitat, primarily depending on the presence and availability of prey and the absence of human pressure.

- The major threat facing the snow leopard and prey population within the study area is poaching. Secondary threats come from habitat degradation caused by grazing pressure, human disturbance and proposed development (a through road to Tuva and a gas pipeline). If development goes ahead it will exacerbate the poaching problem and cause further damage to an already fragile ecosystem.

Management recommendations include:

- An immediate temporary ban on hunting any of the larger prey species. Ibex and argali numbers are not high enough locally (though these seem to be increasing, particularly of the ibex) to support hunting pressure and it is almost impossible to regulate what is shot once a license is issued.

- Improving the economic situation of local people in return for participation in wildlife monitoring and helping with anti-poaching. This might be possible using the combination of ecotourism and marketing products made by herders. This aspect needs further investigation and consultation with herders.

- Further research in the study area especially the corridor area (survey block 2 and beyond, as indicated by the ecological niche modeling) and lower valleys (survey block 1). One winter survey (this would be of shorter duration), or extension of the expedition season into September, would enhance monitor snow leopard and prey population trends.

Outlook & future expedition work:

Further research is needed to monitor snow leopard and prey population trends in the survey area. Presence/absence surveys will be repeated in the following years and relative abundance surveys will also be undertaken in the most suitable habitat areas. Finding a trail and/or relic scrape(s) is still a high priority. If either of these are found, remote camera-trapping will be included as a survey tool. Collecting scat for DNA analysis must continue to play an important part in the research; for this purpose the search should be continued for an appropriate grant for processing the scat samples in a laboratory. Liaising with local people will continue to play a key part in the research. Continued dialogue with herders is very important, not only to find out what has happened in between expedition periods, but to involve them more fully in the research and explore possibilities of benefiting the local community.

Заключение

С 6 июля по 8 августа 2006 г. проведено обследование на наличие снежного барса в районе горного массива Талдуаир и оценка подходящих для вида местообитаний. Вели поиск отпечатков лап, поскребов, экскрементов, мочи и мочевых меток. Исследования прошлых лет года дали основания считать, что в районе обитает по крайней мере одна особь. Находка лишь одного образца экскремента в 2004 году дало повод предположить, что вид покинул рассматриваемую территорию или только временно ее посещает. Сделанные в 2005 г. находки отпечатков лап и мочевых меток указывают на возвращение в район снежного барса, что может быть связано с некоторым увеличением численности его потенциальных жертв, в первую очередь горного козла, но отсутствие подобных следов в 2006 г. (все находки были сделаны в другом районе – на СЗ от основного района исследований) позволяет предположить, что возрастающее негативное влияние оказывает беспокойство со стороны людей.

редполагается, что снежный барс проникает на территорию горного массива Талдуаир с массивов, расположенных севернее линии, образуемой реками Бугузун-Карагай-Текелю, и входящими с состав своебразного миграционного коридора.

одобное предположение покрепляется полевыми наблюдениями и компьютерным моделированием экологической ниши снежного барса, выполненным с помощью ГИС-технологии.

Оценка подходящих для вида местообитаний, расположенных на высотах 2134-3280 м н.у.м., показал, что имеется определенный потенциал для присутствия здесь снежного барса, чему способствует рельеф, слабая посещаемость мест скотоводами (хотя в расположенных ниже угодьях выпасание домашних животных является обычной практикой), признаки пребывания потенциальных жертв (прежде всего, сибирського горного козла и аргали).

Вместе с тем, имеются признаки незаконной охоты на основных потенциальных жертв снежного барса, и снижение их численности может привести к полному исчезновению вида на рассматриваемой территории.

Необходимо ввести запрет и/ или строгий контроль на отстрел диких копытных и придание району Талдуаир природоохранного статуса. Улучшение благосостояния местного населения и экологическое просвещение могут стать составными элементами комплексной природоохранной программы, целью которой станет сохранение такого флагманского для всей экосистемы вида как снежного барса.

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Please note: Each expedition report is written as a stand-alone document that can be read without having to refer back to previous reports. As such, much of this section, which remains valid and relevant, is a repetition from previous reports, copied here to provide the reader with an uninterrupted flow of argument and rationale.

3. Bird Survey

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3.1. Introduction

It is often asserted that birds are convenient indicators of biodiversity, at least at larger scales and that they are useful for monitoring environmental change (as discussed by Furness & Greenwood 1993). One reason is that birds have long been popular with naturalists, amateur and professional, and consequently their systematics and distributions are better known than any other comparable group of animals

A measure of the species diversity is a meaningful complementary result from a wildlife count survey. It allows managers to document the ecosystem health with reference to similar ecogeographical areas and to evaluate the biological potential of an area managed with objectives of natural resources exploitation. Under a monitoring scheme, regular information on community composition and species assemblage, combined together with a special focus on target species (harvested or flagship species, such, for instance, as the snow leopard), provides greater sensitivity to evaluate ecosystem responses to development of anthropogenic activities or to changes in management strategies (Kremen et al. 1994). Comprehensive ecological monitoring is therefore a crucial source of information to integrate both conservation and management objectives.

3.2. Methods

The abundance of birds and the diversity of their communities are difficult things to measure. The acquisition of quantitative data presents many problems, yet such data are becoming more necessary, for example in allocating categories of threat to the rarer species (Mace & Stuart 1994, Sisk et al. 1994, Bennun & Njoroge 1996).

For the purpose of measuring and comparing bird diversity there are two broad groups of methods: those which generate a species list, perhaps with an approximation of abundance, and those which generate a species list with a quantifiable measure of abundance (for details see Bibby et al. 1992; Russian version published in 2000).

For birds, abundance is enormously difficult to measure with any precision. A key problem is the difference between observed and real abundance. Various methods can yield data on distribution as well as abundance, but they differ considerably in the amount and types of data they produce in relation to the effort put into them. All quantitative methods are relatively time-consuming and cost-effectiveness is thus important. Using a combined measure of abundance and diversity is a widespread practice in bird surveys.

Typically, a survey consists of set of counts. The mean score for each species is regarded as an index of its abundance. Bibby et al. (2000) proposed a simple approach, in which abundance is indexed by the simple proportion of the counts in a survey in which a species is encountered. It is obvious that the more common the species, the more likely it is to be recorded with higher frequency. For example, out of the total of 499 records of species being encountered on a particular day, 28 (or 5.6%) belong to the black-eared kite, one of the most common birds in the study area. On the contrary, rare species met only once account only for about 0.25%.

In general, the timing of the expedition survey and available logistics constrained our choice to presence-absence methodologies and those which could yield useable data in one day's sampling per transect.

The census methods we employed consisted of different transect counts (car day and foot counts). The overwhelming majority of censuses were based on direct sightings. Animals detected were identified either by naked eye or with binoculars. For the analysis car day counts and foot counts were pooled.

Sampling units (i.e. transects) were spread over the whole study area and covered all habitat types. This network did allow for a relatively fair proportional coverage of habitat units, so we consider it to provide a representative sample of the area for a reliable estimate of bird diversity. The time to complete a transect took time between 2 and 9 hours and varied around an average of 6 ± 0.5 hours. Sampling time (in days) was used in our analysis as a measure of the sampling effort; around a quarter (22.6%) of the surveys were carried out by expedition team members which devoted their spare time between the slots for recording bird species within the proximity of the base camp (Table 3.2a).

Table 3.2a. Sampling effort (by slots, between slots and total).

Slots	Dates	Sampling effort
1	4.07.-12.07.	9
2	18.07.-26.07.	8
3	1.08.-8.08.	7
1-3	4.07.-9.08.	**subtotal: 24**
Surveys undertaken between slots	14.07-17.07 29.07-31.07	7
		Total: 31

Records were entered into a datasheet after each survey in the evening of the same day.

3.3. Data Analysis

The simplest and least controversial estimate of diversity is the number of species (S, species richness) in a defined area, such as a particular habitat (Magurran 1988). The total species richness of a site can only be approximated by exhaustive data collection. Even then, 'new' species can be added after thousands of hours in the field. However, species richness can be extrapolated in various ways from the numbers actually recorded.

One way of assessing inventory completeness and standardizing the comparisons of different inventories is through the use of species accumulation models fitted to species accumulation curves (Soberon & Llorente 1993), in which the cumulative number of species is plotted against some measure of the effort it took to obtain that sample (Hayek & Buzas 1997). The measure of effort can be the number of individuals observing, number of samples, traps, trap-days or some other measure of area or time (Soberon & Llorente 1993, Colwell & Coddington 1994, Hayek & Buzas 1997, Longino & Colwell 1997). The curves of species accumulation models reach an asymptote when the probability of adding a new species to the list approaches zero.

Species accumulation models allow: (i) measures of inventory effectiveness and completeness within a given study, and (ii) valid comparisons between studies based upon a standardised measure of sampling effort. The use of species accumulation functions can result in better planning and sampling protocols by providing reliable estimates of the minimum effort required to obtain an efficient inventory, and, consequently, can result in notable savings in time and field expenses (Soberon & Llorente 1993).

To assess the completeness of the inventory method relative to the sampling effort invested, and to project species accumulation curves, we fit two asymptotic models (reviewed by Soberon & Llorente 1993) to our species accumulation data: the linear dependence model and Clench model.

The linear dependence model is based on the concept that the number of species collected decreases linearly as sampling effort increases:

$$S(t) = a/b[1-exp(-bt)],$$

where t is a measure of effort (in our case number of days), $S(t)$ is the predicted number of species at t, a represents the rate of increase at the beginning of the sampling, and b is species accumulation. Soberon & Llorente (1993) recommended this model for situations where the taxon is well known or the study area is relatively small and could theoretically reach an asymptote over a infinite period of time.

We used Lamas, Robbins & Harvey's (1991) equation for estimating the time required to register a proportion of the total fauna as predicted by the asymptote (*tq*):

$$t_q = - 1/b \ ln(1-q),$$

where *q* is the desired proportion of the total fauna for which the required time is estimated.

The Clench model assumes that the probability of adding species to the list decreases with the number of species already recorded, but increases over time:

$$S(t) = at/(1+bt).$$

Soberon & Llorente (1993) recommend this model for larger areas than those where the linear dependence model would be applied, or for taxa for which the probability of adding new species will increase as more time is spent in the field, until an upper limit is reached. For this model, we applied Soberon & Llorente's (1993) equation for *tq*:

$$tq = q/[b(1-q)].$$

For both models the predicted asymptote is calculated as *a/b*.

Moreno and Halffter (2000) reported for bat sampling that the linear dependence model best predicted the 'lower limit' asymptote and that the Clench model best predicted the 'upper limit' asymptote, with the true relationship lying between these two curves.

The species accumulation curves were obtained by taking the number of survey days as sampling effort. To eliminate the influence of the order in which nights were added to the total, the sample order was randomized 100 times using *EstimateS* software (Colwell 2005), for which either abundance data, or using summed incidence data (frequencies of occurrence, pooled among samples), are suitable.

This produces smoothed species accumulation curves (Fig.3.4a) by repeated random reordering of the samples (Longino & Colwell 1997). We fitted the asymptotic models to these smoothed curves.

We assessed the completeness of our bird inventory by calculating the proportion of the maximum number of species (asymptote) registered at the end of sampling. By definition, reaching 100% richness would require an infinite effort, and the rate of species recorded per effort invested decreases markedly as the curve approaches the asymptote (Soberon & Llorente 1993). Thus, the effort required to register a species increases substantially as the proportion of species encountered approaches the total number of species present. We selected 90% of the total fauna as a conservative, but satisfactory, level of inventory completeness for the purpose of making valid comparisons, and estimated the effort required to reach this level. We used a non-linear regression (Statistica Package 1995) to fit the two models to the smoothed curves of the observed data.

The Chao2 (Chao, 1987) species richness estimator was also calculated (using *EstimateS* software) for the data:

$$S_{Chao} = S_{obs} + F_1^2/2F_2,$$

where S_{obs} is the number of species observed, F_1 is the number of species with exactly one individual and F_2 is the number of species with exactly two individuals. Several authors recommend Chao2 as the most robust estimator of species richness where most species are infrequent (Colwell & Coddington 1994, Chazdon et al. 1998). In our case more than half of the species were observed only once or twice.

Both species accumulation and species richness estimator curves represent the average values from 100 randomisations of sample order.

Diversity was estimated by the Shannon index (entropy, *H'*), which takes into account the number of individuals (or its analogue) as well as number of taxa:

$$H' = - \sum n_i/n \ ln \ (n_i/n),$$

where n is the total number of individuals and n_i is number of individuals of taxon i. This index varies from 0 for communities with only a single taxon to high values for communities with many taxa, each with few individuals. The variance of *H'* (*Var H'*) is used as a measure of statistical error, however the significance of differences in diversity between subsamples was by preference determined by bootstrap analysis with 1000 random permutations (Hammer et al. 2005).

Of course, all methods have weaknesses, but it is only big differences in species richness which are likely to be useful as indicators of conservation value. However, when considering conservation priorities, species richness should, wherever possible, be combined with other measures, such as the presence of rare or restricted range species (see, for example, Usher 1986). For the local avifauna abundance categories have been ascertained using a restricted logarithmic scale (Pesenko 1982).

3.4. Results

The methods used resulted in a presence-absence data set. A total of 105 species were recorded (belonging to 14 orders, 31 families, and 67 genera). Another 7 species were not identified or there are doubts about their identification.

Up to now a total of 148 bird species have been recorded by Biosphere Expedition teams in the area since the surveys commenced in 2003 (see appendix 1).

The following analyses of bird diversity were made:

Species richness & diversity

Species accumulation curves were plotted to estimate inventory effectiveness and completeness and allow valid comparisons in further monitoring studies applying the same or similar methodologies. Both the total simple species accumulation curve and theoretical (smoothed) curve together with its upper and lower 95% confidence boundaries are presented in Fig.3.4a. This graph shows that in the beginning of the survey (for a period of around 20 days) more species were encountered than could be theoretically expected: points representing the raw data overstep the upper 95% confidence boundary of the smoothed curve. Quite likely such a departure between the total simple species accumulation curve and theoretical (smoothed) curve could be due to a larger portion of experienced birdwatchers amongst the team members coming in the first half of the expedition and more frequent visits to the Kokorya and Bailukem lowlands yielding a fairly high number of wetland birds (particularly duck species, grebes etc.) not usually seen before.

The rate at which the curve flattens is crucial for estimating inventory effectiveness and completeness. A visual analysis of the graph indicates that perhaps more species would have been encountered if the expedition period lasted longer (as it is quite obvious that the curve has not reached its “ceiling”). Formally a plateau in the species accumulation can be defined here as the point where the rate of species accumulation over a 10-sample interval falls below 0.10 (O’Dea et al. 2004), however in the last 10-sample interval it remains above this threshold and comprises a value of 0.14.

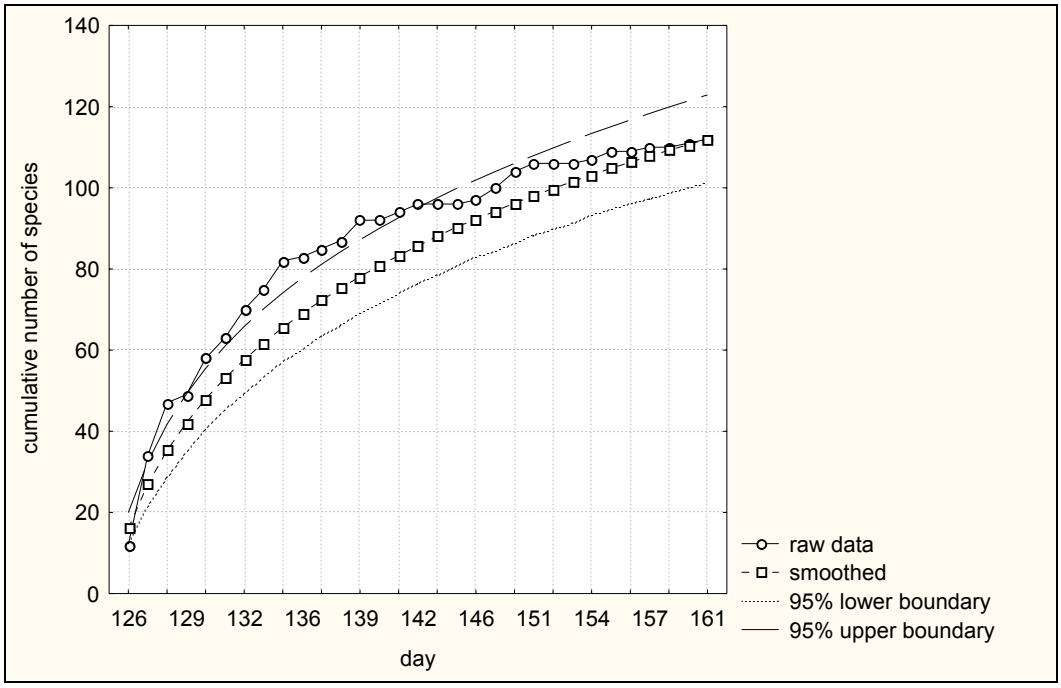

Figure 3.4a. The total simple species accumulation curve (smoothed curve produced by 50 random reorderings).

Theoretically the linear dependence model predicts that 109 species are expected to be met in the area, whereas the Clench model envisages about 139 (see Table 3.4a). In fact the real number of species recorded in one year is likely to be between these estimates. It may be worth noting here that in 1974 a team of professional ornithologists led by I.A. Neufeldt recorded 139 species in the comparatively nearby and similar, but presumably richer in birdlife Chagan-Uzun catchment area (Neufeldt 1986).

On the other hand each year of inventory is a unique event (because of varying weather conditions, varying numbers of keen birdwatchers, etc.), so it would be hard to expect the resulting bird species lists to be identical and share 100% of common species. But they do overlap to a considerable extent, ranging from 60.6% (inventories accomplished in 2003 and 2006) up to 71.8% (2004 and 2005) of common species, so eventually the total number of species recorded in the area since 2003 reaches 148.

Table 3.4a. Number of species recorded, parameters and predictions of two species accumulation models fitted for the total data, where *a* is the slope at the beginning of the sampling, *b* is a parameter related to the shape of the accumulation of new species during the sampling, *a/b* is the asymptote (expected number of species), t_{90} is the expected effort (in days) for revealing 90% of the avifauna, and *R* is the correlation coefficient.

Number of species	*a*	*b*	*a/b*	t_{90}	*R*
		Linear dependence model			
112	10.789±0.413	0.099±0.005	109.0	24	0.987
		Clench model			
112	13.597±0.433	0.098±0.005	138.7	92	0.996

As for the simple species accumulation curve, no plateau in the estimate of total richness (calculated by the Chao2 estimator) was achieved when standard deviations in the Chao2 estimate fall to below 5% of the estimated species richness (O'Dea et al. 2004). In our case standard deviations remain substantially above 5% of the estimated species richness, reaching the lowest value of 18.8% of an expected number of bird species in the study area ranging between 53 and 134.

The overall diversity of the avifauna (assessed by the Shannon index, *H'*) comprised 4.147 (*VarH'*=0.00173). The bootstrap analysis detected no significant differences in diversity between samples collected in the previous year and 2006 (t=1.73<1.96).

Table 3.4b. Summary of species in each taxonomic unit (bird order and family).

Order	No. of species	Family	No. of species
Passeriformes	47	Alaudidae	3
		Cinclidae	1
		Corvidae	9
		Emberizidae	3
		Fringillidae	2
		Hirundinidae	3
		Laniidae	1
		Motacillidae	5
		Paridae	1
		Ploceidae	1
		Prunellidae	2
		Sturnidae	1
		Sylviidae	3
		Turdidae	12
Falconiformes	17	Accipitridae	14
		Falconidae	3
Charadriiformes	14	Charadriidae	10
		Laridae	4
Anseriformes	8	Anatidae	8
Galliformes	5	Phasianidae	3
		Tetraonidae	2
Columbiformes	3	Columbidae	2
		Pteroclidae	1
Gruiformes	2	Gruidae	2
Podicipitiformes	2	Podicipitidae	2
Strigiformes	2	Strigidae	2
Ciconiiformes	1	Ciconiidae	1
Coraciiformes	1	Upupidae	1
Cuculiformes	1	Cuculidae	1
Gaviformes	1	Gaviidae	1
Piciformes	1	Picidae	1
Total: 14 orders		**Total: 31 families**	

A qualitative analysis of species diversity done by taxonomic unit (bird order and family) shows that most species (47 out of 105, or 44.8%) belong, as one could expect, to passerine families (Table 3.4b). In terms of species numbers, passerines are followed almost in equal proportions by raptors (families Accipitridae and Falconidae) and waders (predominantly Charadriidae), composing respectively 16.2% and 13.4% of the local avifauna.

