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EXPEDITION REPORT

Expedition dates: 30 June – 23 August 2008
Report published: June 2009

Mountain ghosts: snow leopards and other animals in the mountains of the Altai Republic, Central Asia.

BEST VOLUNTEERING ORGANISATION	BEST FOR GREEN-MINDED TRAVELLERS	TOP RESPONSIBLE HOLIDAY	BEST WILDLIFE VOLUNTEERING HOLIDAY	BEST IN SUSTAINABLE TRAVEL	ENVIRONMENT AWARD	TOP HOLIDAY FOR NATURE
UK	UK	UK	UK	USA	Germany	Germany

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Mountain ghosts: snow leopards and other animals in the mountains of the Altai Republic, Central Asia.

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Matthias Hammer (editor)
Biosphere Expeditions

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 30 June to 23 August 2008. 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 were conducted throughout the study period across the entire survey area (approximately 200 square kilometers). In 2007 surveys were extended to areas away from the Tapduair massif site to the valley and surrounding ridges of Irbistu Mountain, Tara Valley and Karaghem Mountain Pass. 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.

The fluctuations in numbers of the primary prey species observed recently could make it very likely that food availability is not in favour of the snow leopard in the study area. In addition human disturbance is considered to be a severe threat. This is supported by the fact that in 2006 there were no records of snow leopard sign in the core area, in 2007 only a few were found, and in 2008 no records whatever. Nevertheless, the study area still 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 and raising public awareness is vital if conservation initiatives are to succeed. Today work on establishing four additional nature parks in the Republic of Tuva and the Sailugem Nature Reserve in the Republic of Altai that will protect the biggest Russian population of the snow leopard is in progress.

Резюме

Данное исследование проводилось в рамках экспедиции в Кош-Агачском районе Республики Алтай РФ, организованной природоохранным агентством «Biosphere Expeditions» в период с 30 июня по 23 августа 2008 г. Целью работы было изучение присутствия снежного барса в данном регионе, а также учет 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). В этом году исследовали также район долин рек Ирбисту и Тара, окрестности Карагемского перевала. Интервью местных скотоводов также стало важной частью исследования, что фиксировалось в разработанной для этой цели анкете.

В 2008 г. какие-либо следы барсов отсутствовали. Колебания численности поголовья главных потенциальных жертв не способствует появлению тут снежного барса, но можно предположить, что главенствующее негативное влияние на снежного барса оказывают антропогенные факторы. 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, но его численность стремительно падает, и горного козла). Район исследования крайне нуждается в защите, однако, вовлечение в работу местного населения (в т.ч. проведение разъяснительной кампании) является необходимым условием для того, чтобы инициативы по созданию биосферного 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 30 June – 23 August 2008. This expedition conducted a survey of snow leopards as well as their prey species such as 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 and snow leopard numbers. Data collected by this expedition will be crucial in the fight for wild snow leopard survival.

The Altai Republic sits in the very centre of central Asia between China, Mongolia, Kazakhstan, Russia and the Tuva Republic. In it, the Altai mountains rise from 350 to 4500 m 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 they provide 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.

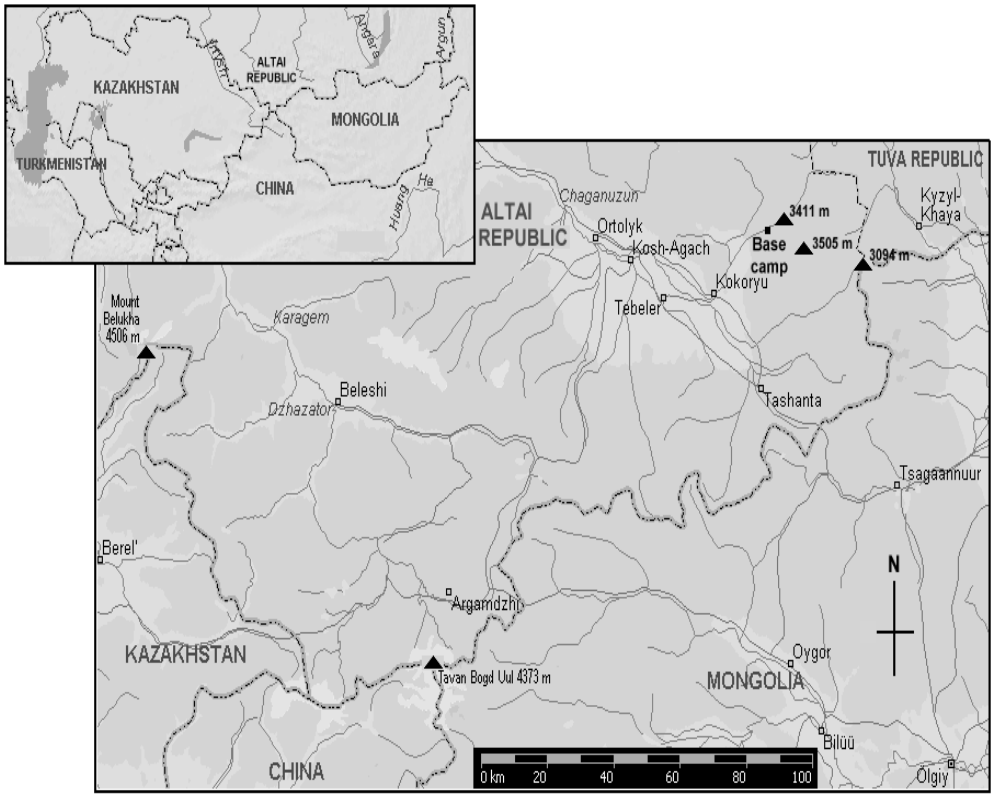
Little is known about the status and distribution of the globally endangered snow leopard in the area and its interaction with prey animals such as the argali and Altai ibex, and its reliance on smaller prey such as marmots, ground squirrels and game birds. Biosphere Expeditions will provide vital data on these issues, which can then be used in the formulation of management and protection plans.

1.2. Research Area

Flag and location of the Altai and study site.

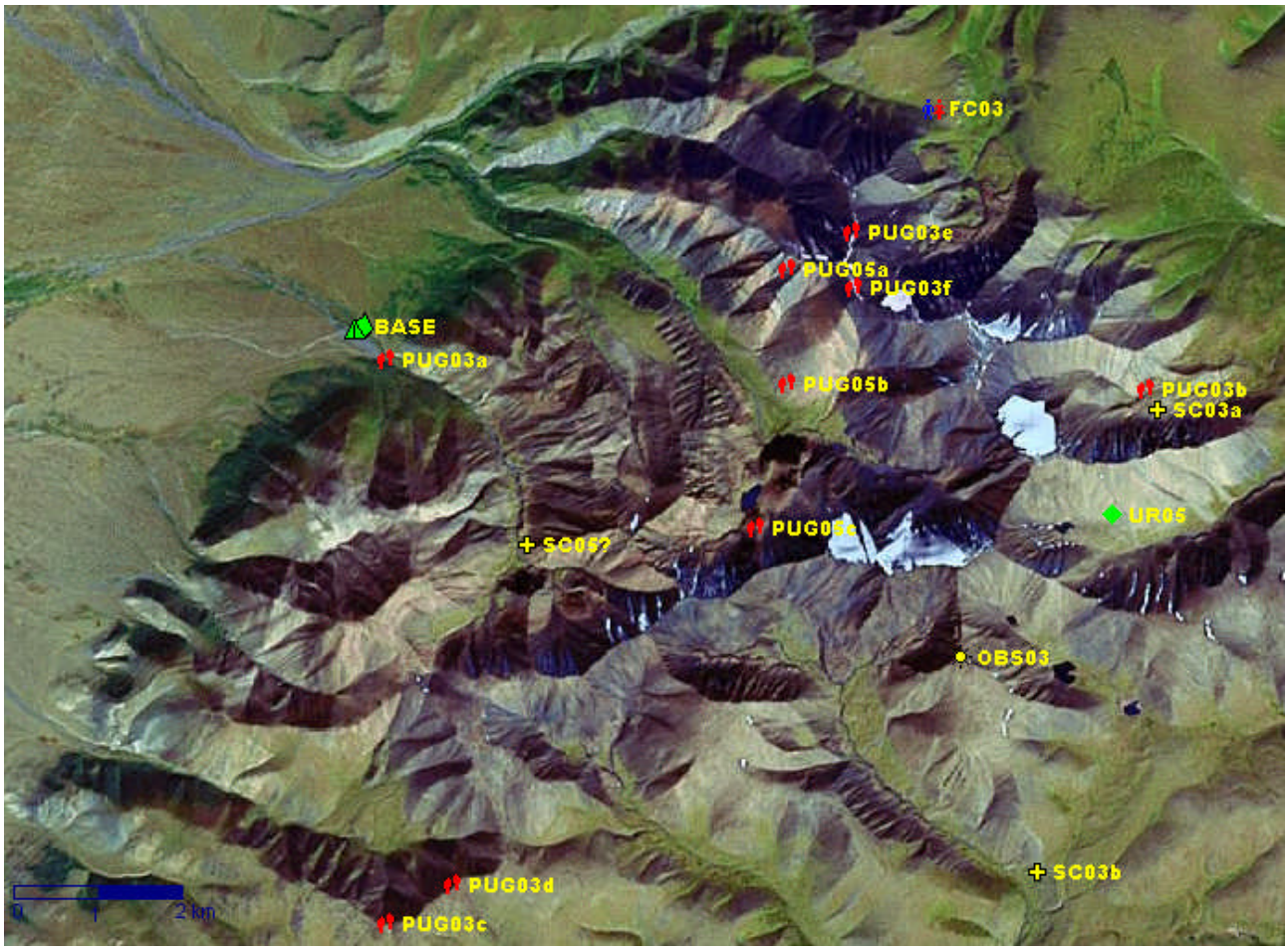
An overview of Biosphere Expeditions' research sites, assembly points, base camp and office locations is at Google Maps.

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 stunning 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 Sajlugem (3411 m), overshadow base camp.



Map showing the Altai region and location of 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 steppes, 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.



Satellite map of the research area showing base camp and some sites of interest (PUG = snow leopard track found, SC = scratch mark, UR = urine mark, OBS = observation, FC = forward research camp. Numbers indicate years). Note that data points shown here are only up to 2005. Data points found in 2006 are further northwest 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 Altai Republic is very sparsely populated, with just about 200,000 people, 53,000 of whom live in the main city of Gorno-Altajsk. 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 more remote 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. More information on the Altai is at www.altai-republic.com.

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

30 June - 12 July | 14 - 26 July | 28 July - 9 August | 11 - 23 August 2008.

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.

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, four Motorola GP320 hand-held and three GM340 mobile radios were available 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 dealers Avtoland of Novosibirsk and Ekaterinburg, the expedition had the use of there Land Rover Defenders and one Land Rover Discovery.

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 small district hospital in the town of Kosh Agach (60 km from the camp) and a large hospital in Gorno Altaisk (500 km from camp). There was also a helicopter rescue service. 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 was one minor medical incident of a team member sick and confined to camp for one day.

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

Andrew Stronach was born in Scotland, studied Engineering and then flew aircraft for the Royal Air Force before working in wildlife. Surveys of wild plants, birds and marine mammals led him into anti-wildlife crime work that has become his passion and taken him all over Britain and Cyprus. He has taken part in expeditions to Belize, Honduras and Sulawesi, surveying coral reefs and rainforest. Due to a rare allergy to offices, Andrew is almost always found outdoors, whether it is working in the highlands of Scotland, trekking in some remote national park on one of his many foreign travels or dangling from a rope on a rock face.

1.7. Expedition Team

The expedition team was recruited by Biosphere Expeditions and consisted of a mixture of all ages, nationalities and backgrounds. They were (with country of residence):

30 June - 12 July

Sharon Bickford (Australia), Stacie Blair (USA), Jourdan Bounds (UK), Hilary Brown (UK), Kurt Ersland (UK), Brian Green (UK), Iqbal Hamiduddin (UK), Elisabeth Meadowcroft (UK), Jane Pearman (UK), Mike Scholey (UK), Claire Shapiro (USA), Brain Warner (UK).

14 - 26 July

Brian Augello (USA), Judith Bird (Canada), Peter Bird (Canada), Jennifer Brooker (UK), Axinja Munkel (Germany), Christine Newell (UK), Gundula Otto (Germany), Helene Otto (Germany), Mareike Zander (Germany), Axel Zander (Germany).

28 July - 9 August

Gabor Bencsik (Germany), James Cruickshank (Germany), Adrian Healy (UK), Tania John (Russia), Carla Marchesan (UK), Christine Newell (UK), Julie Olenn (USA), Jane O'Shaughnessy (Ireland), Iris Ostermayer (Germany), Peter Pilbeam (UK), James Reynolds (Russia), Imke Rümenapf (Germany).

11 - 23 August

Katrin Burow (Switzerland), Henry Cottee-Jones (UK), Susan Evans (UK), Birgit Kadur (Germany), Maggie Neal (UK), John Skinner (UK), Graham Thewlis (UK), Jens Thomas (Germany).

Throughout the expedition

Timofei Klimov (translator and all round fixer), Marina Permyakova (translator), Roman Rolin & Oleg (mountain guides), Nina Taranova (cook and our Russian mother who looked after us so well with wonderful food), and camp helpers Uri, Anton, Emil & Sergej.

1.8. Expedition Budget

Each team member paid towards expedition costs a contribution of £1390 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	60,088
Expenditure	
Base camp and food includes all meals, base camp equipment	4,567
Transport includes fuel, vehicle maintenance	4,667
Equipment and hardware includes research materials, research gear	1,203
Biosphere Expeditions staff includes salaries, travel and expenses to Novosibirsk	5,467
Local staff includes salaries, travel and expenses, Biosphere Expedition tips, gifts	5,698
Administration includes bribes, registration fees, sundries, etc	2,645
Logistics & co-ordination Payment to Sibalp	8,944
Team recruitment Altai as estimated % of PR costs for Biosphere Expeditions	7,233
Income – Expenditure	19,654
Total percentage spent directly on project	67%

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, Swarovski Optik, Cotswold Outdoor, Globetrotter Ausrüstung, Snowgum, 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

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 square 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 is chosen for several reasons including: (1) the area before was poorly surveyed for snow leopard; previous expeditions to the area since 2003 suggest the fragility of the area for sustaining a viable snow leopard population and its temporary status as a snow leopard habitat, however more evidence is needed before coming to a final conclusion; (2) a map study suggests 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 Tyva Republic and a proposed gas pipeline. However, there is a potential here for establishing a protected area that would favour wildlife, accommodate local residents and fit into a supposed network of reserves, national nature parks, etc. designed under a running GEF (Global Environmental Facility) project for biodiversity conservation in the Altai-Sayan area (see, for instance, http://www.altai-sayan.org/files/rf_bd_conservation-altai-sayan.pdf).

The study site (Tapduair area) totals approximately 200 square km (in a square roughly between 50.10°N, 89.20°E and 49.85°N, 89.48°E) and is delineated by geographical features – rivers, in particular Buguzun and Bar-Burghazy, 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 (or on foot if near base camp). All surveys were conducted on foot. Base camp (49.99°N, 89.23°E) was situated in a valley, at the entrance to the core area, below the mountain of Kunduyak (3399 m). It afforded the necessary shelter and fresh water source from Kunduyak Stream needed by the expedition.

In 2008 surveys were extended to areas out of the primary Tapduair site to the valley and surrounding ridges of Irbistu mountain (camping location approximately at 49.44°N, 89.09°E), Karaghem mountain pass area (49.97°N, 87.77°E) and the Tara Valley (49.70°N, 88.09°E) in the Southern Chuya range. One of the reasons for selecting these areas was the digital modeling exercise (see below), which indicated the places as favourable (in terms of bioclimatic parameters) for the snow leopard. One survey was accomplished in the Kamtytyghem area (50.06°N, 89.03°E), a place adjacent to the Tapduair site and visited twice before (in 2006 and 2007).

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. Methods

Snow leopard presence-absence survey

Presence-absence surveys of snow leopard and prey (SLIMS Form 1, see appendix 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.

snow leopard presence can be detected by sign, i.e. pugmarks (tracks) (PUG), scrapes (SC), faeces (scat) (FE), urination (UR) and rock scent spray (RC). 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.

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.

Interviews

The social and economic crises of the 1990s in Russia strongly influenced the intensity and character of how the environment is used, which had a dual effect on the snow leopard. On one hand, due to a decreased number of livestock and related pressure on natural pastures, population numbers of major prey species, Siberian ibex and Argali, have grown. On the other hand, due to the fact that the living standards of the locals have declined, its pressure on biological resources has also increased. People who have lost their jobs have intensified their use of hunting grounds, including the introduction of poaching techniques highly dangerous for the snow leopard. The current global recession may only aggrevate the problem.

Grazing livestock in the highlands is part of traditional land use that directly affects the snow leopard, and herders, many of whom are hunters too, form the part of the human population that is present in the snow leopard habitats and encounters them most often. The expedition found it instructive to interview these people to find out about their attitudes to and sightings of snow leopards and other wildlife. These interviews were conducted in Russian and translated to the team members as they happened. Their job was to make sure that all topics in a formalized questionnaire (see appendix 2) were covered and all questions were asked as far as possible. Datasheets were discussed in the evening with scientific staff as part of the filling in datasheet activity.

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 (http://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

2.4.1. Snow leopard presence/absence survey

From 2 July and up to 21 August 2008, 36 snow leopard presence-absence surveys were carried out. The average length of one survey route was about 10.5 km, and an average of 7.3±0.5 hours was needed for making an inspection. Elevations ranged from approximately 2000 m (in the Buguzun floodplain) to around 3600 m (nearby the Karaghem Mountain Pass). The dominant landscape surveyed in the area consisted of narrow valleys (NVAL), broken terrain (BTER), and steeply (SROL) and gently (GROL) rolling slopes met, respectively, in 32, 23, 12 and 8% of the cases; other landforms included grass plateau, ridges, rock falls, 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.

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), so any conclusions are fairly dubious.

No sets of pugmarks likely to be left behind by the snow leopard were encountered this year.

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 occasional snowfall throughout much of the survey period also reduced the possibility of finding scrapes.

No scrapes possibly belonging to the snow leopard were encountered.

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, for instance, 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 definite samples of faeces supposed of belonging to snow leopard were discovered this year.

Urination: Urine can be deposited on scrape piles and is commonly deposited along regular paths or trails.

No definite 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 during a survey conducted this year.

Claw rakes: These are occasionally left on a rock face, log or upright tree trunk.

No claw rakes were found during the survey period.

2.4.2. 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 18 out of the 28 accomplished snow leopard presence-absence surveys (50%) and are primarily confined to foothills and valley floor. More grazing occurs obviously in the Irbistu area, where several herders' summer stations are in place and dogs are kept in plenty, however here, as elsewhere, most of human impact occurs at lower altitudes. Much of the same is seen in the Tara Valley and nearby the Karaghem Mountain Pass

In general, the grazing pressure in the area continues to remain fairly stable and considerably reduced, compared to communist times. Many areas suitable for grazing (as, for instance, along the Tekelyu River) have been abandoned by herders, which are no longer subsidized by the Government. Today these areas are considered to be 'empty', not meaning, of course, that even in the near future they can once again be used by the herders (or, for instance, as private hunting grounds, for example).

Occasional horse droppings, 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 rubbish left behind by visitors, collection of firewood 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.

In the previous year (2007) it was very disappointing to find tracks of a quad cycles in the fairly remote corridor area (north of the Tapduair area along the Tekelu River, 49.9^{o}N, 89.43^{o}E); this surely is a bad sign, has nothing in common with the local traditional land use and may become an additional factor of disturbance. Whatever the consequences of such an intrusion are remain unknown, but the fact is that the animals (argali, in particular) have left the place (as evidenced by a repeated survey).

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

2.4.3. Prey base survey

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

In 2008 a total of 107 signs of Argali were recorded. These included faeces, hoof prints, pieces of wool, skulls and horns, resting depressions ('beds') found in 13 places (varying from 2 to 11 beds in one place). The individual animals were spotted in places between altitudes of 2668 and 2801 m four times.

A total of 144 signs of Siberian ibex were recorded. These included records of faeces), hoof prints, 'beds' (22, varying from 4 to 18 beds in one place), skulls, tufts of hair. In 9 documented cases animals were seen between altitudes of 2789 and 3223 m in numbers between 1 and 16 (average 8).

In pooled samples average elevations for both argali and ibex records are in fact much the same, varying around 2800 m. Signs indicating the altitudes at which the animals are met, highlight the area as a potential habitat for the snow leopard.

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. It is quite difficult to give any statistical interpretation of these estimates (solely based on the number of records), however, in general, the pool of the 'primary' prey species intuitively seems to have decreased, especially for the argali.

