EARTHWATCH INSTITUTE FIELD REPORT

Earthwatch Institute Mission: *Earthwatch engages people worldwide in scientific field research and education to promote the understanding and action necessary for a sustainable environment.*

Earthwatch Institute uses the UNESCO Definition of a Sustainable Environment*:*
A sustainable environment is one in which the natural environment, economic development and social life are seen as mutually dependent - and the interaction between them contributes to the sustainability and enhancement of the quality of people's lives and the natural environment.

SECTION I: UNEP- WCMC WEBLINK INFORMATION

Section I of the field report will be publicized on our weblink with the United Nations Environment Program (UNEP) World Conservation Monitoring Centre (WCMC) at www.unep-wcmc.org. This website is available to the general public.

Both Sections I and II will be sent to Earthwatch Institute volunteers who participated on your field project. If there is any part of Section I that you would prefer **not** be shared with volunteers, please indicate using the ***** symbol.

Project Title: Ecology & Conservation of Argali Sheep (*Ovis ammon*) in Mongolia

Principal Investigator (s): Richard P. Reading & Ganchimeg Wingard

Position/Affiliations: Director of Conservation Biology & Research Associate, respectively, with Denver Zoological Foundation

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Research Site(s) (geographic location, include coordinates if known, e.g. Lat/Long):
Ikh Nartiin Chuluu Nature Reserve, Dornogobi Aimag, Mongolia (research camp = Lat: N45.72323° and Long: E108.64525°

Local Management Status of the Research Site(s) (e.g. National Park, RAMSAR Site, World Heritage Site, IBA etc.): Nature Reserve (Mongolia) & Important Breeding Bird Area (BildLife International)

Scientific names of primary species being studied (if appropriate):
Argali Sheep (*Ovis ammon*); Siberian Ibex (*Capra (Ibex] sibirica*); Cinereous Vulture (*Aegypius monachus*); Corsac Fox (*Vulpes corsac*); Red Fox (*Vulpes vulpes*); Eurasian Badger (*Meles meles*); Pallas' Cat (*Otocolobus manul*); Daurian Hedgehog (*Hemiechinus dauricus*); Long-eared Hedgehog (*Hemiechinus auritus*).

Key Research Objectives (5-8 brief bullet points):

Overall Objective: Understand argali sheep ecology well enough to develop a long-term conservation management plan for the species.

1) Capture (a) 2 – 4 adult and 8 – 10 lamb argali sheep; (b) 2 – 8 adult and 1 – 5 kid ibex; (c) 5-10 small carnivores; and (d) 1-4 hedgehogs and fit them with radio collars;
2) Determine sources of mortality for argali and other collared animals.
3) Understand movement patterns and habitat use of argali and other collared animals.
4) Compare habitat use and forage plants of argali sheep, ibex, and domestic sheep and goats.
5) Better understand argali behavior.
6) Determine cinereous vulture nesting success rates and sources of nest failure.
7) Use the data collected from our research to develop a conservation management plan for argali sheep and other wildlife in Ikh Nart.
8) Train Mongolian biologists and conservationists.

Date this report was completed: July 14, 2006

Data Collection and Results

a) Give a concise account of the data you have collected during the past field season.

Argali Sheep & Siberian Ibex

Our research expeditions were divided into 2 autumn and 2 spring teams (4 teams total); however, we were forced to cancel Team IV (2nd spring team) due to lack of volunteers (only 1). All teams participated in radio telemetry tracking, behavioral observations, and vegetation sampling. The autumn teams also assisted in animal capture and collaring using drive nets. Altogether, we obtained 145 locations of our radio collared argali (primarily) and ibex, including 39 locations during the autumn and 106 locations during the spring. The reduced number of locations over last year was related to the fact that we had fewer volunteers this past year (and 1 less team), yet a greater number of research task. We also experienced more difficulty in capturing animals using drive netting animals relative to past years, forcing us to spend more time on this task. We gathered group size and composition data on 325 argali herds and 65 ibex herds, including 139 argali and 25 ibex herds in autumn and 186 argali and 40 ibex herds in spring. We gathered 32 hours and 59 minutes of behavioral data on argali, including 7 hours and 47 minutes during the autumn and 25 hours and 12 minutes during the spring. We improved implementation of behavioral data collection this year and put a full-time student on the project, greatly improving the quality of the data. We sampled 160 vegetation plots during both autumn and spring, for a total of 320 plots.

We captured and collared a large number of animals, including more ibex than ever before over the past year. In autumn, we captured and collared 2 adult ewe argalis, 2 billy ibex, 2 nanny ibex, 1 yearling female ibex, and 1 female kid ibex in drive nets. In spring, prior to the arrival of our Earthwatch team, we captured and collared 14 lamb argali, but no kid ibex. One of the primary goals of our radio telemetry work is to determine causes of mortality. We lost 14 collared argali and 6 collared ibex since September, 2005, primarily neonatal animals, and we worked to determine the causes of mortality where possible. We lost 1 adult argali to predation;

2 lambs to predation and unknown causes; and 11 neonatal lambs to predation (n = 3), starvation (n = 4), and unknown causes (n = 4). Predators killed 2 neonatal ibex kids and adult ibex, while the other neonatal kid and adult ibex died of unknown causes.