More duck species (Anseriformes) were recorded this year as a consequence of a more intense birdwatching survey of the wetlands adjacent to the study area, particularly those located in the floodplains of the Kokorya and Bailukem rivers. In general, however, the distribution of species amongst the major bird orders for the years 2004-2006 (excluding the Anseriformes) remains stable as shown by the Chi-square statistical tests (all *p*-values above the 0.05 threshold) (see Table 3.4c).

Table 3.4.c. Distribution of species amongst the major bird orders for survey years 2004-2006.

Orders	2004	2005	2006
Passeriformes	36	48	47
Charadriiformes	12	15	14
Falconiformes	14	12	17
Galliformes	6	5	5
Other (pooled)	8	10	14

$\text{Chi-square}_{2004/2005} = 1.34$, $d.f. = 4$, $p = 0.85$;
$\text{Chi-square}_{2005/2006} = 1.31$, $d.f. = 4$, $p = 0.86$

Trophic diversity

Species recorded were divided into five trophic categories (carnivore, herbivore, insectivore, piscivore and omnivore) on the basis of their primary food diets: Carnivores include raptors and species that feed on carrion; herbivores consume herbaceous food, however may occasionally pick up insects and other non-insect prey; insectivores (a fairly conditional category) too may feed on non-insect invertebrates, include herbaceous food items to their diet; piscivores feed primarily on fish, but may also prey on invertebrates etc.; omnivores usually consume any kind of available food.

Table 3.4d. Summary of trophic diversity of recorded species.

Trophic category	insectivore	carnivore	herbivore	piscivore	omnivore
No. of species (2004)	46	13	10	5	4
%	59.0	16.7	12.8	6.4	5.1
No. of species (2005)	61	12	12	3	5
%	65.6	12.9	12.9	3.2	5.4
No. of species (2006)	59	15	20	6	5
%	56.2	14.3	19.0	5.7	4.8

$\text{Chi-square}_{2004/2005} = 1.08$, $d.f. = 3$; $p = 0.783$;
$\text{Chi-square}_{2005/2006} = 2.12$, $d.f. = 3$; $p = 0.548$

In most cases there are hardly any clear-cut rules for assigning a species to a certain category and the food composition of species belonging to different categories may overlap, so there will always be room for some uncertainty.

Table 3.4d summarizes the trophic diversity (diet guilds) of the recorded species. Generally speaking, figures in the table are in compliance with the species diversity analysis done by taxonomic unit. Indeed, passerines representing around half (45%) of the species in the area are primarily insectivorous. So, as well, are many of the recorded wader species.

As in previous years carnivores continue to make up a high-ranking diet guild (a position in terms of proportions shared this year with the herbivores, p=0.165<0.05), indicating a rich source of secondary production in the area capable of maintaining an array of raptor species and specialized scavengers. The Chi-square tests (summarized in Table 3.4d) show that variations in the figures observed between the survey years are statistically insignificant.

Habitat diversity

The study area has been subdivided arbitrarily into the following eight large habitat units: fluvial lowland (including the Buguzun River floodplain and adjacent lake areas), steppe (in fact, the floor of the largest valleys), forest (primarily Siberian larch stands, reaching the treeline at an altutude of approximately 2400 m), mountain steppe, mountain tundra, open rock (including cliffs and scree fields), intrazonal habitats (such as, for instance, narrow mountain river valleys, gorges etc. quite often vegetated differently from the surrounding landscape), urban (places in and around human settlements, but in our case poorly investigated).

Table 3.4e. Summary of similarity of the avifauna of various habitat types and number of species met in each particular habitat type

	Fluvial lowland	Steppe	Forest	Mountain steppe	Mountain tundra	Open rock	Intrazonal habitats	Urban
Fluvial lowland	x	x	x	x	x	x	x	x
Steppe	0.137	x	x	x	x	x	x	x
Forest	0.147	0.222	x	x	x	x	x	x
Mountain steppe	0.068	0.370	0.204	x	x	x	x	x
Mountain tundra	0.041	0	0.205	0.400	x	x	x	x
Open rock	0	0	0	0.267	0.600	x	x	x
Intrazonal habitats	0.197	0.286	0.275	0.095	0	0	x	x
Urban	0.089	0.150	0	0.077	0	0	0	x
Total number of species seen in: (data 2006)	39	34	29	21	10	10	22	6
Total number of species seen in: (data 2005)	34	27	26	21	14	11	15	4
Total number of species seen in: (data 2004)	26	26	23	20	10	9	17	2

$\text{Chi-square}_{2004/2005} = 0.90$, $d.f. = 6$; $p = 0.99$;
$\text{Chi-square}_{2005/2006} = 2.64$, $d.f. = 6$; $p = 0.85$

The upper part of Table 3.4e summarises the similarity of the avifauna of various habitat types (assessed in by the Sørenson qualitative measure, 2M/(2M+N), using M for the number of matches and N for the total number of taxa with presences in just one sample. The lower part shows the total number of bird species met in each particular habitat type. The Sørenson measure is a simple measure suitable for presence and absence data, and it treats all species as equal irrespective of whether they are abundant or rare (Magurran 1988).

Figures in the table confirm a common distributional pattern: lowlands, in general, are richer in bird species than are highlands (Zlotin 1975). In our case (for 2006) the fluvial floodplain area and the floor of the largest valleys harbour 39 and 34 species, respectively, whereas, on the other side of the spectrum mountain tundra and open rock habitats accomodate 10 species each. Forests, as an intermediate set of habitats, harbour 29 species, sharing around 20% of them with the mountain steppe above and another 20% with the steppe below. Intrazonal habitats, frequently found penetrating deeply into mountain massifs, or represented in the form of patches, harbour 22 species, primarily of lowland origin: some 20% are shared with the avifauna of the fluvial floodplain, around 30% are found in the steppe, approximately 28% are forest dwellers, and only about 10% of the species is shared with the mountain steppe birdlife.

Although highlands in the study area are noticeably poorer in species, similarity measures indicate the presence here of a unique fauna, quite distinct from the fauna below, sharing between the specific habitats up to 60% of the bird species. This notion is strongly supported by a principle component analysis (for details of the method see Ludwig & Reynolds 1988), showing a strong positive correlation for the species' composition of the highland habitats with the first principle component (PC1, which may be interpreted as "altitude", and PC2 perhaps as "wetness of the habitat type"), whereas the rest are correlated negatively (Fig. 3.4b).

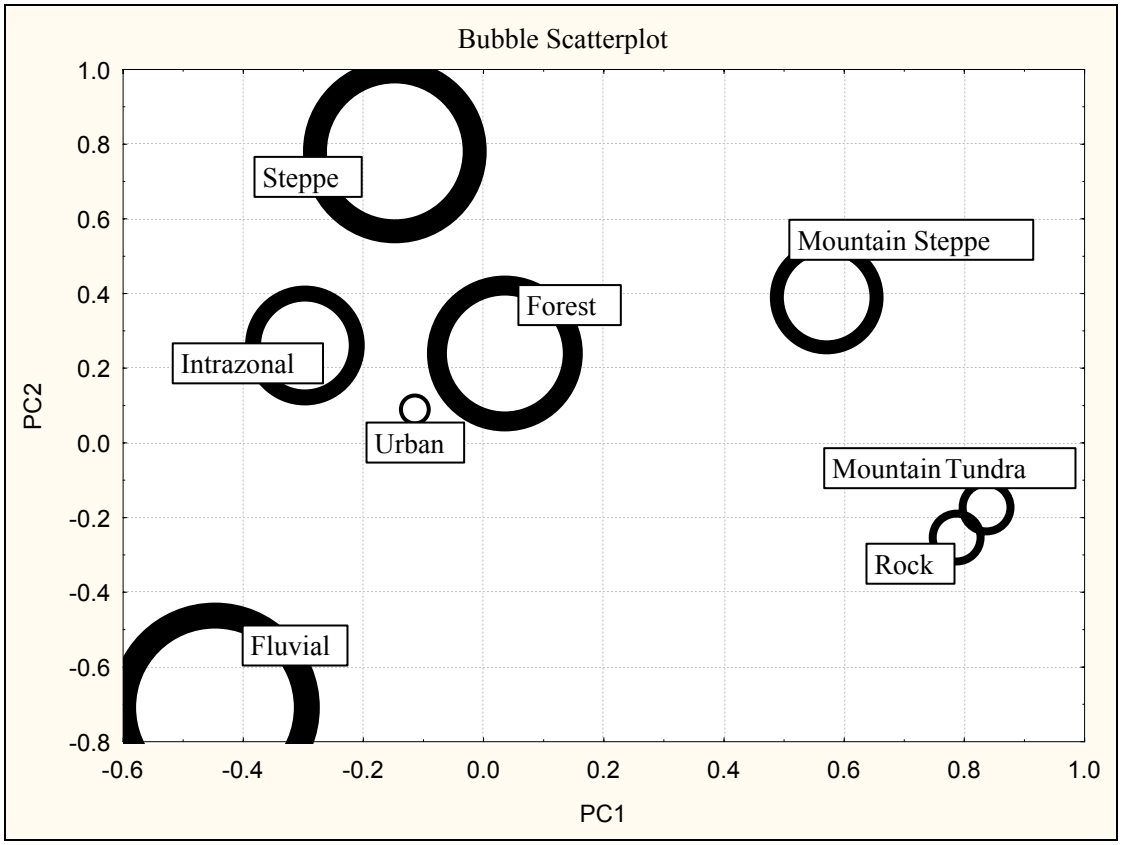

Figure 3.4b. Principle component analysis for avifauna of various habitat types (circles of varying sizes "bubbles" correspond to the total number of bird species met in a particular habitat).

Despite the observed variations in figures, the distribution of species amongst the major bird habitats in the study area for both years (2004 and 2005) remains fairly stable as evidenced by the Chi-square statistical tests (see Table 3.4e).

Body size category.

Together with diet guilds and foraging habitat, guilds body size classes are important for the assessment of functional diversity and relative community "completeness". Wing length was taken as an index of the overall body size of a bird (Ivanov & Shtegman 1978).

Naturally bird communities, as communities of many other animals, particularly vertebrates, being more or less intact consist of many small-sized species and fewer ones of large size, and mathematically such a distribution of size classes is satisfactorily modelled by the lognormal function (Hemmingsen 1934). This general rule also applies to our data quite well (see reports for 2004 and 2005).

In disturbed communities larger species usually are the first to be affected by negative influences and their chances to disappear are higher. Statistically speaking, this will distort the distribution by shifting the parameters of the mean and variance of the lognormal function. However, variations in the figures (note: size data has been log-transformed) observed between the consecutive survey years are statistically insignificant as shown in Fig. 3.4c ($t_{2004/2005}$ = 1.28, $d.f.$ = 169, p = 0.20; $t_{2005/2006}$ = 1.39, $d.f.$ = 196, p = 0.16; $F_{2004/2005}$ = 1.080, $d.f._1$ = 92, $d.f._2$ = 92, p = 0.63; $F_{2005/2006}$ = 1.075, $d.f._1$ =104, $d.f._2$ = 92, p = 0.64).

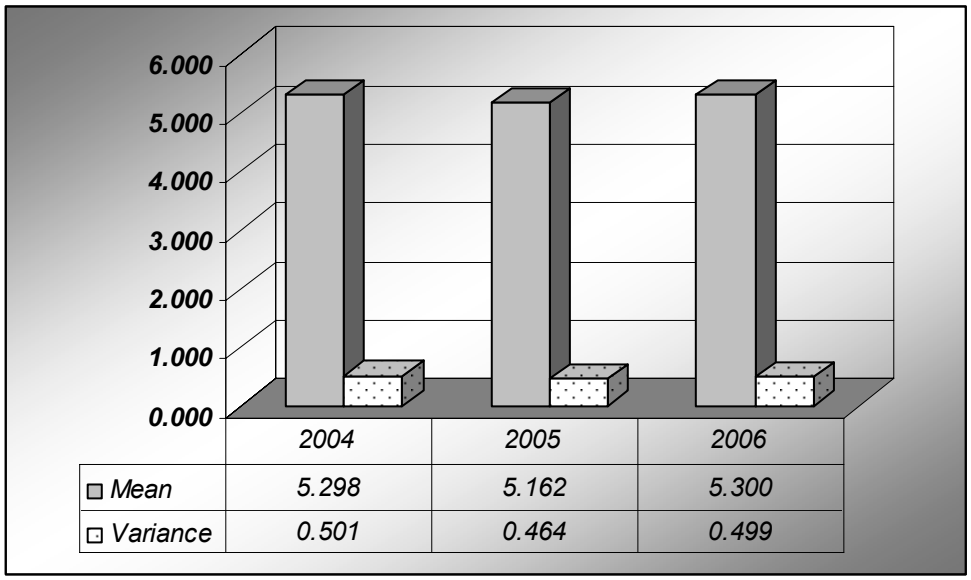

Figure 3.4c. Means and variances of the log-transformed size of bird species in the avifauna of the study area.

Local and regional rarity

Different methods have been proposed for defining abundance classes. Following Pesenko (1982), we use the logarithmic approach in which the upper boundary for each abundance class is defined as: $N^{a/k}$, (a=1, 2, ..., k), so the upper boundary for the rarest category in a series of 5 abundance classes (k =5) will be set at $31^{0.2}$ = 1.99 (rounded off to 2). In such a way the uniques (species that occur in only one sample) and duplicates (species known from two samples) fall into one abundance class, and in our case they comprise 52.7% of all the recorded species. Boundaries for the remaining four abundance classes (2 to 5) are presented in Table 3.4f.

Table 3.4f. Summary of abundances of recorded bird species (2004-2006)

Abundance classes					
1 (rare)		2 (few)	3 (moderate)	4 (common)	5 (abundant)
Data 2004					
1-2 records		3-4 records	5-8 records	9-16 records	17-31 records
uniques: 26 (33.3%) duplicates:18 (23.1%)	*Total:* 44 (56%)	12 (15.4%)	8 (10.3%)	8 (10.3%)	6 (7.7%)
Data 2005					
1-2 records		3-4 records	5-8 records	9-15 records	16-30 records
uniques: 38 (40.9%) duplicates:11 (11.8%)	*Total:* 49 (52.7%)	13 (14.0%)	15 (16.1%)	12 (12.9%)	4 (4.3%)
Data 2006					
1-2 records		3-4 records	5-8 records	9-16 records	17-30 records
uniques: 37 (35.2%) duplicates:19 (18.1%)	*Total:* 56 (53.3%)	15 (14.3%)	18 (17.1%)	10 (9.5%)	6 (5.7%)

Chi-square$_{2004/2005}$ =2.31, *d.f.* = 4; p = 0.67;
Chi-square$_{2005/2006}$ = 0.74, *d.f.* = 4; p = 0.95

Amongst the most common birds (abundant) are the black-eared kite, Isabelline wheatear, Northern wheatear, Demoiselle crane*(III), white (or pied) wagtail, red-billed chough.

Next in abundance are the hoopoe, steppe eagle, yellow-beaked chough, long-legged buzzard, rock ptarmigan, common kestrel, Eurasian skylark, golden eagle*(II), ruddy shelduck, carrion crow.

Moderate records were made of the common redshank, common sandpiper, horned skylark, stonechat, Altai snowcock*(III), citrine wagtail, common cuckoo, Guldenstad's redstart, common tern, crested lark, grey wagtail, cinereous vulture* (I), little ringed plover, raven, redstart, rufous-tailed rock thrush, Saker falcon*(III), yellow wagtail.

Fewer records were made of the black-billed magpie, bluethroat, dark- throated thrush, pine bunting, tufted duck, common quail, Daurian jackdaw, greenish warbler, herring gull, imperial eagle*(II), Northern house martin, sand martin, solitary snipe* (II), upland buzzard, willow tit.

Seven species marked with an asterisk are listed in the Red Data Book of the Altai Republic (I-IV stand for their assigned nature conservation status: I – globally threatened, II – declining species, III – rare, IV – species on the edge of its home range and/or poorly known). In 2004 there were nine such species and eight in 2005.

Amongst the rarest species 14 (in 2004 there were seven, in 2005, nine) are listed in the Red Data Book of the Altay Republic: Eurasian eagle owl (II), upland buzzard (III), black stork (II), whooper swan (III), peregrine falcon (I), black-throated loon (II), common crane (II), bearded vulture (I), white-tailed eagle (I), black-tailed godwit (III), white-winged scoter (III), red-breasted merganser (III), rose-coloured starling (III), Pallas' sandgrouse (II).

Alltogether 21 species out of 67 (or about 30%) listed in the Red Data Book of the Altai Republic have been spotted by the expedition team during the survey. In 2004 there were 16 such species (17 in 2005), and since 2003 – a total of 30 (see appendix 1)!

The Chi-square tests shows that variations in the figures concerning the distribution of bird species between the abundance classes observed between the consecutive survey years (Table 3.4f) are statistically insignificant (all *p* above the critical value of 0.05).

3.5. Conclusions (Заключение)

1. A repeated bird species inventory undertaken by Biosphere Expeditions in the Talduair area of the Altai Republic between 4 June and 9 August 2006, involving a total sampling effort of 31 days, yielded 105 species belonging to 14 orders and 31 families; another 7 species were not identified beyond doubt.

1. В районе горного массива Талдуаир в Республике Алтай РФ с 4 июля по 9 августа 2006 г. проводили очередную инвентаризацию фауны птиц и учет их численности. Работа велась силами трех команд волонтеров, участников экспедиции, в среднем по 12 человек в каждой. Общее количество дней, потраченных на наблюдения, составило 31. В итоге обнаружено 105 видов птиц (принадлежащих к 14 отрядам и 31 семейству); для еще 7 видов нужны дополнительные данные для их надежного определения.

2. Extrapolation methods used to assess the completeness of the inventory indicate that more species would have been encountered if the expedition period (i.e. the sampling effort) had lasted longer. The real number of species recorded in one year is likely to be between the estimates of 109 and 139 species. Now a total of 148 bird species has been recorded by Biosphere Expedition teams in the area since the surveys commenced in 2003.

2. Экстраполяционные методы, использованные для оценки полноты инвентаризации, указывают, что список видов предположительно был бы больше, если экспедиция была бы продлена на дольший срок (соответственно, увеличилось бы количество дней наблюдений). Возможно, что число видов обнаруженых в течении одного полевого сезона составило б 109-139 видов. Усилиями экпедиции за 4 полевых сезона (начиная с 2003 г.) обнаружено 148 видов птиц.

3. An analysis of species diversity done by taxonomic unit (bird order and family) shows that the majority of species belong to passerine families. As in previous years carnivores continue to make up a high-ranking diet guild, indicating a rich source of secondary production in the area capable of maintaining an array of raptor species and specialized scavengers.

3. Анализ таксономического разнообразия птиц показывает, что большинство видов принадлежит к Воробьиным. Хищные птицы продолжают составлять существенную по численности видов трофическую группу, что указывает на достаточные ресурсы вторичной продукции, способные содержать многих хищников и падальщиков.

4. Highlands in the area appear to be poorer in bird species than lowlands, but similarity measures indicate the presence here of a unique fauna, fairly distinct from the fauna below, sharing between the specific habitats a considerable portion of the bird species.

4. Высокогорье в плане количества видов птиц оказалось беднее, чем прилежащие равнины и низкогорье (что является общей экологической закономерностью), однако показатели сходства указывают на наличие здесь уникальной орнитофауны, обособленной от аналогичной фауны расположенной ниже.

5. Intrazonal habitats accommodate primarily species of lowland origin and offer them “corridors” leading into the highlands.