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 analyze the rate at which we gaining our data, presuming that more animals in the area will be producing more signs. This can be assessed by plotting cumulated numbers of signs (or days when signs were recorded) against the dates from the beginning of the survey up to its end, and estimating the corresponding regression values (coefficients) or, in other words, the 'encounter rate'. For this purpose dates have to be transformed into a continuous sequence of numbers (Zaitsev, 1984).

Interestingly, the accumulated number of day/signs versus the dates fits well into the linear regression model (*R*, the correlation coefficient, ranging between 0.98-0.99). This indicates a fairly constant number of animals in the area, and perhaps there is no significant migration of the animals within any summer season into (or out) of the area. Mortalities too, perhaps, are fairly low.

Placed in a row of subsequent years (fig.2), it is evident by corresponding 'encounter rates' that numbers of Argali have been steadily dropping since 2004 and by 2008 have suffered an almost threefold reduction (0.900/0.329=2.74). On the other hand, Siberian ibex numbers have seen both rises (2004-2006, 2007-2008) and declines (2006-2007), and indeed may be fairly steady in the long run.

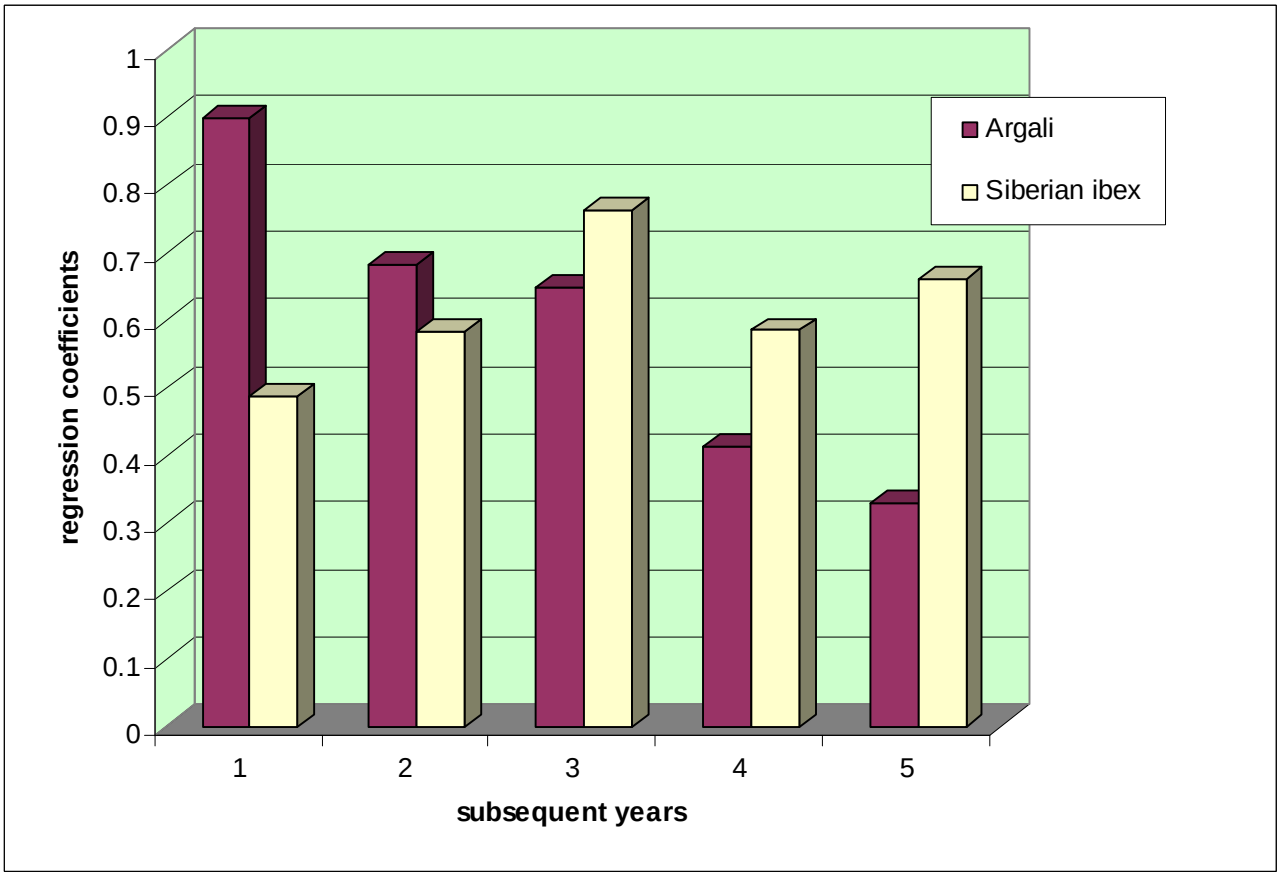

Figure 2.4.3a. Encounter rates for argali and Siberian ibex
for expedition years 2004 (1), 2005 (2), 2006 (3), 2007 (4), 2008 (5).

Fig. 2.4.4a presents the records of the potential prey species. About a third (31.6%) 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 together make up 53.2% of the records. There are fewer records (grouped in the category 'other') of maral, roe deer, wild boar and the Arctic ground squirrel.

2.4.4. Interviews

Seven interviews of people were taken in the field, almost all of men (only once women were involved), aged between 30 and 50, primarily local residents coming from around Kosh-Agach. One person was a tourist from St. Petersburg. Five of them are full-time shepherds, and one is an official (interviewed at a local spa).

All the shepherds keep livestock: sheep (numbers belonging to one owner fluctuate between 50 and 800), goats (50-500), cows (20-100), horses (10-12; in fact, a portion of the livestock belongs to other people such as for instance, teachers, policemen etc.) for whom the shepherd for a fee keep the animals in the field. In general, the shepherds were fairly vague (or reluctant?) in their statements on the exact number of livestock under their supervision.

The overall feeling towards the snow leopard and other wildlife was diverse: 'strongly dislike' (one case), 'indifferent' (2), 'like' (2), and 'strongly like' (2, including the tourist).

On the question about the presence of the snow leopard, 2 replied that this was a 'good thing', 3 were 'indifferent', 1 person said this was a 'bad thing'.

Only three locals have seen a snow leopard in the wild between 2004 and summer of 2007 nearby Mt. Chornaya.

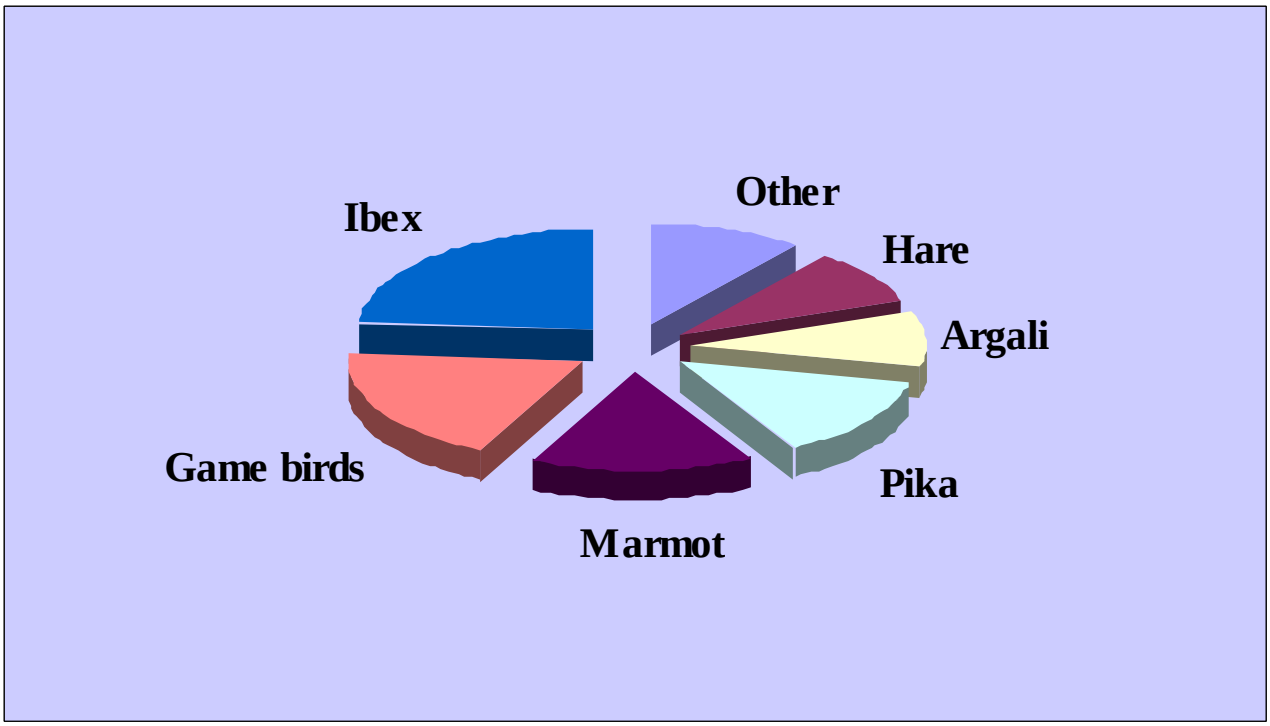

Figure 2.4.4a. Summary for the survey of potential prey species.

The question 'how many snow leopards do you think live in the region' was a puzzle to the interviewees: nobody could say anything.

Only two were explicitly knowledgeable that the snow leopard is protected in Russia.

Responses to questions related to the impact of the snow leopard on wildlife, particularly 'primary' and 'secondary' prey species, attacks on humans and domestic livestock depredation were distributed as per Table 2.4.4a below.

Table 2.4.4a. Questions related to the impact of the snow leopard on wildlife

Questions related to the impact of the snow leopard on wildlife	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Snow leopards have a considerable impact on large game (argali, ibex, etc.)	3	-	1	1	1
Snow leopards have a considerable impact on small game (marmots, ground squirrels, etc.)	1	-	1	1	1
Snow leopards reduce populations of argali and ibex to unacceptable levels.	2	-	1	-	-
Snow leopard attacks on humans are more frequent in regions where snow leopards live in close proximity to humans.	-	-	-	-	-
In regions where snow leopards live in close proximity to livestock, they feed primarily on domestic animals.	1	1	-	-	-
We already have enough snow leopards in the region	1	1	-	-	1
Total	**8**	**2**	**3**	**2**	**3**

Most of the interviewees considered the impact of the snow leopard on 'primary' and 'secondary' prey species to be either neutral, or more or less disagree with the notion that snow leopards can reduce populations of argali and ibex to unacceptable levels or that snow leopard attacks on humans are more frequent in regions where the leopards live in close proximity to humans. None of the local residents to whom we spoke considered the snow leopard not to be a threat to humans.

Contrary to the common expectations, the interviewees, most of whose welfare is so dependent on the well-being their livestock, do not agree that in regions where snow leopards live in close proximity to livestock, they feed primarily on domestic animals.

On the question concerning the attraction of more tourists to the region because of snow leopards, nothing was explicitly said. In general, people in the area are not against tourists from outside, provided they are respectful of the environment, but one of the interviewees was opposed to the idea of having more tourists.

Unfortunately, as the nation becomes richer (after the economic crisis in the 1990s) more people are coming to the region and displaying an aggressive attitude towards the use of the natural resources of the area, attempting to privatise at any cost areas for their selfish economic needs and hardly respecting traditions such as for instance, hunting rules established by consensus between the local residents and kept in force for many years.

Today, however, this process may slow down for some time due to the global recession, but the threat remains in place. This winter (2009) has seen a very worrying example of this as allegations of poaching by a hunting expedition aboard a Mi-171 helicopter has received wide coverage even in the government-friendly media outlets (see http://www.themoscowtimes.com/article/1010/42/376853.htm).

A remedy to this intrusion could be the establishment here of a protected area, preferably a national park or a biosphere reserve. WWF Russia has been working on this issue for 10 years, recently aided by data from this expedition. During this period the "Strategy for Conservation of the Snow Leopard" was developed (Anon, 2002 and see 2.6. Summary & Management Recommendations) and approved by the government, several anti-poaching units were created, a monitoring programme was put in place and new protected areas were established (Katon-Karagai National Park in Kazakhstan, nature parks "Argut" and "Ukok" in the Republic of Altai). Today work on establishing four additional nature parks in the Republic of Tuva and the Sailugem Nature Reserve in the Republic of Altai that will protect the biggest Russian population of the snow leopard is in progress.

However, people to whom we spoke do not think the whole area should be protected and do not seem to realise the threat that encroaching civilization could bring to the area. So far the herders and people in the steppe have managed to prevent privatisation of the land and are trying their best to resist poachers from the big cities.

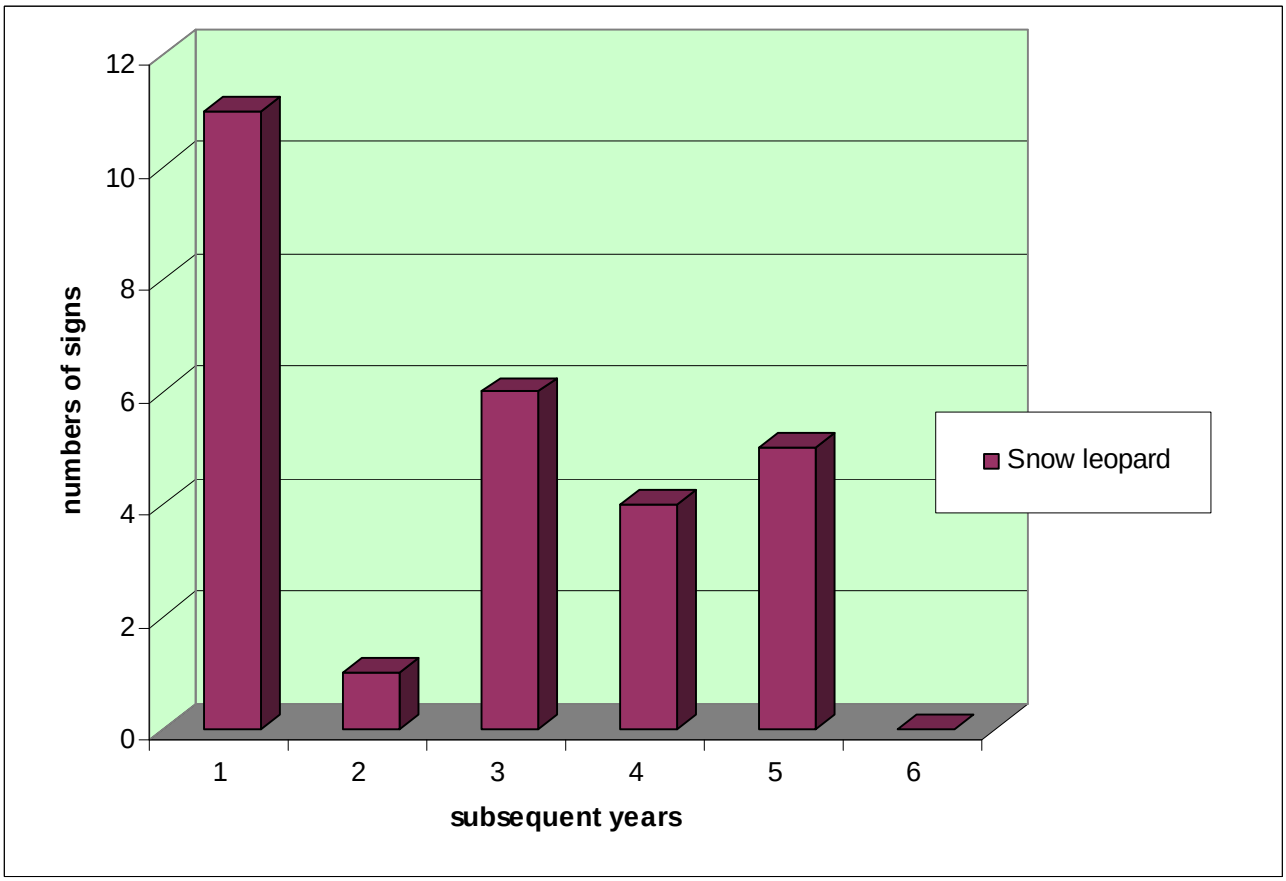

Figure 2.4.4b. Numbers of snow leopard sign detected during expedition years 2003 (1), 2004 (2), 2005 (3), 2006 (4), 2007 (5), 2008 (6) (pooled data, including core area, i.e. blocks 1 and 2, and additionally surveyed areas)

2.4.5. Additional surveys

Evidence of other carnivores sharing snow leopard habitat was also recorded. These were wolf, fox and manul. Wolf sign were found at various elevations (up to 3223 m).

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.

No video camera trapping was carried by the expedition in 2008. Previously 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

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 first expedition in 2003 indicated that snow leopard was present in the core 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 years no other sign was found, besides fairly old (perhaps a few months) scat samples presumably belonging to the species, showing that snow leopards may have left the area or are visiting it on an occasional basis. Although sign of prey species is found throughout the survey area, 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 seem to be present in relatively small numbers subjected to fluctuations and/or even sharp decline (as in the case of the Argali).

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 frequently adjacent to, or in the core area. Sightings have decreased significantly since 1998, although, according to the locals, animals still do occur in the proximity of the Tapduair area (for instance, mountains Chornaya, Tabajoc, surroundings of Arzhan-Buguzun). Snow leopard predation of domestic livestock occurred in the past, but there are 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. We hypothesies that the main cause for this is increased poaching of snow leopard and ungulates (particularly argali) exacerbated by seriously diminished facilities to combat these problems.

On the other hand, repeated surveys evidence the habitat in the Tapduair 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, especially of Siberian ibex.

The developing relationship between the predator and prey species seems to be very fragile, so any decline (perhaps, even slight) in the prey species may drive the snow leopard out of the core area. On the other hand, numbers of Siberian ibex, intuitively recognized as the most abundant prey species for the snow leopard in the area, have seen both 'ups and downs', whereas even the pooled records of the predator (Fig. 2.4.4b.) are becoming increasingly scarce.

Indeed, poaching and disturbance may be the main factors for driving animals out of the site: in 2006 there were no records of snow leopard sign in the core area, in 2007 only few were found, and none (including distant areas) in 2008.

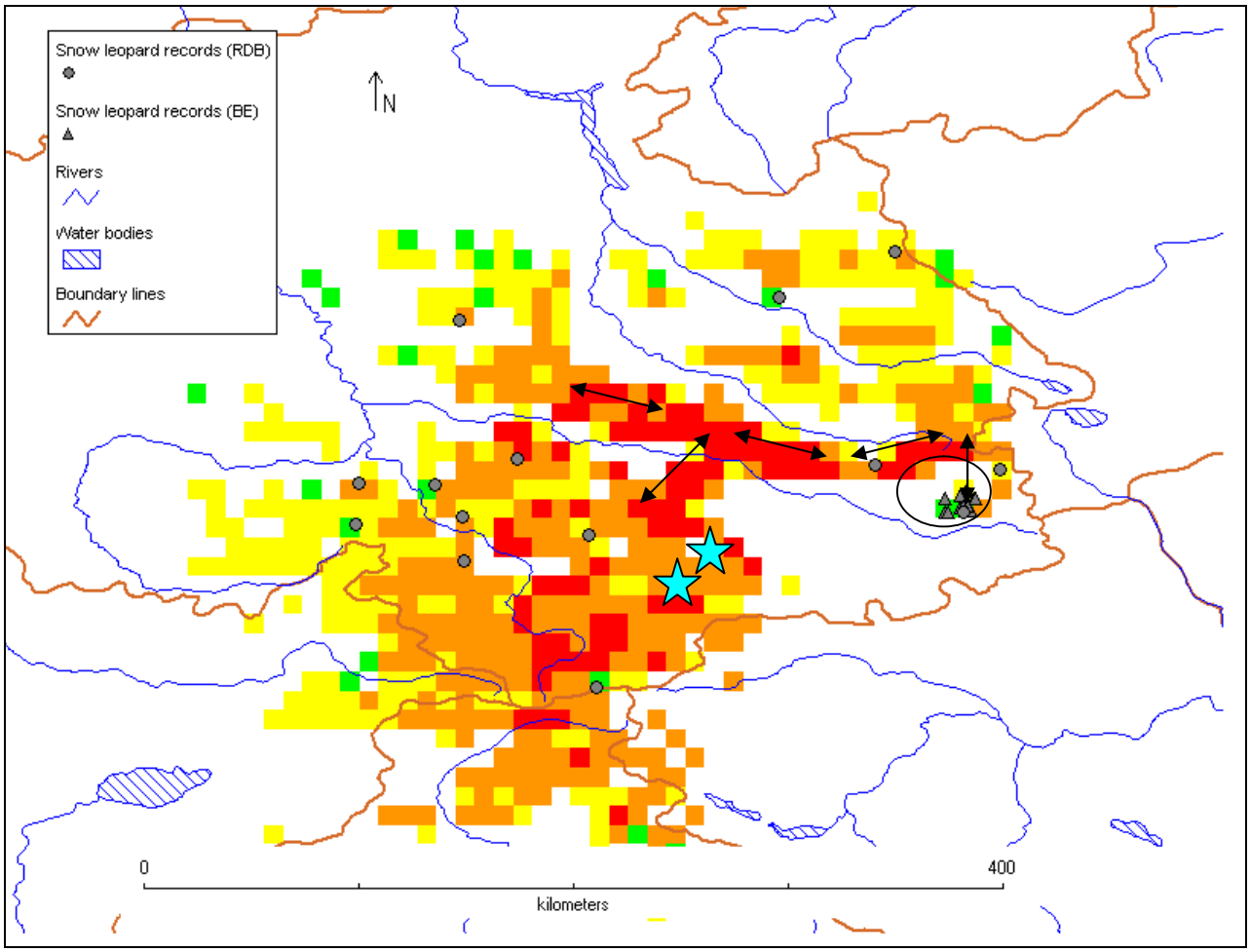

Figure 2.5a. Digital distribution model of the snow leopard in the Republic of Altai (and some adjacent areas); areas within the red-coloured cells present the most favourable ('excellent') combination of ecological conditions required by the species, green – the least favourable; arrows indicate potential migration routes and corridors between areas of 'excellent' habitat; the circle encloses the BE survey area; the blue stars are placed in the Irbistu area (together with the Tara valley) and the area of the Karaghem mountain pass.