We conducted 2 surveys to estimate argali population size in autumn (we did not have enough volunteers to do this work during spring). We sampled argali along 9 straight transects and used the Distance program to analyze those data. Unfortunately, our surveys yielded insufficient data (the developers of the software recommend a minimum of n = 40 groups; Buckland et al. 1993, Laake et al. 1993) for accurate modeling. During our second survey on September 23, we saw far too few animals to even enter the data into the program. Our small sample size on September 3 yielded large huge 95% confidence limits of 2.09 – 16.17 animals/km2 (point estimate = 5.82 ±3.06 animals/ km2). This gave us a population estimate of 334 – 2,587 argali (point estimate = 931 argali) in the study area. This estimate was far greater than our estimates in September 2004.

Finally, we encountered 26 argali (14♂: 9♀: 2Y: 1L) and 8 ibex (2♂: 6♀) skulls during our fieldwork in Ikh Nart (Table 1). These data include skull measurements from the 2 (non-neonatal) argali and 6 (non-neonatal) ibex we captured. These data were added into our overall database, which now contains measurements for 296 argali (181♂: 75♀: 29Y: 11L) and 136 ibex (109♂: 18♀: 4Y: 5K). We hope to evaluate these data (for argali) in the next year or so.

Table 1. Argali (*Ovis ammon*) and Ibex (*Capra sibirica*) Horn Measurements (cm).

			Length		Basal Circumference		Span	
Species	**Gender**	**Age**	**Right**	**Left**	**Right**	**Left**	**Wide**	**Narrow**
Ikh Nart								
Argali	**Lamb**	1	17.5	13	18.5	12	23.5	
	Yearling	0.75	11	9.5	11	9	15	
		9	107.5	40	80	38	55	28
	Female	8	42.5	19.5	42	20	44.5	
		1	24	15	23.5	15	34.5	
		8.5	107	33	80	35	54	27
		10	87.5	23	86.5	22.5	33	
		7	98	39	90	39	42	34
		7	96	38	94	38	50	28
		13	58	18.5	59	18.5	43.5	
		9	51	16	46	15.5	36	
		3	27	12.5	27	12.5	28	
	Male	7	94	42	90.5	42	51.5	47
		8	89	38	109	38.5	62	29
		5	80.5	32.5	80	32.5	49.5	33
		9	114.5	45.5	105	44		
		4.5	64	26.5	64	26.5	47.5	43

Table 3. continued.

Species	Gender	Age	Length		Basal Circumference		Span	
			Right	Left	Right	Left	Wide	Narrow
		1	17	12	17.5	13	22	
		9	44.5	13	44	14		
		7	45.5	15	44	15.5		
		7	41	16	38	16	20	
		3	37	23	41	23	36.5	
		1	20	13	19	12.5	26	
		9	41	15.5	40	16	38	
		7	101	38	98	38	60	35
		1	14	10	14.5	9.5	21	
Ibex	**Female**	10	45	17	45	18	38	
		6	25.5	10.5	26	11	26	
		9	30	11.5	30	11.5	19.5	
		5	24	11	24.5	11	15	
		1.5	13	8.5	13.7	8.5	8.5	
		0.5	5	7	4.5	7	6.5	
	Male	4	47	24	47	24	15	
		3	27.5	18	29	18.5	15	

Cinereous Vultures

We seriously expanded our cinereous vulture research in 2005 and 2006, and completed a paper on our preliminary findings from 2003 and 2004 (Reading et al. 2005). In autumn 2005, we measured and weighed 12 chicks on 15 different occasions (i.e., 3 chicks twice). We also put leg bands on 4 chicks and found 2 new vulture nests with chicks. These were the last chicks in our study to fledge, with the last chick to fledge not leaving the nest until early October (after the Earthwatch team left). We also gathered nest characteristic data, including nest length, width, depth, cup size, and height; nesting substrate (rock or tree); diameter at breast height and species for tree nests; slope, aspect, and viewshed for rock nests; latitude, longitude, and elevation; and any other comments of note, for 32 nests for which we lacked some or all of these data.

In spring 2006, we visited 220 vulture nests. Of these 61 were actively used for nesting by a pair of vultures. By June 12, 2006, 36 of these nests remained active. We gathered size and fertility data on 51 eggs, and egg shell thicknesses on 22 egg shell fragments from hatched or failed nests. Several eggs began pipping in mid to late April. We divided active nests into nests that we actively monitored by collecting data on chick morphometrics and those that we monitored for activity only (from a distance). We collected morphometric data on 56 occasions from 22 separate chicks from actively monitored nests. Finally, we gathered nest characteristic data for 15 nests for which we lacked some or all of these data. Finally, we located 5 news nests in June, including 3 new nests with vulture chicks in them.

Other

Earthwatch volunteers also assisted with a project on hedgehogs, small carnivores, and small carnivore prey. In September 2005, that project captured and radio collared 5 corsac foxes, and 1 Pallas' cat, and volunteers assisted in a couple of these captures. In June, 2006, we captured and collared 1 corsac fox, 2 red foxes, and 1 Eurasian badger, and volunteers assisted in 2 of these captures. We captured and radio-tagged our first hedgehog (a long-eared) in autumn, but our main hedgehog project began during the June Earthwatch expedition, when we capture and radio tagged 2 long-eared and 1 Daurian hedgehogs. The June Team assisted radio tracking the small carnivores and hedgehogs as well.