5. Интразональные биотопы населены преимущественно птицами, которые встречаются обычно на равнине или в низкогорных местообитаниях; интразональные биотопы служат этим видам своеобразными «коридорами», ведущими вглубь горных массивов.

6. The distribution of body size classes of birds in the area is satisfactorily modelled by the lognormal function, indicating an undisturbed avian community. Quantifications in this respect may be of use for monitoring long term disturbances that may affect the biota. Variations in the figures observed between the consecutive survey years are statistically insignificant.

6. Статистическое распределение птиц местной фауны по размеру тела удовлетворительно описывается логнормальной функцией, что указывает на относительную «укомплектованность» сообщества. Количественные показатели данного распределения могут быть использованы для длительного мониторинга возможных отрицательных последствий различных факторов на биоту в исследованном регионе. Различий между показателями разных лет не обнаружено.

7. 56 (or 53.3%) of the recorded species can be considered rare; 14 of them are listed in the Red Data Book of the Altai Republic. Since 2003 a total of 30 species listed in the Red Data Book of the Altai Republic have been recorded.

7. 56 (или 53,3%) зарегистрированных здесь видов птиц можно считать редкими; 14 из них занесены в Красную книгу Республики Алтай. Начиная с 2003 г., отмечено 30 видов птиц, занесенных в Красную книгу Республики Алтай.

8. 49 species belong to other abundance categories, ranging from “few” to “abundant”; 7 of them are listed in the Red Data Book of the Altai Republic. A pleasing fact may be considered the presence, even amongst birds the abundance of which has been categorized as “abundant” or “common”, of such flagship species as the Demoiselle crane, or the golden eagle, etc.

8. 49 вида принадлежат к других категориям встречаемости (от «мало» до «очень много»); 7 из них числятся в Красной книге Республики Алтай. Радует тот факт, что среди них (даже принадлежащих к категориям «много» и «обычные») встречаются такие виды как красавка, беркут и др.

9. Comparisons between inventories of 2004-2006 seem to confirm no significant environmental change in the study area and the validity of the approaches we have chosen for biodiversity assessment based on bird species richness and functional (guild) type, especially in terms of replicability.

9. Сравнение результатов учетов 2004-2006 гг. указывет на относительную стабильность окружающей среды в исследованном районе, а также обоснованность методов, используемых для оценки биоразнообразия через структурные и функциональные особенности орнитофауны, особенно в аспекте получения стабильных повторных результатов.

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Please note: Each expedition report is written as a stand-alone document that can be read without having to refer back to previous reports. As such, much of this section, which remains valid and relevant, is a repetition from previous reports, copied here to provide the reader with an uninterrupted flow of argument and rationale.

4. Mammal Survey

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4.1. Introduction

Mammal species have long been far less popular than birds with naturalists, amateur and professional, and consequently their systematics and distributions are poorer known than any other comparable group of animals.

The basic objectives and methods used for the mammal inventory are much the same as for the bird inventory. Methods we employed consisted of different transect counts (car day and foot counts). The censuses were based on both direct sightings (encounters) and signs (tracks, faeces, bones etc.). Animals detected were identified either by the naked eye or with binoculars. Signs were associated with particular species using relevant field guides (Bang & Dahlstrøm 2001, Dolejš 1987, Rukovskiy 1984). For the analysis car day counts and foot counts were pooled. The sampling effort totaled 30 days (between 4 July and 8 August 2006). Records were entered into a datasheet after each survey in the evening of the same day.

4.2. Results

The methods used resulted in a presence-absence data set (appendix 2). A total of 25 species were recorded (belonging to 4 orders, 11 families, and 20 genera). Since 2004 the total number of species has reached 32 (5 orders, 12 families, 24 genera; see appendix 2).

The overall diversity of the mammal fauna (assessed by the Shannon index, H') was 2.83 ($VarH'$ = 0.00280). The Shannon diversity t-test detected no significant differences in diversity between inventories performed in 2004 and 2005, 2005 and 2006 ($t_{2004/2005}$=0.72, p=0.469; $t_{2005/2006}$=0.35, p=0.72), meaning the quantitative structure of the mammal fauna in the area is most likely to be stable. Qualitative similarity between these inventories, as assessed by the Sørenson measure, is high as well and reaches the levels of 85.2% and 86.3% of the species composition.

Table 4.2a. Summary of mammal species in each taxonomic unit.

Order	No. of species	Family	No. of species
Carnivora	8	Canidae	3
		Felidae	3
		Mustelidae	2
Rodentia	7	Sciuridae	4
		Cricetidae	2
		Dipodidae	1
Artiodactyla	5	Bovidae	2
		Cervidae	2
		Suidae	1
Lagomorpha	5	Leporidae	2
		Ochotonidae	3
Total: 4		**Total: 11**	

The fairly large proportion of Carnivora (32%, or around a third of the species) may be (as in the case of the bird fauna) an indication of the complexity of the local community structure and diverse food webs, leading to a corresponding pattern of trophic diversity.

Local and regional rarity

As for the bird inventory we follow Pesenko (1982) in distinguishing the abundance classes using the logarithmic approach in which the upper boundary for each abundance class is defined as: $N^{a/k}$, (a=1, 2, ..., k), so the upper boundary for the rarest category in a series of 5 abundance classes (k =5) will be set at $30^{0.2}$ = 1.96 (rounded off to 2). In such a way the uniques (species that occur in only one sample) and duplicates (species known from two samples) fall into one abundance class, and in our case they comprise together 24% of all the recorded species. Boundaries for the remaining four abundance classes (2 to 5) are presented in Table 4.2b. In general, the distribution of mammal species between the abundance classes observed between the consecutive survey years is fairly similar (p well above 0.05).

Table 4.2b. Summary of abundances of recorded mammal species.

		Abundance classes			
1 (rare)		2 (few)	3 (moderate)	4 (common)	5 (abundant)
		Data 2004			
1-2 records		3-4 records	5-7 records	8-13 records	14-25 records
uniques: 8 (28.6%) duplicates:3 (10.7%)	*Total:* 11 (39.3%)	5 (17.8%)	4 (14.3%)	4 (14.3%)	4 (14.3%)
		Data 2005			
1-2 records		3-4 records	5-8 records	9-15 records	16-29 records
uniques: 6 (23.1%) duplicates: 4 (15.4 %)	*Total:* 10 (38.5%)	4 (15.4 %)	4 (15.4 %)	2 (7.7 %)	6 (23 %)
		Data 2006			
1-2 records		3-4 records	5-8 records	9-15 records	16-30 records
uniques: 3 (12%) duplicates: 3 (12 %)	*Total:* 6 (24%)	7 (28%)	4 (16%)	2 (8 %)	6 (24%)

$\text{Chi-square}_{2004/2005}$ =0.06, *d.f.* = 1*; p = 0.81;
$\text{Chi-square}_{2005/2006}$ = 0.02, *d.f.* = 1; p = 0.89

*as some of the scores in the abundance classes are less than 5, neighbouring classes have been pooled into two: one made up of abundance classes 1-2, and the second made up of abundance classes 3-4; therefore the degrees of freedom (*d.f.*) is reduced to 1 (i.e., number of classes minus 1).

Amongst the most common mammal species (abundant) are the arctic ground squirrell, grey or Altai marmot, Siberian ibex, argali sheep*(I), arctic or mountain hare, Northern pika.

Compared to the data of 2004 and 2005, argali sheep maintained the frequency by which the species has been recorded, 0.84, 0.62, and 0.67 respectively (the difference is statistically insignificant, $t_{2004/2005}$=1.85<1.96; $t_{2005/2006}$=0.37<1.96). On the other hand more records were made of the Siberian ibex (particularly since 2004, $t_{2004/2006}$=2.27>1.96) and the species having shifted in 2005 from the "common" category up to the "abundant" continues to occupy that category in the current year.

Next in abundance (common) are the wold and maral deer.

The wolf continues to be be a common species in the study area, met approximately at the same frequency as in the previous year (0.400 versus 0.483, $t_{2005/2006}$=0.65<1.96). More records have been made of the maral and the species now occupies the category "common". However, this positive trend is as yet statistically insignificant ($t_{2005/2006}$=1.81<1.96).

Moderate records were made of the Tolai hare, Northern red squirrel, red fox, wild boar.

Fewer records were made of the large-eared or Altai vole, Mongolian five-toed jerboa*(III), Siberian chipmunk, Evermann's or steppe polecat, lynx, manul*(II), Mongolian pika.

In this category of particular nature conservation interest is the manul. Unfortunately, since 2004 this species has shifted down to the "fewer" category; the frequencies by which the manul has been observed have dropped from 0.480 (in 2004) to 0.100 (in 2006) and the observed changes are statistically significant ($t_{2004/2006}$=5.42>1.96).

Three species marked above with an asterisk are listed in the Red Data Book of the Altai Republic (I-III stand for their assigned nature conservation status; see bird report above for an explanation).

Six of the mammal species recorded this year are considered rare. Unfortunately, once again (as in 2004) the snow leopard*(I) is in this category; on the other hand this negative trend is not supported statistically ($t_{2005/2006}$=1.27<1.96). Other species in this category are the roe deer, wolverine, Corsac or steppe fox, Daurian pika, and Russian dwarf hamster.

Alltogether four mammal species out of 19 (or about 21%) listed in the Red Data Book of the Altai Republic have been spotted by the expedition team during the survey. In 2006 these were the same species as in the previous years.

4.3. Conclusions / Заключение

1. A total of 25 species of mammals were recorded (belonging to 4 orders, 11 families, and 20 genera). Since 2004 the total number of species recorded in the study area has reached 32 (5 orders, 12 families, 24 genera).

2. Отмечено наличие в исследованном районе 25 видов млекопитающих (принадлежащих к 4 отрядам, 11 семействам, 20 родам). Начиная с 2004 г., отмечено 32 вида (5 отрядов, 12 семейств, 24 рода).

2. A fairly large proportion of Carnivora species (ranging between 32 and 38.5%) may be an indication of the complexity of the local community structure and diverse food webs.

2. Относительно большая доля видов отряда Хищные (меняющаяся в пределах 32 – 38,5%) может быть показателем сложности структуры местной экосистемы и разнообразия пищевых цепей.

3. Uniques and duplicates comprise together a noticeable portion of the fauna (from 24% up to around 40% of all the recorded species).

3. Виды, которые наблюдались один или два раза, составляють примерно от 24% до 40% фауны.

4. Potential mammal prey species of the snow leopard (Siberian ibex, argali sheep, grey or Altai marmot, arctic or mountain hare, Northern pika, arctic ground squirrell, maral deer) are either relatively abundant or common in the area, some even being recorded at a more frequent rate (as, for instance, the Siberian ibex or, perhaps, the maral deer).

4. Потенциальные жертвы снежного барса (горный козел, аргали, серый сурок, заяц-беляк, алтайская пищуха, длиннохвостый суслик, марал) относительно многочисленны и обычны в исследованном районе, а некоторые (например, горный козел и, возможно, марал) стали чаще встречаться на маршрутах.

5. Unfortunately, once again (as in 2004) the snow leopard is in the abundance category “rare”. Of serious concern is another felid species, the manul. Since 2004 this species has shifted down to the “fewer” category; the frequencies with which the manul has been observed have dropped from 0.480 (in 2004) to 0.100 (in 2006) and the observed changes are statistically significant.

5. К сожалению, снежный барс вновь (как и в 2004 г.) оказался в категории редких видов. Положение другого представителя семейства кошек, манула, вызывает тревогу. Этот вид стал реже встречаться (вероятность встречи в 0,480 в 2004 г. упала до 0,100 в 2006 г. и наблюдаемые изменения статистически достоверны).

6. A total of four mammal species out of 19 listed in the Red Data Book of the Altai Republic have been spotted by the expedition team during the 2004-2006 surveys.

6. С 2004 по 2006 гг. Отмечено наличие 4 из 19 видов млекопитающих, внесенных в Красную книгу республики Алтай.

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5. Plant Survey

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5.1. Introduction

It has been estimated that there are more than 2000 plant species across the whole 1.6m ha Altai World Heritage site. This floral richness results from the great diversity of habitats, which range from flat steppe to high rocky mountain ridges, and the accompanying changes in climatic conditions. In the Altai mountains several vegetation zones have been recognized, including montane desert-steppe, rocky, dry montane-steppe, larch forest, montane- and subalpine-steppe and an alpine zone, which grades into bare rock and scree (Walter & Box 1983). Aside from the floral richness and diversity, the location of the Altai mountains at the centre of the huge Eurasian land mass together with high mountain terrain, makes it an interesting area with regard to species composition.

The Altai alpine flora has been estimated to include approximately 300 species, of which about 60% are arctic-alpine plants, and 40% are alpine. Approximately half the species are restricted to an Asiatic distribution, about one third are circumpolar, 10% are Eurasian, 10% are endemic and found only in the Altai, and a few species show Asiatic-American distributions (Good 1974). While plants are not always viewed as being as exciting or intrinsically interesting as birds or animals, nevertheless they are fundamental to the ecosystem. A number of snow leopard prey species, including argali, ibex, deer, marmot and ground squirrel, to name but a few, are herbivores dependent upon vegetation for their living. Thus plants form the bottom link of the food chain and the health of the flora, its diversity and wellbeing are essential for the maintenance of the ecosystem as a whole.

5.2. Methods

Plants were collected during daily excursions to various parts of the survey site. In order to reduce weight as much as possible a small A5 format (15x21cm) was used to press either whole plants or parts of plants instead of the more usual collection format of 29x42cm. Plants were pressed in pieces of newspaper cut to size, interspersed with cardboard at regular intervals. Papers were changed every two days until the plants had dried. Pressure was provided by a heavy weight to keep the plants flat while drying. Data recorded at the time of collection included the date, elevation if noteworthy and brief note of the type of habitat.

5.3. Results

During the course of a two-week period in each of the years 2003-2006 approximately 259 species were collected (see appendix 3). Collections were identified by means of the Flora of the U.S.S.R. (Komarov 1935). Some species could be checked against pictures on the website of Oleg Kosterin (http://pisum.bionet.nsc.ru).

The identified species encompassed 48 plant families, with the largest number of species belonging to large families such as Asteraceae (daisy family), Fabaceae (pea family), Ranunculaceae (buttercup family) and Rosaceae (rose family). Some species could not be identified conclusively owing to the complexity of the identification keys and the need to have in hand all parts of the plant including roots, flowers and seeds, which were not all available in a two-week period.

5.4. Conclusions

A striking feature of the survey area is the huge variety of plant species and the often very beautiful flowers. Some plants such as the attractive pale yellow poppy *Papaver nudicaule*, yellow saxifrage, *Saxifraga hirculus* and *Rhodiola quadrifida* (Crassulaceae) show a wide range of adaptation and can be found both in the lower mountain meadows as well as on rocky ridges at about 3000 m. At the higher elevations these plants are tiny, miniature versions of the same species at lower levels. Other species, however, such as *Dryadanthe tetranda* (Rosaceae) are only found on rocky slopes at the higher elevations above about 2500 m. All the species collected are perennials, a reflection of the extreme variability of the climate and the short growing season. Interestingly, the stony river bed in which base camp is sited has many different plants and shrubs growing in it; after the winter, melting snow and rain presumably send huge volumes of water down the river valley. The plants in the river bed must have deep underground roots and stems to allow them to grow again in spring and not get washed away by the sheer volume of water.

On the whole the majority of plants were seen on more than one occasion and in most parts of the survey area. Rarities include the single orchid species, *Coeloglossum viride*, found in a few locations only, and one parasitic broomrape, *Orobanche caesia*, found only once. Ferns (Polypodiaceae) also do not seem to be common, as only three species were found in two locations. One of the most common plants is the Crassulacean *Orostachys spinosa*, a plant which makes small rounded mounds of fleshy leaves somewhat similar to a house-leek. Despite its succulent appearance it is abundunt over large areas in the steppe and seems to be able to either resist or escape grazing.

It should be pointed out that the species names as listed have been taken from the Flora of the U.S.S.R. since this is available as an English translation. However, the Flora dates from the 1930s and many of these names may well be out of date if more recent treatments of genera have been undertaken. Unfortunately without a good grounding in the Russian language, it is virtually impossible to extract information from books and articles published in Russian.

It should also be pointed out that only those plants were collected, which were in flower at the time of the survey, as leaves alone are not readily identifiable when the area holds such large numbers of species. The enormity of the Siberian flora is brought home when one is faced with identifying an *Astragalus* amongst the 800 listed *Astragalus* species in the Flora. Hence the species collected during Biosphere Expeditions project times are those which happened to be in flower at the time of the expedition and as such are probably just a small representation of the total number growing in the area. Nonetheless, the composition of the collection mirrors the diversity and richness of the area and contains elements from all the categories listed by Good (1974), from Altai endemics found nowhere else to species familiar in Europe and globally-distributed plants such as *Polygonum viviparum*.

With regard to the future, as the domestic herds of grazing animals become larger, and as the herds are driven higher up the hillsides to find fresh grazing, inevitably there will be some effect on the vegetation. Depending on the feeding habits of the domestic grazing animals, under heavy grazing pressure, some species will be favoured at the expense of others, thereby changing the floral composition over time. Whether this will have a deleterious effect on the species favoured by the wild goats and sheep that make up the snow leopard's main prey remains to be seen.

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Appendix 1
Inventory of birds (alphabetical by species) seen during the expeditions 2003 - 2006.