In this respect the corridor area located to the north beyond the Buguzun-Karagai-Tekelu boundary is of vital importance for animals recolonizing the core area. 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 Tapduair massif together with the Kurayskiy range form an extensive cluster of ‘excellent’ habitat area interconnected with similar areas in the Chuyskiy ranges favouring snow leopard presence. So, given a sufficient ‘primary’ prey population and reduction of human disturbance, 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 (especially of argali) is affecting these areas as well; too much grazing of livestock is occuring, 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 (proved by visits to the valleys of Iribistu, Tara, Dzhelo, a valley on the way to the Karaghem mountain pass). 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.

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, 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 Tyva and a gas pipeline), and land privatization. If development goes ahead it will exacerbate the poaching problem and cause further damage to an already fragile ecosystem.

2.6. Summary & Management Recommendations

Management recommendations are in line with the Strategy for Conservation of the Snow Leopard in the Russian Federation (2002) and include the following:

- III.1* *Safeguarding the range structure* – conduct further research in the study area especially 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.

- III.3. *Measures for conservation of major prey species and control over potential competitors* – 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 licence is issued.

- III.5. *Solutions to the conflict between snow leopards and local herders* – improve the economic situation of local people in return for participation in wildlife monitoring and help with anti-poaching. In fact, interviews have shown that locals in their majority have no hostile feelings to the snow leopard, so it might be reasonable for this purpose using the combination of ecotourism and marketing products made by herders.

- V. *Raising public awareness of snow leopard conservation* – further investigation and consultation with herders are needed, so they would reach an understanding of the snow leopard as a 'flagship' species not only for nature conservationists, but a species benefiting them as well. More attention has to be drawn to realizing the threat that encroaching civilization is bringing to the area and to the understanding of protected areas concept as a tool for withstanding against privatization of land by non-residents and maintaining sustainable nature resource use in the traditional fashion.

2.7. 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 as pointed out in the digital modelling. Finding a trail and/or relic scrape(s) is yet 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 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.

* As numbered in the Strategy for Conservation of the snow leopard in the Russian Federation of Anon (2002).

2.8. Заключение

С 2 июля по 21 августа 2008 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. В 2007 г. найдены лишь старые следы и экскременты, а предположительное снижение поголовья главных потенциальных жертв не способствует появлению тут снежного барса. В 2008 г. вообще не обнаружено каких-либо следов пребывания снежного барса.

Предполагается, что снежный барс потенциально может проникать на территорию горного массива Талдуаир с массивов, расположенных севернее линии, образуемой реками Бугузун-Карагай-Текелю, и входящими с состав своеобразного миграционного коридора. Подобное предположение покрепляется полевыми наблюдениями и компьютерным моделированием экологической ниши снежного барса, выполненным с помощю ГИС-технологии.

Оценка подходящих для вида местообитаний, расположенных на высотах 2789 -3223 м н.у.м., показала, 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, относительная численность которого, однако, стремительно падает).

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. Вместе с тем, хотя относительная численность аргали снижается (предполагается, что за последние пять лет она снизилась примерно в три раза), относительная численность козла за этот период испытывала как падения, так и подъемы, но это, по-видимому, никак не отразилось на количесто регистраций хищника. Тем не менее необходимо ввести запрет и/ или строгий контроль на отстрел диких копытных и придание району Талдуаир природоохранного статуса. Кроме того, 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, Merenlender & Murphy, 1994). Comprehensive ecological monitoring is therefore a crucial source of information to integrate both conservation and management objectives.

With this in mind, the aims and objectives of this study were to provide baseline data for terrestrial biodiversity assessment based on bird species richness and functional (guild) type.

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, Burgess & Hill, 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 distributions 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 commoner the species, the more likely it is to be recorded with higher frequency. For example, out of the total of 706 records of species being encountered during the surveys, 34 (or 4.8%) belong to the black-eared kite, one of the most common birds in the study area. On the contrary, rare species recorded only once account only for about 0.14%.

In general, the time horizon 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 the naked eye or with binoculars. For the analysis car day counts and foot counts are pooled.

Sampling units (i.e. transects) were spread over the whole Talduair study area (this year including sites around Irbistu mountain (49.74^{o}N, 88.20^{o}E), Karaghem mountain pass (49.97^{o}N, 87.77^{o}E) and the Tara valley (49.70^{o}N, 88.09^{o}E) in the Southern Chuya range) 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 3 and 9 hours and varied around an average of 7.3±0.5 hours. The number of routes was used in our analysis as a measure of the sampling effort (as far as more than one route could be accomplished in one day, say by 2 separate teams). Around 5.6% 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	2.07-10.07	8
2	16.07-23.07	10
3	30.07-7.08	7
4	12.08-21.08	9
1-4	10.07-15.08	subtotal: 34
Surveys undertaken between slots	27.07, 8-12.08	2
		Total: 36

Records were entered into a data-sheet after each survey in the evening of the same day.

Data storage and access

The dataset in the appendix of this report shows a total species list. This dataset is a combined and agreed record taken from the datasheets and field notebooks of the group of observers in each slot. Additional values were assigned to each species in order to facilitate investigation of trophic diversity, habitat diversity, body size category and conservation category.

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 observed, 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 efficacy and completeness within a given study, and (ii) valid comparisons between studies based upon a standardized 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 surveys), $S(t)$ 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 (t_q):

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

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 t_q:

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

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 days were added to the total, the sample order was randomized 50 times using *EstimateS* software (Colwell, 2005), for which either abundance data, or using summed incidence data (frequencies of occurence, pooled among samples), are suitable.

This produces smoothed species accumulation curves (Fig. 3.3a) 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. Non-linear regression (Statistica Package, 1995) has been used to fit the two models to the smoothed curves of the observed data.

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'*) can be used as a measure of statistical error, however the significance of differences in diversity between samples was preferably determined by using the Shannon diversity *t*-test (Hammer et al., 2008).

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 asserted using a restricted logarithmic scale (Pesenko, 1982).

3.3. Results

The methods used resulted in a presence-absence data set consisting of 706 records. A total of 126 species (subspecies) were recorded (belonging to 14 orders and 37 families). In 66 additional cases species were not identified (most of these were pipits, *Anthus*, or redstarts, *Phoenicurus*, occasional raptors etc.) or there are doubts on how proper the identification could be, particularly if only feathers were found.

Up to now a total of 197 bird species have been recorded by Biosphere Expedition teams in the area since the surveys commenced in 2003 and 13.7% of additional species (i.e. not seen before) were recorded in 2008.

The following analyses of bird diversity were made:

3.3.1. Species richness & diversity.

Species accumulation curves were plotted to estimate inventory efficacy and completeness and allow valid comparisons in further monitoring studies applying the same or similar methodologies. Both the total simple (raw) species accumulation curve and theoretical (smoothed) curve together with its upper and lower 95% confidence boundaries are presented in Fig. 3.3.1a. From the graph a conclusion can be made that in general around as many species have been encountered as could be theoretically expected, however points representing the raw data do overstep the lower 95% confidence boundary of the smoothed curve, particularly between the 11th and 25th surveys (18.07-6.08), indicating a slowdown in the process of the recording of bird species. Nevertheless, vigorous efforts undertaken in the 4th slot luckily corrected the position.

The rate at which the curve flattens is crucial for estimating inventory efficacy and completeness. A visual analysis of the graph indicates that perhaps more species would have been encountered if the expedition period lasted longer (as far as it is quite obvious that the curve has not reached its ‘ceiling’).

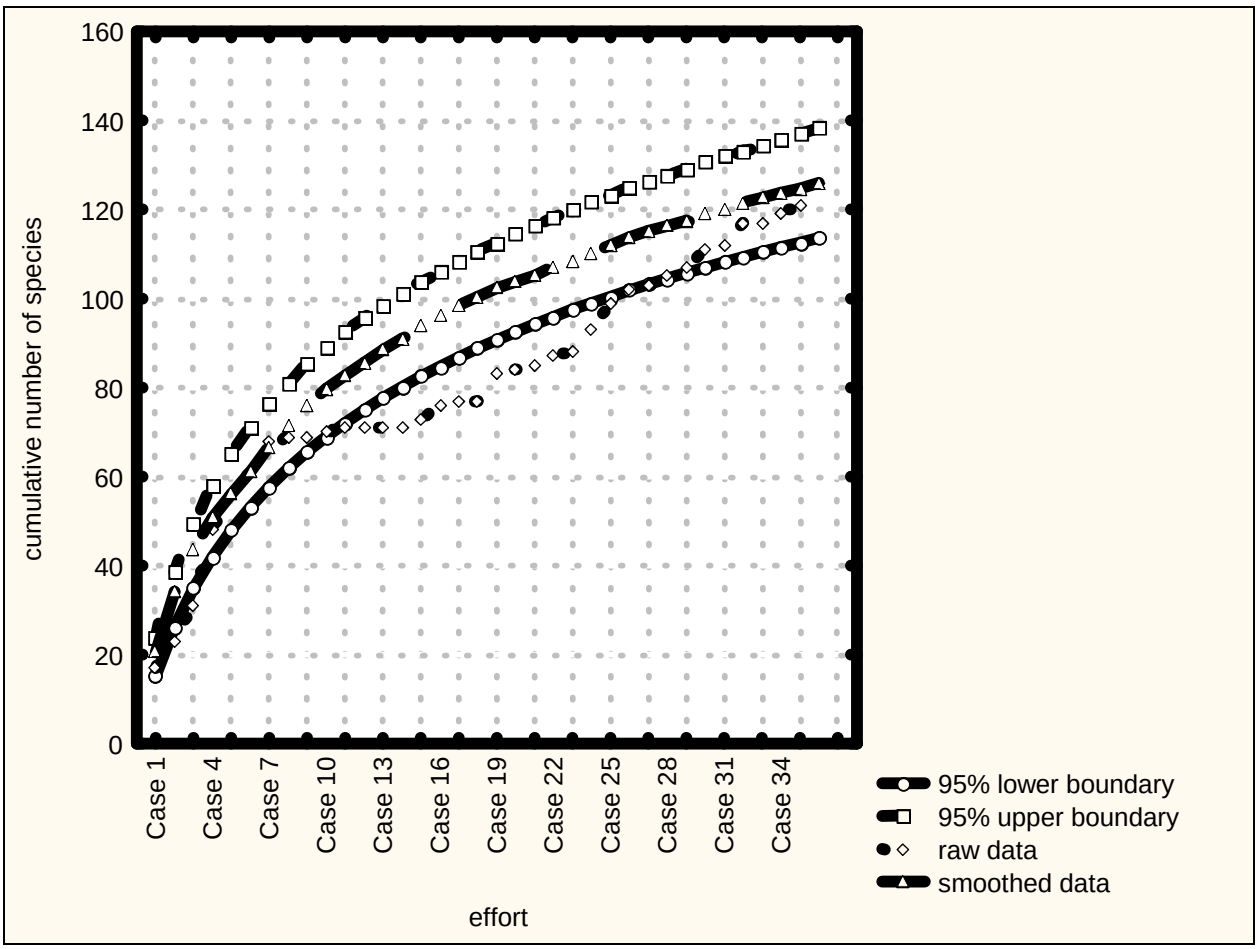

Figure 3.3a. The total simple species accumulation curve (smoothed curve produced by 50 random reorderings).

Theoretically the linear dependence model predicts that 116 species are expected to be met in the area, whereas the Clench model envisages about 149 (see Table 3.3a). In fact, the real number of species recorded in one year is most likely to be between these estimates.

In view of the fact that each inventory year is a somewhat unique event (because of varying weather conditions, varying numbers of keen birdwatchers, reconnaissance studies of new areas etc.), it would be hard to expect the resulting bird species lists to be identical and share 100% of common species. In reality they 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.

More reconnaissance trips accomplished this year (particularly moving out to the Karagem mountain pass and Tara valley areas, etc.) have yielded more species not sighted before, so that to date the total number of species recorded in the area since 2003 has reached 197. As a consequence, the resulting bird lists of 2007 and 2008 share only 62.8% of the species.

Table 3.3a. 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 surveys) 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			
126	9.629±0.759	0.083±0.010	116.0	27.7	0.934
		Clench model			
126	12.372±1.180	0.083±0.012	149.1	108.4	0.952

The overall diversity of the avifauna (assessed by the Shannon index, *H'*) comprised 4.337. The Shannon diversity *t*-test has detected for the first time differences in diversity between samples collected in consecutive years (4.048 in 2007) (t=5.1>1.96). This rise most likely is due to several factors, including spending more time on overnights in new areas, increasing the number of visits to wetlands, etc.

A qualitative analysis of species diversity done by taxonomic unit (bird order and family) shows that approximately a half of the species (60 out of 126, or 47.6%) are represented, as one could expect, by passerines (Table 3.4b). In terms of species numbers passerines are followed (exactly as in previous years) in almost equal proportions by raptors (families *Accipitridae* and *Falconidae*) and waders (predominantly *Charadriidae*), composing respectively 16.7% and 11.9% of the local bird fauna.

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

Order	No. of species	Family	No. of species
Passeriformes	60	Turdidae	12
		Motacillidae	11
		Corvidae	8
		Fringillidae	5
		Hirundinidae	4
		Prunellidae	3
		Sylviidae	3
		Alaudidae	2
		Emberizidae	2
		Paridae	2
		Passeridae	2
		Apodidae	1
		Certhiidae	1
		Cinclidae	1
		Laniidae	1
		Sittidae	1
		Sturnidae	1
Falconiformes	21	Accipitridae	14
		Falconidae	7
Charadriiformes	15	Charadriidae	11
		Laridae	3
		Sternidae	1
Anseriformes	9	Anatidae	9
Galliformes	5	Phasianidae	3
		Tetraonidae	2
Columbiformes	4	Columbidae	3
		Pteroclidae	1
Ciconiiformes	2	Ciconiidae	1
		Ardeidae	1
Gruiformes	2	Gruidae	1
		Rallidae	1
Piciformes	2	Picidae	2
Podicipitiformes	2	Podicipitidae	2
Coraciiformes	1	Upupidae	1
Cuculiformes	1	Cuculidae	1
Gaviformes	1	Gaviidae	1
Pelecaniformes	1	Phalacrocoracidae	1
Total orders: 14		**Total families: 37**	**Total species (subspecies): 126**

In general the distribution of species amongst the major bird orders remains stable as evidenced by the Chi-square statistical tests (all *p* above the 0.05 threshold) (see Table 3.4c).

Table 3.4c. Distribution of species amongst the major bird orders for survey years 2004-2007.

Orders	2005	2006	2007	2008
Passeriformes	48	47	51	60
Charadriiformes	15	14	13	15
Falconiformes	12	17	16	21
Other (pooled)	15	19	18	30

$\text{Chi-square}_{2005/2006} = 1.12$, *d.f.* = 3, $p = 0.77$
$\text{Chi-square}_{2006/2007} = 0.25$, *d.f.* = 3, $p = 0.97$
$\text{Chi-square}_{2007/2008} = 1.06$, *d.f.* = 3, $p = 0.79$

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 (2007)	59	18	16	4	6
%	*57.3*	*17.5*	*15.5*	*3.9*	*5.8*
No. of species (2008)	83	21	28	6	48
%	*58.5*	*14.8*	*19.7*	*4.2*	*2.8*

$\text{Chi-square}_{2007/2008} = 1.39$, *d.f.* = 3; $p = 0.71$

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 presenting above a half (47.6%) of the species in the area are primarily insectivorous. So, as well, are many of the recorded wader species.

Carnivores, though to a relatively reduced extent, 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. The Chi-square tests (summarized in Table 3.4d) show that variations in the figures observed between the two consecutive survey years (2007 and 2008) 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 the altutude of approximately 2,400 m), mountain steppe, mountain tundra, open rock (including cliffs and barren scree fields), intrazonal habitats (such, for instance, as narrow mountain river valleys, gorges etc. quite often vegetated differently from the surrounding landscape), urban (places in and around human settlements).

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	0.053	x	x	x	x	x	x	x
Forest	0.060	0.161	x	x	x	x	x	x
Mountain steppe	0.029	0.208	0.078	x	x	x	x	x
Mountain tundra	0.019	0	0.027	0.156	x	x	x	x
Open rock	0	0	0	0.108	0.412	x	x	x
Intrazonal habitats	0.056	0.063	0.105	0.079	0	0	x	x
Urban	0.039	0.068	0	0.028	0	0	0.043	x
Total number of species seen in: (data 2007)	29	31	25	26	8	12	21	8
Total number of species seen in: (data 2008)	43	37	28	27	10	14	14	10

$\text{Chi-square}_{2007/2008} = 3.91$, $d.f. = 7$; $p = 0.79$

The upper part of Table 3.4e summarizes the similarity of the avifauna of various habitat types (assessed in by the Jaccard measure). The lower part shows the total number of bird species met in each particular habitat type. The Jaccard 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 2008) the fluvial floodplain area and the floor of the largest valleys house 43 and 37 species, respectively, whereas, on the other side of the spectrum mountain tundra and open rock habitats accomodate 10 and 14 species, respectively. Forests, as an intermediate set of habitats, house 28 species, sharing around 7.8% of them with the mountain steppe above and 16.1% with the steppe below. Intrazonal habitats, frequently found penetrating deeply into mountain massifs, or presented in the form of patches, house 14 species, primarily of lowland origin: some 5.6% are shared with the avifauna of the fluvial floodplain, around 6.3% are found in the steppe, approximately 10.5% are forests dwellers, and only about 7.9% of the species is shared with the composition of the upper birdlife in the mountain steppe.

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 41.2% of the bird species. This notion is distinctly supported by a principle component analysis (for details of the method see Ludwig & Reynolds, 1988), showing a strong separation for the species' composition of the highland habitats from the rest along the axis of the first principle component (PC1), which may be interpreted as "altitude". PC2 characterizes most likely the "wetness of the habitat type", clearly separating the bird fauna of the fluvial lowlands from the fauna of the dry steppe (Fig. 3.4b).

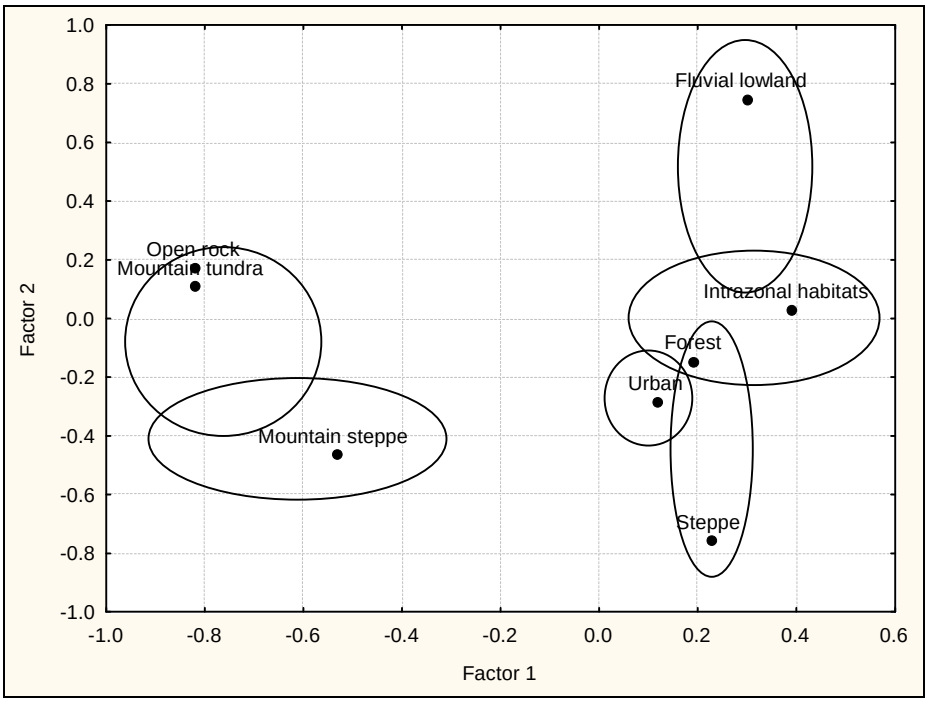

Figure 3.4b. Principle component analysis for avifauna of various habitat types.