To evaluate small carnivore prey, we trapped for small mammals and insects, and conducted line transects for lizards. We established 4 100 m x 100 m grids for trapping small mammals in September (2 teams) and 2 grids in June (1 team). The grids and transects each included 100 traps and we trapped each for 4 consecutive nights (1,600 trap nights total). Volunteers assisted in checking traps and processing captured animals, which included Mongolian jirds (or gerbils) (*Meriones unguiculatus*), midday jirds (or gerbils) (*M. meridianus*), Roborovskii's dwarf hamsters (*Phodopus roborovskii*), dwarf hamsters (*P. sungorus*), striped hamsters (*Cricetulus barabensis*), and Royle's mountain voles (*Alticola argentatus*). We used 20 pitfall traps for insects that we ran simultaneously with the small mammal trapping. In June we established 10 300 m transects 50 m apart on 2 sites that we walked to assess lizard population densities. We conducted the surveys twice at each site.

b) What progress have you made towards achieving your original objectives?

Overall Objective: Understand argali sheep ecology well enough to develop a long-term conservation management plan for the species.

We have made substantial progress toward this overall objective, learning much about sources of mortality, habitat use, dietary overlap with livestock, genetic considerations, behavior, and more. We are using the knowledge gleaned from our work to assist 1) the Mongolian Ministry for Nature and Environment in developing a conservation management plan for the species and 2) the Dalanjargal Soum in developing a management plan for Ikh Nart that includes a major focus on argali sheep. Drafts of both plans will undoubtedly be completed in the next couple of years (at most). Yet, our knowledge of argali ecology remains incomplete. We hope to continue our work for several more years and revise the management plan accordingly.

1) Capture (a) 2 – 4 adult and 8 – 10 neonatal lamb argali sheep; (b) 2 – 8 adult and 1 – 5 neonatal kid ibex; (c) 5-10 small carnivores; and (d) 1-4 hedgehogs and fit them with radio collars;

We met or exceeded our objectives in terms of animal captures, with the exception of neonatal ibex kids. We captured and radio collared 2 adult argali, 4 adult ibex, 1 yearling ibex, 1 ibex kid, 14 neonatal argali lambs, 10 small carnivores, and 4 hedgehogs. At this point, we will target capturing as many animals as necessary to replace animals that die or whose collars fail each year, as we are simply unable to track many more animals. .

2) Determine sources of mortality for argali and other collared animals.

We continually monitor collared animals and immediately work to locate animals that die (our collars include mortality switches). For the majority of animals this is possible, but even

getting to a dead animal quickly does not guarantee that we can determine the cause of death (in some cases we only find collars) and a large proportion of animals that die are not easily diagnosed. Still, our project has determined the cause of mortality for most animals that died and we are beginning to gain an understanding of the most important mortality factors for the different species we study.

3) Understand movement patterns and habitat use of argali and other collared animals.

We have been tracking radio collared animals daily (365 days/year), although we do not get locations on all animals each day (usually only once every several days) and some animals go several days without locations being recorded. We have not had the time to rigorously analyze all of the movement data collected, but we are beginning these analyses (see below and Reading et al. 2004, 2005). We have gathered some satellite imagery data and collected a substantial amount of vegetation data as well that will permit us to examine habitat use in the future. We are also gathering data on small carnivore prey that we will use to compare with carnivore use areas.

4) Compare habitat use and forage plants of argali sheep, ibex, and domestic sheep and goats.

Our analyses of dietary overlap between argali sheep and domestic shoats are complete and published as Ganchimeg Wingard's M.S. thesis (Wingard 2005). Basically, we found substantial overlap in the diets of these ungulates, which has serious management implications for the reserve. We will publish parts of Ganaa's thesis as scientific papers soon. We have just begun to look at ibex diets and will be expanding our dietary analyses into a comparison of vegetation inside and outside of argali core areas as a master's project for one of our graduate students (Ankhaa).

5) Better understand argali behavior.

We have substantially upgraded our behavioral research with the initiation of a master's project by Tsogoo. As such, we have collected a substantial amount of much higher quality data than in the past. Tsogoo has only recently begun to compile, summarize, and analyze these data.

6) Determine cinereous vulture nesting success rates and sources of nest failure.

Our cinereous vulture nesting ecology study is progressing well. Our first 2 years served as a pilot study for our more rigorous research in 2005 and 2006. We published the results of our pilot study (Reading et al. 2005). We have completed the initial analyses of our 2005 data (summarized below). Although we are getting a handle on vulture chick development and nest failure rates, we still do not understand the factors that influence nesting success. As such, we have been gathering data on a larger set of variables in 2005 and 2006, which we will begin to analyze after this nesting season.

7) Use the data collected from our research to develop a conservation management plan for argali sheep and other wildlife in Ikh Nart.

We have worked with the Mongolian federal government to develop a national management plan for argali, but it remains in draft form. A recent change of government (Jan. 2006) bodes well for conservation, but also means that many actions undertaken by the former Minister of Nature and Environment have been put on hold. We are monitoring the situation. On the local level, we are working actively with the Soum (like a county) governor and other local officials to develop active management of Ikh Nart. Toward that end, we secured grants from the Open Forum (Mongolia) and Trust for Mutual Understanding (New York) to begin a comprehensive conservation program for the nature reserve. We have been actively

implementing that work, which involves forming a ranger corps, establishing a protected areas office, environmental education, developing ecotourism, and drafting a management plan for Ikh Nart. We hope to develop a sister park relationship with Anza-Borrego State Park in California, USA later this year. We wrote a guidebook for Ikh Nart to be used as an education tool and to help develop ecotourism. That book is currently being printed (Reading et al. 2006).

8) Train Mongolian biologists and conservationists.

Training has progressed well. Over the past year, we worked with and trained 7 Mongolian undergraduate students and 3 Mongolian graduate students at the Mongolian National University, 3 researchers with the Mongolian Academy of Sciences, 1 Mongolian researcher with a Mongolian NGO, and 1 Mongolian graduate student in the U.S. One of the Mongolian researchers at the Academy is also pursuing his Ph.D. at the Mongolia National University.

c) Please provide a summary of your results (even if they are preliminary).