Scientific name	English name	Русское название	2003	2004	2005	2006	Nature conservation status in the Red Data Book of the Altai Republic Природоохранный статус в Красной книге Республики Алтай
Acanthis flavirostris	Twite	горная чечетка	1	0	1	0	
Accipiter gentilis	Northern goshawk	тетеревятник	0	0	0	1	
Accipiter nisus	Eurasian sparrowhawk	перепелятник	1	1	0	1	
Actitis hypoleucos	Common sandpiper	перевозчик	1	1	1	1	
Aegypius monachus	Cinereous vulture	черный гриф	1	1	1	1	III
Alauda arvensis	Eurasian skylark	полевой жаворонок	1	1	1	1	
Alectoris chukar	Chukar	каменная куропатка, кеклик	1	1	0	0	III
Anas clypeata	Shoveler	широконоска	0	0	0	1	
Anas crecca	Teal	чирок-свистунок	0	0	0	1	
Anthropoides virgo	Demoiselle crane	красавка	1	1	1	1	III
Anthus petrosus	Rock pipit	горный конек	0	1	1	0	
Anthus pratensis	Meadow pipit	луговой конек	0	0	1	0	
Anthus richardi	Richard's pipit	степной конек	1	1	1	1	
Anthus trivialis	Tree pipit	лесной конек	1	1	1	0	
Apus apus	Swift	черный стриж	1	0	0	0	
Aquila chrysaetos	Golden eagle	беркут	1	1	1	1	II
Aquila clanga	Spotted eagle	большой подорлик	1	0	0	0	II
Aquila heliaca	Imperial eagle	могильник	1	1	1	1	II
Aquila nipalensis	Steppe eagle	восточный степной орел	0	1	1	1	

Continued…

Scientific name	English name	Русское название	2003	2004	2005	2006	Nature conservation status in the Red Data Book of the Altai Republic Природоохранный статус в Красной книге Республики Алтай
Aquila rapax	Tawny eagle	степной орел	1	1	1	1	III
Asio flammeus	Short-eared owl	сова болотная	0	0	0	1	
Athene noctua	Little owl	домовый сыч	0	0	1	0	
Aythya ferina	Pochard	красноголовый нырок	0	0	1	1	
Aythya fuligula	Tufted duck	хохлатая чернеть	0	0	1	1	
Aythya nyroca	Ferruginous duck	белоглазый нырок	0	1	0	0	
Bubo bubo	Eurasian eagle owl	филин	0	0	0	1	II
Buteo buteo	Common buzzard	канюк	1	0	0	1	
Buteo hemilasius	Upland buzzard	мохноногий курганник	1	1	0	1	III
Buteo lagopus	Rough legged buzzard	зимняк	0	1	0	1	
Buteo rufinus	Long-legged buzzard	курганник	1	1	1	1	
Calidris alpina	Dunlin	чернозобик	0	0	1	0	
Carpodacus erythrinus	Common rosefinch	обыкновенная чечевица	1	1	1	1	
Carpodacus roseus	Siberian rosefinch	сибирская чечевица	1	0	0	0	
Charadrius dubius	Little ringed plover	малый зуек	0	1	1	1	
Charadrius hiaticula	Ringed plover	галстучник	0	0	1	1	
Charadrius mongolus	Lesser sand plover	монгольский зуек	0	0	1	0	
Charadrius morinellus	Eurasian dotterel	хрустан	1	1	0	0	
Charadrius veredus	Oriental plover	восточный зуек	0	0	1	0	
Chlamydotis undulata	Houbara bustard	джек	1	0	0	0	
Ciconia nigra	Black stork	черный аист	0	1	1	1	II

Continued…

Scientific name	English name	Русское название	2003	2004	2005	2006	Nature conservation status in the Red Data Book of the Altai Republic Природоохранный статус в Красной книге Республики Алтай
Cinclus cinclus	Dipper	оляпка	1	1	1	1	
Columba livia	Rock pigeon	сизый голубь	1	1	0	1	
Columba rupestris	Hill pigeon	скальный голубь	0	1	1	1	
Corvus corax	Raven	ворон	0	1	1	1	
Corvus cornix	Hooded crow	серая ворона	0	1	1	1	
Corvus corone	Carrion crow	черная ворона	0	1	1	1	
Corvus dauuricus	Daurian jackdaw	даурская галка	0	0	1	1	
Corvus monedula	Western jackdaw	обыкновенная галка	1	1	1	1	
Corvus ruficollis	Brown-necked raven	пустынный ворон	0	1	1	0	
Coturnix coturnix	Common quail	перепел	0	0	0	1	
Crex crex	Corncrake	коростель	1	0	0	0	
Cuculus canorus	Common cuckoo	кукушка	1	1	1	1	
Cygnus cygnus	Whooper swan	лебедь-кликун	0	0	0	1	III
Delichon urbica	Northern house martin	городская ласточка	0	0	1	1	
Emberiza citrinella	Yellowhammer	обыкновенная овсянка	1	1	0	1	
Emberiza hortulana	Ortulan bunting	садовая овсянка	0	0	0	1	
Emberiza leucocephalos	Pine bunting	белошапочная овсянка	0	0	1	1	
Emberiza schoeniclus	Reed bunting	камышовая овсянка	0	0	1	0	
Eremophila alpestris	Horned skylark	рогатый жаворонок	0	1	1	1	
Falco cherrug	Saker falcon	балобан	1	1	1	1	III
Falco naumanni	Lesser kestrel	степная пустельга	1	1	1	0	I

Continued…

Scientific name	English name	Русское название	2003	2004	2005	2006	Nature conservation status in the Red Data Book of the Altai Republic Природоохранный статус в Красной книге Республики Алтай
Falco peregrinus	Peregrine falcon	сапсан	0	0	0	1	I
Falco tinnunculus	Common kestrel	обыкновення пустельга	1	1	1	1	
Ficedula parva	Red breated flycatcher	малая мухоловка	0	1	0	0	
Galerida cristata	Crested lark	хохлатый жаворонок	0	1	1	1	
Gallinago media	Great snipe	дупель	0	1	0	0	III
Gallinago solitaria	Solitary snipe	горный дупель	1	1	1	1	II
Gallinago stenura	Pintail snipe	азиатский бекас	0	1	0	1	
Gavia arctica	Black-throated loon	чернозобая гагара	0	0	0	1	II
Grus grus	Common crane	серый журавль	0	0	0	1	II
Gypaetus barbatus	Bearded vulture	бородач	1	0	1	1	I
Gyps fulvus	Griffon vulture	белоголовый сип	1	0	0	0	III
Haliaeetus albicilla	White-tailed eagle	орлан-белохвост	1	1	1	1	I
Herbivocula schwarzi	Radde's warbler	толстоклювая пеночка	1	0	0	0	
Hirundo rustica	Swallow	деревенская ласточка	1	0	0	1	
Lagopus lagopus	Snow grouse	белая куропатка	1	1	1	1	
Lagopus mutus	Rock ptarmigan	тундряная куропатка	1	1	1	1	
Lanius isabellinus	Rufous-tailed shrike	буланый сорокопут	0	0	0	1	
Larus argentatus	Herring gull	серебристая чайка	0	0	0	1	
Larus canus	Gull common	сизая чайка	1	1	0	1	
Larus ridibundus	Black-headed gull	озерная чайка	1	0	0	0	
Leucosticte nemoricola	Plain Mountain finch	гималайский вьюрок	0	0	1	0	

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Scientific name	English name	Русское название	2003	2004	2005	2006	Nature conservation status in the Red Data Book of the Altai Republic Природоохранный статус в Красной книге Республики Алтай
Limnodromus semipalmatus	Asian/longbilled dowitcher	азиатский бекасовидный веретенник	0	0	1	0	
Limosa lapponica	Bar-tailed godwit	малый веретенник	0	0	0	1	
Limosa limosa	Black-tailed godwit	большой веретенник	0	1	1	1	III
Locustella certhiola	Rusty rumped or Pallas's grasshopper warbler	певчий сверчок	0	0	1	0	
Loxia curvirostra	Red crossbill	клест-еловик	0	0	0	1	
Luscinia svecica	Bluethroat	варакушка	0	0	0	1	
Melanitta deglandi	White-winged scoter	горбоносый турпан	0	0	0	1	III
Mergus serrator	Red-breasted merganser	длинноносый крохаль	0	0	0	1	III
Milvus lineatus	Black-eared kite	черный коршун	1	1	1	1	
Monticola saxatilis	Rufous-tailed rock thrush	пестрый каменный дрозд	1	1	1	1	
Monticola solitarius	Blue rock thrush	синий каменный дрозд	0	0	1	0	
Motacilla alba	White (or Pied) wagtail	белая трясогузка	1	1	1	1	
Motacilla cinerea	Grey wagtail	горная трясогузка	1	1	1	1	
Motacilla citreola	Citrine wagtail	желтоголовая трясогузка	1	1	1	1	
Motacilla flava	Yellow wagtail	желтая трясогузка	0	1	1	1	
Oenanthe isabellina	Isabelline wheatear	каменка-плясунья	1	1	1	1	
Oenanthe oenanthe	Northern wheatear	обыкновенная каменка	1	1	1	1	
Parus montanus	Willow tit	буроголовая гаичка	1	1	0	1	
Parus palustris	Marsh tit	черноголовая гаичка	1	1	1	0	
Passer montanus	Tree sparrow	полевой воробей	0	0	0	1	

Continued…

Scientific name	English name	Русское название	2003	2004	2005	2006	Nature conservation status in the Red Data Book of the Altai Republic Природоохранный статус в Красной книге Республики Алтай
Perdix perdix	Grey partridge	серая куропатка	1	1	1	1	
Phalacrocorax carbo	Great cormorant	большой баклан	1	1	1	0	II
Philomachus pugnax	Ruff	турухтан	0	0	1	0	IV
Phoenicurus erythrogaster	Guldenstad's redstart (=White-winged redstart)	краснобрюхая горихвостка	1	1	1	1	
Phoenicurus erythronotus	Eversmann's redstart	красноспинная горихвостка	1	1	1	1	
Phoenicurus phoenicurus	Redstart	горихвостка-лысушка	0	1	1	1	
Phylloscopus collybita tristris	Siberian chiffchaff	сибирская пеночка-теньковка	0	0	1	1	
Phylloscopus humei	Hume's leaf warbler (yellow browed)	алтайская пеночка	1	1	1	1	
Phylloscopus inornatus	Yellow-browed warbler	зарничка	1	0	0	0	
Phylloscopus trochilis	Willow warbler	пеночка-весничка	0	0	1	0	
Phylloscopus trochiloides	Greenish warbler	зеленая пеночка	1	1	1	1	
Pica pica	Black-billed magpie	сорока	1	1	1	1	
Picoides tridactylus	Three-toed woodpecker	трехпалый дятел	0	0	0	1	
Plectrophenax nivalis	Snow bunting	пуночка	0	0	1	0	
Pluvialis apricaria	Golden plover	золотистая ржанка	0	0	1	0	
Podiceps auritus	Slavonian grebe	красношейная поганка	0	0	0	1	
Podiceps nigricollis	Black-necked grebe	черношейная поганка	0	0	1	0	III
Podiceps ruficollis	Little grebe	малая поганка	0	0	0	1	
Podoces hendersoni	Mongolian ground jay	монгольская сойка	0	0	0	1	
Prunella collaris	Alpine accentor	альпийская завирушка	0	1	0	1	
Prunella himalayana	Altai accentor	гималайская завирушка	0	0	0	1	

Continued…

Scientific name	English name	Русское название	2003	2004	2005	2006	Nature conservation status in the Red Data Book of the Altai Republic Природоохранный статус в Красной книге Республики Алтай
Pterocles orientalis	Black-bellied sandgrouse	чернобрюхий рябок	0	0	1	0	
Pyrrhocorax graculus	Chough yellow-beaked	альпийская галка	1	1	1	1	
Pyrrhocorax pyrrhocorax	Chough red-billed	клушица	1	1	1	1	
Rhyacornis fuliginosus	Plumbeous water-redstart	сизая горихвостка	0	0	0	1	
Riparia riparia	Sand martin	береговушка	1	1	1	1	
Saxicola maura	Siberian stonechat	сибирский чекан	0	0	1	0	
Saxicola torquata	Stonechat	черноголовый чекан	1	1	1	1	
Sterna hirundo	Common tern	обыкновенная крачка	1	1	1	1	
Sterna paradisaea	Arctic tern	полярная крачка	0	1	0	1	
Sturnus roseus	Rose-coloured starling	розовый скворец	1	0	1	1	III
Sturnus vulgaris	Starling	скворец	0	1	0	0	
Sylvia communis	Whitethroat	серая славка	0	0	1	0	
Syrrhaptes paradoxus	Pallas' sandgrouse	саджа	0	0	0	1	II
Tadorna ferruginea	Ruddy shelduck	огарь	1	1	1	1	
Tetrao tetrix	Black grouse	тетерев	0	1	1	0	
Tetraogallus altaicus	Altai snowcock	алтайский улар	1	1	1	1	III
Tetrax tetrax	Little bustard	стрепет	0	1	0	0	
Tringa glareola	Wood sandpiper	фифи	0	0	1	1	
Tringa totanus	Common redshank	травник	1	1	1	1	
Turdus atrogularis	Black-throated thrush	чернозобый дрозд	0	1	0	1	
Turdus ruficollis	Dark- throated thrush	темнозобый дрозд	1	0	0	1	

Continued…

Scientific name	English name	Русское название	2003	2004	2005	2006	Nature conservation status in the Red Data Book of the Altai Republic Природоохранный статус в Красной книге Республики Алтай
Turdus viscivorus	Mistle thrush	деряба	1	0	1	1	
Upupa epops	Hoopoe	удод	1	1	1	1	
Uragus sibiricus	Long-tailed rosefinch	урагус	1	0	0	0	
Vanellus vanellus	Lapwing	чибис	0	1	1	1	

Appendix 2
Alphabetic list of mammal species seen during the expedition 2004-2006.

Scientific name	English name	Русское название	2004	2005	2006	Nature conservation status in the Red Data Book of the Altai Republic Природоохранный статус в Красной книге Республики Алтай
Allactaga sibirica	Mongolian five-toed jerboa	тушканчик-прыгун	1	1	1	III
Alticola macrotis	Large-eared or Altai vole	большеухая горная полевка	1	1	1	
Canis lupus	Wolf	серый волк	1	1	1	
Capra sibirica	Siberian ibex	сибирский горный козел	1	1	1	
Capreolus capreolus	Roe deer	косуля	0	1	1	
Cervus elaphus	Maral deer	марал	1	1	1	
Citellus undulatus	Arctic ground squirrell	длиннохвостый суслик	1	1	1	
Eutamias sibiricus	Siberian chipmunk	бурундук	1	1	1	
Felis lynx	Lynx	рысь	1	1	1	
Felis manul	Manul	манул	1	1	1	II
Gulo gulo	Wolverine	росомаха	0	1	1	
Lepus timidus	Arctic or Mountain hare	заяц-беляк	1	1	1	
Lepus tolai	Tolai hare	заяц-толай	1	1	1	
Marmota baibacina	Grey or Altai marmot	серый, или алтайский, сурок	1	1	1	
Martes zibellina	Sable	соболь	1	1	0	
Microtus agrestis	Field vole	темная полевка	1	0	0	
Microtus gregalis	Narrow-skulled or narrow-headed vole	узкочерепная полевка	1	0	0	
Moschus moschiferus	Siberian musk deer	кабарга	1	0	0	
Mustela altaica	Mountain or Altai weasel	солонгой	1	1	0	
Mustela erminea	Stoat	горностай	1	1	0	

Continued…

Scientific name	English name	Русское название	2004	2005	2006	Nature conservation status in the Red Data Book of the Altai Republic Природоохранный статус в Красной книге Республики Алтай
Mustela eversmanni	Evermann's or Steppe polecat	степной хорь	0	0	1	
Ochotona alpina	Northern pika	алтайская пищуха	1	1	1	
Ochotona daurica	Daurian pika	даурская пищуха	1	0	1	
Ochotona pricei	Mongolian pika	монгольская пищуха	1	1	1	
Ovis ammon	Argali sheep	горный баран, аргали	1	1	1	I
Phodopus sungorus	Russian dwarf hamster	джунгарский хомячок	1	0	1	
Sciurus vulgaris	Northern red squirrell	обыкновенная белка	1	1	1	
Sus scrofa	Wild boar	дикий кабан	1	1	1	
Talpa altaica	Siberian or Altai mole	сибирский крот	0	1	0	
Uncia uncia	Snow leopard	снежный барс, ирбис	1	1	1	I
Vulpes corsac	Corsac or Steppe fox	корсак	1	1	1	
Vulpes vulpes	Red fox	обыкновенная лисица	1	1	1	

Appendix 3
Plants identified and/or collected by expedition team member Christine Newell 2003-2006.

Family	Genus	Species	Authority (Location of Type Specimen)	Common name	Source	Collection notes
Apiaceae	*Bupleurum*	*longiinvolucratum*	Kryl. (Tomsk)	Hare's ears	1 (16)	13/7/05 Back valley
	Bupleurum	*pusillum*	Kryl. (Tomsk)	Hare's ears	1 (16)	9/7/05 Steppe
	Heracleum	*dissectum*	Ldb. (LE)	Hogweed	1 (17)	12/7/05 Base camp 2200m
	Bupleurum	*multinerve*	D.C. (Geneva)	Hare's-ears	1 (16)	5/8/03 #1, 12/8/03 #4 Base camp 2200m
	Bupleurum	*triradiatum*	Adams (Moscow)		1 (16)	5/7/04 #11 Base camp 2200m
	Pachypleurum?	*alpinum?*	Ldb. (Leningrad)		1 (17)	5/8/03 #6 Base camp 2200m
	Phlojodicarpus?	*villosus?*	Turcz. (Leningrad)		1 (16)	6/8/03 B High, damp steppe
	Schultzia	*crinita*	(Pall.)Spreng. (London)		1 (16)	4/7/06 Base camp 2200m
	Seseli	*strictum*	Ldb. (Leningrad)	Moon carrot	1 (16)	13/8/03 #2 Hillside near base camp
Asteraceae	*Achillea*	*asiatica*	Serg. (TK)	Yarrow	1 (26)	7/7/05 Base camp 2200m
	Antennaria	*dioica*	(L.) Gaertn.		1 (25)	9/7/06 Hillside above Lake Bailukem
	Artemisia	*altaiensis*	Krasch. (LE)	Mugwort	1 (26)	5/8/03 #4 Base camp 2200m
	Artemisia	*borealis*	Pall. (?BM)		1 (26)	12/7/04 #10 Dry hillside behind base camp
	Artemisia	*frigida*	Willd. (B)		1 (26)	12/7/04 #8 Dry hillside behind base camp
	Artemisia	*glauca*	Pall. (?B)		1 (26)	12/7/04 #9 Dry hillside behind base camp
	Artemisia	*pontica*	L. (LINN)	Mugwort	1 (26)	5/8/03 Steppe near base camp 2200m
	Aster	*serpentimontanus*	Tamamsch. (LE)	Aster	1 (25)	5/8/03 # 5 Base camp 2200m
	**Cirsium*	*acaule*	(L.) Scop.	Dwarf thistle	2	6/8/03 Steppe
	Erigeron	*elongatus*	Ldb. (LE)		1 (25)	9/7/04 #3 River valley on way to Mt. Saylyugem
	Erigeron	*eriocalyx*	(Ldb.) Vierh. (LE)	Fleabane	1 (25)	12/7/05
	Erigeron	*flaccidus*	(Bge.) Botsch. (LE)		1 (25)	7/7/04 #16 Hillside behind base camp
	Erigeron	*krylovii?*	Serg. (LE, TK)	Fleabane	1 (25)	5/8/03 #10 Base camp 2200m
	Heteropappus	*altaicus*	(Willd.) Novopokr. (B?)		1 (25)	8/8/03 #2
	Leontopodium	*ochroleucum*	Beauv. (LE) var. *campestre*	Eidelweiss	1 (25)	6/8/03 #11 Steppe adjacent to river
	Ligularia	*altaica*	DC. (P; iso-LE)		1 (26)	6/7/04 #3 Base camp 2200m
	Nardosmia	*angulosa*	Cass. (LE)		1 (26)	6/7/06 Bog on ridge 2870m above base camp

Continued…

Family	Genus	Species	Authority (Location of Type Specimen)	Common name	Source	Collection notes
Asteraceae	*Pyrethrum*	*pulchrum*	Ledeb.(LE)	Daisy	2	9/8/03 #7 mountain ridge 2985m
	Saussurea	*ambigua*	Kryl. ex Serg. (LE)		1 (27)	5/8/03 #12 Base camp 2200m
	Saussurea	*controversa*	DC. (LE)		1 (27)	5/8/03 #22 Base camp 2200m
	Saussurea	*foliosa*	Ldb. (LE)		1 (27)	11/7/04 #2 Mountain slopes towards back valley
	Saussurea	*frolovii*	(Ldb.) (LE)		1 (27)	6/8/03 #6 Hillside
	Saussurea	*glacialis*	Herder (LE)		1 (27)	12/7/05 Back valley
	Saussurea	*leucophylla*	Schrenk. (LE)		1 (27)	7/7/04 #7 Dry hillside behind base camp
	Saussurea	*schanginiana*	(Wydl.)Fisch. ex Herd. (LE)		1 (27)	8/7/04 #9 Hillside by back valley
	Saussurea	*sumneviczii?*	Serg. (LE)		1 (27)	7/8/03 #2 Hillside
	Senecio	*crispa-dilatata?*	Schischk. (TK)		1 (26)	6/7/04 #5 Base camp 2200m
	Senecio	*Pricei*	Simps. (?BM)		1 (26)	12/7/04 High ridge behind base camp
	Senecio	*resedifolius*	Less. (B)	Ragwort	1 (26)	7/7/05 Hillside north of base camp
	Senecio	*sumneviczii*	Schischk. (TK)		1 (26)	6/7/04 #4 Base camp 2200m
	**Tragopogon*	species?		Goat's beard		5/8/03 Base camp 2200m
	Tripleurospermum	*ambiguum*	(Ldb.) Fr.et Sav. (LE)		1 (26)	8/7/04 #3 Hillside by back valley
	Waldheimia	*tridactylites*	Kar.et Kir. (LE)		1 (26)	12/7/04 Ridge behind base camp
Berberidaceae	*Berberis*	*sibirica*	Pall. (Leningrad)	Barberry	1 (7)	7/8/03 #3 Hillside
Betulaceae	*Betula*	*rotundifolia*	Spach. (Paris)	Dwarf birch	2	6/8/03 Hillside
Boraginaceae	*Eritrichum*	*altaicum*	M. Pop. (London)		1 (19)	12/7/04 #15 Dry hillside behind base camp
	Lappula	*consanguinea*	(Fisch. et Mey) Gurke (LE)		1 (19)	5/7/05
	Myosotis	*asiatica*	Schischk. (Tomsk)	Forget-me-not	1 (19)	9/8/03 #3 Lake side 2758 m
Brassicaceae	*Alyssum*	*lenense*	Adams. (Leningrad)		1 (8)	6/7/05
	Braya	*rosea*	(Turcz.) Bge. (Leningrad)		1 (8)	10/7/05 Hillside 2800m
	Cardamine	*pratensis*	L. (London)	Ladys smock	1(8)	9/7/06 Marshy area around Lake Bailukem
	Clausia	*aprica*	(Steph.) Korn (Berlin)		1 (8)	7/7/04 Hillside behind base camp
	Draba	*fladnizensis*	Wulf.		1 (8)	6/7/06 Hillside behind base camp 2500m