Despite the observed variations in figures, the distribution of species amongst the major bird habitats in the study area for 2 consecutive survey years (2007 and 2008) 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 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 quite well applies to our data (see reports for 2004-2006).

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 or force to quit the model at all, however variations in the figures (note: size data has been log-transformed) observed between the consecutive survey years are statistically insignificant (*Mean size*$_{2007}$ = 5.203±0.069, *Variance*$_{2007}$ = 0.467; *Mean size*$_{2008}$ = 5.217±0.060, *Variance*$_{2008}$ = 0.460; $t_{2007/2008}$ = 0.93, p = 0.30, $F_{2006/2007}$ = 1.02, p = 0.72).

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 $36^{0.2} \approx 2$. 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 42.8% 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 (2007-2008).

Abundance classes					
1 (rare)		2 (few)	3 (moderate)	4 (common)	5 (abundant)
Data 2007					
1-2 records		3-4 records	5-8 records	9-16 records	17-31 records
uniques: 37 (37.8%) duplicates:18 (18.4%)	*Total:* 55 (56.1%)	12 (12.2%)	16 (16.3%)	8 (8.2%)	7 (7.1%)
Data 2008					
1-2 records		3-4 records	5-8 records	9-16 records	17-32 records
uniques: 40 (31.7%) duplicates:14 (11.1%)	*Total:* 54 (42.8%)	23 (18.3%)	23 (18.3%)	16 (12.7%)	10 (7.9%)
Chi-square$_{2007/2008}$ = 5.106, *d.f.* = 5; p = 0.403					

Amongst the most common birds (abundant) are the black-eared kite, red-billed chough, Isabelline wheatear, Northern wheatear, common kestrel, Demoiselle crane*(III), hoopoe, horned skylark, white (or pied) wagtail and steppe eagle *(III), considered in the Red Data Book of the Altai Republic as *Aquila rapax nipalensis*.

Next in abundance (common) are the Altai snowcock*(III), barn swallow, black-billed magpie, bluethroat, carrion crow, common sandpiper, common tern, Eurasian skylark, grey wagtail, Richard's pipit, rock ptarmigan, ruddy shelduck, saker falcon (iii), tawny eagle (considered in the Red Data Book of the Altai Republic conspecific to the Steppe eagle), Tufted duck and Twite.

Moderate records have been made of the booted eagle*(i), cinereous vulture*(i), citrine wagtail, common buzzard, common cuckoo, common stonechat, dark-throated thrush, Eurasian jackdaw, golden eagle*(II), Guldenstad's redstart (= white-winged redstart), herring gull, house sparrow, Hume's warbler, bearded vulture*(I), little ringed plover, long-legged buzzard, rosy starling*(iii), sand martin, spotted nutcracker, whooper swan*(iii), willow grouse and yellow-billed chough.

Fewer records are made of the Altai accentor, black-headed gull, buff-bellied pipit, coot, crimson-winged finch, desert wheatear, Eurasian nuthatch (subsp. asiatica), Eurasian sparrowhawk, great cormorant, great-crested grebe, green sandpiper, greenish warbler, grey heron*(ii), imperial eagle*(ii), merlin, northern house martin, pochard, red-crested pochard, red-necked phalarope, Slavonian grebe, upland buzzard*(iii), white wagtail (personata), willow tit.

Thirteeen 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[1]). In 2007 there were eight such species.

Amongst the rarest species ten are listed in the Red Data Book of the Altai Republic the Mongolian finch, black stork, Altai falcon, gyrfalcon, black-throated diver, spotted eagle (all of category ii), Brant's mountain finch, black-tailed godwit (all of category iii), azure tit, wallcreeper (category iv).

Together 25 species out of 67 (or about 37%) listed in the Red Data Book of the Altai Republic were spotted by the expedition team during the survey. In 2006 there were 17 such species. Since 2003 a total of 37 species listed in the Red Data Book of the Altai Republic have been recorded.

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 3.4d) are statistically insignificant (*p* well above the critical value of 0.05).

[1] I – globally threatened, II – declining species, III – rare, IV – species at the edge of its home range and/or poorly known.

3.5. Conclusions / Заключение

1. A repeated bird species inventory undertaken by Biosphere Expeditions in the Talduair area of the Altai Republic (this year including several sites in the Southern Chuya Range) between the 2 July and 15 August 2008, involving a total sampling effort of 36 days, yielded 126 species (subspecies) belonging to 14 orders and 37 families; in 66 additional cases species were not identified or there were doubts on how proper the identification could be.

1. В районе горного массива Талдуаир в Республике Алтай РФ (а в этом году еще в районе Южно-Чуйского хребта) с 2 июля по 15 августа 2008 г. проводили очередную инвентаризацию фауны птиц и учет их численности. Работа велась силами трех команд волонтеров, участников экспедиции, в 5-12 человек в каждой. Общее количество маршрутов, потраченных на наблюдения, составило 36. В итоге обнаружено 126 видов (подвидов) птиц (принадлежащих к 14 отрядам и 37 семействам); в 66 случаях нужны дополнительные данные для надежного определения птиц.

2. Extrapolation methods used to assess the completeness of the inventory indicate that more species would have been encountered if the expedition period (consequently, the sampling effort) had lasted longer. The real number of species recorded in one year is likely to be between the estimates of 116 and 149 species. Now a total of 197 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 продлена на дольший срок (соответственно, увеличилось бы количество дней наблюдений). Возможно, что число видов обнаруженых в течении одного полевого сезона составило б 116-149 видов. Усилиями экпедиции за 6 полевых сезона (начиная с 2003 г.) обнаружено 197 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 in 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 низкогорних 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 (2007 and 2008) 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 2007-2008 гг. не обнаружено.

7. 54 (or 48.2%) of the recorded species can be considered rare; 10 of them are listed in the Red Data Book of the Altai Republic. Since 2003 a total of 37 species listed in the Red Data Book of the Altai Republic have been recorded.

7. 54 (или 48.2%) зарегистрированных здесь видов птиц можно считать редкими; 10 из них занесены в Красную книгу Республики Алтай. Начиная с 2003 г., отмечено 37 видов птиц, занесенных в Красную книгу Республики Алтай.

8. 72 species belong to other abundance categories, ranging from “few” to “abundant”; 13 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 Steppe eagle, Saker falcon etc.

8. 72 вида принадлежат к других категориям встречаемости (от «мало» до «очень много»); 13 из них числятся в Красной книге Республики Алтай. Радует тот факт, что среди них (даже принадлежащих к категориям «много» и «обычные») встречаются такие «знаковые» для природоохраны виды как красавка, степной орел, балобан и др.

9. Comparisons between inventories of 2007-2008 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 2007-2008 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 taxonomy 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 using binoculars, signs were associated with particular species using relevant field guides (Bang, Dahlstrøm, 2001; Dolejš, 1987; Rukovskiy, 1984; etc.). For the analysis car day counts and foot counts were pooled. The sampling effort totaled 34 routes (accomplished between 2 July and 2 August 2008). Records were entered into a data-sheet after each survey in the evening of the same day.

4.2. Results

The methods used resulted in a presence-absence data set (appendix 4). A total of 31 species were recorded (belonging to 5 orders and 14 families). In some cases (*Microtinae* and *Mustelidae*) it was difficult to identify the animals to the species level. Since 2004 the total number of recognized mammal species has reached 37.

The overall diversity of the mammal fauna (assessed by the Shannon index, *H'*) comprised 2.902. The Shannon diversity *t*-test detected no significant differences in diversity between inventories performed in 2007 and 2008 ($t_{2007/2008}$=0.13, p=0.89), meaning the quantitative structure of the mammal fauna in the area is most likely to be in a steady condition. Qualitative similarity between these inventories, assessed by the Jaccard measure, is high as well and reaches the level of 63.2% of the species' composition.

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

Order	No. of species	Family	No. of species
Rodentia	11	Cricetidae	6
		Sciuridae	4
		Dipodidae	1
Carnivora	9	Mustelidae	4
		Canidae	3
		Felidae	1
		Ursidae	1
Artiodactyla	5	Bovidae	2
		Cervidae	2
		Suidae	1
Lagomorpha	4	Leporidae	2
		Ochotonidae	2
Insectivora	2	Talpidae	1
		Soricidae	1
Total: 5		**Total: 14**	**Total: 31**

The fairly large proportion of Carnivora (almost 30%) may be 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

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 $34^{0.2}$ is approximately 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 2. 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 (including unidentified taxa)

Abundance classes					
1 (rare)		2 (few)	3 (moderate)	4 (common)	5 (abundant)
Data 2007					
1-2 records		3-4 records	5-8 records	9-15 records	16-30 records
uniques: 5 (17%) duplicates: 3 (11 %)	*Total:* 8 (28%)	5 (17%)	7 (24%)	6 (21 %)	3 (10%)
Data 2008					
1-2 records		3-4 records	5-8 records	9-15 records	16-32 records
uniques: 9 (29%) duplicates: 2 (6.5 %)	*Total:* 11 (35.5%)	5 (16.1%)	6 (19.4%)	3 (9.7%)	6 (19.4%)
Chi-square$_{2007/2008}$ =0.48, *d.f.* = 3*; p = 0.92					

*as far as some of the scores in the abundance classes are less than 5 neighbouring 4 and 5 classes have been pooled into one; consequently the degrees of freedom (*d.f.*) is reduced to 3 (i.e., number of classes minus 1)

Amongst the most abundant mammal species are the Arctic ground squirrell, grey or Altai marmot, Arctic or mountain hare, Siberian ibex, Northern pika, red fox.

Next in abundance (common) are the argali sheep*(I), large-eared or Altai vole, wolf.

Moderate records have been made of the Daurian pika, wild boar, Siberian chipmunk, maral deer, Northern red squirrell, roe deer.

Fewer records are made of the stoat, Corsac or steppe fox, manul*(II), mountain or Altai weasel, Tolai hare.

Two species marked above with an asterisk are listed in the Red Data Book of the Altai Republic (I-II stand for their assigned nature conservation status).

Eleven of the mammal species recorded this year are considered rare. Identified species in this category are flat-headed vole, grey-sided vole, brown bear, common vole, Evermann's or steppe polecat, minute shrew, Mongolian five-toed jerboa*(III), Northern red-backed vole, Russian dwarf hamster, Siberian or Altai mole, wolverine.

Together three mammal species out of 19 (or about 16%) listed in the Red Data Book of the Altai Republic were spotted by the expedition team during the survey.

4.3. Conclusions/ Заключение

1. A total of 31 species of mammals were recorded (belonging to 5 orders and 14 families). Since 2004 the total number of species recorded in the study area has reached 37.

2. Отмечено наличие в исследованном районе 31 вид млекопитающих (принадлежащих к 5 отрядам, 14 семействам. Начиная с 2004 г., отмечено 37 видов.

2. A fairly large proportion of Carnivora species (about 30%) may be an indication of the complexity of the local community structure and diverse food webs.

2. Относительно большая доля видов отряда Хищные (примерно 30%) может быть показателем сложности структуры местной экосистемы и разнообразия пищевых цепей.

3. Uniques and duplicates comprise together a noticeable portion of the fauna (35.5%).

3. Виды, которые наблюдались один или два раза, составляют примерно 35.5% 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.

4. Потенциальные жертвы снежного барса (горный козел, аргали, серый сурок, заяц-беляк, алтайская пищуха, длиннохвостый суслик, марал) относительно многочисленны и обычны в исследованном районе.

5. An alarming fact is that no sign of Snow leopard has been detected. As another felid species, the Manul, since 2004 has shifted down to the “fewer” category, however yet continues to remain there.

5. Следов снежного барса в отчетном году не обнаружено, что является тревожным фактом. Положение другого представителя семейства кошек, манула, также вызывает тревогу. Этот вид продолжает редко встречаться.

6. Three mammal species out of 19 listed in the Red Data Book of the Altai Republic have been spotted by the expedition team during the 2008 survey.

6. В 2008 г. отмечено наличие 3 из 19 видов млекопитающих, внесенных в Красную книгу республики Алтай.

Altogether five mammal species out of 19 (or about 26%) listed in the Red Data Book of the Altai Republic were spotted by the expedition team during the survey.

4.4. References

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Appendix 1: SLIMS form 1.

BIOSPHERE EXPEDITIONS

Datasheet: **Altai**

SLIMS form 1: snow leopard presence/absence survey: snow leopard

Observer names		Date		Survey Block Number	

Summary of snow leopard sign observed in this survey block

Column 1 Search site number	Column 2 Type and amount of sign	Column 3 Search effort (km^2 and time)	Column 4 Dominant landscape
This is the number of the search SITE within the survey BLOCK. You should be given this number before you set out. If not, ask. Fill in one sheet for each search site.	A simple list for each discrete sign. Take GPS reading for each sign and note approximate age (new or old) into your notebook. On completing the search, total the number of each type of sign and enter below. If no sign is found enter 0 below. Sign types: PUG = pugmark (track). SC = scrape. FE = scat or feces. UR = urination. RC = rock scent spray. Age of sign: OLD = old or very old sign (> 1 month). FRE = fresh or very fresh sign (1 day to 1 month).	Note the approximate size of the area searched and the time it took to do this. Remember to note down your search start and end time!	Note the dominant landscape at each search site. PLA = plain. GROL = gently rolling (low hills and valleys without distinct ridgelines). SROL = steeply rolling (steep or very steep slopes of more than 30 m). BTER = broken terrain (land surface broken by irregular slopes, cliffs, rocky outcrops, gullies). WVAL = wide valley (wide, level floor more than 1 km wide). NVAL = narrow valley (steep sides with floor less than 1 km wide). GORG = gorge (extremely steep-sided and deep valley with cliffs and bluffs along its edges). OTH = other (describe).
	PUG		
	SC		
	FE		
	UR		
	RC		

Threats to snow leopard

Comments

SLIMS form 1: snow leopard presence/absence survey: prey species

Information on prey species is obtained in two ways: Interviews with locals and noting all species observed or their sign. Because animals may be disturbed while searching for snow leopard sign, a separate morning or afternoon should be devoted to searching for prey animals. If at all possible the same groups should search for snow leopard sign *within the same search site* and then for prey species and use this one form to record results for both searches. From prominent ridges or hill tops, but well-hidden from view, scope the area with binoculars. When using the same search site, be aware that prey species use less rugged terrain such as a wide valley or gently rolling hill slopes.

Observer names		Date		Survey Block Number	

Summary of prey species and their sign observed in this survey block

Column 1 Prey species	Column 2 Type and amount of sign	Column 3 Relative abundance	Column 4 Threats
Ibex, Argali, Red deer, Musk deer, Wild boar, Marmot, Pika, Hare, Rabbits, Game birds (including Altai snowcock).	Kind of evidence and amount. Kinds of evidence are INT = interview (describe). OBS = observation by researchers (describe numbers, behaviour etc). SIG = sign (describe what kind of sign and deductions made from sign).	Record, for example, the number of herds seen at the search site or the number of days a particular species or sign was seen. Also note your observations and opinion on whether the prey species populations are low, average or high and give reasons.	Is there evidence of poaching? If so, how widespread is it, who is involved and where are products sold? Also record information on livestock that may be competing with prey species. If possible, interview locals to learn how much predation there is on prey species and livestock (but exercise caution when asking questions and interpreting responses).

Comments

Appendix 2: Interview datasheet.

DATASHEET: RECORDING INTERVIEWS

ALTAI

You will be visiting local people to find out about their attitudes to and sightings of snow leopards and other wildlife. These interviews will be conducted in Russian and translated to you as they happen. It is your job to make sure that all topics on this sheet are covered and all questions asked as far as possible.

However, interviews will be conducted in a very informal, "chatty" way as formal interviews with datasheets tend to result in inaccurate information. This is because as soon as an interviewee sees a formal datasheet and is asked questions in a very rigid way, he or she is likely to become tense and will attempt to second-guess what answers the interviewer would like to hear, rather than give his or her true opinion. This effect can be avoided by having a very informal chat which nevertheless covers all the topics.

Guidelines

1. Be relaxed, friendly, chatty.
2. Take pictures only after asking for permission and then only a few.
3. Keep the datasheet out of sight as much as possible.
4. You can glance at the datasheet or record the questions in your notebook beforehand to make sure they are all covered. If necessary, prompt the interviewer to make sure this is done.
5. Immediately after the interview and out of sight of the interviewee, discuss the datasheet and record the answers, using your judgment.
6. Discuss the datasheet in the evening with scientific staff as part of the filling in datasheet activity and make changes as necessary.

INTERVIEW CONDUCTED BY: **DATE OF INTERVIEW:**

PERSONAL INFORMATION ABOUT THE INTERVIEWEE

Sex:

Age:

Place of residence (name of community):

Place of birth (region):

Occupation:

If you are a livestock owner/raiser, what kind of animals do you have?

Sheep Goats Cows Horses Other

INFORMATION ABOUT SNOW LEOPARDS AND OTHER WILDLIFE

Which of the following statements best describes your feeling towards snow leopards?

Strongly dislike Dislike Indifferent
Like Strongly like

The presence of snow leopards for you is

A good thing
A bad thing
You are indifferent

Have you ever seen a snow leopard?

No
Yes, when _____ and where _____

How many snow leopards do you think live in the region?

_____ number

Are snow leopards protected in Russia?

Yes
No
Don't know

	Strongly disagree	Disagree	Neutral	Agree	Strongly disagree
snow leopards have a considerable impact on large game (argali, ibex, etc.)	1	2	3	4	5
snow leopards have a considerable impact on small game (marmots, susliks, etc.)	1	2	3	4	5
snow leopards reduce populations of argali and ibex to unacceptable levels.	1	2	3	4	5
snow leopard attacks on humans are more frequent in regions where snow leopards live in close proximity to humans.	1	2	3	4	5
In regions where snow leopards live in close proximity to livestock, they feed primarily on domestic animals.	1	2	3	4	5
We already have enough snow leopards in the region.	1	2	3	4	5

If snow leopards attracted more tourists to the region, this would be

A good thing
A bad thing
You are indifferent

Comments (record any other useful/interesting information here)

Appendix 3: Bird species recorded by Biosphere Expeditions in the Altai (2008). Names and classification following Cramp, S and Simmons, K E L (eds.) (2004), BWPi: Birds of the Western Palearctic interactive (DVD-ROM). BirdGuides Ltd, Sheffield.