Argali Sheep

We are gaining an ever-improving picture of the ecology of argali sheep in Ikh Nart and have now published 2 preliminary papers (Reading et al. 2004, 2005) on the topic. In addition, Ganchimeg Wingard completed her M.S. degree on argali dietary ecology (Wingard 2005). We hope to expand on our initial findings and publish additional papers in the next year or so. More importantly, we are gaining sufficient insight into argali ecology to enable us to begin drafting a conservation management plan for Ikh Nart (and Mongolia in general), working with the appropriate government officials.

Movement Patterns & Habitat Use. We continue to improve our picture of argali movement patterns, although we have not undertaken an in-depth analysis of movement patterns since our last publication (Reading et al. 2005a). In that paper, we note that we lack evidence for seasonality in argali movement patterns. This may be due to the fact that argali in our study site do not inhabit a mountain range, but a relatively level area with rocky outcrops. Prior to 2005, home ranges averaged 57 ±3.7 SE km^2 using the 100% minimum convex polygon (MCP) method, while core use areas averaged 76 ±5.3 SE km^2 for 95% kernel; 32 ±3.7 SE km^2 for 75% kernel; 11 ±1.6 km^2 for 50% kernel; and 3.8 ±0.5 km^2 for 25% kernel ranges. For 2005, we found similar results: home ranges for animals with >35 fixes averaged 61 ±6.5 SE km^2 using the 100% MCP)method, with core use areas averaging 63 ±5.9 SE km^2 for 95% kernel; 23 ±2.9 SE km^2 for 75% kernel; and 8 ±1.1 km^2 for 50% kernel ranges (Table 2). These ranges are mostly larger than ranges for desert bighorn sheep (*Ovis canadensis*), but this is not surprising, as argali are more of a cursorial animal than bighorn, built more for running than climbing.

Argali sheep from the northern part of Ikh Nart utilize 2 main areas of the reserve: an area just north of our research camp with some large, rocky outcrops and an area even further north, with less rocks and more rolling terrain (see figures in Reading et al. 2005a). Another important region exists in the southern park of Ikh Nart near another permanent water source. Now that we have these telemetry data we can analyze the habitat characteristics that draw argali to these regions. We are currently analyzing vegetation within and outside of these heavy use areas for future comparisons. We will also use a geographic information system (GIS) to analyze other variables, such as proximity to water, roads, people, and rocky areas.

Group Size. We have accumulated a large database on argali (and to a lesser extent ibex) group size and composition. These data are being combined with data from other months and years to evaluate seasonality in group sizes and composition (see Figure 1), which we hope to

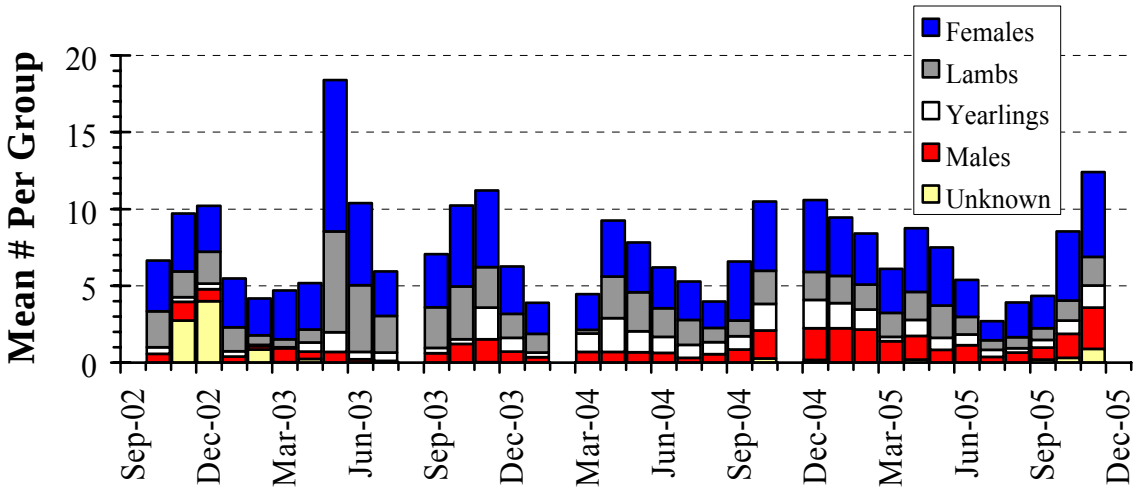
Table 2. Home Range Sizes in 2005 for Argali in the Ikh Nartiin Chuluu Nature Reserve, Mongolia. MCP = Minimum Convex Polygon