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Family	Genus	Species	Authority (Location of Type Specimen)	Common name	Source	Collection notes
Brassicaceae	*Draba*	*lanceolata*	Royle		1 (8)	6/7/06 Hillside behind base camp 2500m
	Draba	*nemorosa*	L.		1 (8)	8/7/06 Base camp 2200m
	Draba	*oreades*	Schrenk (Leningrad)		1 (8)	6/7/06 Top of ridge near base camp 2800m
	Draba	*turczaninovi*	Pohle et N.Bosch (LE)		1 (8)	6/7/06 Hillside behind base camp 2500m
	Erysimum	*humillimum*	(Ldb.) N. Busch (LE)		1 (8)	6/7/05
	Parrya	*exscapa*	C.A.M. (Leningrad)		1 (8)	8/7/04 #14 Hillside by back valley
	Smelovskia	*calycina*	(Steph.) C.A.M. (Leningrad)		1 (8)	10/7/05
Campanulaceae	*Campanula*	*altaica*	Ldb. (LE)		1 (24)	9/7/06 Hillside above Lake Bailukem
	Campanula	*glomerata*	L. (London)		1 (24)	10/7/04 #8 Steppe margin near base camp
	Campanula	*langsdorffiana*	Fisch. (Leningrad)	Harebell	1 (24)	9/7/04 #8 Base camp 2200m
Caprifoliaceae	*Lonicera*	*altaica*	Pall. (Leningrad)	Honeysuckle	1 (23)	5/7/05 Base camp 2200m
	Lonicera	*hispida*	Pall.exRoem et Schult.(B)		1 (23)	9/7/06 Hillside above Lake Bailukem
	Lonicera	*stenantha*	Pojark (LE)		1 (23)	10/7/06 Hillside above Lake Bailukem
Caryophyllaceae	*Arenaria*	*formosa*	Fisch. ex D.C. (Geneva)		1 (6)	8/7/04 #7 Hillside by back valley
	Arenaria	*mongolica*	Schischk. (LE)		1 (6)	10/7/06 Hillside above Lake Bailukem
	Cerastium	*cerastoides*	Britt. (London)		1 (6)	8/7/04 #5 Hillside by back valley
	Cerastium	*lithospermifolium*	Fisch. (Leningrad))	Mouse-ear	2	9/8/03 #4 Lakeside 2758m
	Cerastium	*pusillum*	Ser.		1 (6)	14/7/04 #6 River valley behind base camp
	Dianthus	*superbus*	L. (London)	Fringed pink	1 (6)	5/8/03 #17 Riverside behind base camp 2200m
	Dianthus	*versicolor*	Fisch. (Russia)	Pink	1 (6)	5/8/03 #9 Base camp 2200m
	Gastrolychnis	*tristis*	(Bunge)Czer		2	12/8/03 #1 Damp streambank
	Gypsophila	*patrinii*	Ser. (Geneva)	Baby's breath	1 (6)	5/8/03 #20 Rocky riverbank base camp 2200m
	Melandrium	*apetalum*	(L.) Fenzl. (London)		1 (6)	6/7/06 Hillside behind base camp 2600m
	Minuartia	*verna*	(L.) Hiern. (London)		1 (6)	11/7/04 #5 Mountain slopes of back valley
	Silene	*chamarensis*	Turcz. (Leningrad)		1 (6)	7/7/04 #12 Hillside behind base camp
	Silene	*repens*	Patr. (Paris)	Campion	1 (6)	5/8/03 #12 Base camp 2200m

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Family	Genus	Species	Authority (Location of Type Specimen)	Common name	Source	Collection notes
Caryophyllaceae	*Silene*	*graminifolia*	Otth. (Geneva)	Campion	1 (6)	5/8/03 #19 Base camp 2200m
	Stellaria	*dichotoma*	L. (London)	Stitchwort	1 (6)	8/8/03 #1 Steppe 2206m
Chenopodiaceae	*Chenopodium*	*prostratum?*	Bge. Ex Herder (Leningrad)	Goosefoot	1 (6)	6/8/03 Steppe
Crassulaceae	*Orostachys*	*spinosa*	L. (London)		1 (9)	12/8/03 #5 steppe and hillsides, common
	Rhodiola	*quadrifida*	(Pall.) Fisch. et Mey. (LE)		1 (9)	7/7/04 A Hillside behind base camp
	Rhodiola	*rosea*	L. (Leningrad)		1 (9)	8/7/04 #4 Hillside by back valley
	Sedum	*ewersii*	Ldb. (LE)		1 (9)	9/7/06 Hillside above Lake Bailukem
	Sedum	*hybridum*	L. (London)		1 (9)	12/7/06 River valley near winter station
Cupressaceae	*Juniperus*	*pseudosabina*	Fisch. et Mey. (?)	Juniper	1(1)	7/8/03 #10 dry, stony east side of hill ca. 2432m
Cyperaceae	*Eriophorum*	*humile*	Turcz.	Cotton grass	1 (3)	10/8/03 #3 Pool, damp hillside behind camp
Empetraceae	*Empetrum*	*nigrum*	L.	crowberry	2	7/8/03 Damp hillside
Ephedraceae	*Ephedra*	*monosperma*	C.A.M. Mono. (Lena)	Joint pine	1 (1)	7/8/03 #9 hilltop, dry stony east side ca. 2432m
	Ephedra	*distachya*	L. (London)	Joint pine	1	9/7/05 Steppe
Equisetaceae	*Equisetum*	*variegatum*	Schleich. (Lausanne)	Horse-tail	1 (7)	4/7/06 Marsh on steppe edge near base camp
Ericaceae	*Vaccinium*	*vitis idaea*	Koch (London)	Cowberry	1 (18)	10/8/03 #2 Damp woods behind camp 2300m
	Arctous	*alpina*	(L.) Niedenzu (London)	Arctic bearberry	1 (18)	7/8/03 #11 Damp hillside
Fabaceae	*Astragalus*	*alpinus*	L. (Leningrad)	Blue & white fls	1 (12)	14/7/04 #1 River valley behind base camp
	Astragalus	*australis*	(L.) Lam.	Milk-vetch	1 (12)	7/7/05 Base camp 2200m
	Astragalus	*austrosibiricus*	B. Schischk. (Leningrad)		1 (12)	11/8/03 #3 Woods along steep stream valley
	Astragalus	*frigidus*	(L.) Bge. (London)	**Lg creamy fls	1 (12)	7/7/04 #17 Hillside behind base camp
	Astragalus	*laguroides*	Pall. Reise (London)	Milk-vetch	1 (12)	9/7/05 Steppe

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Family	Genus	Species	Authority (Location of Type Specimen)	Common name	Source	Collection notes
Fabaceae	*Astragalus*	*mongholicus*	Bge. (Leningrad)		1 (12)	9/7/04 #4 River valley up to Mt. Saylyugem
	Astragalus	*puberulus*	Ldb. (Leningrad)	Tiny white fls	1 (12)	12/7/04 #1 River valley across steppe
	Caragana	*bungei*	Ldb. (Leningrad)		1 (11)	9/7/05
	Caragana	*pygmaea*	(L.) DC (London)		1 (11)	9/7/05
	Hedysarum	*neglectum*	Ldb. (Leningrad)		1 (13)	5/8/03 #3 Base camp 2200m
	Oxytropis	*alpestris?*	B. Schischk. (Leningrad)		1 (13)	6/8/03 #5 Dry hillside
	Oxytropis	*alpina*	Bge. ((type?)		1 (13)	7/7/04 #9 Hillside behind base camp
	Oxytropis	*ladyginii*	Kryl. (Leningrad)		1 (13)	7/7/05
	Oxytropis	*macrosema*	Bge. (Leningrad)		1 (13)	7/7/04 #13 Hillside behind base camp
	Oxytropis	*martjanovii*	Kryl. (Leningrad)		1 (13)	6/7/06 Saddle on ridge above base camp 2800m
	Oxytropis	*nivea*	Bge. (Paris)		1 (13)	6/7/05
	Oxytropis	*physocarpa*	Ldb. (Leningrad)		1 (13)	9/7/04 #6 River valley up to Mt. Saylyugem
	Oxytropis	*pumila*	Fisch. ex D.C. (LE)		1 (13)	9/7/05 Steppe
	Oxytropis	*recognita*	Bge. (Leningrad)		1 (13)	6/7/05
	Oxytropis	*tragacanthoides*	Fisch. (Geneva)		1 (13)	6/7/05 River valley up to Mt. Saylyugem
	Trifolium	*eximium*	Steph. ex. D.C. (Leningrad)	Clover	1 (13)	7/8/03 #13 Dry hilltop
	Trifolium	*lupinaster*	L. (London)		1 (13)	8/7/06 Base camp 2200m
	**Vicia*	*cracca*	(L.)	Tufted vetch		5/8/03 Base camp 2200m
Fumariaceae	*Corydalis*	*pauciflora*	(Steph.) Pers. (Berlin)		1 (7)	14/7/04 #3 River bank behind base camp
	Corydalis	*inconspicua*	Bge. (Leningrad)		1 (7)	10/7/05 Ridge behind base camp 2900m
Gentianaceae	*Gentiana*	*plebeja?*	Cham. et Schlecht.(Berlin?)	Gentian	1 (18)	10/8/03 #10 Damp woods behind camp 2200m
	Gentiana	*algida*	Pall. (Leningrad)	Gentian	1 (18)	6/8/03 #8 Hillside
	Gentiana	*azurea*	Bge. (Leningrad)	Gentian	1 (18)	6/8/03 #10 Hillside
	Gentiana	*barbata*	Froel	Gentian	1 (18)	10/8/03 #9 Riverside behind base camp 2200m
	Gentiana	*decumbens*	L. (London)	Gentian	2	5/8/03 #2 Base camp 2200m
	Gentiana	*grandiflora*	Laxm. (Leningrad)	Gentian	1 (18)	8/7/04 #2 Hillside by back valley
	Gentiana	*nutans*	Bge. (Leningrad)	Gentian	1 (18)	9/8/03 #1 Damp hillside 2901m
	Gentiana	*uniflora*	Georgi (Leningrad)	Gentian	1 (18)	11/7/06 Hillside, back valley

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Family	Genus	Species	Authority (Location of Type Specimen)	Common name	Source	Collection notes
Gentianaceae	*Lomatogonium*	*carinthiacum*	(Wulfen.) A. Br. (?)		1 (18)	12/8/03 #2 Damp hillside
	Swertia	*obtusa*	Ldb. (Leningrad)		1 (18)	13/8/03 #3 River valley and damp woodland
Geraniaceae	*Biebersteinia*	*odora*	Steph. (LE)		1 (14)	9/7/04 River valley up to Mt. Saylyugem
	Geranium	*affine*	Ldb. (Leningrad)	Crane's bill	1 (14)	12/7/05 Base camp 2200m
	Geranium	*pratense*	(L.)	Meadow crane's bill	2	5/8/03 #15 Base camp 2200m
	Geranium	*pseudosibiricum*	J. Mayer (?type)		1 (14)	6/7/04 #8 Base camp 2200m
Grossulariaceae	*Ribes*	*graveolens*	Bge. (Leningrad)	Currant	1 (9)	11/7/05 Hills behind Lake Bailukem
Lamiaceae	*Dracocephalum*	*grandiflorum*	L. (London)		1 (20)	6/7/04 #6 Base camp 2200m
	Dracocephalum	*imberbe*	Bge. (LE)		1 (20)	10/7/05 Ridge behind base camp
	Dracocephalum	*nutans*	L. (London)		1 (20)	12/7/04 River valley across steppe
	Dracocephalum	*origanoides*	Steph. Ex Willd. (Berlin)		1 (20)	7/7/04 #14 Stony hillside behind base camp
	Dracocephalum	*peregrinum*	L. (London)		1 (20,21)	7/8/03 #4, 13/8/03 #1 Hillsides
	Lagopsis	*marrubiastrum*	(Steph.) Ik.-Gal.		2	6/8/03 #7 Shale slope
	Lagopsis	*flava*	Kar. et Kir. (Leningrad)		1 (20)	8/7/04 #1 Dry steppe
	Leonurus	*sibiricus ?*	L. (Amman cit.)	Motherwort	(20,21)	11/8/03 #2 Dry hillside
	Nepeta	*sibirica*	L. (London)		1 (20)	12/7/04 #3 River valley across steppe
	Thymus	*serpillum*	L.	Thyme	2	6/8/03 #13 Steppe along river side
	Ziziphora	*clinopodioides*	Lam. (Paris)		(20,21)	7/8/03 #7 Dry hillside
Liliaceae	**Allium*	*altaicum*	Pall. (?)	Onion	2	Disturbed soil around marmot, squirrel colonies
	Allium	*clathratum*	Ldb. (LE)	Onion	1 (4)	9/7/05 Base camp 2200m
	Allium	*tenuissimum*	L. (?)	Onion	1 (4)	9/7/05Base camp 2200m
	Gagea	*altaica*	Schischk. et Sumn.(Tomsk)		1 (4)	7/7/05
	Lilium	*martagon*	L. (London)		1 (4)	9/7/06 Hillside above Lake Bailukem
	Veratrum	*lobelianum*	Bernh. in Schrad. (Vienna)		1 (4)	11/7/05 Lake Bailukem

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Family	Genus	Species	Authority (Location of Type Specimen)	Common name	Source	Collection notes
Limonaceae	*Goniolimon*	*speciosum*	(L.) Boiss. (London)	var. *multicaule*?	1 (18)	8/8/03 #4 Rolling steppe 2280m
Onagraceae	**Chamerion*	*angustifolium*	(L.) Holub	rosebay willowherb	1 (15)	5/8/03 Base camp 2200m
	Chamerion	*latifolium*	L. (London)		1 (15)	5/8/03 #16 Rocky riverbed, base camp 2200m
Orobanchaceae	*Orobanche*	*caesia*	Rchb. (Austria)	Broomrape	1 (23)	11/7/05 River bed at base camp 2200m
Orchidaceae	*Coeloglossum*	*viride*	(L.) Hartm. (London)	orchid	1 (14)	7/7/04 #10 Hillside behind base camp
Papaveraceae	*Papaver*	*nudicaule*	L. (London)	Poppy	2	5/8/03 #11 Base camp 2200m
Parnassiaceae	*Parnassia*	*palustris*	L. (London)	Grass of Parnassus	1 (9)	6/8/03 #1 River valley, steppe
Poaceae	*Agropyrum*	*cristatum*	(L.) Gaerth. (Leningrad)		1 (2)	12/7/04 #12 Dry hillside behind base camp
	Avenastrum	*asiaticum*	Roshev. (Leningrad)		1 (2)	12/7/04 #13 Dry hillside behind base camp
	Festuca	*kryloviana ?*	Reverd. (Tomsk)		1 (2)	11/7/04 Mountain slopes of back valley
	Festuca	*tristis*	Kryl. Et Ivanitzk (Tomsk)		1 (2)	11/7/04 Mountain slopes of back valley
	Ptilagrostis	*mongholica*	(Turcz) Griseb (Leningrad)		1 (2)	11/7/04 #4 Mountain slopes of back valley
Polemoniaceae	*Polemonium*	*coeruleum*	L. (London)	Jacob's ladder	1 (19)	5/8/03 #19 Woods behind base camp 2200m
Polygalaceae	*Polygala*	*hybrida*	D.C. (Geneva)	Milkwort	1 (14)	7/7/05 Hillside north of base camp
	Polygala	*tenuifolia*	Willd. (Berlin)	Milkwort	1 (14)	14/7/04 #10 Valley hillside behind base camp
Polygonaceae	*Oxyria*	*digyna*	(L.) Hill. (London)		1 (5)	14/7/04 #5 Valley hillside behind base camp
	Polygonum	*alpinum*	All. (type?)		1 (5)	12/7/04 #11 Stony hillside behind base camp
	Polygonum	*bistorta ?*	L. (London)	*nitens*?	1 (5)	6/8/03 #3 Hillside
	Polygonum	*viviparum*	L. (London)	Knotgrass	1 (5)	5/8/03 #21, 6/8 #4 Hillside
	Rheum	*altaicum*	A. Los. (Leningrad)	Wild rhubarb	1 (5)	13/8/03 Hillside near base camp in disturbed soil

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Family	Genus	Species	Authority (Location of Type Specimen)	Common name	Source	Collection notes
Polypodiaceae	*Cystopteris*	*Dickieana*	Sim.	Bladder-fern	1 (1)	5/8/06 Rocky outcrop (Manul Rock) above camp
	Cystopteris	*fragilis*	(L.) Bernh. (London)	Bladder-fern	1 (1)	11/7/05 Rocky cliffs behind Lake Bailukem
	Woodsia	*ilvensis*	R.Br. (London)	Oblong woodsia	1 (1)	11/7/05 Rocky cliffs behind Lake Bailukem
Portulacaceae	*Claytonia*	*joanneana*	Roem. et Schult. (London)	Purslane	1 (6)	6/8/03 #2
Primulaceae	*Androsace*	*Fedtschenkoi?*	Ovcz. (Leningrad)		1 (18)	8/7/04 #8 Hillside by back valley
	Androsace	*septentrionalis*	L. (London)		1 (18)	10/7/04 #4 Steppe along margin by tree line
	Glaux	*maritima*	L. (London)	Sea-milkwort	1 (18)	9/7/05 Grassland in irrigation area
	Primula	*algida*	Ad. (no type)		1 (18)	7/7/04 #1 Hillside by base camp
	Primula	*nivalis*	Pall. (London)	Primula	1 (18)	10/7/06 Top of ridge near Lake Bailukem 3000m
	Primula	*sibirica*	Jacq. (London)	Primula	1 (18)	5/7/05 near base camp
Pyrolaceae	*Pyrola*	*incarnata*	Fisch.ex D.C.	wintergreen	1 (18)	10/8/03 #1 Damp woods behind base camp
Ranunculaceae	*Aconitum*	*anthora*	L. (London)		1 (7)	7/7/06 Wood edge near base camp 2200m
	Aconitum	*barbatum*	Pers. (London)	Wolf's-bane	1(7)	5/8/03 #13,15 Base camp 2200m
	Aconitum	*excelsum*	Rchb. (Vienna)		1 (7)	11/7/06 Hillside, back valley
	Aconitum	*volubile*	Pall. Ex. Koelle (London)		1 (7)	8/7/06 Wood edge near base camp 2200m
	Anemone	*sylvestris*	L. (London)	Anemone	1 (7)	10/7/04 #7 Steppe, near wood margin
	Aquilegia	*sibirica*	Lam. (Paris)	Columbine	1 (7)	8/7/05 Streamside in woods near base camp
	Atragene	*sibirica*	L. (London)	Clematis-like	1 (7)	7/7/04 #15 Rocky hillside above camp
	Delphinium	*inconspicuum*	Serg. (Tomsk)	Larkspur	1 (7)	11/7/05 Lake Bailukem
	Halerpestes	*ruthenica*	(Jacq.) Ovcz.		1 (7)	9/7/05 Marshland in old irrigation area, steppe
	Hegemone	*lilacina*	Bge. (Leningrad)		1 (7)	6/7/06 Bog in saddle of ridge above bc 2800m
	Leptopyrum	*fumarioides*	(L.) Rchb. (London)		1 (7)	4/7/06 Hillside near base camp
	Oxygraphis	*glacialis*	(Fisch.) Bge. (Leningrad)		1 (7)	9/7/05 Marshy area on ridge 2889m
	Paraquilegia	*microphylla*	(Royle)Drum.et Hutch.(Lon)		1 (7)	10/7/06 River valley above Lake Bailukem
	Pulsatilla	*ambigua*	(Turcz) Juz. (Leningrad)	Pasque flower	1 (7)	9/7/04 #11 Base camp 2200m
	Pulsatilla	*campanella ?*	Fisch. (Zeyher Herbarium)	Pasque flower	1 (7)	9/7/04 #10 Base camp 2200m