English name	Scientific name	Русское название	Nature conservation status in the Red Data Book of the Altai Republic. Природоохранный статус в Красной книге Республики Алтай
Alpine accentor	*Prunella collaris*	альпийская завирушка	
Altai accentor	*Prunella himalayana*	гималайская завирушка	
Altai falcon	*Falco altaicus*	алтайский кречет	II
Altai snowcock	*Tetraogallus altaicus*	алтайский улар	III
Azure tit	*Parus cyanus*	белая лазоревка	IV
Barbary falcon	*Falco pelegrinoides*	шахин	
Barn swallow	*Hirundo rustica*	деревенская ласточка	
Bar-tailed godwit	*Limosa lapponica*	малый веретенник	
Bearded vulture	*Gypaetus barbatus*	бородач	I
Black redstart	*Phoenicurus ochruros*	горихвостка-чернушка	
Black stork	*Ciconia nigra*	черный аист	II
Black-bellied sand grouse	*Pterocles orientalis*	чернобрюхий рябок	
Black-billed magpie	*Pica pica*	сорока	
Black-eared kite	*Milvus lineatus*	черный коршун	
Black-headed gull	*Larus ridibundus*	озерная чайка	
Black-tailed godwit	*Limosa limosa*	большой веретенник	III
Black-throated diver	*Gavia arctica*	чернозобая гагара	II
Bluethroat	*Luscinia svecica*	варакушка	
Blyth's pipit	*Anthus godlewskii*	конек Годлевского	
Booted eagle	*Aquila pennata*	орел-карлик	I
Brant's mountain finch	*Leucosticte brandti*	жемчужный вьюрок	III
Brown accentor	*Prunella fulvescens*	бледная завирушка	
Brown-headed gull	*Larus brunnicephalus*	бурогловая чайка	
Buff-bellied pipit	*Anthus rubescens*	гольцовый конек	
Carrion crow	*Corvus corone*	черная ворона	
Cinereous vulture	*Aegypius monachus*	черный гриф	III
Citrine wagtail	*Motacilla citreola*	желтоголовая трясогузка	
Common buzzard	*Buteo buteo*	канюк	
Common coot	*Fulica atra*	лысуха	
Common cuckoo	*Cuculus canorus*	кукушка	
Common kestrel	*Falco tinnunculus*	обыкновення пустельга	
Common quail	*Coturnix coturnix*	перепел	
Common redshank	*Tringa totanus*	травник	
Common sandpiper	*Actitis hypoleucos*	перевозчик	
Common stonechat	*Saxicola torquata*	черноголовый чекан	

English name	Scientific name	Русское название	Nature conservation status in the Red Data Book of the Altai Republic. Природоохранный статус в Красной книге Республики Алтай
Common tern	*Sterna hirundo*	обыкновенная крачка	
Crimson-winged finch	*Rhodopechys sanguinea*	чечевичник краснокрылый	
Dark-throated thrush	*Turdus ruficollis*	темнозобый дрозд	
Demoiselle crane	*Anthropoides virgo*	красавка	III
Desert wheatear	*Oenanthe deserti*	пустынная каменка	
Dipper	*Cinclus cinclus*	оляпка	
Dusky warbler	*Phylloscopus fuscatus*	бурая пеночка	
Eurasian crag martin	*Hirundo rupestris*	скальная ласточка	
Eurasian hobby	*Falco subbuteo*	чеглок	
Eurasian jackdaw	*Corvus monedula*	обыкновенная галка	
Eurasian nuthatch (subsp. asiatica)	*Sitta europaea*	обыкновенный поползень	
Eurasian skylark	*Alauda arvensis*	полевой жаворонок	
Eurasian sparrowhawk	*Accipiter nisus*	перепелятник	
Eurasian tree sparrow	*Passer montanus*	полевой воробей	
Feral pigeon	*Columba livia domestica*	домашний голубь	
Golden eagle	*Aquila chrysaetos*	беркут	II
Great cormorant	*Phalacrocorax carbo*	большой баклан	II
Great spotted woodpecker	*Dendrocopos major*	большой пестрый дятел	
Great-crested grebe	*Podiceps cristatus*	большая поганка	
Greater scaup	*Aythya marila*	морская чернеть	
Green sandpiper	*Tringa ochropus*	черныш	
Greenish warbler	*Phylloscopus trochiloides*	зеленая пеночка	
Grey heron	*Ardea cinerea*	серая цапля	II
Grey partridge	*Perdix perdix*	серая куропатка	
Grey wagtail	*Motacilla cinerea*	горная трясогузка	
Guldenstadt's redstart	*Phoenicurus erythrogaster*	краснобрюхая горихвостка	
Gyrfalcon	*Falco rusticolus*	кречет	II
Herring gull	*Larus argentatus*	серебристая чайка	
Hill pigeon	*Columba rupestris*	скальный голубь	
Hoopoe	*Upupa epops*	удод	
Horned skylark	*Eremophila alpestris*	рогатый жаворонок	
House martin	*Delichon urbica*	городска́я ла́сточка	
House sparrow	*Passer domesticus*	домовый воробей	
Hume's warbler	*Phylloscopus humei*	алтайская пеночка	
Imperial eagle	*Aquila heliaca*	могильник	II
Isabelline wheatear	*Oenanthe isabellina*	каменка-плясунья	
Lapwing	*Vanellus vanellus*	чибис	

English name	Scientific name	Русское название	Nature conservation status in the Red Data Book of the Altai Republic. Природоохранный статус в Красной книге Республики Алтай
Little ringed plover	*Charadrius dubius*	малый зуек	
Long-legged buzzard	*Buteo rufinus*	курганник	
Mallard	*Anas platyrhynchos*	кряква	
Meadow pipit	*Anthus pratensis*	луговой конек	
Merlin	*Falco columbarius*	дербник	
Mistle thrush	*Turdus viscivorus*	деряба	
Mongolian finch	*Bucanetes mongolicus*	монгольский снегирь	II
Mongolian ground-jay	*Podoces hendersoni*	монгольская сойка	
Northern goshawk	*Accipiter gentilis*	тетеревятник	
Northern shoveler	*Anas clypeata*	широконоска	
Northern wheatear	*Oenanthe oenanthe*	обыкновенная каменка	
Ortolan bunting	*Emberiza hortulana*	садовая овсянка	
Pintailed snipe	*Gallinago stenura*	азиатский бекас	
Plain mountain finch	*Leucosticte nemoricola*	гималайский вьюрок	
Pochard	*Aythya ferina*	красноголовый нырок	
Red-billed chough	*Pyrrhocorax pyrrhocorax*	клушица	
Red-crested pochard	*Netta rufina*	красноносый нырок	
Red-necked phalarope	*Phalaropus lobatus*	круглоносый плавунчик	
Richard's pipit	*Anthus richardi*	степной конек	
Rock bunting	*Emberiza cia*	горная овсянка	
Rock pigeon	*Columba livia*	сизый голубь	
Rock ptarmigan	*Lagopus mutus*	тундряная куропатка	
Rook	*Corvus frugilegus*	грач	
Rosy starling	*Sturnus roseus*	розовый скворец	III
Ruddy shelduck	*Tadorna ferruginea*	огарь	
Rufous-backed redstart	*Phoenicurus erythronotus*	красноспинная горихвостка	
Rufous-tailed rock thrush	*Monticola saxatilis*	пестрый каменный дрозд	
Rufous-tailed shrike	*Lanius isabellinus*	буланый сорокопут	
Saker falcon	*Falco cherrug*	балобан	III
Sand martin	*Riparia riparia*	береговушка	
Slavonian grebe	*Podiceps auritus*	красношейная поганка	
Spotted eagle	*Aquila clanga*	большой подорлик	II
Spotted nutcracker	*Nucifraga caryocatactes*	кедровка	
Spotted redshank	*Tringa erythropus*	щеголь	
Steppe eagle	*Aquila nipalensis*	восточный степной орел	III
Swift	*Apus apus*	черный стриж	
Tawny eagle	*Aquila rapax*	степной орел	III

English name	Scientific name	Русское название	Nature conservation status in the Red Data Book of the Altai Republic. Природоохранный статус в Красной книге Республики Алтай
Tawny pipit	*Anthus campestris*	полевой конек	
Teal	*Anas crecca*	чирок-свистунок	
Temminck stint	*Calidris temminckii*	белохвостый песочник	
Three-toed woodpecker	*Picoides tridactylus*	трехпалый дятел	
Tree pipit	*Anthus trivialis*	лесной конек	
Tufted duck	*Aythya fuligula*	хохлатая чернеть	
Twite	*Acanthis flavirostris*	горная чечетка	
Upland buzzard	*Buteo hemilasius*	мохноногий курганник	III
Wallcreeper	*Tichodroma muraria*	краснокрылый стенолаз	IV
Water pipit	*Anthus spinoletta*	горный конек	
White (pied) wagtail	*Motacilla alba*	белая трясогузка	
White (pied) wagtail_personata	*Motacilla personata*	маскированная трясогузка	
Whooper swan	*Cygnus cygnus*	лебедь-кликун	III
Willow grouse	*Lagopus lagopus*	белая куропатка	
Willow tit	*Parus montanus*	буроголовая гаичка	
Windchat	*Saxicola rubetra*	луговой чекан	
Yellow-billed chough	*Pyrrhocorax graculus*	альпийская галка	

Appendix 4: Mammal species recorded by Biosphere Expeditions in the Altai (2008).

English name	Scientific name	Русское название	Nature conservation status in the Red Data Book of the Altai Republic. Природоохранный статус в Красной книге Республики Алтай
Arctic ground squirrell	*Citellus undulatus*	длиннохвостый суслик	
Arctic or Mountain hare	*Lepus timidus*	заяц-беляк	
Argali sheep	*Ovis ammon*	горный баран, аргали	I
Brown bear	*Ursus arctos*	бурый медведь	
Common vole	*Microtus arvalis*	обыкновенная полевка	
Corsac or Steppe fox	*Vulpes corsac*	корсак	
Daurian pika	*Ochotona daurica*	даурская пищуха	
Evermann's or Steppe Polecat	*Mustela eversmanni*	степной хорь	
Flat-headed vole	*Alticola strelzowi*	плоскочерепная полевка	
Grey or Altai marmot	*Marmota baibacina*	серый, или алтайский, сурок	
Grey-sided vole	*Clethrionomys rufocanus*	красно-серая полевка	
Large-eared or Altai vole	*Alticola macrotus*	большеухая горная полевка	
Manul	*Felis manul*	манул	II
Maral deer	*Cervus elaphus*	марал	
Minute shrew	*Sorex minutissimus*	крошечная бурозубка	
Mongolian five-toed jerboa	*Allactaga sibirica*	тушканчик-прыгун	III
Mountain or Altai weasel	*Mustela altaica*	солонгой	
Northern pika	*Ochotona alpina*	алтайская пищуха	
Northern red squirrell	*Sciurus vulgaris*	обыкновенная белка	
Northern red-backed vole	*Clethrionomys rutilus*	рыжая полевка	
Red fox	*Vulpes vulpes*	обыкновенная лисица	
Roe-deer	*Capreolus capreolus*	косуля	
Russian dwarf hamster	*Phodopus sungorus*	джунгарский хомячок	
Siberian chipmunk	*Eutamias sibiricus*	бурундук	
Siberian ibex	*Capra sibirica*	сибирский горный козел	
Siberian or Altai mole	*Talpa altaica*	сибирский крот	
Stoat	*Mustela erminea*	горностай	
Tolai hare	*Lepus tolai*	заяц-толай	
Wild boar	*Sus scrofa*	дикий кабан	
Wolf	*Canis lupus*	волк	
Wolverine	*Gulo gulo*	росомаха	

Appendix 5: Plants identified and/or collected by expedition team member Christine Newell in 2008. See also summary plant list in appendix 6 below.

Family	Genus	Species	Authority (Location of Type Specimen)	Common name	Source	Collection notes
Asteraceae	*Cirsium*	*schischkinii*	Serg. TK; LE	Shishkin's thistle	1 (28)	4/8/08 Along river bank,Yoldary River valley
	Crepis	*czuensis*	Serg. TK	Hawk's-beard	1 (29)	28/7/08 Buguzon River floodplain
	Dendranthema	*sinuatum*	(Ldb.) Tzvel. LE	Chrysanthemum	1 (26)	3/8/08 Stony slopes, Taldura River valley
	Echinops	*humilis*	Bieb. LE	Dwarf Globe thistle	1 (26)	8/8/08 Valley near Tuvan restaurant
	Hieracium	*ganeschinii*	Zahn. LE	Hawkweed	1 (30)	4/8/08 Dry hillside above Yoldary River
	Hieracium	*korshinskyi*	Zahn. LE	Hawkweed	1 (30)	28/7/08 Buguzon River floodplain
	Hieracium	*virosum*	Pall. LE	Hawkweed	1 (30)	4/8/08 Dry hillside above Yoldary River
	Saussurea	*daurica*	Adams LE	Saw-wort	1 (26)	8/8/08 Roadside near Kokoria
Boraginaceae	*Eritrichium*	*villosum*	(Ldb.)Bge. Verzeichn. LE		1 (19)	22/7/08 Tara River Valley ridge
	Lappula	*consanguinea*	(Fisch.et May) Gurke LE	Bur Forget-me-not	1 (19)	2/8/08 Roadside west of Kosh Agach
Brassicaceae	*Barbarea*	*arcuata*	Rchb. London	Winter-cress	1 (8)	18/7/08 River floodplain, back valley
	Isatis	*lasiocarpa*	Ldb. LE	Woad	1 (8)	7/8/08 Along Buguzon River
Crassulaceae	*Rhodiola*	*krylovii*	Polozhij & Revjak	Krylov's Roseroot	5	18/7/08 Stream valley, back valley
	Rhodiola	*coccinea*	(Royle) A.Bor. LE	Roseroot	1 (9)	1/8/08 Hillside above base camp
Equisetaceae	*Equisetum*	*palustre*	L. London	Horsetail	1 (1)	2/8/08 River flood plain, Taldura Valley
Euphorbiaceae	*Euphorbia*	*discolor*	Ldb. LE	Spurge	1 (14)	4/8/08 Yoldary River valley
	Euphorbia	*tshuiensis*	(Prokh.) Serg. LE	Chuya spurge	1 (14)	27/7/08 Stony slopes, Taldura River valley
Fabaceae	*Cicer*	*songoricum*	Steph. Ex DC LE	Chick pea	1 (13)	4/8/08 Dry hillside above Yoldary River
	Onobrychis	*tanaitica*	Sprengel Berlin	Sainfoin	1 (13)	21/7/08 Tara River valley
	Oxytropis	*glabra*	(Lam.)DC Paris	Oxytrope	1 (13)	7/8/08 Along Buguzon River
	Oxytropis	*gebleri ?*	Fisch. LE	Oxytrope	1 (13)	4/8/08 Yoldary River valley
Fumariaceae	*Corydalis*	*stricta*	Steph. Geneva	Corydalis	1 (7)	27/7/08 Stony slopes, Taldura Valley

Family	Genus	Species	Authority (Location of Type Specimen)	Common name	Source	Collection notes
Gentianaceae	*Gentiana*	*macrophylla*	Pall. LE	Gentian	1 (18)	4/8/08 Yoldary River valley
	Lomatogonium	*rotatum*	(L.) Fries ex Nym. Lond.		1 (18)	2/8/08 River flood plain,Taldura Valley
Poaceae	*Alopecurus*	*pratensis*	L. London	Foxtail	1 (2)	17/7/08 Hill behind base camp
	Festuca	*altaica*	Trin. LE	Fescue	1 (2)	17/7/08 Hill behind base camp
Rosaceae	*Potentilla*	*anserina*	L. London	Cinquefoil	1 (10)	7/8/08 Along Buguzon River
	Potentilla	*gelida*	C.A.M LE	Cinquefoil	1 (10)	3/8/08 Taldura River valley
	Potentilla	*sericea*	L. London	Cinquefoil	1 (10)	18/7/08 Campsite, river floodplain, back valley
Salicaceae	*Populus*	*laurifolia*	Ldb. LE	Laurel-leaved Poplar	1 (5)	7/8/08 Along Buguzon River
Scrophulariaceae	*Castilleja*	*pallida*	(L.) Kunth. LINN	Paintbrush	1 (22)	4/8/08 Along Yoldary River

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
5. Pyak, A.I. et. al., 2008, Endemic Plants of the Altai Mountain Country, **WILD**Guides Ltd., UK

Appendix 6: Plant list 2003 – 2008 collated by expedition team member Christine Newell.

Family	Genus	Species	Common name
Apiaceae	*Archangelica*	*decurrens*	Angelica
	Aulacospermum	*anomalum*	
	Bupleurum	*pusillum*	Hare's ears
	Bupleurum	*multinerve*	Hare's-ears
	Bupleurum	*triradiatum*	Hare's-ears
	Heracleum	*dissectum*	Hogweed
	Libanotis	*condensata*	
	Pachypleurum	*alpinum*	
	Sajanella	*monstrosa*	
	Schultzia	*crinita*	
	Seseli	*strictum*	Moon carrot
	Stenocoelium	*athamantoides*	
Asteraceae	*Achillea*	*asiatica*	Yarrow
	Antennaria	*dioica*	Mountain everlasting
	Artemisia	*altaiensis*	Mugwort
	Artemisia	*borealis*	Mugwort
	Artemisia	*frigida*	Mugwort
	Artemisia	*glauca*	Mugwort
	Artemisia	*macrantha*	Mugwort
	Artemisia	*macrocephala*	Mugwort
	Aster	*serpentimontanus*	Aster
	Cirsium	*esculentum*	Dwarf thistle
	Cirsium	*schischkinii*	Shishkin's thistle
	Crepis	*czuensis*	Hawk's-beard
	Dendranthema	*sinuata*	Chrysanthemum
	Echinops	*humilis*	Dwarf Globe thistle
	Crepis	*bungei*	Hawk's beard
	Crepis	*crocea*	Hawk's beard
	Crepis	*karelinii*	Hawk's beard
	Crepis	*nana*	Hawk's beard
	Erigeron	*altaicus*	Fleabane
	Erigeron	*elongatus*	Fleabane
	Erigeron	*eriocalyx*	Fleabane
	Erigeron	*flaccidus*	Fleabane
	Erigeron	*krylovii?*	Fleabane
	Erigeron	*petiolaris*	Fleabane
	Heteropappus	*altaicus*	
	Heteropappus	*distortus*	
	Hieracium	*ganeschinii*	Hawkweed
	Hieracium	*korshinskyi*	Hawkweed
	Hieracium	*virosum*	Hawkweed
	Leontopodium	*ochroleucum*	Eidelweiss
	Ligularia	*altaica*	Altai Leopardplant
	Petasites	*rubellus*	Butterbur
	Pyrethrum	*pulchrum*	Daisy
	Saussurea	*amara*	Saw-wort
	Saussurea	*controversa*	Saw-wort
	Saussurea	*daurica*	Saw-wort

Family	Genus	Species	Common name
Asteraceae	*Saussurea*	*foliosa*	Saw-wort
	Saussurea	*glacialis*	Saw-wort
	Saussurea	*leucophylla*	Saw-wort
	Saussurea	*pricei*	Price's Saw-wort
	Saussurea	*pseudoalpina*	Saw-wort
	Saussurea	*salicilifolia*	Saw-wort
	Saussurea	*schanginiana*	Saw-wort
	Saussurea	*stubendorffii*	Saw-wort
	Saussurea	*sukaczevii*	Saw-wort
	Scorzonera	*radiata*	Viper's-grass
	Senecio	*integrifolius*	Ragwort
	Senecio	*praticola*	Ragwort
	Senecio	*pricei*	Ragwort
	Senecio	*resedifolius*	Ragwort
	Serratula	*algida*	
	Taraxacum	*altaicum*	Dandelion
	Tragopogon	*orientalis*	Goat's-beard
	Tripleurospermum	*ambiguum*	
	Waldheimia	*tridactylites*	
	Youngia	*diversifolia*	
	Youngia	*tenuicaulis*	
Berberidaceae	*Berberis*	*sibirica*	Barberry
Betulaceae	*Betula*	*rotundifolia*	Dwarf birch
Boraginaceae	*Eritrichum*	*altaicum*	
	Eritrichium	*villosum*	
	Lappula	*consanguinea*	Bur Forget-me-not
	Lappula	*intermedia*	Bur Forget-me-not
	Myosotis	*asiatica*	Forget-me-not
Brassicaceae	*Alyssum*	*obovatum*	Alison
	Barbarea	*arcuata*	Winter-cress
	Braya	*rosea*	
	Cardamine	*pratensis*	Ladys smock
	Clausia	*aprica*	
	Draba	*fladnizensis*	Whitlowgrass
	Draba	*lanceolata*	Whitlowgrass
	Draba	*nemorosa*	Whitlowgrass
	Draba	*oreades*	Whitlowgrass
	Draba	*sibirica*	Whitlowgrass
	Draba	*turczaninovi*	Whitlowgrass
	Erysimum	*humillimum*	Wallflower
	Isatis	*lasiocarpa*	Woad
	Leiospora	*exscapa*	Stemless Leiospora
	Smelovskia	*calycina*	
Campanulaceae	*Campanula*	*wolgensis*	Bellflower
	Campanula	*glomerata*	Bellflower
	Campanula	*langsdorffiana*	Bellflower
	Campanula	*rotundifolia*	Bellflower