Animal	Sex	Age	Date collared	Days in study	Days with fixes	100% MCP (km^2)	Kernel Home Range (km^2) 95%	75%	50%
Amaraa	F	Adult	9/05/04	365	74	48.06	35.1	8.3	4.1
Christa	F	Adult	9/18/05	87	31	36.59	49.9	17.0	4.3
Eggnog	F	Adult	9/09/04	167	24	22.69	30.7	9.2	4.6
Janice	F	Adult	9/18/04	130	26	55.73	29.7	13.0	6.1
Jerry	F	Adult	9/09/04	365	58	44.15	60.4	27.7	9.9
Lisa2	F	Adult	9/18/05	104	29	66.22	86.5	37.3	11.3
Lynn	F	Adult	9/18/04	365	58	36.06	33.9	12.2	5.3
Mandakh	F	Adult	9/15/02	365	74	64.42	78.8	23.6	6.7
Sue	F	Adult	9/04/04	365	39	43.02	53.2	19.6	5.7
Tuya	F	Adult	9/17/02	365	61	69.43	90.4	37.4	13.3
Vickie	F	Adult	9/05/04	365	33	49.23	82.7	32.9	13.2
Zulaa	F	Adult	4/22/03	325	25	41.19	47.8	11.4	4.3
Ganaa2	F	Yearling	9/11/04	365	85	80.69	64.9	26.6	9.4
Lauren2	F	Yearling	3/29/04	172	16	31.99	55.5	15.9	6.2
Dot	F		9/05/04	110	22	15.79	18.2	9.4	5.5
Bataa	M	Adult	9/11/04	365	71	109.68	89.4	38.8	14.4
Scott	M	Adult	9/19/04	365	17	16.78	26.9	8.6	4.6
Jargal	M	Yearling	4/06/04	511	38	65.61	55.4	15.2	5.1
Joe	M	Lamb	4/09/05	266	18	18.51	36.1	14.9	3
Khokh	M	Lamb	4/12/05	221	48	66.04	76.8	21.4	8.2
Khongilt	M	Lamb	4/15/05	248	47	43.13	49.2	18.6	3.4
Mean				**285.29**	**42.57**	**48.81**	**54.83**	**19.95**	**7.08**
S.E.				**25.63**	**4.68**	**5.07**	**4.89**	**2.18**	**0.76**
>35 Fixes									
Mean				**236.55**	**59.36**	**60.94**	**62.50**	**22.67**	**7.77**
S.E.				**41.92**	**4.65**	**6.47**	**5.93**	**2.89**	**1.10**

publish in 2007. Group size and composition appear cyclical, with larger group sizes in autumn and spring compared to winter and summer.

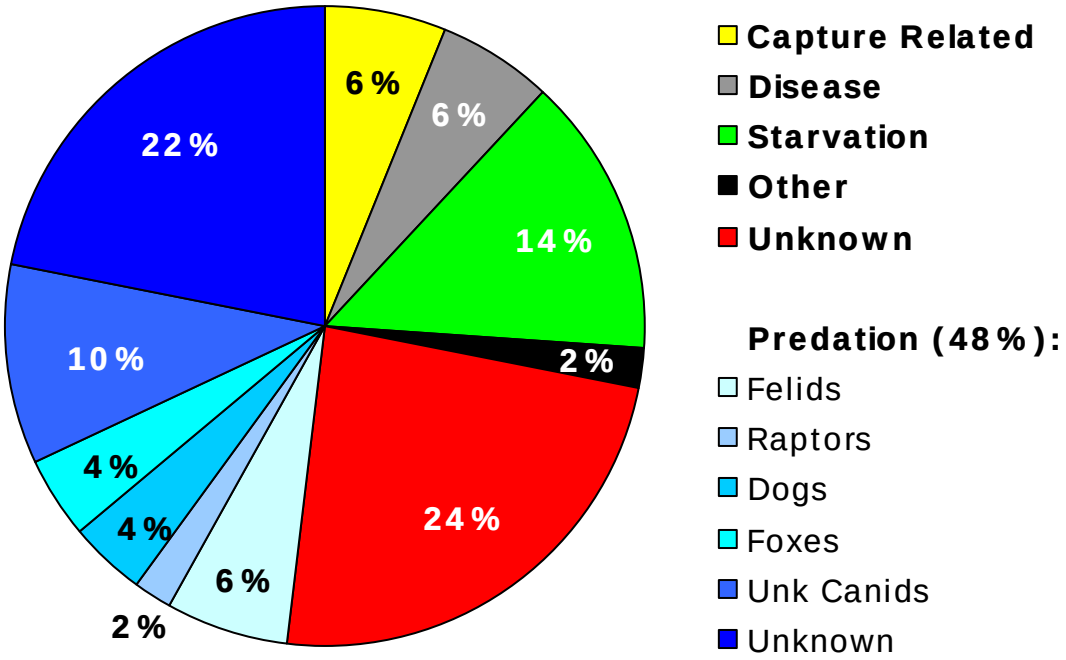
Mortality. Overall, of the 74 argali we collared in Ikh Nart since 2000, at least 50 (67.6%) have died. An additional 12 animals lost their collars (some collars are designed to fall off) and may or may not still be alive. Lambs comprised the vast majority (72.0%) of the mortalities we recorded, and we expect high mortality rates for neonatal animals (< 6 weeks old), which comprised 50.0% of all mortalities. Predators killed the majority of argali (n = 24) for which we could determine a cause of death (Figure 2). In addition, 3 animals died from capture related

Figure 1. Mean Number and Composition of Argali per Group in Ikh Nartiin Chuluu Nature Reserve, Dornogobi Aimag, 2002 – 2005.



problems (one from each from the three techniques we employed), 3 died from disease, 7 of starvation, and 1 died from an attack by a domestic horse that it startled after we frightened a group of argali (we witnessed this attack; Figure 2). We could not determine the cause of death for the other 12 animals.

Figure 2. Causes of Death for Radio Collared Argali in Ikh Nartiin Chuluu Nature Reserve, Mongolia, 2000-2005.