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Family	Genus	Species	Authority (Location of Type Specimen)	Common name	Source	Collection notes
Ranunculaceae	*Ranunculus*	*altaicus*	Laxm.	Buttercup	1 (7)	7/7/05
	Ranunculus	*lasiocarpus*	C.A.M. (Leningrad)	Buttercup	1 (7)	9/8/03 #6 Small waterhole, ca. 2758m
	Ranunculus	*pulchellus*	C.A.M. (Leningrad)	Buttercup	1 (7)	10/7/04 #3 Steppe, near wood margin
	Ranunculus	*pseudohirculus*	Schrenk. (Leningrad)	Buttercup	1 (7)	2004
	Thalictrum	*foetidum*	L. (London)	Meadow-rue	1 (7)	9/7/04 #9 Base camp 2200m
	Thalictrum	*alpinum*	L. (London)	Meadow-rue	1 (7)	5/7/05 Base camp 2200m
	Thalictrum	*minus*	L. (London)	Meadow-rue	1 (7)	11/7/05 Lake Bailukem
	Trollius	*asiaticus*	L. (London)	Globe flower	1 (7)	6/7/04 #7 Base camp 2200m
Rosaceae	*Alchemilla*	*altaica*	Juz. (Leningrad)	Lady's mantle	1 (10)	11/7/05 Shores of Lake Bailukem
	Alchemilla	*cyrtopleura ?*	Juz. (Leningrad)	Lady's mantle	1 (10)	8/7/04 #11 Stream bank in back valley
	Chamaerhodos	*altaica*	(Laxm.) Bge.		1 (10)	9/7/04 Rocks on high mountain ridge
	Chamaerhodos	*erecta*	(L.) Bge. (London)		1 (10)	12/7/06 River valley behind winter station
	Comarum	*salesovianum*	(Steph.) Aschers. et Grebn.	Cinquefoil	2	5/8/03 #14 Rocky streamside, base camp 2200m
	Dryadanthe	*tetranda*	(Bge.) Juz. (Leningrad)	High alpine	1 (10)	12/7/04 Mt. Saylyugem 3000m
	Dryas	*oxyodonta*	Juz.	Mountain avens	1 (10)	6/8/03 #9 Hillsides, common
	**Pentaphylloides*	*fruticosa*	(L.) O. Schwartz	Cinquefoil	2	5/8/03 Base camp 2200m
	Potentilla	*acaulis*	L. (London)	Cinquefoil	1 (10)	7/7/05 Base camp 2200m
	Potentilla	*bifurca*	L. (London)		1 (10)	7/7/05 Base camp 2200m
	Potentilla	*multifida*	L. (London)		1 (10)	11/7/04 #4 Back valley
	Potentilla	*nivea*	L.		1 (10)	6/7/04 #10 Base camp 2200m
	Potentilla	*sericea*	L. (London)	Cinquefoil	1 (10)	11/8/03 #1 Rocky hillside
	Rosa	*spinosissima*	L. (London)		1 (10)	9/7/06 Hillside above Lake Bailukem
	Spiraea	*alpina*	Pall. (Leningrad)		1 (9)	8/7/04 #6 Hillside by back valley
	Spiraea	*chamaedryfolia*	L. (London)		1 (9)	14/7/04 #11 Stony hillside behind base camp
Rubiaceae	*Galium*	*verum*	L.	Ladies bedstraw	2	6/8/03 Base camp 2200m
	Galium	*boreale*	L. (LINN)	Bedstraw	1 (23)	7/7/05 Base camp 2200m

Continued…

Family	Genus	Species	Authority (Location of Type Specimen)	Common name	Source	Collection notes
Salicaceae	*Salix*	*nummularia*	Anderss. (?)	Prostrate willow	1 (5)	9/8/03 #8 Damp hillside ca.2758m
	**Salix*	*reticulata*	L. (London)	Net-leaved willow		10/8/03 Damp woods behind base camp
Santalaceae	*Thesium*	*repens*	Ldb. (LE)		1 (5)	8/7/06 Base camp 2200m
Saxifragaceae	*Bergenia*	*crassifolia*	(L.) Fritsch. (London)		1 (9)	11/7/05 Hills behind Lake Bailukem
	Saxifraga	*cernua*	L. (London)		1 (9)	14/7/04 #4 Alongside river behind base camp
	Saxifraga	*hieracifolia*	Waldst. et Kit. (Vienna)		1 (9)	12/7/05 Hillside of back valley
	Saxifraga	*hirculus*	L. (London)	Saxifrage	1 (9)	12/8/03 #3, 9/8/03 #2 2901m
	Saxifraga	*melaleuca*	Fisch. (Leningrad)		1 (9)	11/7/04 #1 Mountain slopes by back valley
	Saxifraga	*oppositifolia*	L. (London)	High alpine	1 (9)	7/7/04 #10 Hillside by back valley (also 3000m)
	Saxifraga	*punctata*	L. (London)	Saxifrage	1 (9)	7/8/03 #8 Damp hillside stream bank
	Saxifraga	*setigera*	Pursh. (? type)	High alpine	1 (9)	8/7/04 #10 Hillside by back valley
	Saxifraga	*sibirica*	L. (Leningrad)	Saxifrage	1 (9)	10/8/03 #6 Rocky streambed behind base camp
Scrophulariaceae	*Euphrasia*	*tatarica*	Fisch. (LE)	Eyebright	1 (22)	14/7/04 #8 Hillside behind base camp
	Lagotis	*integrifolia*	(Willd.) Schischk. (BHU)		1 (22)	9/8/03 #5 Lakeside 2758 m
	Linaria	*vulgaris*	Mill. (LINN)	Toadflax	1 (22)	12/7/04 #6A River valley across steppe
	Pedicularis	*abrotanifolia*	M.B. ex Stev. (LE)		1 (22)	7/7/04 #3 Base camp 2200
	Pedicularis	*arguteserrata*	Vved. (LE)	Lousewort	1 (22)	7/7/05 Damp hillside behind base camp
	Pedicularis	*oederi*	Vahl. (Norway)		1 (22)	6/7/06 Top of ridge behind base camp 2800m
	Pedicularis	*tristis?*	L. (LINN)	Lousewort	1 (22)	10/8/03 #11 Damp woods above base camp
	Pedicularis	*uliginosa*	Bge.	Lousewort	1 (22)	6/8/03
	Pedicularis	*verae ?*	Vved. (LE)		1 (22)	7/7/04 A Base camp 2200m
	Pedicularis	*venusta*	Schangin ex. Bge (LE)	Lousewort	1 (22)	6/7/05 River valley
	Pedicularis	*verticillata*	L.		1 (22)	7/7/04 #11 Base camp 2200m
	Pedicularis	*violascens*	Schrenk (LE)	Lousewort	1 (22)	7/7/03
	Scrophularia	*incisa*	Weinm. (Siberia)		1 (22)	10/7/04 #2 Gravel river bed at base camp 2200m
	Veronica	*macrostemon*	Bge. (LE)		1 (22)	14/7/04 #2 River valley behind base camp
	Veronica	*sessiliflora*	Bge. ex Ldb. (Leningrad)	Speedwell	1 (22)	6/8/03 C
	Veronica	*pinnata*	L. (LINN)		1 (22)	8/7/04 #2 Hillside by back valley

Continued…

Family	Genus	Species	Authority (Location of Type Specimen)	Common name	Source	Collection notes
Tamaricaceae	*Myricaria*	*dahurica*	(Willd.) Ehrenb. (Berlin)	Tamarisk	1 (15)	12/7/04 Riverside on steppe
Valerianaceae	*Patrinia*	*sibirica*	(L.) Juss. (LINN)		1 (23)	7/7/04 #4 Hillside behind base camp
	Valeriana	*capitata*	Pall. ex Link. (?B)		1 (23)	14/7/04 #3a River valley behind base camp
	Valeriana	*dubia*	Bge. (Leningrad)		1 (23)	9/7/06 Hillside above Lake Bailukem
	Valeriana	*petrophila*	Bge. (Leningrad)		1 (23)	13/7/05 Back valley
Violaceae	*Viola*	*biflora*	L. (London)	Viola	1 (15)	7/7/05
	Viola	*altaica*	Ker.-Gawl. (London)	Viola	1 (15)	9/7/06 Hillside above Lake Bailukem
	Viola	*rupestris*	F.W.Schmidt	Viola	1 (15)	9/7/06 Hillside above Lake Bailukem

Sources

1. Flora of the USSR - Initiated by VL Komarov. Israel Program for Scientific Translations, Jerusalem 1967
2. Plant Species - Oleg Kosterin (http://pisum.bionet.nsc.ru/kosterin/planta.htm)
3. Common name of genera: Stace, C. New Flora of the British Isles. 2nd. Edition 1997
4. LE: Botanical Institute of the Academy of Sciences of the USSR

* Species seen but not collected

Appendix 4
Expedition diary by Tessa McGregor.

26 June

And so it's that time of year again. Today spent preparing for and packing up for the expedition in Wuerzburg, Germany. It's hot. Football fever reigns. Matthias even wearing 'man make-up' (red St. George's cross on his – German - cheeks). Matthias and Peter wanted us to come to a party with a big screen and England playing. I think it had something to do with football? Luckily my flight was delayed, as was Andrew's, so we did not make it. Andy is assistant expedition leader for the two first slots this year and Peter, who is also with us (and knows everything there is to know about football, maps and GPS), will be joining the expedition in the third slot. All on target and we will be flying out to Russia tomorrow. Matthias has told me "you don't have to write a bloody novel..". Some things never change!. I'll sign off and write again form Novosibirsk. Oh, and I am also attaching a daily plan for the expedition, just so that you know what the inevitable & regular changes of plan are made from ;->

28 June

Flew to Moscow and on to Novosibirsk. All went very smoothly. One out of two Transaero flights on time (an improvement) and amazingly smooth 'collecting baggage from Moscow flight and checking in for Novosibirsk flight' despite very little time. Most incredibly of all, we got through customs without the usual hassle! Too good to be true. We met our scientist Volodya and his wife Irene just as we were boarding the plane. So good to see them again.

Landed Novosibirsk at 5:30 and were met my Olga who works for Sibalp and Kolia. It's hot and humid in Novosibirsk. Most of the wooden houses that lined the road near the airport are gone. There is a lot of new building. Checked into the Hotel Central. It hasn't changed one bit. The same grumpy ladies behind the desk, the same sparrow chatter, the same Soviet feel. Spent the day photocopying fresh data sheets and buying expedition essentials as well as trying to get hold of Pavel at Autoland (the Novosibirsk Land Rover dealer) who was never in. Finally got hold of him late afternoon. We will go to Autoland tomorrow to inspect/collect vehicles. We met Nastya (our translator) in the evening for supper. It's lovely to see her again.

29 June

Another hot day. Shopping in the morning. The afternoon was spent in Autoland with Andy and Nastya. We were met by two shiny Defenders with number plates. One is a silver '90', the other a black '110'. The latter has a winch and a huge black, roof-rack. Our two other expedition vehicles may be brand new, but have no number plates and no paperwork which means we can't drive them anywhere. Remember – this is an expedition – plans will change AND this is Russia! We inspected all the vehicles in the baking heat, showered by poplar "snow" (the seeds look like cotton wool) and accompanied by tiny (biting?) flies.

Discussions took a long time, as did persuading Autoland of the importance of finding our expedition gear, stored with them (high-lift jack, waffle boards, car fluids etc). Andy drove the '90' back to the hotel. His first time in Novosibirsk traffic, but you would never have guessed. He's a real pro. At the hotel we were met by Sergey Kurgin, our Russian logistigs coordinator, just back from Mongolia. He is on top form and when he heard about the incomplete vehicle paperwork he laughed and said "it's expedition!". But I wanted more concrete help from him so suggested using his Jeep. He was very obliging – but his Jeep is in pieces and will take time to repair. Yes, it has become my mantra "it's Russia, it's expedition!" but have no worries, we will get you all to base camp and the research will continue as assiduously as ever.

Novosibirsk was particularly lovely this evening. Pink sky with luminous trails of cloud. Flocks of swifts hunted under a sickle moon, their cries so evocative of summer.

30 June

Another very hot and humid day – we have sorted out transport to base camp so that is an achievement. We drove to Autoland this morning before the Land Rover press conference, to sort out exactly when the other two vehicles will be ready. Also to collect the high-lift jack etc. You won't be surprised to hear nothing was ready. I asked Pavel about it. He said he couldn't find it. I asked if he or anyone had looked for it. His reply was no. All as helpful as ever, at which point I took a deep breath and said it had to be ready after the press conference as we don't have the time to make twice daily visits to Autoland (it's at the opposite end of the city to the hotel). It was hot and I was steaming, although externally we kept our cool and were all smiles for the press conference, which was well attended. Andy, Volodya and Sergey went back to Autoland and collected the expedition gear. Spectacular thunderstorm driving back from the press conference and deluginous rain.

1 July

Team members arrived in the morning. Lovely to see 6 team members from 2005 again (Christine, Toril, Peter, Jens, James and Helge -and Christine, Peter and Toril are back for the 4th year running) all back and eager for more! Although team members have all arrived safely, 2 of them don't have their luggage. Luckily, after lots of phoning and help from Olga I finally hear it's made it to Novosibirsk at 18:00. Nastya is a star and drops everything to go with James and Ian to the airport and they are all miraculously back in time for the team supper where we get to catch up with the team members we know and meet the new ones. Football is a hot topic - James and Ian are determined to find a screen and see it. After another hot and humid day the rain comes down, just as I go the supermarket for last minute supplies with Volodya and Irene, and, can you believe it?...all alcohol apart from beer is cordoned off. It's not possible to buy vodka and the shelves are almost empty! It's a new Putin directive and has something to do with relabeling all bottles and tax.

2 July

Team members very prompt with their luggage downstairs (Hugh is down by 6.30). It's a good start to the first slot. We have breakfast and briefing. Andrey prompt and reliable as always in his beloved white minibus. Nina and Ivan there - big embraces and delighted to see them again. Nina has her black Scottie dog with her called Timi. Timi is coming to base camp with us and is a very cute mascot. We set off after collecting lots more Altai Republic registration papers from Olga. The forms have changed, again! Our convoy sets off - 2 Land Rover Defenders and 2 minibuses (one is hired to get the team down to base camp as we don't have all 4 Defenders yet, but hopefully they will be ready later in the week).

The drive, now so familiar, is lovely. We travel through the rich agricultural farmlands of Siberia. Dark, rich soils visible through growing crops. People tilling, hoeing, weeding. Bright headscarves top the bent outlines of peasant women. We go through vast forests of birch and pine.

People dotted at intervals along the road selling wild produce they've gathered. The weather very changeable. We make good time and stop for lunch at the usual roadside restaurant - it's closed - so drive on and stop at new place an hours drive further. It's very good and the service surprisingly fast. Andy and Ian driving the Land Rover 90 and Peter, Toril and Helge driving the 110. We pass the Altai republic border in the afternoon sun. The Katun River and Altai foothills are truly beautiful. We have entered a different place. We reach Anoz by 19:00. It's warm and sunny after heavy rain. Multa, the cream coloured guard dog is now fully grown and as friendly as ever. Kindra and Toril make a big fuss of her. The Katun River at the bottom of the garden is flowing fast. Countless white butterflies are roosting on intense blue flowers that cover the slope down to the river. There is a new banya at the bottom of the garden. It's not finished (I'm glad, as I love the old one we always use). Lena has prepared an excellent supper and after filling in the new registration forms, the team is ready for the banya and general relaxation in this delightful place. Nastya, as usual, works late into the night doing the paperwork for tomorrow 's registration.

3 July

We awake to a beautiful morning. Thick dew, sun, warmth, birdsong, tinkling cowbells and dogs barking in the village. Birds are busy feeding young in the bushes and trees around us. Nastya and Andrey go to Gorno Altaisk to do the registration. The rest of us to Silver Springs - the craft market and sacred springs. The team buys maps and local artifacts. We have tea and piroshkis, then, later, more tea and shashliks. We wait, and wait, and wait. Nastya and Andrey join us eventually and I'm very relieved, but Nastya explains the whole registration process has changed again - it is now necessary to have not only original passports, letter of invitation etc, but also photocopies of all these documents. As photocopying facilities in Gorno Altaisk are very limited and, if they exist, are nowhere near the registration office it makes things even more difficult. Nastya managed to achieve the impossible and got us all registered, BUT PLEASE CAN ALL TEAM MEMBERS FOR 2ND AND 3RD SLOT MAKE SURE THEY HAVE A PHOTOCOPY OF THEIR PASSPORT (PAGE WITH THE PHOTO AND DETAILS), THEIR RUSSIAN VISA AND LETTER OF SUPPORT PLUS AND ANY OTHER DOCUMENTS SUPPLIED BY THE VISA ISSUING AGENCY (IF APPLICABLE). We left Silver Springs at 13:30. Very relieved to be registered and on the road again. The long drive takes us through the mountains, valleys, villages and settlements. The alpine landscapes become more austere and stony as we drive deeper into Asia after the Chikitman pass.

Drivers are excellent. We no longer follow the Katun river, but the Chuya. We reach 'Chuya Ouzi' restaurant by 18:00. It expands every year. Then the last leg of the journey to Koch Agach. Arrive at 22:30. It's 16 degrees and not raining! Fuel up all the vehicles and drive to Kokoria, where we leave the tarmac and drive off-road, across the step to base camp. See jerboas on the way and resting larks fly up from the tracks. Arrive 00:30. Met by Roman who has been looking after base camp. After unloading the vehicles and allocating tents there is a wonderful soup (made by Roman), bread, hot drinks and biscuits in the candlelit mess tent. I can't describe what it's like to be back.

4 July

Rain in the night but stops by morning. After a hearty breakfast we do risk assessment and introduction to the science and equipment. Then vehicle checks and off-road driving - instruction by Andy (he read engineering, has flown planes and helicopters so I'm more than happy to delegate!). At the end of the day, I go to see Abai and Gulinara (our herder friends) with Roman and Nastya. The rivers are fast flowing but luckily not too deep to cross. It is very moving to see Gulinara and Abai again and we spend time drinking tea, eating boursak and freshly made pasta and meat and catching up with all that's happened in the last year. Very sadly, Ascir, Abai's father has died, as has one of his sisters (aged 33). Spring is late and very cold. Melt water kept the rivers high and they have only recently put up their yurt - the subject of yurts is close to my heart as I would like one for base camp again this year. It's almost impossible to borrow or hire one in summer, because that's when all the herderds use them, but thanks to Abai and Gulinara, its possible again this year. Bless them!

5 July

Roman and I leave early to collect Abai and bring him to base camp. Morning sun hits the mountains. Sheep and goats, tightly packed in the coral cough, fart, grind their teeth and are generally restless, waiting to be led out to graze. Aikun (Abai and Gulinara's son and Gulfat, their niece are sound asleep in the yurt when we arrive. Angelic faces peeping from quilts. We get back to base camp in heavy rain. Delay survey departure and then change plans as slopes will be too slippery, so team goes out to survey birds in the steppe and lakes with Andy and Volodya. Hugh takes his fishing rod and catches many grayling, but releases them all. James and Ian stay back with me to do all the necessary work at base camp. We get it done in good time, the rain stops and sun comes out, as do the mosquitoes and horseflies! Abai and Andrey return with the yurt and the whole team helps put it up. First the wooden frame - circular lattice, then the circular top, held by Abai and Roman on a pole and steadied by team members, the roof poles that must be slotted into the circular top and finally the sheets of felt. All stages involve much tying and binding. It takes us 3 hours and by 20:00 it's done.

We christen it with a bottle of champagne. I'm happy! Base camp looks right. As Nina prepares tea Hugh calls me over. He has spotted ibex. We are joined by the rest of the team so a barrage of binoculars and the spotting scope are trained onto the slope behind base camp and we observe 12 - 16 individuals feed and traverse the scree. All are females and 4 of them have young. They are pale coloured. Dusk falls as we observe for about half an hour. Back into the yurt, delighted with this exciting sighting and we finish the evening with vodka, tea, fresh thyme tea and an array of sweet biscuits. The yurt has been well christened.