Family	Genus	Species	Common name
Caprifoliaceae	*Lonicera*	*altaica*	Honeysuckle
	Lonicera	*hispida*	Honeysuckle
Caryophyllaceae	*Arenaria*	*formosa*	Sandwort
	Arenaria	*mongolica*	Sandwort
	Cerastium	*arvense*	Field Mouse-ear
	Cerastium	*cerastoides*	Starwort Mouse-ear
	Cerastium	*lithospermifolium*	Mouse-ear
	Cerastium	*pusillum*	Mouse-ear
	Dianthus	*superbus*	Fringed pink
	Dianthus	*versicolor*	Pink
	Gastrolychnis	*tristis*	
	Gypsophila	*desertorum*	Baby's breath
	Gypsophila	*patrinii*	Baby's breath
	Melandrium	*apetalum*	Campion
	Minuartia	*verna*	Sandwort
	Silene	*chamarensis*	Campion
	Silene	*repens*	Campion
	Silene	*graminifolia*	Campion
	Stellaria	*bungeana*	Stitchwort
	Stellaria	*dichotoma*	Stitchwort
	Stellaria	*petraea*	Stitchwort
	Stellaria	*peduncularis*	Stitchwort
Chenopodiaceae	*Chenopodium*	*prostratum*	Goosefoot
Convolvulaceae	*Convolvulus*	*ammanii*	Bindweed
Crassulaceae	*Orostachys*	*spinosa*	
	Rhodiola	*algida*	Ice Roseroot
	Rhodiola	*coccinea*	Roseroot
	Rhodiola	*krylovii*	Krylov's Roseroot
	Rhodiola	*quadrifida*	Roseroot
	Rhodiola	*rosea*	Roseroot
	Sedum	*ewersii*	Stonecrop
	Sedum	*hybridum*	Stonecrop
Cupressaceae	*Juniperus*	*pseudosabina*	Juniper
Cyperaceae	*Eriophorum*	*humile*	Cotton grass
Empetraceae	*Empetrum*	*nigrum*	crowberry
Ephedraceae	*Ephedra*	*monosperma*	Joint pine
	Ephedra	*distachya*	Joint pine
Equisetaceae	*Equisetum*	*palustre*	Horsetail
	Equisetum	*variegatum*	Horse-tail
Ericaceae	*Vaccinium*	*vitis idaea*	Cowberry
	Arctous	*alpina*	Arctic bearberry

Family	Genus	Species	Common name
Euphorbiaceae	*Euphorbia*	*discolor*	Spurge
	Euphorbia	*tshuiensis*	Chuya spurge
Fabaceae	*Astragalus*	*alpinus*	Milk-vetch
	Astragalus	*austrosibiricus*	Milk-vetch
	Astragalus	*dilutus*	Milk-vetch
	Astragalus	*frigidus*	Milk-vetch
	Astragalus	*laguroides*	Milk-vetch
	Astragalus	*mongholicus*	Milk-vetch
	Astragalus	*multicaulis*	Milk-vetch
	Astragalus	*puberulus*	Milk-vetch
	Caragana	*bungei*	
	Caragana	*pygmaea*	
	Cicer	*songoricum*	Chick pea
	Hedysarum	*neglectum*	
	Onobrychis	*tanaitica*	Sainfoin
	Oxytropis	*alpestris?*	Oxytrope
	Oxytropis	*alpina*	Oxytrope
	Oxytropis	*glabra*	Oxytrope
	Oxytropis	*gebleri ?*	Oxytrope
	Oxytropis	*ladyginii*	Oxytrope
	Oxytropis	*macrosema*	Oxytrope
	Oxytropis	*martjanovii*	Martyanov's Oxytrope
	Oxytropis	*nivea*	Dwarf Snow-white Oxy.
	Oxytropis	*physocarpa*	Whorled Bladder Oxy.
	Oxytropis	*pumila*	Dwarf Bladder Oxy.
	Oxytropis	*recognita*	Oxytrope
	Oxytropis	*tragacanthoides*	Oxytrope
	Trifolium	*eximium*	Clover
	Trifolium	*lupinaster*	Clover
	**Vicia*	*cracca*	Tufted vetch
Fumariaceae	*Corydalis*	*pauciflora*	Few-flowered Purple Cor.
	Corydalis	*inconspicua*	Corydalis
	Corydalis	*stricta*	Corydalis
Gentianaceae	*Gentiana*	*algida*	Gentian
	Gentiana	*amarella*	Gentian
	Gentiana	*azurea*	Gentian
	Gentiana	*barbata*	Gentian
	Gentiana	*decumbens*	Gentian
	Gentiana	*grandiflora*	Gentian
	Gentiana	*macrophylla*	Gentian
	Gentiana	*nutans*	Gentian
	Gentiana	*uniflora*	Gentian
	Lomatogonium	*carinthiacum*	
	Lomatogonium	*rotatum*	
	Swertia	*obtusa*	

Family	Genus	Species	Common name
Geraniaceae	*Biebersteinia*	*odora*	Sweet Biebersteinia
	Geranium	*krylovii*	Crane's bill
	Geranium	*pratense*	Meadow crane's bill
	Geranium	*pseudosibiricum*	Crane's bill
Grossulariaceae	*Ribes*	*graveolens*	Currant
Juncaginaceae	*Triglochin*	*palustre*	Marsh arrowgrass
Lamiaceae	*Dracocephalum*	*bungeanum*	Woolly Dragon's Head
	Dracocephalum	*grandiflorum*	Dragon's Head
	Dracocephalum	*imberbe*	Dragon's Head
	Dracocephalum	*nutans*	Dragon's Head
	Dracocephalum	*origanoides*	Dragon's Head
	Dracocephalum	*peregrinum*	Dragon's Head
	Lagopsis	*marrubiastrum*	Horehound
	Leonurus	*glaucescens*	Motherwort
	Nepeta	*sibirica*	Cat-mint
	Panzerina	*canescens*	Grey False Motherwort
	Thymus	*serpillum*	Thyme
	Ziziphora	*clinopodioides*	
Liliaceae	*Allium*	*altaicum*	Onion
	Allium	*clathratum*	Onion
	Allium	*rubens*	Onion
	Allium	*schoenoprasum*	Chives
	Lilium	*martagon*	Martagon Lily
	Lloydia	*serotina*	Snowdon Lily
	Veratrum	*lobelianum*	False-helleborine
Limonaceae	*Goniolimon*	*speciosum*	Statice
Onagraceae	**Chamerion*	*angustifolium*	rosebay willowherb
	Chamerion	*latifolium*	
Orobanchaceae	*Orobanche*	*caesia*	Broomrape
Orchidaceae	*Coeloglossum*	*viride*	Frog Orchid
Papaveraceae	*Papaver*	*pseudocanescens*	Poppy
Parnassiaceae	*Parnassia*	*palustris*	Grass of Parnassus
Poaceae	*Agropyrum*	*cristatum*	Couch grass
	Alopecurus	*pratensis*	Foxtail
	Festuca	*altaica*	Fescue
	Festuca	*kryloviana ?*	Fescue
	Festuca	*tristis*	Fescue
	Helictotrichon	*hookeri*	Oat-grass
	Poa	*alpina*	Alpine meadowgrass
	Ptilagrostis	*mongholica*	
	Roegneria	*schrenkiana*	

Family	Genus	Species	Common name
Polemoniaceae	*Polemonium*	*coeruleum*	Jacob's ladder
Polygalaceae	*Polygala*	*hybrida*	Milkwort
	Polygala	*tenuifolia*	Milkwort
Polygonaceae	*Oxyria*	*digyna*	Mountain sorrel
	Polygonum	*alpinum*	Knotgrass
	Polygonum	*bistorta* or *nitans?*	Knotgrass
	Polygonum	*viviparum*	Knotgrass
	Rheum	*altaicum*	Wild rhubarb
Polypodiaceae	*Cystopteris*	*Dickieana*	Bladder-fern
	Cystopteris	*fragilis*	Bladder-fern
	Woodsia	*ilvensis*	Oblong woodsia
Portulacaceae	*Claytonia*	*joanneana*	Purslane
Potamogetonaceae	*Potamogeton*	*praelongus*	Pondweed
Primulaceae	*Androsace*	*Fedtschenkoi?*	
	Androsace	*septentrionalis*	
	Glaux	*maritima*	Sea-milkwort
	Primula	*algida*	Primula
	Primula	*nivalis*	Primula
	Primula	*nutans*	Primula
Pyrolaceae	*Pyrola*	*incarnata*	Wintergreen
Ranunculaceae	*Aconitum*	*altaicum*	Monk's-hood
	Aconitum	*anthora*	Monk's-hood
	Aconitum	*barbatum*	Wolf's-bane
	Aconitum	*septentrionale*	Monk's-hood
	Aconitum	*volubile*	Monk's-hood
	Anemone	*sylvestris*	Anemone
	Aquilegia	*sibirica*	Columbine
	Atragene	*sibirica*	Clematis-like
	Batrachium	*mongolicum*	Water crowfoot
	Batrachium	*trichophyllum*	Water crowfoot
	Delphinium	*inconspicuum*	Confused Mountain Larkspur
	Halerpestes	*ruthenica*	
	Halerpestes	*salsuginosa*	
	Hegemone	*lilacina*	
	Leptopyrum	*fumarioides*	
	Oxygraphis	*glacialis*	
	Paraquilegia	*microphylla*	
	Pulsatilla	*ambigua*	Pasque flower
	Pulsatilla	*campanella ?*	Pasque flower
	Ranunculus	*altaicus*	Buttercup
	Ranunculus	*lasiocarpus*	Hairy-fruited Buttercup
	Ranunculus	*pedatus*	Buttercup
	Ranunculus	*pseudohirculus*	Buttercup
	Ranunculus	*pulchellus*	Buttercup

Family	Genus	Species	Common name
Ranunculaceae	*Ranunculus*	*radicans*	Buttercup
	Thalictrum	*foetidum*	Meadow-rue
	Thalictrum	*alpinum*	Meadow-rue
	Thalictrum	*minus*	Meadow-rue
	Trollius	*altaicus*	Globe flower
Rosaceae	*Alchemilla*	*altaica*	Lady's mantle
	Alchemilla	*cyrtopleura*	Lady's mantle
	Chamaerhodos	*altaica*	
	Chamaerhodos	*erecta*	
	Comarum	*salesovianum*	Cinquefoil
	Cotoneaster	*uniflora*	Cotoneaster
	Dryadanthe	*tetranda*	High alpine
	Dryas	*oxyodonta*	Mountain avens
	**Pentaphylloides*	*fruticosa*	Cinquefoil
	Potentilla	*acaulis*	Cinquefoil
	Potentilla	*anserina*	Cinquefoil
	Potentilla	*bifurca*	Cinquefoil
	Potentilla	*conferta*	Cinquefoil
	Potentilla	*gelida*	Cinquefoil
	Potentilla	*multifida*	Cinquefoil
	Potentilla	*nivea*	Cinquefoil
	Potentilla	*sericea*	Cinquefoil
	Rosa	*oxyacantha*	Rose
	Spiraea	*alpina*	Bridewort
	Spiraea	*chamaedryfolia*	Bridewort
Rubiaceae	*Galium*	*verum*	Ladies bedstraw
	Galium	*boreale*	Bedstraw
Salicaceae	*Populus*	*laurifolia*	Laurel-leaved Poplar
	Salix	*nummularia*	Prostrate willow
	**Salix*	*reticulata*	Net-leaved willow
	Salix	*Turczaninowii*	Willow
Santalaceae	*Thesium*	*repens*	Bastard-toadflax
Saxifragaceae	*Bergenia*	*crassifolia*	Elephant-ear
	Saxifraga	*caespitosa*	Tufted Saxifrage
	Saxifraga	*cernua*	Drooping Saxifrage
	Saxifraga	*hieracifolia*	Saxifrage
	Saxifraga	*hirculus*	Marsh Saxifrage
	Saxifraga	*macrocalyx*	Saxifrage
	Saxifraga	*melaleuca*	Saxifrage
	Saxifraga	*oppositifolia*	Purple Saxifrage
	Saxifraga	*punctata*	Saxifrage
	Saxifraga	*sibirica*	Saxifrage
Scrophulariaceae	*Castilleja*	*pallida*	Paintbrush
	Euphrasia	*pectinata*	Eyebright
	Lagotis	*integrifolia*	
	Linaria	*vulgaris*	Toadflax

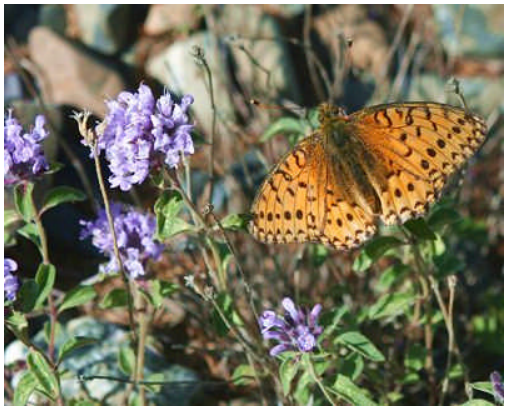
Family	Genus	Species	Common name
Scrophulariaceae	*Pedicularis*	*abrotanifolia*	Yellow Whorled Lousewort
	Pedicularis	*amoena*	Lousewort
	Pedicularis	*longiflora*	Lousewort
	Pedicularis	*tristis?*	Lousewort
	Pedicularis	*uliginosa*	Lousewort
	Pedicularis	*oederi*	Lousewort
	Pedicularis	*venusta*	Lousewort
	Pedicularis	*verticillata*	Lousewort
	Pedicularis	*violascens*	Lousewort
	Scrophularia	*incisa*	Figwort
	Veronica	*macrostemon*	Speedwell
	Veronica	*sessiliflora*	Speedwell
	Veronica	*pinnata*	Speedwell
Tamaricaceae	*Myricaria*	*dahurica*	Tamarisk
Valerianaceae	*Patrinia*	*sibirica*	
	Valeriana	*dubia*	Valerian
	Valeriana	*fedtschenkoi*	Valerian
	Valeriana	*petrophila*	Valerian
Violaceae	*Viola*	*biflora*	Viola
	Viola	*altaica*	Viola
	Viola	*rupestris*	Viola

Appendix 7: Pictures of plants collected by expedition team member Christine Newell.

Astragalus frigidus

Castilleja pallida

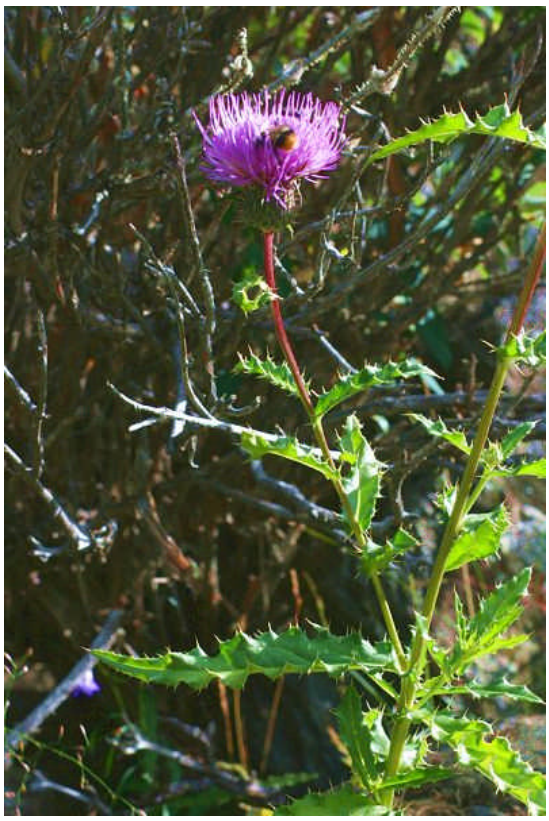
Waldheimia tridactylites



Ziziphora clinopodioides

Bupleurum pusillum

Crepis karelinii



Cirsium schischkinii

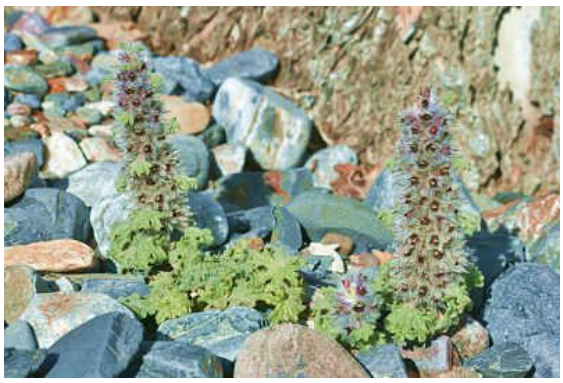
Echinops humilis

Dendranthema sinuata

Dracocephalum grandiflorum

Euphorbia discolor

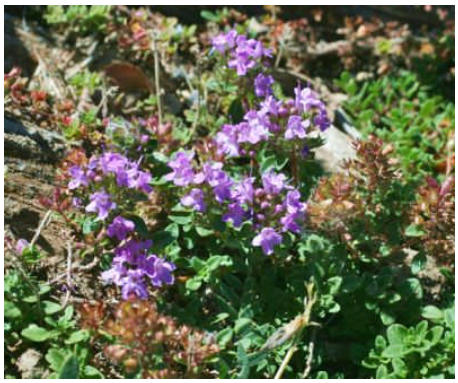
Goniolimon speciosum



Lagopsis marrubiastrum

Onobrychis tanaitica

Rhodiola algida



Thymus serpillum

Saussurea leucophylla

Saussurea pseudoalpina

Appendix 8: Expedition leader diary by Andy Stronach.

23 June

Hi folks

I'm Andrew Stronach and will be your expedition leader for the Altai. During the last few days, I've been preparing for the expedition, by watching You Tube videos of snow leopard, wolf, argali, siberian ibex, wolverine, etc. so that I'm not only familiar with what they look like ;), but more importantly, with the way they move – a very useful skill in the identification of these animals. I have also packed all my equipment and was trying to remember our mantra last year when packing for a day in the mountains; "sunscreen, waterproofs, fleece and ice-cream" - I'm sure that's was what it was. Anyway, I've got everything for the weather there which is generally absolutely beautiful, but occasionally also very wet and very cold!

Yesterday, I travelled from my home in Aberdeen, Scotland to Biosphere Expeditions HQ in Norwich, England. Today was spent in the office collecting a few missing bits of equipment and formulating plans for the surveys we will be doing. There are areas we have not surveyed before, but that have been predicted to be good for snow leopard by Volodya, our scientist, after he completed an analysis of the area looking at altitude, annual maximum and minimum temperatures and a whole host of other variables. So, we need to jump into our trusty Land Lovers and go and check these areas out as well as re-surveying other areas. Involving more local people and telling them about what we are up to will also be a focus for this year. Anyway, I can't wait and look forward to seeing you very soon and getting stuck in.

I'll be waiting in the lobby of Hotel Sibir at 20:00 on 29 June for anyone from the first slot who is up for an informal meeting before we kick off for real the next morning (and this pattern will be the same for all four slots). Anyone who would like to join in is welcome to do so.

Safe travels and see you in good old Novosibirsk

Andy

P.S. All things being well, my mobile number in Russia should be +7 913 4540878. Remember this is for emergency purposes only - such as if you are late for assembly.

23 June

Travelled from Norwich to Moscow.

Arrived at Domodedovo airport which, with its squadrons of busses and tractors racing around the airfield amongst the aircraft, was a little different (!) from the Heathrow I had left. There were aircraft from so many different airlines, almost all of which I had never heard of before, my favourite being "Bashkortostan Airlines"; there will be a prize for the first person to tell me where that is! [Ed. Wikipedia says that Air Bashkortostan, LLC «Авиакомпания «Башкортостан» is an airline based in Ufa, Bashkortostan, Russia]. For anyone who is missing any equipment for the expedition, there is a pseudo-camping shop on the top floor of departures where you can buy a few bits and pieces such as socks, mugs etc; however please view this shop as a back-up if you have forgotten something, rather than banking to get things there!

24 June

Travelled form Moscow to Novosibirsk.

If you get an overnight flight to Novosibirsk and if you sit by a window on the left side of the aircraft and if the weather is good, then you, as I was, may be treated to a fantastic sunrise on the way to Novosibirsk. At 0330 (Novosibirsk time) the sky was spectacular; aflame with deep reds and oranges, a wonderful welcome to Siberia. On our final approach, the sky was clear, the land was flat from horizon to horizon and mist rose from lakes and from patches of trees. Small streams, normally easily missed, were marked out by their ribbon of mist drifting gently on the morning breeze.

My welcome at Novosibirsk was less heavenly, but certainly not short of enthusiasm or friendliness. Vasili from Land Rover / Jaguar met me at the airport and drove me into town, the 10 km taking approximately two minutes and fourteen point six seconds; I did think that 140 kph through the streets of Novosibirsk was a little excessive. Not content with trying to scare me to death, he then had a go at re-arranging my internal organs, playing his music at full blast – that woke me up properly!