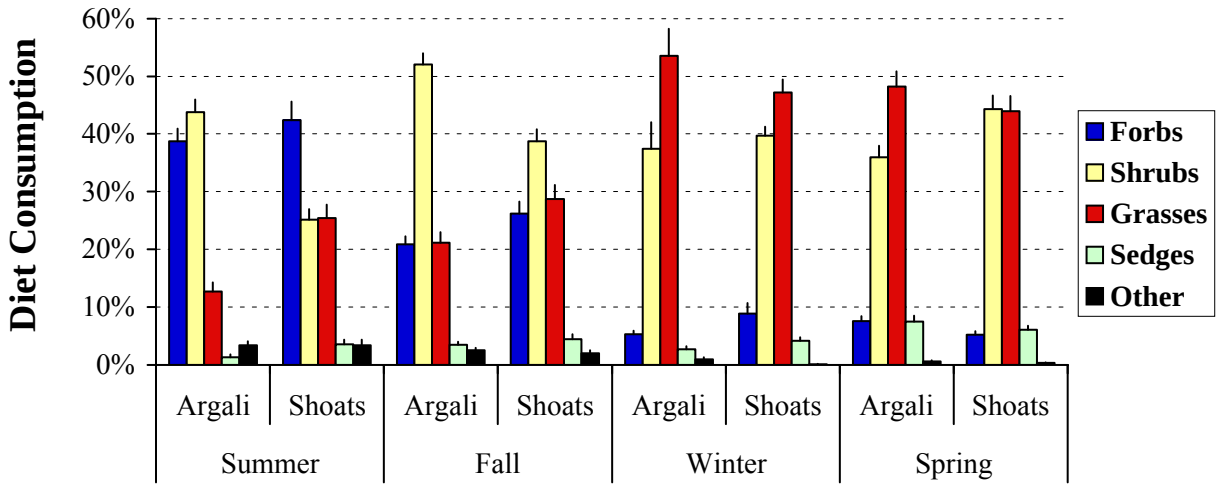
For 11 (45.8%) argali killed by predators, we were unable to determine the predator (Figure 2). Of the remaining 13 mortalities, 9 were killed by canids, 2 neonatal lambs were

killed by Pallas' cats, 1 animal was killed by an unknown felid, and 1 neonatal lamb was killed by a raptor. Kills by canids included 2 neonatal lambs killed by red foxes, 2 yearlings killed by domestic dogs (we witnessed these), and 5 argali killed by either domestic dogs or wolves. Of course, predation might well be the proximate cause of mortality for animals already predisposed due to illness or starvation, which should be considered the ultimate cause of death.

We obtained additional data on causes of mortality for non-collared animals. We observed domestic dogs killing uncollared argali on 3 occasions and found additional evidence of large canid predation on argali. From 2003-2005, but mostly in 2004, several argali died of an unknown disease that first caused them to go blind. Local herders reported the same problem in their domestic livestock at this time. Finally, in late winter/early spring we found several argali that had starved to death each year (as determined by their status of their bone marrow).

Diet & Dietary Overlap with Livestock. Wingard (2005) reports the results of our research into argali diet and dietary overlap with livestock in detail. We only provide a summary of that work here. Available forage biomass decreased in Ikh Nart from summer to winter, from 19g/m^2 to 3.4g/m^2. Fecal analysis determined the plants that argali and sheep and goats (hereafter shoats) consumed during different seasons of the year more accurately than direct observations. Both argali and shoats selected shrubs for most of their forage overall, followed by grasses, forbs, and sedges; however, preference changed seasonally (Figure 3). In summer, forbs increased dramatically in importance for both argali and shoats, and shoats selected forbs most at this time. In winter and spring, argali and shoats relied much more on grasses, which comprised the mostly common food source for both species. Argali consumed a more varied diet than shoats in all seasons. Of course, pastoralist herders tend their livestock and direct their movements. This may well limit areas frequented by shoats.

Figure 3. Dietary composition of argali and shoats diet in summer, fall, winter, and spring in Ikh Nart, Mongolia 2002-2003



We found high dietary overlap between argali and shoats no matter the season, category of plant, or index used (Wingard 2005). Dietary overlap ranged as high as 92% in summer and 99% in winter. Dietary overlap was greater in winter and spring (85% – 99%), when food resources are more limiting, than in summer and autumn (72% – 94%). Not surprisingly, dietary

overlap was highest using the broadest category of analysis, plant categories, and lowest using the narrowest category of analysis, mean species, but in all cases, overlap remained high. The high degree of dietary overlap, low biomass availability, and extremely cold winters in Ikh Nart suggests that a strong potential for competition exists between argali and shoats. As a result, reduction of livestock grazing in the reserve would likely improve the situation for argali.

Behavior. Argali behavioral research and analyses gained a major boost, when one of our undergraduate student, Tsogoo, decided to pursue this aspect of argali ecology for his Master's degree at the Mongolian National University. In addition to work in Ikh Nart, Tsogoo will likely gather data on argali behavior in western Mongolia (Uvs Aimag) with Dr. Barrry Rosenbaum, a Research Associate of DZF. Over the past several months, and with Earthwatch volunteer assistance, Tsogoo has vastly increased our behavioral database, but is only now beginning to summarize his finding and conduct data analyses. We envision producing at least a preliminary manuscript on argali behavior over the next year.

Siberian Ibex

Our data on Siberian ibex remain preliminary, although we are beginning to gather sufficient data on enough animals to begin analyses and comparisons with argali sheep. A major goal over the next year or so will be to conduct these analyses and draft at least a preliminary report or publication on our findings. Over the next year we will again strive to increase the number of ibex we study, although we were unable to collar any ibex kids this past spring.