6 July

Volodya and Andrey take half the team to survey the left ridge and plateau behind base camp and put up the hide. I take the rest of the team with Roman and Nastya to do more yurt interviews. We meet new herders across the Buguzun river. Slava and Tonia invite us in to their yurt. Outside, other family members are putting freshly made cheese to dry on car bonnet and wooden platform. We have tea, home made bread and thick, fresh cream. Slava says 6 wolves were killed in the area in winter. They were poisoned. Slava also tells me he heard snow leopard mating calls last winter, deep in the mountains. These herders don't go back to live in the village, but stay in their winter station, towards Tabozhok. We then go on to recce new survey areas for overnight camps in the region of Builugiem. The lakes are heaving with fish. We see ducks, terns, waders, demoiselle cranes, a pair of breeding whooper swans with 4 young and a great northern diver carrying her 6 chicks on her back. The area is stunning. The 'road' is not easy, the rain sweeps in. We get back to base camp late afternoon. It clears. Supper followed by data sheets and scat identification and now Andy is here feather identification as well! Lively discussions last well into the evening. A very good day.

7 July

Heavy rain in the morning means we have to change our survey plan. The steppe is just a great, grey expanse. Visibility is low. Andy and I catch up on paperwork. Team members read field guides and research material. The weather lifts at mid-day so we decide to survey after 'lost valley' after all. The rivers are flowing fast. We survey the beginning of the valley, walking through thick larch forest full of bushes, shrubs and flowers. We find lots of faeces! Lynx, maral, ibex, argali, hare and large mustelid - probably pine martin. We see two marmots and countless burrows, plus the usual ground squirrel colonies and pretty pika tables or pika salads as Volodya often calls them. The rain comes down again and turns to sleet so we turn back to base camp. We are greeted by s smoking yurt chimney - everyone dives into the yurt and peels off sodden layers. Altai weather is a test for any waterproof jacket and only two people (Ian and Jens) have jackets that withstood today's weather. Andy does some nifty drying and incidental ironing of his very wet jacket on the stove pipe. He not only does his job expertly but looks pristine as well. Wow! It's great to thaw out and hot sweet tea has never tasted so good. The sleet turns back to rain, then eases and the ibex come to visit again early evening - the same slope behind base camp. It looks like the same herd of females and young. More good observations. Roman, Nastya and I go to find Marat, a hunter who has horses.

The steppe is very wet, the skies leaden and all the mountains white. It takes an hour to get to his 'ail' (wooden yurt). See a pair of demoiselle with two chicks on the way. Marat is not back from Kosh Agach so we head home again. Hopefully we'll catch him tomorrow. The rain sets in again and it's cold. Wet feet don't help!

P.S. Genya and Maxim arrived today with their Land Rover. They were with us last year. It's lovely to see them and a third vehicle is very welcome!

8 July

Wake up to no rain and snow covering the mountains down to the tree line. It's very beautiful and to make the day just perfect the ibex come and see us again. "Turns out that base camp is the best hide" says Volodya and he's right. We watch two groups - one on the ridge made up of 19 individuals. Females, juveniles and young plus 1 young male. The second herd is on the slope below - four females with young and one juvenile. The two groups merge and the herd moves off over the ridge and out of sight after having given us the chance to watch them pawing the snow, feeding, sparring and generally enjoying the morning. They are very clear through the spotting scope. It's the best observation yet and it looks like most of the ibex population of our core area is here. It's a perfect start to our day off. Half the group goes with Andrey to see the burial mounds and standing stones in the Valley of 1000 stones. Other team members go to look for tracks in the fresh snow. Roman and I go to see Marat. So many birds of prey, including eagles. Find Marat this time. Discuss plans for next slot and after tea and fried bits of sheep offal in "ail" go off in Marat's 'Uaz' (Russian jeep) for 'Russian driving course'. Another memorable experience. Cracked windscreen, no brakes, Marat puffing smoke between Roman and me. Roman drives back. We have set new recce for the 19th July, by which date he is sure to be sober.

Beautiful drive back across the steppe. Many birds of prey. It's grandiose. Back at base camp have just enough time to change for the wedding I've been invited to in Tibilir (Kazakh village). We go in Andrey's minibus, Roman, Nastya, Andy and me. The steppe glows inn the afternoon light and the air is like champagne. See many birds of prey. Make good time and arrive Tibilir (without getting lost! - but then Andrey is an ace driver) 6.30. The village of wooden houses and one-horse streets looks ravishing as the colours intensify and the surrounding mountains are capped with snow. A large local 'marquee' type wooden structure is already laid out with trestle tables, benches and food. More food is being prepared. Kazakh pop vies with the calls of black-eared kites displaying above the decorations. We see Tarbia and Assipa plus other herders we know and are invited in to the house. A large room packed with low tables, stools, food, vodka, beer and wine and so many people. We sit. It's hot. The toasts flow fast - all in Kazakh, so none of us understand, punctuated by traditional singing. Temperatures soar. Nastya and Roman very stoic as they are both not well. We all need air and Assipa takes us to her house to show us traditional needlework and carpets. Then back to the wedding house. More people arrive. We watch the sun set and shadows lengthen. Bride and groom arrive at 9pm to much hooting of horns. Andy gets some great shots. More standing around, speeches, a traditional song and finally into the marquee in a great swarm to sit at the tables, eat, drink and dance. I'm still standing when asked to give a toast and sing. Luckily Roman there to help me. It's all clear until 11pm when I know its time to go, but those last toast as we leave...arghhh!!! Brilliant wedding. These people certainly know how to party!!

9 July

Up feeling very much worse for wear but we get ready for overnighter led by Andy and Volodya with Roman. Drive the approaches of 'Chorni', a mountain near Bilugiem (new research block No: 3). Both vehicles go. The overnight group sets up camp and my team goes and does more yurt interviews. First one not very productive, but that is often the case on first visit. Stop by at Abai and Gulinara's yurt on way back where sheep shearing is taking place. So skillfully done by hand and so fast. Back at base camp and discuss our work in the yurt. Very cosy with the stove on. It's still very cool. Very heavy rain in the night.

10 July

Luckily rain stops in the morning and I take my team to survey lost valley and glacial lake. Weather clears and mosquitoes come out in droves. See a steppe viper on the way up, under a stone by the river. Also see more sign of argali/ibex and maral plus hare. Marmot alarm calls and sightings as we progress up the valley. It looks spectacular with fresh snowfall on Silugiem and Tapduair and the glacier is dazzlingly white. Guy spots ibex at the head of the valley and we observe two females and young, above us on the precipitous slopes. We all have great views through the spotting scope of feeding, pawing the ground and resting. They are very pale - the adults in full moult, tufts of hair even sticking to the horns of one female where she has been scratching her coat. We make it up to the glacial lake. Find ibex tracks and faeces but no sign of argali. The walk back down the valley to the vehicle always feels about twice as long as on the way up. Everyone very pleased with the day and we all pile into the Land Rover (8 people + rucksacks in a short wheelbase - lucky it's only a short journey!).

Back at base camp, showers very welcome. Beautiful evening, but very cold. Magnificent light on the slopes behind base camp. The overnight team come back 20:40 - ruddy faced and glowing with achievement and cold! They did a big survey and got to the top of Chorni. Data sheets late into the night - but plenty of data so Volodya and I very happy and proud of the team.

Christine found a rare wild lily and the bird list with Andy and Peter/Christine/Toril/Helge is also growing.

11 July

Whole team out to survey back valleys. Another grey and cool morning. Impressive drive and hard to find way up the river bed after a whole year. The river beds change after every winter. See steppe, golden and tawny eagle on the way + buzzard and kites. Bitter when we arrive. Split into two teams. One to survey 'snow leopard ridge' (where we had the trail master last year) and one to survey the glacial lake and surrounding are below. Find a lot of fresh sign of wild boar and good sightings of ptarmigan. Also fresh wolverine tracks and manul (adult and cub) tracks. Very little sign of argali (and what we do find is old) but ridge team see 12 ibex (a distant sighting of adults and 2 young). Excellent survey and long drive back. More good data sheets and vodka in the mess tent. Unusually, I haven't been able to touch the stuff since the wedding!

12 July

Volodya takes group to survey valley not far from base camp. Beautiful; day - we pay for it in mosquito and horsefly bites. Good to be able to air tents and dry out sleeping bags. Andy and I take rest of team to yurts with Nastya and Roman. Then to 'Argan Su' - sacred springs. It's a rough drive and we arrive to find some a truck, a 'Uaz' and a hobbled horse with families of herders - some we know. All go down and drink the sacred waters and splash our faces (they cure everything, apparently, and are very good for body and soul). Roman goes for full immersion. It's a sacred place and ribbons drape surrounding bushes and the standpipes from which the water gushes. It tastes too sweet and pure to describe. It's also very cold! I'm handed the horse and I don't know if it's the water or having a horse between my legs but I get a surge of energy and I'm happier than a sand lark (where does that expression come from?). It's a short ride but it's my first this year. I'm happy. We pick up Gulinara and Noursan her 15 year old nephew on the way back, (Abai went to Kosh Agach 3 days ago and hasn't been heard of since) and bring them to base camp for the first slot party. Team photos by yurt. Champagne. A cake for Kindra's birthday (she's 17 tomorrow) and dancing (Helge is amazing!!!!) then around the stove in the yurt and Ian sings. It's a brilliant party. This first slot has been so productive despite bad weather and lack of third Defender. We have never had so many ibex sightings. I have also picked up a lot of info about snow leopard activity over the winter from local people. A great beginning to the 2006 expedition. No shooting stars, but I've got plenty of wishes when I see them. Top of my list is the other vehicles for slot 2!

13 July

Sad good-byes as the team leaves in the morning. Andy is in charge of this change-over. It's strange as we have never had so many team members staying in camp between slots. There are five (Hugh, Guy, James, Jens and Tracy). I am also staying as are Volodya, Irene and Nina (plus Timi of course!). Timi is as good as gold. I stay at base camp. There is the usual between-slots cleaning and tidying to do, plus admin, not to mention catching up with two weeks washing. Although bright, the morning is surprisingly cold. Team members help around camp, chopping wood, helping me and generally recuperating. After another of Nina's delicious meals we retire to the yurt where we chat about big cats, wildlife and how wildlife sounds in Wyoming & Tennessee (where Hugh comes from).

14 July

Wake up to a much warmer morning. Volodya and Irene set off for 24 hours in the hide. Guy goes to identify butterflies. Hugh goes off to survey ridges and Tracy to survey the forest and river edge. The grasshoppers start to stridulate. A sound I love as it means heat. Sure enough the temperature rises and the biting insects are merciless. Oleg arrives in the afternoon having driven all night to get the 3rd Defender to base camp! I can hardly believe we finally have it!! It's a graphite 110. Oleg disappears for a well-earned rest. Hugh and Tracy return in the evening. Tracy found a fresh wolf track and Hugh has done the ridges behind and around Tapduair (the way he can cover ground is extraordinary) and seen 18 ibex (females and young) at the head of the glacial lake above 'lost valley' and 18 argali in the valley behind Tapduair. He spotted them from the ridges and also had a close encounter with a cinereous vulture. It flew just over him while he was lying on the ridge - probably checking him out to see if he was a potential meal!

15 July

Up at 4:00 & leave 5:00 to take Oleg into Kosh Agach to catch a bus back. I'm accompanied by Nina, Jens, James and Hugh. It's raining and the sky is heavy with cloud. Swarms of mosquitoes attack the car. After dropping off Oleg we find the only shop open so early in the morning - customers buy food through the bars of a small window, but we are allowed in - the metal door bolted firmly behind us as soon as we enter. Buy provisions (vodka and chocolate for team members) and back to base camp. Volodya and Irene get back from the hide in the afternoon. We all take it easy and then at 18:00 we celebrate James 20th birthday. Nina has cut flowers for him and pulls out all the culinary stops - including fern salad and a birthday cake plus 20 candles (too big to put on the cake so dotted along the table). Many toasts (vodka and Russian champagne) and a great evening!

16 July

Beautiful morning. The Chikachova range (Mongolian border) has beckoned ever since I first saw it. Volodya and I are very keen to survey it and we decide to take a closer look. Genya comes with us in his Defender. The day and the 'road' are spectacular. Off road tracks split, twist and disappear and what looks obvious on the map is obscure in reality. The driving is challenging and we go through magnificent country. Bird of prey sightings are breathtaking - cinereous vultures, steppe, golden and imperial eagle, buzzards, kites and falcons.
We get close enough to the Chikachova range to observe slopes, ridges, valleys..and it's very surveyable - it looks awesome and I wish we could just start now, but we need to get special permissions. I'm moved, as ever, by the grandeur, infinite skies, horizons and the beauty of this vast landscape.

Grasshoppers and locusts are preparing to swarm - the dirt track pullulates with them. Back at base camp we enjoy the late afternoon sun and a river-cooled beer with Volodya and Genya. It's warm, the evening is golden. The river seems to join our conversation. After supper we sit and look at the stars around the camp fire. They are very bright and shimmer as the temperature drops. The spotting scope is out and we look at Jupiter and its moons - five are visible. An unforgettable day.

P.S. Have awarded Tracy the most glamorously-clad team member award - she floats around in beautiful tops and never looks grubby. How does she do it?

17 July

Overcast and grey this morning with spits of rain. Good day for fishing and Hugh goes off with his rod. Maxim and Genya leave for Novosibirsk. Team members survey in areas around camp. Jens is a star, chopping more wood and filling up the showers. Nina gets a luxury one (really hot!) and she deserves it. I go up to observation point above base camp in the afternoon.

I love just being there and hearing the river below that sounds like the wind - no other sounds… Spot two argali on rocky slope far up the valley - a very distant sighting (two adults) also get good view of marmot. Make my way back down to camp. The slope is very steep. The smell of crushed herbs underfoot, the intense colours of the flowers. It's a heady sensory experience. The wild onions and rhubarb are perfect for harvesting now and the mushrooms are coming out. Everyone back at base camp in early evening.

Volodya and Irene saw an adult maral in the forest and Hugh has caught fish! Fabulous borscht for supper. Nina is a wonder. Then sit around camp fire. Stars very beautiful. Wait for new team members to arrive and they make it just after 22:00 and I am very happy to see Gerald is with them, despite the problems with his visa. It was all sorted in Moscow. We have a very lively and late evening chatting in the mess tent and toasting the safe arrival. James goes up to a ridge above base camp to sleep in his bivy bag in the hope of early morning wildlife observations. It's nearly dawn by the time I get to my tent!

18 July

A beautiful sunny day. Andy is taking over as expedition leader this slot and I am concentrating on being just a scientist. He is very competent and does the risk assessment and off-road driving course. Volodya takes second-slot team members out to survey valley and forest near Compe Petrovich's winter station. It's an area that has magnificent mature Siberian pines and is full of large bird of prey pellets. I go to find Marat with Roman and Nastya to finalize the recce plan for this week. He is not there - but his son Gena is. Very good to see him and warm embrace (my lucky day - he's not even wearing a shirt!). We have tea, wild rhubarb preserve and thick cream and talk. Gena saw a snow leopard in the winter while out hunting with his brother - at a range of about 500m. He says it was in January. I ask about the temperature. "Oh, not cold. About 20 degrees – minus.". We go and see the wonderful black horse I rode last year. He's very lame after winning a race back in May/June. He is also as wild as ever. Eventually Gena ropes him and I can take a look. He has bust tendons and the injury is bad. I'm heartbroken I won't get to ride him this year.

Back to camp. New team members studying the data sheets and background reading. Hugh has come back with two impressive ibex skulls (again he has powered up steep sided valleys and ridges). Volodya's team has found a lot of sign including steaming fresh wild boar and wolf faeces. We cook Hugh's fish and eat them around the camp fire - heaven! Stars amazing. James off to sleep on a mountain again.

20 July

[by Andy Stronach, assistant expedition leader]

Tessa disappeared over the horizon in a cloud of dust on horseback, hair blowing in the wind with Roman (our mountain guide) and Marat (a local herder/hunter) today - she told us she was doing a reconnaissance for next years' expedition and mentioned something about picking up a snow leopard skull; sounds like a jolly to me though! As such, I (Andy) will be doing the expedition diary for the next few days.

Took our new team members (Angela, Maryse, Michelle, Gerald and Stefan) up to the local glacial lakes to survey, and having endured some heavy rain, were rewarded with glorious weather and stunning views of glaciers, ibex, turquoise lakes and a species of redstart new to science (no-one seemed to believe me though!) [note from editor: Andy really does know his birds, so if he says it's new, it's new!]. A few brave souls continued up the valley and after a very long and gruelling climb up a massive scree slope, collapsed in a heap at the top. The views were stupendous; snow clad mountains of Mongolia, Tuva to the north, China and the Altai steppe. A good day.

21 July

Day one of the first overnight trip away from base camp.

Angela, Maryse, Tracy, Jens, Hugh, Guy and I set off for the first overnight trip of this slot after breakfast. After 2½ hours of carefully picking our way up rivers and over rocks in our trusty Land Rovers, we arrived. The afternoon was spent surveying the lower slopes of our objective, where we found ground squirrels and marmot as well as ptarmigan, dotterel, ortolan bunting, bluethroat and other birds. On the way back to camp, we found some wild rhubarb, so loaded up; stewed with a few cubes of 'asucre' it was a delicious and very gratifying end to dinner. It was great to get away from the light pollution of base camp ;-> and to enjoy a sky full of stars and a vodka or two whilst chatting about life, the universe and everything around the camp fire.

22 July

Day 2 of the overnight trip away from base camp.

Got up early, had breakfast, packed up camp and got ready to go. The heavens then opened, so we retired to the Land Rovers, wished we had stayed in bed longer and drank Indian Spice tea as the raindrops rolled down the windscreens. After a bit of will we/won't we, we bit the bullet, put on our waterproofs and set off uphill to the glacial lakes. Ten minutes later, the sky cleared, the sun came out and we took off our waterproofs and continued uphill into a wonderful day in the mountains.

Sometimes we have butterfly days and sometimes, grasshopper days; today it was Burnett moths - beautiful black and red moths that we saw on practically every one of the many flowers we passed, slowing our progress as we marvelled at how beautiful they looked. As we came to the last ridge before reaching the glacial lakes, a small rockfall caught my attention; closer inspection revealed that it was not caused simply by topography and gravity, but by animals - four animals. Four big brown and gold furry animals playfully bouncing down the slope together, apparently having just as great a time in the beautiful summer sun as we were. These were wolverine!! I'm not going to tell you how chuffed I was at seeing there fantastic animals because my English is not up to it! They stopped, rolled on their backs and played together for a long time before noticing us and trotting uphill over the ridge and into Biosphere legend.

23 July

"Day Off"

After a long lie-in and a late breakfast, Andrey, Nastya, Angela, Jens, Gerald and Volodya went on a trip to the valley of a thousand stones on the far side of our study area. There were stone circles, tombs and standing stones all over the steppe, but the highlight of the trip was watching a man riding his horse up and down the steppe dragging a metal roller behind, flattening felt he was making. The afternoon was spent at the 'bird lakes' where we recorded many beautiful waterbirds, including a pair of Slavonian grebes with four black and white striped young on their backs. With the early evening steppe sun setting behind us, the birds looked stunning.