I should point out that this expedition is very much your expedition and I will be asking you what kind of work you feel up to doing, which surveys you feel comfortable doing, etc., etc. However, driving style and technique does not fall into the realm of discussion as it has the potential for serious accidents and as such I will be dictating how the driving is done and banning from driving, anyone who drives dangerously so that we all stay safe and have a great expedition. ;-)

26 June

Most of today was spent sorting out our vehicles. Due to Land Rover's generous sponsorship, we have three brand new Land Rover Discoveries and one almost new Land Rover Defender 110, they look great! Oh, and will get us wherever we need to go too ;o)

Novosibirsk is a city in party mood; Sunday 29th is Novosibirsk's birthday and seating is being prepared in Lenin square for entertainment on the big day. In the central park, there were buskers performing some excellent drumming, full of energy and passion, whilst others were break dancing. Now, I'm not a world authority on break dancing, but this looked like very Russian break dancing to me. One guy in particular was clearly a very skilled horse gymnast, demonstrating incredible strength and precision as he moved from arm to arm, legs spinning to the side, overhead and everywhere else in between!

In Lenin Square by the Opera House, in front of Lenin's massive statue, a large group of people gathered, painted in Russians colours, waving flags, whilst big motorbikes did wheelies the length of the square (at around 100 kph of course). Some cars were completely painted in Russian colours whilst almost all had flags. When the cars passed the crowds, some honked their horns and the crowd screamed back, when a bus honked, they went wild. I've no idea what it was all about, but it could have something to do with the football and I was fully expecting a conquering army of Russian heroes to march into the square at any moment.

On the steps of the Opera House, Novosibirsk's Music Academy Orchestra (if my translation is correct!) played to an open air audience; Tchaikovsky, Borodin, Wagner, Rimsky Korsakov, Prokofiev. [Excuse me a minute. Sorry about the break; as I was writing this, there were fireworks going off by the river Ob and I've got a great view from my hotel window so had to watch then – fantastic]. The Orchestra were accompanied by swifts in the hot evening air above, catching insects and adding even more to the already wonderful ambiance. The grand finale was Verdi, sung by some penguin suit clad gentlemen and some soprano princesses dressed in satin; when it was all over, the crowd got to their feet, waved their Russian flags and gave the orchestra a standing ovation…….quite right too.

28 June

Happy birthday to me, happy birthday to me, happy birthday to me, happy birthday to me. Well, I have to say, I'm overwhelmed by the generosity of the Russians on my birthday; from Avtoland, I got a silver Land Rover Defender 110 and three, yes three, brand new Discoveries (I would have been happy, even with just one). If you team members are good, I might let you have a go with them ;o)

On getting back to Hotel Sibir with a pocket full of keys I thought I'd go and get some key fobs so we could easily tell which key was for which car. In my room on my desk, were a little black box and a red card, the card read: "Dear Mr Stronach, thought we'd forgot?... Never! Happy birthday to you! Hotel Sibir" And inside the little black box? Yes, you guessed it a key fob! :o)

Well, if that wasn't enough, the Ukrainians, in the form of Volodya our splendid expedition scientist got in on the act too. From out of nowhere, he produced the finest birthday cake I've ever had; a selection of wonderful dried fruit (dates, apricots and banana) surrounded by fine quality chocolate and all very artistically arranged. None of that icing sugar nonsense or sponge, who on earth would put sponge in something that's supposed to taste good?

29 June - Novosibirsk

Happy birthday to Novosibirsk, happy birthday to Novosibirsk etc. etc. Lenin square and much of the centre of Novosibirsk closed off today for Novosibirsk's birthday celebrations. The police were out in force with pressed uniforms, shiny vehicles and unfeasibly large hats. Two rows of 30 spotless police vehicles were lined up in the square with military precision as their drivers stood to attention at the side. Volodya and myself spent the day getting some equipment for the vehicles: emergency boxes; tow ropes and the like, finishing off our preparations for the expedition.

At 20:00, in Hotel Sibir's lobby, I met with most of the team and after briefing them on the plan for the next couple of days, we went to a local restaurant for dinner; it was great to finally meet the team and have a good blether.. Back at the hotel later on, the fireworks started and from my 12th floor room, I had a fantastic view of them as they lit up the city below.

30 June - Novosibirsk to Anoz

In the morning, everyone was there and having packed the vehicles and eaten breakfast, we set off on our adventure, heading for a blank space on the map in search of mountain ghosts ;o)

The 500 km to Anoz where we spent the night was broken by a stop at the honey market where we had lunch and at Gorno Altaisk, Altai's capital, where we registered with the authorities.

1 July

A beautiful hot sunny day. Departed Anoz at 07:00 and drove through beautiful tree-filled valleys with lively rivers and streams with their bridges built entirely from logs. Had lunch at the Tuvan restaurant; no idea why everyone calls it that because its name (in big letters above the door) is "Chuy-oozi", which means the end of the Oozi, the river that joins the mighty Katun nearby. The food has always been good here, but today it was excellent; the cabbage soup that didn't sound very inspiring was full of flavour, the spicy, meaty noodle soup was delicious, the plov filled a big empty stomach and the goulash was particularly goulashy. After lunch, we had a look at some ancient petroglyphs nearby, beautiful images of deer, hunters, boar and horses. Volodya thought they were about 8 years old.

Next stop was Aktash where we attended to more paperwork, hopefully the last, getting permission to work in the area near the Mongolian border where our camp is located.

We have been swapping drivers frequently during the journey and everyone has now driven both a Defender and a Discovery; competently and safely I might add :-)

I plan to stop in Kosh Agash, the last town before base camp and e-mail this diary. If you are reading this today, then I guess I was successful. If you are reading this yesterday then I guess that time machine I've been working on wasn't such a waste of time after all :o)

Next instalment may be some time, perhaps the end of this slot, so please be patient.

2 July

First full day at basecamp and first day of training. Volodya spent the whole day training the team in the survey methodology we will be using during the expedition. Everyone in the team is now fully aware of where to find all the best scat (crap); pine trees for example are a great place to look for wolf scat and rocky outcrop for ibex scat. But it's not all pooh-pooh here. We talked about tracks too, how to identify them and the best places to look for them; big herbivores such as deer, ibex having two cleaves, whereas wolf has five pads and claws, etc. In the afternoon, practical application of the lessons involved a beautiful walk through a Siberian larch forest, the ground covered with fragrant artemesia, asters, vetches, buttercups and even more fragrant and exciting wolf scat. The far point of the walk was a steep craggy ridge that had on it a huge eagle nest, an imperial eagle was spotted in the area, but nothing at the nest.

Whilst heading back to camp, Jourdan was rather surprised, and suspected I'd been at the vodka again, when I called him on the radio asking if he'd seen any camels; quite a straightforward question I thought. Thankfully, before he had managed to arrange for the men in white coats to come and take me away, another in his group spotted the 16 camels which were just out of sight to myself, Mike, Sharon and Slava. Jourdan directed us to where the camels were resting; 200 meters in our 11 o'clock, off we went, 1.7 km later we got there….

Back, eventually, in camp, we rounded off the day with our first ibex sighting, six by manul rock; two adults, two yearling and two babies :-)

3 July

Training day two. All the drivers did the off-road driving course with myself. We went up and down very steep slopes, through rivers (OK, streams!) and over boulder fields; all very competently and most importantly safely, so now we're ready for action – the Land Rovers always were anyway. In the meantime, Volodya took the non-drivers up the hill by base camp for a wee walk. The effort was rewarded with views across the steppe and even as far as China. Someone thought it would be a good idea to descend a 700 m scree slope. Sharon brought up the rear on the way down and the rest of the team were entertained by her fine impersonation of a Tourettes sufferer, her flailing of arms and cries of unspeakable things as she attempted to smite the swarms of mosquitoes she encountered on the way down. Claire wins the 'dedication to the cause of conservation' prize for trying to save the horn she found, offering it out to Brian saying 'take it' as she went sliding away down the hill towards the river, rather than trying to save herself. Everyone made it back, but I'm not so sure about the 'in one piece' bit, a tough walk.

4 July

First full survey day. Claire, Sharon and Hilary went up the valley from the winter station with Volodya, while everyone else went to the glacial lakes with me. Both teams meandered up their respective valleys under blue skies and hot sun, finding lots of sign of many different animals. However, just as both teams were reaching the high point of the survey, the weather changed a little. The hot sun and blue skies were replaced within about five minutes by black skies, very strong winds, very heavy rain and biting hail; handy things waterproofs! Brian said 'didn't think I'd need my gloves' as he rubbed his hands together trying to warm them up a bit. The glacial lake was spectacular under the blue sky that appeared a bit later and the endemic Altai accentors we saw nearby were a great record.

Back at base camp, after a mountain of delicious Pilau rice, we whiled away the evening playing Uno and partaking of a few 'delicate' 'little' vodkas…….

5 July

Volodya took most of the team up what used to be known as Koshalyu, but is now variously known as Mt Ickers; Ickbal making it to the top first and ****** steep ******* scree ******* next time I see ******** Andy I'll********* ******** the ********* ******, by Sharon who found the going a little tiring.

Meanwhile, Claire, Hilary, Brian and myself had a lovely relaxing day; a lovely scenic drive to Kosh Agash via bird lakes, seeing two new species for the expedition – whooper swan and barbary falcon amongst many other birds. We had planned to post the expedition diary, but the internet was down, so that didn't work; we were very successful in our ice-cream hunting mission though ;o)

6 July - Survey of bird lakes and Kamtitigem

Volodya took Kurt, Sharon, Brian, Mike to the small lakes in the middle of the steppe to carry out a bird survey. Meantime, Iqbal, Claire, Sian, Hilary, Brian, Stacie, Jane and Jourdan came with me to Kamtitigem to survey there. On arrival, we split into the hard walk group - Iqbal, Brian, Stacie, Jane and Jourdan, and the easy walk group - Claire, Sian, Hilary and myself. The plan was to have a leisurely amble around and to see what wildlife was around the vicinity of the vehicles, however, that plan was fairly comprehensively wrecked by Claire (it's all her fault) when she spotted an eagle's eyrie (= nest). We wanted to see into the eyrie to see if anyone was at home, so decided to walk a little upstream before climbing up the hill to near to where the eyrie was located. After an 'interesting' 'eventful' 'demanding' 'little' walk, we arrived at the top and had lunch and a little nap, OK, we were all exhausted and collapsed in a heap unable to move!

Finally got into a position where we could see what was in the eyrie, and looking back at us was a great big fluffy ball of beak and talons, a week old eagle chick ;o) that made it all worthwhile. Got back to the Land Rovers where the others who had been on the hard walk were fresh and ready for action, we collapsed into the cars and vowed never to look for eagles again. Shortly after getting back to base camp, Kurt spotted an unusual bird, on checking, I saw it was a booted eagle; a first record for the expedition – oh well.

7 July - Tapduair overnighter

Everyone loaded up the vehicles with food, tents and sleeping bags for a trip to survey Tapduair; a 3500 m mountain where we have seen snow leopard before. After a long drive of about two hours, we reached the end of the track and set up camp. Iqbal, Jane, Jourdan, Sian and myself had planned to bivvy high on Tapduair overnight and then walk to Sailugiem and back to base camp, over the whole mountain range. However, the weather was very changeable, windy and very wet, so that plan was abandoned. We did, however, see a couple of argali which was a great record of these endangered animals. Volodya had found information about old Turkic carved standing stones in the Barburgazi river valley, which was close to our site, so we set off to try to locate these as well as to do some yurt interviews (an integral part of the expedition study) if the opportunity presented itself. We stopped at a yurt by the river and Brian was straight into a conversation with the herders, loving every minute of it. Iqbal wanted to take a few photos, so asked the women, but they suggested he take some photos of the men instead as they were apparently not dressed for it; it's all the same, the world over!

Meanwhile Sharon made friends with one of the dogs belonging to the herders and was fascinated to observe how closely its behavior was to that of a wolf; there's probably a reason for that….

Back at camp, we had dinner and then Iqbal, Jane, Jourdan and Sian, not wanting to be deprived of their bivvy experience, headed over the ridge a little way from camp to spend the night where argali had been seen earlier.

8 July - Tapduair survey, return to base camp

Waking in the back of one of the Discoveries in the morning, I wiped the condensation from the window to see out, it didn't seem to make any difference, so I wiped it again, only then realizing that the view outside was actually pretty similar to that of a condensation covered window – yes it was winter wonderland time at Tapduair advanced research camp with a beautiful covering of about 1 cm of snow! I was delighted with this as it is perfect for finding tracks of animals yet not deep enough to be a problem. Our expert wildlife spotter Kurt was already up and had spotted three argali; very rare wild sheep listed as endangered in the Red Data Book; what a great start to the day. When the bivvy team returned, they brought with them, stories of dare and do as well as of argali spying on Jane as she went to the loo! After breakfast, we split into various teams and headed off to survey the various valleys and ridges of Tapduair. Sharon was in particularly high spirits, loving every minute of the snow showers and planning to take some home with her to Australia; I didn't have the heart to tell her. My goal was a beautiful valley with three glacial lakes; as soon as we arrived at the first, we heard rocks falling from a nearby steep slope, on inspection we saw that the rock fall was caused by – you guessed it – yet more or more precisely two argali – fantastic! The two animals then ran off up the hill, and joined another group, making a total of six adults and six juveniles; I've only seen a total of two argali in two seasons here before, so I was delighted ;o)

All three lakes were very beautiful, but by general consensus, it was agreed that the final one, at the head of the valley and surrounded by steep scree slopes and jagged cliffs, was the most beautiful. The drive back to base camp was uneventful; just the usual stunning views over the border to the glacier clad mountains of Mongolia, yurts located by a river in the middle of nowhere and a herd of Bactrian camels minding their own business trying their best to look aloof.. Pretty dull, really.

9 July - Reconnaissance of new area

Around 100 km to the south east of base camp, near the border with Mongolia, is an area of mountains that look promising for snow leopard. Last year, Biosphere's director, Matthias, headed off to check out the area, but got no further than the first checkpoint where he was promptly arrested for not having the right bit of permissions paperwork, despite being confident that he did. None of the current team have been arrested recently, so we thought we would give it a go too and see how far we got.

We passed Kosh Agach and then the seemingly endless flat stony steppe beyond it, before entering the hills at its far side and arriving at the checkpoint; cue the dark dramatic organ music! Eventually someone in camouflage uniform appeared and collected our passports, taking them away inside the building – never a good feeling being separated from your passport in a foreign land….. There was a selection of sounds coming from inside the building, variously imagined to be; the old rusty shackles being dusted down for use, Kalashnikov toting reinforcements leaping into action and large Alsatian war dogs braying for action. None of these materialized though and 15 minutes later we had our passports back and were off past the checkpoint heading for mountains new. See how it's done Matthias!

On the drive down the valley, we looked for access routes into the mountains, which would be good for us to gain access, but might also indicate human presence which would reduce the chances of us finding sign of snow leopard. A group of 12 rare cinereous vultures were seen, a great record of this rare bird and the first this year.

The Tara river valley was the most beautiful area we saw with scattered pines on its slopes leading to rocky and glaciated summits; it looked great snow leopard habitat.
On the way back we made a small detour to Lake Karakul; it was not far, but turned out to be a test for our Land Rovers. First, we crossed a small river, next, it was up an increasingly steep and increasingly loose and rocky slope, next down a steep, loose rocky slope and finally over some soft grassy ground to the lake. Both the drivers and the Land Rovers handled the challenging terrain with panache getting us where we needed to be safely. It was worth the effort, as we saw four rare black-bellied sand grouse, only the second time on an expedition.

10 July - Day off ☺

Sharon, Sian, Hilary and Kurt took a drive across the steppe to see Marat, a long standing friend of the expedition. Marat has some of the finest horses in the area and the girls and Kurt hired them for a fantastic gallop across the steppe.

Iqbal, Brian, Brian, Jourdan and Jane needed one last fix of mountaineering, so climbed the mountain by base camp to wonderful views across the steppe and a nice snooze on a high level flower filled alpine meadow.

Claire, Stacie, Volodia, Uri and myself set off in search of Volodya's fabled carved stones. First stop was the new and only shop in Kokorya for an ice cream ;-) On the steppe, a falcon swooped across the front of the car and landed on to of a fence post nearby where it ate a small rodent it had in its talons. This was a hobby and the first recorded by the expedition; we all sat mesmerized by this beautiful bird as it ate its meal so close by – wow! As we approached a stone circle, we were suddenly in the middle of a large flock of beautiful rosy starlings. The birds were catching crickets that were being disturbed by our passing; catching them, knocking off their legs and wings and then eating them or taking

them away. After departing the stone circles that were meeting places for the tribes millennia ago, we visited an area of rocky outcrops where Volodya knew of some petrogylphs; an ibex and a wolf. After looking around, we found far more; deer with fantastical antlers, ibex with shapely rather than stylized features, finely carved ibex; it's amazing to look around for just 30 min and find so many beautiful and ancient artworks, what a place! Having crossed the Barburgazi river, we stopped for lunch at a burial site with a few carved standing stones. Volodya likes to share good times with those who have passed before us; we were a Russian, Ukranian, English, American and Scottish and we shared our food, vodka (except for me as I was driving!) and tales. We all had a wonderful, joy filled, peaceful time full of friendship and fun; I hope those below us did too.

Heading back, I wondered if we could get some ice-creams to base camp for the others to enjoy; it's a long drive from Kokorya to base camp and I wasn't sure, but gave it a go. On getting back, the long talked about cricket match was underway, I drove up and parked between the wickets to a torrent of abuse; I unloaded the ice-creams and was instantly elevated to the status of hero. We finished the ice-creams and then the cricket, had a lovely last dinner courtesy of Nina, drank some vodka, played some music, danced a little and then slept under the stars of the steppe for the last time.

11 July - Base camp to Anoz

Having had breakfast and packed, we got off to a flying stop when one of the vehicles had a puncture. Re-surfacing works on the main road with loose gravel and a lunatic speeding lorry driver showered all three of our vehicles in stones and resulted in two cracked windscreens :-(

The rest of the journey was uneventful, lunch at the Tuvan restaurant and arriving at Anoz for dinner, a banya (sauna) and dip in the mighty Katun river before a sleep in a bed without any rocks in it ;-)

12 July - Anoz to Novosibirsk

Woke to light rain and beautiful mist clad cliffs overlooking our cozy wooden house. The 500 km drive to Novosibirsk we broke with a stop at the honey market for raspberry and cherry blinis and later, a stop for dinner of shashliks (kebabs) for the carnivores and salad for the weirdos.

All back safely now. Thank you so much to slot 1 and looking forward to meeting up with slot 2 Sunday night or Monday morning!

13 July - Novosibirsk

Spent the day getting some bits and bobs such as batteries, a new mobile phone to replace the one that was broken, etc.

Met those remaining team members from slot one for a last blether at 7pm before meeting the new team members of slot 2 at 8pm.

After giving an initial briefing covering the next two days and completing all the very exciting paperwork, we went to Jelly Belly restaurant for some fine food and congenial conversation; it's lovely to meet the new team and start getting to know them.

14 July - Novosibirsk to Anoz

Having managed to successfully escape the clutches of rush hour in Novosibirsk, a pall of smoke came into view on the horizon of the dead flat land we were traversing. The dead straight road led us directly to the pall, but it took a long time; such is the difficulty of judging distances here. When eventually we did reach it, many vehicles had stopped at the side of the road by what was a vehicle that had left the road and burst into flames, actually a fireball, that totally engulfed it and anyone unlucky enough to be in it.

15 July - Anoz to Base Camp

Spent a lovely quiet night at Anoz and woke to find hawfinches on a bird cherry tree outside, the first time I've seen these lovely birds. After breakfast and blowing up a slightly flat tyre, we were off. Then we went back to Anoz. Brian got his sun spex and we were off, again ;o) With Axinja at the wheel, sporting her snow leopard necklace she bought at silver springs yesterday, we crossed first the Seminsky pass and then the Chike Taman. This second pass lies on the boundary between two sub-biogeographical zones, and the differences to be seen are remarkably clear. To the west, the land is generally green and lush whilst to the east, the land is brown, dry and rocky. The people too are noticeably different; European features to the west and Asian to the east. At Aktash, we stopped at the FSB office and got our permission to work around base camp, though this did take a bit longer than usual. Past Kosh Agash the last town and then Kokoria, the last village we crossed the steppe for about an hour. I stopped and asked the others in the convoy if they had a map as I thought I'd taken a wrong turning some way back; my acting skills must be improving as there was much rummaging around looking for one ;o) At base camp 5 minutes later, we were greeted by Nina, Egor, Volodya and beautiful evening light across the steppe showing off the mountains to their best; it's great to be home ;o)

16 July - Base camp training

Started the day with the risk assessment and then left the team in Volodya's hands for the science training and how to identify the sign left by various animals. Tim and I went to Marrat's to see about hiring horses, but no-one was at home, so continued to Kosh Agash. First stop was the puncture repair men who pulled a big pointy stone out of one of our tyres that had gone all the way through; a quick and competent repair and we were off again. Next stop was the internet café to post the diary; not sure why I keep trying as again, it was not working. Back at base camp, as reward for a good day's training, I took the team to a nearby eagle's eyrie where we were very lucky to see an adult eagle and two little fluffy white chicks. We got great views of them with the telescope and left without disturbing them ;o) As our stream had retreated uphill a little from camp, we had to walk a little to chill our beer and chocolate for dinner; it's a hard life!