Cinereous Vultures

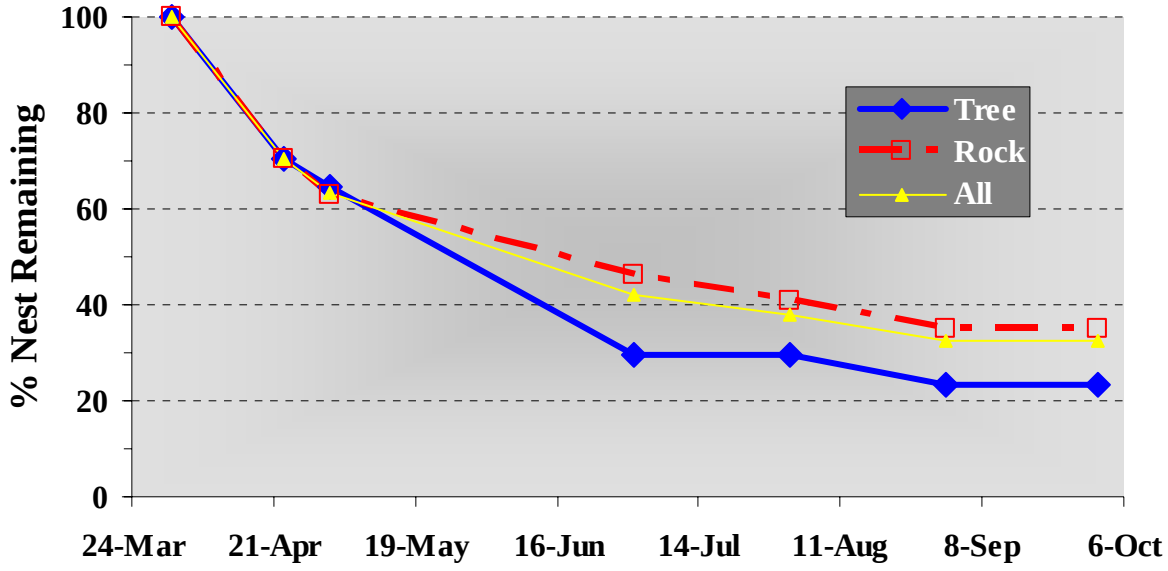
For the 2005 nesting data, of the 190 nests we measured, at least 71 nests were used by a nesting pair of vultures. We monitored these nests to varying degrees – some nests were only found late in the season and some nests we intentionally did not monitor actively to assess the impact of our research efforts on nesting success. Of the 71 active nests, 17 were located on trees and 54 on rocks. As with past years (Reading et al. 2005), most nest failures occurred early in the nesting season, before eggs hatched in early May (Figure 4). Overall, the maximum success rate for vulture pairs in Ikh Nart was 32.4%, although this over-estimates the success rate because new nests with eggs or chicks were found throughout the nesting season (while nest failures obviously were not!). As with 2003 and 2004, nests on trees failed at higher rate than nests on rocks. Only 23.5% of vulture pairs that nested in trees fledged a chick, while 35.2% of pairs that nested on rocks fledged chicks. It is not clear to us why pairs that nest in trees fail to raise young at higher rates than pairs that nest on rocks, especially because nests in trees are harder for ground predators (e.g., wolves, foxes, Pallas' cats) to access.

Small Carnivores & Their Prey.

Our project on small carnivores and their prey studies 4 small carnivores, as well as their insect, reptilian, and small mammal prey. Although we only have sufficient data on a few animals, we are beginning to get home range size data for the small carnivores. Eurasian badgers hold the largest territories, followed by Pallas' cats, and then the 2 species of foxes (Table 3). However, there is great variability in the home range sizes and therefore substantial overlap between species, especially the cat and foxes. Locations are also starting to yield insight into habitat preferences (e.g., red foxes seem to prefer rockier areas and corsac foxes more open areas). Obviously we require more data on more individuals.

Data collection has been hampered by the high mortality small carnivores face in and around Ikh Nart, especially in winter. The winter of 2005-06 was particularly difficult for small

Figure 4. Cinereous Vulture Nesting Success Rates in Ikh Nartiin Chuluu Nature Reserve, Dornogobi Aimag, Mongolia, 2005.



carnivores in our study area, as all of our collared animals died, most by hunters (outside the park) and poachers (inside and outside the park). Since the beginning of the study, we have captured 29 small carnivores (mostly corsac foxes), but 22 (75.9%) of these have died (Figure 5). The vast majority (59.1%) of these deaths were caused by people (primarily harvesting the animals for their furs) (Figure 6). The only other causes of death for animals for which we could determine the cause of death were 1 red fox that died of mange and 1 corsac fox that was killed by another predator.

Figure 5. Numbers of Captures and Mortalities of Radio Collared Small Carnivores in Ikh Nartiin Chuluu Nature Reserve, Mongolia, 2004-2006.