24 July

It's Tessa again - back from my "jolly" with a jolly sore arse! But happy. The past five days have been very productive. I explored the Bashkaus and Kalbaka valleys and found snow leopard rock scent spray plus lots of sign of maral, ibex, argali "loss" (which I think is moose), wild boar, bear shit so fresh it was steaming together with scraping and tracks (mother and cub) and learned a lot more about the poaching situation. It's worse than I thought and snow leopards are still very much a target. Poachers hunt them in winter when it's easier to find them. Young animals (14 - 18 months) seem to be particularly vulnerable as this is when they learn to hunt and separate from their mother. I also saw the Saljak ridges in the distance and the habitat looks perfect. Marat confirmed this was a very good area for snow leopard and primary prey (ibex and argali) but it's inaccessible by vehicle and a long way to ride, let alone walk. However, I now have a very clear picture of areas adjoining our research area, which is increasing all the time. I could write pages about the last few days, but I won't bore you although I want Christine in particular to know the floral diversity is spectacular. Roman was very stoic, as he wasn't well for two days but still rode and did a great job. I also had expert fishing tuition from Marat and caught my first grayling! (At a price - I am covered in mosquito bites). We survived on boiled marmot, fresh grayling, very sweet tea, bread, 'slivka' and vodka. The ride home today was very tiring but the weather was great and we were welcomed at Marat's ail by Andy, Jens, Hugh and Nastya (looking even more gorgeous than when I left). Andy and Jens went riding and after more tea I tried yet another new horse (very briefly). The drive back to base camp in the evening light with cranes and birds of prey, exquisite, and most perfect of all - sighting of three red foxes, glowing in the sunlight, sitting above their earth in the middle of the steppe. While surveying, Andy found a golden eagle nest today with chicks in a valley near base camp and all his team got to see it. The evening ended perfectly in the mess tent with Russian champagne to toast the many sightings and new snow leopard sign.

25 July

Andy, Nastya and I took team (Hugh, Guy, Jens, Maryse) to Chikachova (the Mongolian border). We now have permission to work in the area. We arrived at Aidbai's yurt where the whole family was half way through butchering a goat, so freshly killed it was still twitching. Andy and I hired two horses to cover as much ground as possible and managed two valleys and low ridges. Hugh powered on in his phenomenal way and surveyed one of the bigger ridges. He saw eight argali in the distance (three young and five adults). The others took the Land Rover as far as possible up a valley, past a disused mine and walked from there. It was much colder than in our present survey area. The Chikachova ridges are awesome - higher than Tapduair. The glacial lakes that lie below them are magnificent. Ruddy shellduck are breeding as are terns and gulls and we saw a goosander with eight tiny chicks.

We met back at the yurt in the afternoon. The wind was bitter and cold. Clear light exposed every rocky detail. When the Land Rover returned, we were surprised to see two men leap out - all Kalashnikovs and camouflage. They were border patrol guards. They appeared out of nowhere while Nastya was picking mushrooms near the car. They had spotted all our team (spread out over two valleys and ridges) and tried to catch up with Hugh but had to give up.

Natsya after the initial shock of being accosted by two strange men waving guns, did a perfect job (as always) showing our permissions and explaining our mission. Actually they turned out to be very nice and couldn't take their eyes off Nastya. We all had tea in the yurt and took photos of them next to the Land Rover. They confirmed how good the area is for snow leopard and said there is a resident one. It was a very exciting day. Got back to base camp in the evening and Volodya's overnight team arrived about 21:00, having worked hard surveying a very good valley behind Tapduiar. They found plenty of sign and saw argali. So many sightings this year. It's wonderful. Everyone glowing with exercise, wind-burn (and maybe a hint of vodka?). Very lively evening in the yurt and Gerald recites poetry - even before the party!

26 July

Andy, Hugh, Jens, Nastya, Andrey and I go to Jarnaul village to see poached argali skin and skull - an old male, shot two years ago in Chikachova. Also see impressive maral horns (but they are 40 years old). Then go to museum (it's open!!!! The first one to be open in all the time I've been here). It's about Kazakh people of the Altai and fascinating. In the last room (just like a yurt) we see a snow leopard skin hanging on the wall. It's very fresh and from a juvenile (I would estimate about 15 months old). Makes me very sad, but at least it gives the opportunity for photos and measurements.

Back to base camp and then take team members to meet herders. Have a wolf sighting, out in the open in broad daylight - so good I initially think it must be a dog, but get the binoculars onto it and observe it nervously run into the forest. Amazing and so exciting. End up at Abai's again. He's just finished shearing his sheep. More toasts (except the drivers) and back to base camp for team photos and party in glorious evening light. Another of Nina and Nastya feast!

27 July

I always hate leaving base camp. Today is no exception. Volodya, Irene and Angela are staying behind. Beautiful drive to Anoz. Stephan drives all the way. Can't wrench the steering wheel away from him, but I love being a passenger and enjoying the landscape. Hugh's folk and bluegrass CDs are great. We make very good time and the team enjoys this beautiful stopover as usual.

28 July

Stephan still at the wheel - very cool in shades and cap. He has a smile on his face all the way. The berry blinis at Srostki market are outstanding and the shashliks later on as delicious as ever. Get to Novosibirsk at 18:00. Marsha has arrived minus luggage. It's somewhere between the USA/Paris/Moscow but she seems unfazed and joins us for supper at the Lebanese restaurant as does Peter, who is taking over from Andy for the last slot.

29 July

Day spent catching up on admin, phone calls, emails etc and miracle of miracles, we (Andy, Peter, Nastya and I) collect the 4th Land Rover from Autoland - and it works!!! Meet new team at Russian restaurant in the evening. Guy, Hugh and Andy still with us as their flights not until tomorrow. Sad farewells. Hard to see them all go.

30 July

New team prompt and ready. Bob is back for the 3rd year running and Jane returns after 2004 Altai expedition. Good new team. Marsha, in true expedition spirit decides to come without her luggage and thanks, in large part to James we have spare kit for her. Excellent drivers and again, make Anoz in very good time. It's very busy and there are queues for the banya.

31 July

Nastya, Andrey and I go to Gorno Altiask to register team members and meet Chagat Almashev, Director of FSDA (local NGO) who is joining us for the last slot. Registration causes the usual problems and we wait and wait. Finally make Silver Springs after 13:00 and then the long, but breathtaking drive to base camp. We make very good time and arrive 11:45.

So last team all safe and sound at base camp. It's warm and the sky is alive with stars. The Milky Way so bright it almost lights the way to our tents.

Mess tent so welcoming with candles, soup and flowers. Angela, Irene and Volodya have had a good time and great weather between slots. Jenya is with us again. His familiar Land Rover with snorkel and winch, complementing ours. This team has stamina and stays up well into the small hours!

1 August

Wake up to heavy rain and cold. The usual introductory training day. During off-road driving course in the afternoon the sky clears, sun comes out and it turns glorious. Marsha goes shopping in Kosh Agach for more warm clothes. Chagat is very knowledgeable, and it's a real pleasure having him with us. Another late night in the mess tent.

2 August

Whole team goes out to back valleys to survey argali plateau. It’s a magnificent day and a demanding first survey, but everyone does very well. Less argali activity than in previous years, but then we know a poacher was operating in the area recently. Warm showers and Nina’s cooking are a great way to unwind before doing data sheets.

3 August

Another fine morning and perfect survey weather. I take half the team (Camilla, Katie, Jane, Hannah, James, Ulf, Chagat and Roman) on overnighter to new area near Tabazhok. The rest of the team goes with Volodya and Nastya to survey Silugiem. The girls (Nasty and Angela) are first to the summit. Girl power!!! I learn later that after that they watched a DVD about snow leopards and then went jerboa watching. Talk about stamina! But then my team also shows impressive stamina. We survey steep-sided valley heady with the scent of wild herbs and fruit bushes. Thrushes call from thick willow groves that line the river. We stop to have our packed lunch by the river and the mosquitoes are quick to attack. Then ascend onto the ridge and grassy plateau. Last part of survey is down very steep-sided rocks and trail, used by ibex and argali. It overlooks the valley we are camping in. Perfect for snow leopard and half way down I find what I am always hoping for – a snow leopard scrape. It’s old, but it’s a scrape! And then on a vertiginous slope below, Roman spots a pugmark!

Again, it's old, but it's snow leopard sign. Happiness and joy!!! Camilla, Hannah and Katie glowing with terror or elation, or possibly both. Chagat and Roman as agile as ibex. Chagat takes a team photo. We make our way back down to the valley. I'm on a high.

Collect driftwood from river. Back at the vehicles we join James, Ulf and Jane who surveyed adjoining valley. Ulf sprained his wrist this morning, but it doesn't stop him taking photos using his monopod, despite bandage and sling and he even keeps smiling.

We pitch tents and Roman prepares supper as dusk falls. Eat huge quantities of buckwheat dish + pickles and tea then enjoy blazing camp fire (the best ever!) as the stars come out and a veiled moon rises above the black silhouette of a leaning larch tree. The evening is very lively and long. This team's capacity to work and play hard is impressive!

4 August

Woken by the cries of a herder, echoing up the valley as he drives his cattle to pasture. Up and pack up camp after breakfast. Flock of sheep and goats come past our vehicles and tents with two young herders sharing piebald horse. We all go to the yurt in our valley. Having Chagat with us lovely. He introduces us and the work we are doing and helps me interview local people. We have a very productive discussion and learn that a snow leopard was seen by a hunter, in this valley in January 2006. They also tell us that this area is a migration corridor for ibex and maral.

The team is invited into the yurt for tea, bread, smitana and boursak. Reluctantly move on to survey adjoining area. Drive through remote valleys with the odd yurt or winter station. Then cover over 11 kilometres on steep terrain in under six hours. This team is impressively fit. Find very old cat track in remaining snow patch. It's degraded and can't tell if it's lynx or juvenile snow leopard. Another excellent survey. Glorious drive back to base camp. Showers waiting (Ivan runs camp so smoothly – does everything and is always calm, with a gentle smile on his face.
He is one in a million) and Nina's wonderful cooking (wild and mushroom soup and mountains of freshly made pirozhki). Data sheets followed by looking at Chagat's photos and a film on the Ukok plateau. Then another very lively and late night in the mess tent. My sleep deficit and vodka levels I think even higher than in previous years, but excellent data and expedition really breaking new ground.

After their marathon day on Silugiem etc. Volodya's team does a flat survey and continues with the bird list. Gerald, Adrian and Bob bathe in our "bloody cold river" (Peter's words) – respect! But not as much as for Jens who did that daily first thing in the morning, whatever the weather. Sergey arrives. He is staying with us for a couple of days, which is lovely.

5 August

I go to Kosh Agach in the morning with Chagat to talk with the director of the hunting concession. Andrey, Nastya, Gerald and Ulf with us as well. The director of the hunting concession is away, but find the deputy director up to his elbows in car oil and surrounded by pieces of UAZ (Russian vehicle) in the yard outside his wooden house. Thanks to Chagat, have another very productive interview inside the broken UAZ. Meet up with the others and also bump into Gulinara, who is expecting a baby and learn it is a girl! Very happy moment. Then, back to base camp. Then whole team as well as Sergey, Gena and Lena go to the scared springs, where by a strange coincidence we find the professional ranger I wanted to track down is there, as it's his holiday.

A strong, weather-beaten man wearing shapka (hat) and camouflage jacket. We talk in the Land Rover and again, an excellent contact made and valuable information gained. Then I immerse myself in the springs – the glacial water gushing over me in the slippery, wooden cubicle. The springs are said to be deeply healing and sacred and, believe it or not, I feel like a new person afterwards.

The team then splits. Most go back to base camp. I go to yurts with Nastya, Roman, Peter, Christian, Adrian, Bob and Marsha. We see Tarbia and her gorgeous, red-headed grand-daughters, Gluhart and Gulfat and some of her grandsons. Tarbia is very insistent that she wants to keep Nastya and marry her off to her youngest son. Nastya playing for time, but he'll be waiting for her with fish on the road. Much hilarity. Tarbia is a hoot. As well as the usual, delicious bousak, and tea she feeds me two enormous bowls of airan (type of yogurt) –also deeply healing I'm told and bursting with every vitamin and mineral a body could need. Tear ourselves away and go and see Abai. More tea and good chat and I try his new, young horse. Just broken in. Great fun. Back at base camp. More food! including two grayling, caught by Sergey.

Have a very good evening chatting with him and Nastya followed by another very late night with Russian team.

6 August

Getting up is hard! I go with Sergey, Nastya, Ulf and Gerald to explore future survey area nearer Kosh Agach. Sergey leaves us to rejoin his group after very productive morning. Volodya, Irene, Chagat, Peter and Ivan go to Chikachova and Roman leads rest of team to survey valley behind Tapduair. The Chikachova team discover different area and good mountain pass road. They find themselves in Mongolia without realizing, as frightened shepherd tells Chagat he's Mongolian, not Russian and that "this is Mongolia!" so they quickly hop back over the border!

No sign of border guards this time. Gerald and Ulf are great company and as well as being top rate drivers they make me and Nastya laugh so much that my sides ache by the end of the day, but it's a great feeling. They also wash the Land Rover so well that it looks better than it did in the Avtoland showroom and they chop wood! So they get the hero of the day award.

Lena (Jenya's girlfriend) collects and prepares the most divine wild mushrooms. She is not only beautiful, but she cooks like a dream and I learn she also does tattoos. A real artist. Jenya is lucky. I seem to have eaten more in the last 24 hours than in the previous two weeks! Roman's team did a big survey and found new sign of argali. So another excellent day.

7 August

The weather has turned colder, so getting out of sleeping bag in the morning hard, but seeing all our ridges covered in a light dusting of snow gives me a buzz.. Volodya, Irene, Peter, Adrian, Christian and Gerald off for overnighter – back valleys. My team ('The girls' – Angela, Katie, Camilla, Hannah and Jane plus Bob and James) surveys Tapduair with Roman and Ivan. We take a different route via 'lost valley'.

Angela spots three argali (two females + one young) on rocks at head of valley. Wonderful to see them as we have seen very fresh tracks on the way up and evidence of where they have been using natural salt licks. We start to ascend – steep scree, steeper scree and **** steep scree. It's bitter, rain turns to hail and I almost think of turning back. Almost, I said, but you know me, once out surveying I'm hard to stop.

The weather clears as we go up. Roman picks an excellent way and we are on Tapduair by 13:45. There is snow and the visibility is perfect. Breathtaking views of our research area. To look towards Chickachova now we have been there and officially added it to our research area is very exciting, as is looking at the valleys and ridges all around us that make up our core area. It's an amazing feeling to have surveyed all these valleys and ridges. I see two ibex resting on rocks in the valley behind Tapduair.

Descend Tapduair via different route, following ridges and dropping down into the valley behind base camp. Roman, Ivan and James take the opportunity to 'bum-board' down snow on scree slope. All speed and snow flurries to impress the girls. Then in the valley Angela is the first to spot another group of argali – eight animals (five females, one young and two juveniles). They look in top condition, chestnut coats and creamy rumps, picking their way so effortlessly over rocks. We watch them disappear over the ridge and walk back to base camp in the evening sunlight. Arrive 19:30 tired and happy. Team ravenous and all do justice to Nina's fantastic cooking – then the vodka! Bob's toast "to fit girls" and Angela's "Tapduair, ***** yeah!" mark the beginning of another long and lively evening. Ulf gets the hero of the day award for the second day running. Not only has he washed another Land Rover with Marsha, but he's also mended the shower tent – sewing it with his fair hands. Marsha asks him to marry her but we all protest – she can't have him to herself! (P.S. tragically for us he's married with 3 daughters)

8 August

More rain in the night and it's cold, although I don't seem to notice at the moment (maybe it's got something to do with the vodka???). Take my team out to Tabajoc area where I have arranged for five horses. Chagat is also with us. Arrive at Marat's ail. No sign of horses, but we are invited in for big bowls of 'airan' (type of yogurt). Marat says he has five horses, but only three saddles and bridles. Two horses eventually tacked up, then a third. Take James, Katie, Camilla, Jane, Hannah, Marsha and Nastya riding in relays. I love the grey horse Marat has given me today. He really does have the best horses. Chagat also rides.

I don't even notice the rain. We then drive to a last yurt to deliver a photograph, but the person I wanted to see has already left as haymaking has started.

Back to base camp by 17:00. Gulinara and Tarbia already there. They have been cooking a sheep and have brought us cheese. Volodya's group return. They saw argali on the way home. Abai and Andrey took down the yurt this morning so team photo is in front of Land Rovers and the sun even comes out for us. We open the traditional party champagne (although we have to go easy as there were only four bottles left in Kosh Agach!) James makes the first toast to me and the team present me with the most beautiful traditional carpet – I can't tell you how moved and surprised I am. It's not often your expedition leader is lost for words – but on this occasion I am.

Thank you all, from the bottom of my heart. Abai, Gulinara and Tarbia stay for supper but have to leave soon after as they have cows to milk and children to look after. Emotional goodbyes. I will miss them so much. Gulinara gives me hand-stitched pillowcases so I can still dream I'm in a yurt when I get home. After they leave we party late with much music and dancing. Perfect last party.

9 August

Even a 9 o'clock breakfast is too early for much of the team! Peter and I pack and list all expedition kit while Roman, Ivan and Andrey dismantle camp. Ivan also manages to find time to prepare shashliks with the rest of the sheep and they are cooked over the camp fire after which the evening goes on until the early hours. This team is unstoppable!

10 August

Yes, 3.30am….or maybe later. At some point between then and 7 am breakfast I do make contact with my tent and sleeping bag. We take down our tents. The mess tent comes down and table, benches and latrine and shower floors are strapped to the Land Rover roof racks. Sergey arrives later in his jeep, plus another vehicle and driver. We leave. Cloud, wet steppe, tired team. Peter wonderful, calm, funny and great driver. Always very difficult to leave and this year is no exception. As we drive to Anoz through rain and cloud, the rivers are in full spate. They are brown, muddy and foaming – exciting rafting conditions. Stop at Chuya Oozi – power cut so some food hot and some food cold – but all good. Stop again at Sminsky pass for sweet tea and coffee to keep energy levels up. Weather improves and warms as we get nearer Anoz. Make good time. Smoke coming from the banya. Lena welcoming as ever. Roman, Ivan, Nina and Andrey busy sorting and putting away Biosphere kitchen equipment, tents etc. We stay up again and it's all Nina's fault as she brings in balloons at 23.30 for Angela's birthday tomorrow – so we blow them all up, have a balloon fight and then burst into Angela's room at midnight to wish her Happy Birthday. She (and Marsha who is in the same room) is remarkably good natured about being woken and greeted by so many people. The evening continues. Lovely atmosphere and finally, for me, very late banya, still hot, and all to myself. Bliss

10 August

Beautiful morning. This is where I say goodbye to team members as Chagat and I are off to Gorno Altaisk for meetings today and tomorrow. It's strange to see the Land Rover and minibus convoy go and not be part of it. Sad goodbyes… Sergei drives Chagat and me to the Gorno Altaisky Botanical gardens where we meet the director, Vasiliy Pavlovich. A very knowledgeable and interesting man. I am shown round the gardens and taste 'Quiet fields' herbal tea, followed by the spirit version. A car then takes Chagat and me to Gorno Altiask where I have a very interesting afternoon meeting Micha, hear of NGO 'Arkhar' who has done a lot of work on argali, ibex and snow Leopard, visiting the museum and then to FSDA office where I meet Natalya Yurkova who also works there. We end the evening together in a lively restaurant. Great evening with Chagat and Natalya.

11 August

The morning is spent in meetings with directors of national parks, head of game department, Vasiliy Pavlovich and others, organized by Chagat. We discuss strategies for conservation, sustainable development and ways of working together. It's very productive and I feel very positive about the potential and future of our work. I leave Gorno Altaisk at 3 pm and arrive late in Novosibirsk, but Nastya and Russian team waiting for me and spend best last evening ever with my team. They mean the world to me. No sleep and straight to airport with Nastya and Andrey at 04:30 to catch return flight with Peter, Volodya and Irene.

Thank you all for your hard work, brilliant company and helping this project to be such a success. This year we have gathered so much new data. The picture of snow leopard and prey activity gets clearer every year and ties with local people get ever stronger.The bird inventory is impressive. There is lots more work to do and I look forward to planning the way the project develops. Although this is my last year as expedition leader, my commitment to the project is total and I will continue to be involved as expedition field scientist with Biosphere and in snow leopard conservation here in general. The Altai is in my blood. I can't stay away for long. So thank you Volodya, Irene, Nastya, Nina, Andrey, Ivan, Roman, Andy, Peter, Matthias, Sergey, Chagat, Abai, Gulinara, Tarbia, Marat, Gena (and many other local friends) and Biosphere 2006 team members – you make it happen! And of course, big thank you to Matthias, Katherine and Sergey. Together, we make one hell of a team. My toast (Jack Johnson) "It's always better when we're together".

Tessa McGregor
Expedition Leader