17 July - Base camp & Happy Birthday to Mareike! (oh, and some training)

A beautiful flower (and champagne bottle) bedecked breakfast table greeted Mareike for her 30th birthday. The morning was spent on GPS, map and compass training; the afternoon on off-road driving. Didn't loose anyone, nor did we have any crashes, so must have been successful at some sort of level ;-) We finished the off-road driving with a bit of on-the-job training when Mareike, Axinja, Axel, Tim and myself went to Marrat's isle again to see if we could hire horses for a foray into an otherwise inaccessible area. Marrat's son, Gena was at home, and after pointing at various pointy things at the map and more importantly sorting out the menu, we had a cunning plan and were ready to go the next day, way too easily organized, must have forgotten something.

Nina worked her magic in her tiny kitchen tent and produced a lovely meal for Mareike's birthday, the piece de resistance being the 'black mountain cake'; black, chocolaty (didn't know you could get vodka flavoured chocolate) and covered with purple asters and edelweiss.

Later in the evening, datasheets were filled in (as usual) but never has it been so much fun; with Peter at the helm for the bird tick list, there were some interesting vodka/champagne creations such as wheateaters and twits.

18 July

Today, I split the team in two, most staying with Volodya, but Axinja and Mareike came with me for a three day horse riding expedition. Having packed, we drove across the steppe to meet Gena and our horses. We headed off up a very beautiful valley with a small river, gorge and scattered Siberian larch. One side of the valley was dominated by a huge cliff, red with lichen and home to an eagle nest. Stopped for a snack in a lovely meadow with lots of wild flowers; I was going to tie up my horse, but Gena said it was not necessary, so I just let it go and it got stuck into the flowers. Further up the valley, we crossed the river, some more tentatively than others (can't remember the last time I was on a horse!) as we went further and started to gain height, the trees thinned, the vegetation shortened and the hill tops became rocky. We passed an isle (a wooden hut where herders stay) where there were hundreds of sheep and goats – not god for snow leopard. Still further there were sarlik (yak cow crosses) and cows, again not good for snow leopard because of the disturbance and threat posed by humans and their animals. After about five hours, we reached our camp site at around 3000 m near the top of the ridge. Having set up the tents, and had some food, Axinja and myself went up to the ridge where we found fresh ibex tracks; an encouraging sign. As the sun set and the light faded, we could see four lightning storms around us but could not hear any thunder, despite being quiet; such was the distance to the lightning and the enormous distance of the views all around us, quite spectacular. I managed to make a few photos of the lightning :o) before we headed back to the tents.

19 July - Tokpok

After breakfast Mareike, Axinja and myself headed off along the top of the ridge looking for sign of snow leopard and other animals whilst Gena went off in search of firewood. Along the length of the ridge, there were valleys heading off to the sides; we stopped at each of these in turn scanning them with our binoculars looking for animals. These valleys were very dramatic with cliffs at the head, boulder or scree strewn slopes, a stream or small river at their base and scattered Siberian larch at their end. Unfortunately we did not see any animals, but in one valley, we did hear Altai snowcock, an endemic game bird that birdwatchers get very excited about. The call from these birds is surreal; a cross between a bald eagle and a donkey….. weird. At our furthest point on the ridge, was a wooden triangulation point from where we could see far to the north west, along another ridge where Volodya, our scientist, wanted to survey. Near to where we were, we could see many domestic animals and herders yurts so that area would be useless for snow leopard; however further on, were mountains with massive cliffs, glaciers and no access roads :o) much better. On finding a lovely patch of soft mud I checked it, as always, for tracks. There were none; it seemed such a waste, so I thought I'd just do the right thing and make some tracks; snow leopard to be precise ;o) The photos were later received with great enthusiasm; perhaps a career in forgery…

Back at camp, dinner was pasta with beans in the rain – never tasted so good. We fed Gena's dog with cheese, friends for life now, whereas before, he wasn't too sure of us.

20 July

After an enormous breakfast of buckwheat for 12 (between 4 of us!), we went south east along the ridge with Gena; at the first valley, at the base of the cliffs, we were lucky enough to see two juvenile Siberian ibex ;o) as well as a cinereous vulture ;o) Having packed up, we headed off on the horses. We stopped at the beautiful flower meadow again for a break; us eating chocolate, the horses, flowers. Then it was time to go, Marieke and Axinja got on their horses and I was about to get on mine, but my horse was a bit ahead of the game and set off on its own, at an impressive pace……. A little inconvenient. All of a sudden, our little group had grown, not quite sure how; from four to six people, from four to five horses, from one to three dogs and most disturbingly, from nil to one car :-(

Back at Gena's isle, we unloaded the horses, got in the Land Rover and all regretted bitterly our return to civilization, such was the wonderful time we had shared :o)

Back at base camp, everyone regaled us with tales of wonderful carved standing stones, petroglyphs and stelae that they had been to se earlier in the day on their day off; obviously a very poor attempt to make us jealous – no chance.

21 July - Travel to Tara river valley

Breakfasted, packed up, packed the vehicles and than we all headed off to the Tara River valley - a four day expedition and the first time Biosphere Expeditions set off to survey that area, which looks great for snow leopard judging by the map. First and most important duty of the day was the ice-cream stop at Kosh Agash (also failed to send the diary because the internet was down, again and bought a nice big pile of food to take with us). We drove over the Kosh Agash steppe and into small dry rocky hills at the far side before arriving at the Soloneshenskya checkpoint. Unusually the guard checked all our passports and photos against people in the cars; hmm….. The guard then disappeared inside, only re-appearing after 30 minutes asking why everyone listed on our permission paperwork was not present; we explained that not everyone who had signed up for the expedition had turned up; off he went again….. Various other people came and went, passing the checkpoint with ease. Then the guard appeared and gave us our passports back, opened the barrier and we were on our way!

Mountains, rivers and trees heralded our way, and we stopped by a river for lunch. The road was unsurfaced and rocky and the drivers had to concentrate to avoid holes. Eventually we arrived at the Tara river and we left the good quality road behind. Our first little obstacle was a muddy track; I straddled the ruts and passed easily; Peter who was next decided to drive in the muddy ruts and did not pass with ease; he was rather discombobulated. Pulled him out and we were on our way again. Small river crossings, huge eroded stream beds with interesting entries and exits, rock crawls, etc., etc. entertained us all the way to our camp site near the highest point of the Tara river valley where I finally called a halt to our progress before we tried to do something silly with the vehicles.

22 July - Tara river valley, surveying.

We split into three teams to start our survey of the valley and surrounding mountains. Gundula, Axinja, Brian and myself headed for a high mountain, complete with glacier and apparently a glacial lake (according to our less than wonderful map). After following the Tara river and passing a huge heard of sarlik, we headed up into a side valley and onto terminal moraines (I think!). On a patch of snow in the distance, I could see with my binoculars, what looked like fresh tracks. When we had a close look we could see they were of a large carnivore; Axinja was determined they should be of snow leopard, unfortunately, however, we could see claw marks so that made them wolf, which I was highly delighted with ;o) As we progressed up the valley, at a further two patches of snow, we found more fresh wolf tracks, wonderful. Lunch was with a view; a huge glacier at the head of the main valley, split into three and covered a massive area, behind was a razor sharp ridge of impregnable turrets, occasionally raining down a barrage of rocks on anything stupid enough to approach. After lunch we went up a safe side valley; however, the ascent of its slope required some effort……. One step forward and two back as the scree slid downhill. Eventually we approached the summit ridge where I noticed one of the many furry rocks that you see, this one compete with ears, then the rock ran off – it was a wolf, I was over the moon and shouted to the others, Axinja and Brian saw it, but unfortunately not Gundula.

At the top of the ridge, the views were OK. On the Chinese border, we could see massive mountains totally covered in snow and ice, to the east, Mongolia and to the west Kazakhstan. To the north-west were Altai's highest mountains including Belucha; we were all blown away by the views and the wolf; definitely the high point of the expedition so far.

We descended by a rocky ridge, where we found sign of a bear; only the second record ever for the expedition, the day just kept on getting better; wonderful experiences and great scientific data.

23 July - Tara river valley, surveying.

After yesterday's initial surveys, we set off to 'fill in the holes'. Axinja, Brian, Peter and myself headed up a side valley opposite where we had been yesterday. There was some sign of ibex and possibly argali as well as of a small mustelid (possibly Altai weasel) which I am particularly fond of. After a few kilometers, the valley turned left, we were confronted by a massive wall of terminal moraine, which we climbed and then had a great view of a glacier perhaps three kilometers long snaking up the valley. A heavy hail shower passed and was followed by a longer spell of heavy rain. We made our way back to camp, had dinner round the fire, completed our last datasheets, and then had a celebratory vodka, or was it two? three?

24 July - Tara river valley to base Camp

Woke in the morning to very heavy rain. Got everything packed, including soaking tents and headed off. Mareike, Axinja, Brian and Axel did a fine job of driving us out of the valley when we then drove the long road back to base camp. Nina had done a great job of preparing our last meal, along with a truly mountainous cake, which was delicious. Vodka and tall tales into the night drew a close to slot two :-/ All good things come to an end.

25 July

Rain again this morning when I will say farewell to all the team members of slot two. Volodya will accompany the team to Novosibirsk (and meet slot three team members) there, whilst I will stay at base camp. If you get this, then Volodya and the team have made it back safely to Novosibirsk. Goodbye slot 2, welcome slot 3!

10 August - Novosibirsk

Met the team members of the fourth and last slot and went for a meal together in the evening; it's always great to meet a new team as we always somehow manage to get a great team of diverse and very interesting people ;-)

11 August - Novosibirsk to Anoz

We loaded up our two vehicles – Defender and Discovery and set off for Anoz for the last time.

12 August - Anoz to basecamp

Fuelled up the Land Rovers and set off for base camp. Stopped at Chu Ozi restaurant for lunch, then stopped at Aktash to get our permission to work near the Mongolian border from the FSB office.

13 August - Training

Spent the morning on the risk assessment, the use of GPS (Global Positioning Satellite System), map and compass and the science of the expedition whilst the afternoon was spent training our drivers to drive off road – up and down steep hills, through rivers and over boulders .

14 August - Reconnaissance of Kurai ridge, survey to glacial lakes

I went with Jens, Graham and Marina into the Kurai ridge mountains by Kosh Agach. Volodya's DIVA-GIS computer study predicts this area to be highly suitable for snow leopard, so we are very keen to get there. The first section was across steppe, the next was through a spectacular narrow valley, crowned with craggy sentinels where steppe eagles soared. We followed a dry river bed for a few km before heading up a narrow track cut into the side of a steep hillside; the views were amazing. From the top of the hill and at the high point of our drive, we could look north towards the Bashkaus river; our objective for the day. The descent of the hill was a little 'interesting' but posed no great difficulties or dangers; driving along the valley at the bottom of the hill towards the Bashkaus was a bit different; there were continual difficulties, boulders, muddy areas, muddy streams and large expanses of wet and soft vegetated ground. One of the lessons learned this year is that if somewhere is easy to get to, then human disturbance or persecution of wildlife will probably be great; to get somewhere with significant numbers of large wild mammals requires some effort and good off road vehicles. We had great off road vehicles in our Land Rovers and had put in lots of effort, but we had run out of time as our progress had been slow along the non-existent road so we turned back about 4 km from the Bashkaus river.

In the meantime, Volodya had taken everyone else on a survey to the glacial lakes near base camp. Eden was delighted to have seen two of the three endemic Altai birds he wanted to see; the Altai accentor and the Altai falcon, only leaving the Altai snowcock.

15 August - Survey of Koshalu & Border Guards Presentation

We all headed off in the morning to survey the west side of Koshalu. The eagle eyrie near our start point appeared to be empty; we had seen fully feathered young in the nest about two weeks before, so we headed up to have a look at it. As we moved round and got closer, we could see it was not in fact empty, but had two young steppe eagles, we were very lucky to see those wonderful birds so close.

Back at basecamp, the spectre of crime reared its ugly head when John's very posh down-filled airbed disappeared in suspicious circumstances. Eventually the perpetrator was discovered and a bit of 'an eye for an eye' justice was administered as John pinched Eden's clothes as he showered.
Volodya and myself had pre-arranged with the Border Guards to go to Kosh Agash to give a presentation about Biosphere Expeditions and the work we are doing in Altai; the aim of this being to inform the Border Guards so that they knew why we were in Altai. We arrived on schedule and spoke to the base commander who told us that they were busy and maybe we should try next week…… At least as I was in Kosh Agach I had the opportunity to get an ice-cream ;-)

16 August - Travel to Irbestu – snow Leopard Valley

After breakfast we packed our world (and a big heap of food) into the back of the Land Rovers and headed off to Irbestu – Valley of the snow leopard. After Kosh Agach where we did a bit of food shopping and filled up with diesel, we drove west across the steppe. After the endless miles of billard table flat steppe, the entrance to Irbestu valley was very dramatic with its high cliffs and glaciers. The track was mostly reasonable with a few bits that needed care, though nowhere could you drive quickly. In the distance, we saw a camper van; as we drove closer, we could see it was stuck. The driver asked if we could pull him out, so I had a go, but with little success. The driver then took the van out of gear, that seemed to work better and the van came out no problem…. We then gave him a jump start and that was him sorted.

When we got to our camp site, we hurriedly put up the tents in case the threatening clouds soaked us, but we got them up and our kit sorted in the dry :-) Next job was the toilet; I made what I thought was a fine toilet, comfortable, fine views of river and mountain, a discrete distance from camp and equipped with toilet paper dispenser. However, my efforts did not meet with approval from Eden; previously I had thought his obsession was with birds, I was very wrong. Not content with my 50 cm depth toilet, he armed himself with the spade and set off digging for Australia (or should that be Chile). Next, Eden decided that the dwarf Birch were a bit on the dwarf side in matters of modesty so he set about an engineering task to rival the Great Wall of China, scouring the countryside for rocks to build a wall around the toilet. Last I heard the planning department had been called and Eden was looking for two doors to go between the kitchen and the toilet, or rather, as it has become known, The Garden of Eden.

17 August - Survey

This is the day that all the locals have been predicting for months, that the first snows will fall. Well, no snow, but it certainly felt cold enough for it as we huddled behind the Land Rovers eating our breakfast.

We split into two groups, Volodya with his group heading further up Irbestu valley to the glacial lake at its end. The valley was beautiful and the glacial lake even more so, but the whole valley was completely full of sign of domestic livestock, so no sign of ibex, argail or the like were found.

My group headed up into the mountains to the place that looked to me likely to be the most remote in the area. The valley I went up was very beautiful with glaciers on the mountains at its head. Disappointingly, there was a lot of sign that domestic livestock had been using the area frequently, this meaning that local wildlife would be displaced or worse. In one area, we did find some old sign that ibex had been present, however, there was also much sign that horses had been in the area, at one point this was accompanied by sign of a dog and worse of all, an empty cartridge case; all bits of a jig-saw that taken together painted a grim picture for local wildlife.

As if on cue to cheer me up, a falcon came into view that looked a bit bigger than the Altai falcon that I've become familiar with. As well as its size, its colour was unusual, being all white except for some black spots. This could only be one thing; a Gyr falcon. The Gyr falcon is an almost mythical bird that breeds in the arctic and is not known to be present in Altai; this is a fantastic find for the expedition.

In the evening, a discussion brewed about the first 'star' to appear in the sky; was it a star or was it a planet? Some said Venus. I got out the telescope and had a look, there were four moons in a line on the left hand side, this was Jupiter, everyone else queued up to see, but were thwarted by an orographic cloud, the only one anywhere in the sky that formed and dispersed so maintaining its position in front of Jupiter; everyone eventually managed to see the moons.

18 August - Survey

Volodya headed west into the mountains with his team where Eden completed his holy trinity of birds, being lucky enough to see eight Altai snowcock :-)

Katrin, Marina, John, Jens and myself headed south climbing high up into the mountains in the opposite direction from yesterday. Again, it was disappointing to see so much sign of domestic livestock and so widespread. At around 3300 m, after lunch, Katrin, Marina and Jens headed back down whilst John and myself continued to the top at just over 3500 m. Barely 5 min after the others had left; I spotted a group of 19 ibex resting on a ridge around 400 m away, across a glacier on a ridge. We could see the group split into three – 8 juveniles in the lowest group, 7 immatures in the middle group and probably all adults in the group highest on the ridge, three of these were males with big horns and beards. John and myself who were both dressed in muted colours, kept off the skyline and kept still – the ibex did not appear to see us, just lying there as we watched, it was wonderful.

The much talked about snows of the 17th did not arrive yesterday on schedule, but today, there were small snow flurries around. These were not like the occasional snow showers that we get in the summer when the air is warm and the snow does not last; this was different, the air had a bite to it and heralded harsher times ahead, fantastic.

At the top of the mountain, the 360 degree panorama was stunning. We could see across the steppe to Kosh Agach and beyond to basecamp and beyond that to the snow covered mountains of the Chikichova range in Mongolia. We could see the 6000 m peaks on the border with China and we could see Kazakhstan. Below us we could see exquisite turquoise glacial lakes, hanging glaciers, mountains of moraine in the valleys and a constant stream of raptors cruising past – kestrel, Altai falcon, lammergeier, steppe eagle, long-legged buzzard. John, veteran of travel to 70 countries said 'that's the most stunning view I have ever seen'; I would have to agree.

19 August - Irbestu to Elangash petroglyphs to basecamp

After one of Nina's legendary very hearty breakfasts, we packed and headed for home, taking a small detour to Elangash valley to look for petroglyphs which were reputed to be there. The lower reaches of Elangash were gentle, but the head of the valley was dramatic and dominated by a huge mountain and glacier that commanded the whole area. There was little in the way of potential for petroglyphs in the lower valley but where the mountains started, there were some rocks as well as slabs of bedrock sculpted and smoothed by glaciers long since disappeared; it was to there we headed to start our search. At the side of the track I spotted a rock with two petroglyphs – an ibex and a maral deer, we searched on foot from here. On the big slabs of rock, we found many, many more petroglyphs; ibex, argali, maral, wolf and even a snow leopard attacking a maral. As well as the non-human animals, there were men with bow and arrow and even wheeled vehicles. It was a great privilege to be able to look round such a wonderful site, free from all tourist signs; just the valley, the rocks, the petroglyphs and your imagination.

20 August - Argen Bugazon Sacred Springs

Today we went to Aggen Bugazon sacred springs where locals and not so locals go to take the waters, relax and socialize. A long, long time ago in a place called Argen Bugazon, a hunter shot a deer with his bow and arrow, the wounded deer, with an arrow in its leg struggled to run away and passed through the spring. When it emerged from the spring, the arrow fell away and the deer was strong, healthy and free from any wounds and ran away from the hunter. The hunter went to look at the spring whereupon his lunch of dried fish fell into the water; immediately coming to life and swimming away. The hunter, being a perceptive type, thought there may be some health giving benefits from the spring, so spread the word; it has been in use ever since, even being prescribed by GPs. At the spring, we interviewed all the people who were there, a very important part of our work, both to get information on animals as well as gauging feelings towards wildlife. Interestingly, one man said he had seen a snow leopard last August on Mount Chornie, another man had previously said exactly the same thing.

21 August - Last survey day

I spent the entire day checking all the equipment against our inventory and making notes about things that need to be replaced etc. :-(Volodya and Roman took the team to the bird lakes in the middle of the steppe and then to Kamtitigem for the final survey of the expedition. In the evening, we dined like royalty thanks to Nina; the piece de la resistance being a particularly tasty vodka soaked cake ;-) We all played rizzla head into the night, the final round being me as a snow leopard – I guessed it, eventually…. ;-)

22 August - Basecamp to Anoz

Being frozen into our tents in the morning, a punctured tyre and a police check all conspired against a smooth timely drive to Anoz, so it was 20:30 when we arrived. However, all was not lost and the highlight of the day was, according to Graham, being whipped with birch twigs by Nina in the (very hot) sauna...

23 August - Anoz to Novosibirsk

The day got off to a flying stop with our 7th (?) puncture of the expedition; no spares left for the drive to Novosibirsk……

Well, that's the end of the 2008 Biosphere Expedition to the Altai. This was the year of exploring new areas away from our core zone mountain range; much hard work was done by all our team members so that we now have an idea of the distribution of wildlife outside the core zone – well done and thanks to you all. See you next year ;-)

Andy