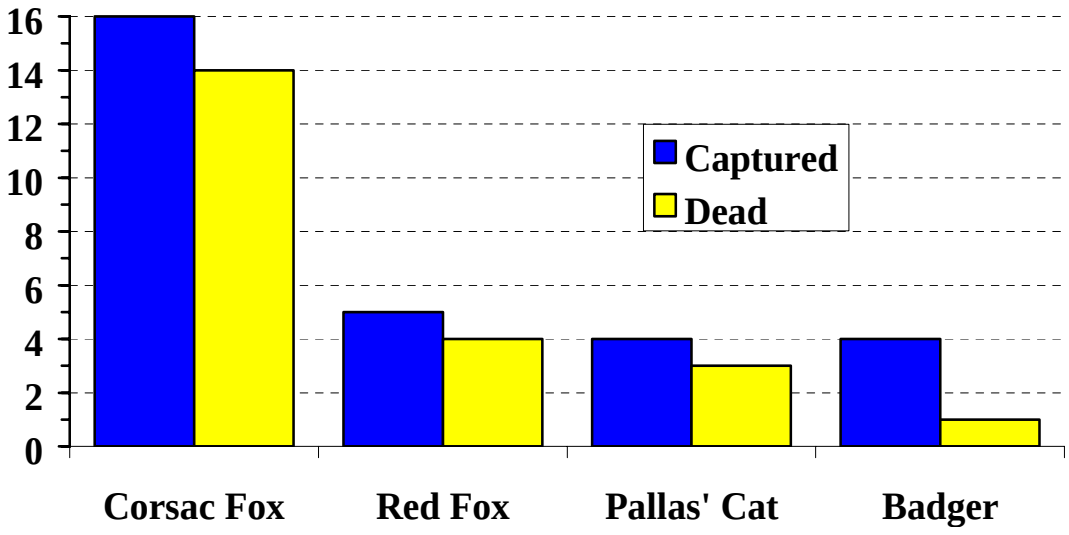
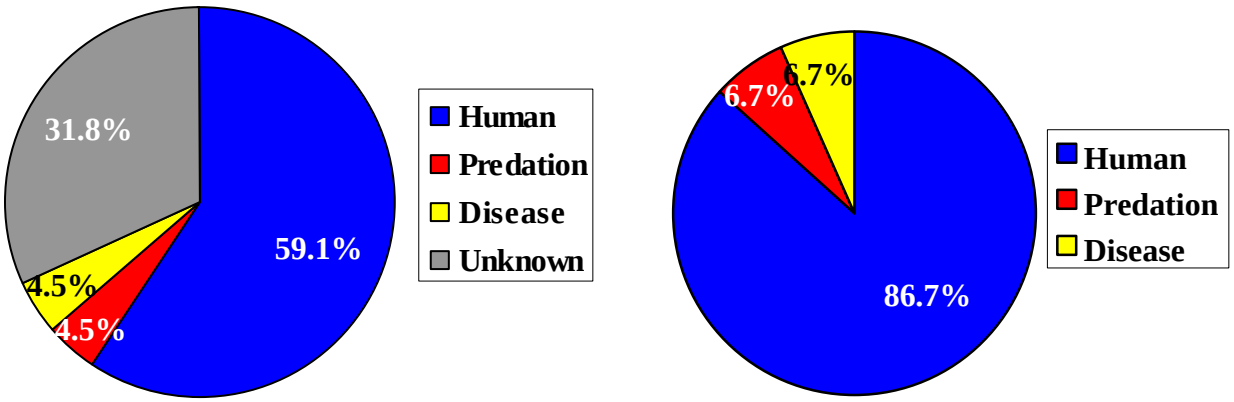


Table 3. Small Carnivore Percent Kernel Home Range Sizes in Ikh Nartiin Chuluu Nature Reserve, Mongolia, 2004-2005.

Species	Gender	90% Kernel Home Range	50% Kernel Home Range
Corsac Fox	Male	7.2	1.6
	Male	9.3	2.7
	Male	4.5	1.2
	Male	11.2	2.1
	Female	5.6	1.1
	Female	3.5	0.6
	Female	11.4	2.8
Corsac Fox Means ±SD		**7.5 ±3.2**	**1.7 ±0.8**
Red Fox	Male	1.7	0.3
	Male	13.8	2.6
Red Fox Means ±SD		**7.8 ±8.6**	**1.5 ±1.6**
Pallas' Cat	Male	9.7	2.2
	Female	12.4	1.6
	Female	3.7	0.5
Pallas' Cat Means ±SD		**8.6 ±4.5**	**1.4 ±0.9**
Badger	Male	14.8	2.3
	Male	75.6	18.3
	Female	87.0	11.0
Badger Means ±SD		**59.1 ±38.8**	**10.5 ±8.0**

Figure 6. Sources of Mortality for Radio Collared Small Carnivores in Ikh Nartiin Chuluu Nature Reserve, Mongolia. Left: All causes. Right: Known causes.



We have collected a substantial amount of data on small carnivore prey, but have yet to fully analyze much of those data. We found very large lizard populations, primarily toad-headed agamas (*Phrenocephalus versicolor*), in 2 of the habitat types we surveyed in July, 2005 and June, 2006 (Table 4). Amazingly, these habitats support 8 – 10,000+ lizards/km^2. We are still analyzing data from our small mammal trapping, but we caught large numbers of small mammals in autumn 2004 (as many as >80 individuals/100 trap nights), but the populations subsequently crashed and have not recovered as of June, 2006 (e.g., usually we have been capturing <10/100 trap nights since). Most of this change was due to numbers of jirds (or gerbils, *Meriones* spp.). We have not completed our analyses of insect pitfall traps or small carnivore scats, although we have collected hundreds of the latter. We plan to conduct more analyses of these data over the next year.

Table 4. Lizard Densities in Shrub-Steppe and Tall Grass Habitats of Ikh Nartiin Chuluu Nature Reserve, Mongolia, 2005-2006.

Habitat	Month	Year	Density	95% C.L.	Model	Adjustment
Long grass	July	2005	10,223/km^2	8,024 – 13,026	Hazard	Cosine
	June	2006	10,563/km^2	7,875 – 14,169	Hazard	None
Shrub-steppe	July	2005	10,541/km^2	6,955 – 15,975	Hazard	Cosine
	June	2006	8,465/km^2	6,581 – 10,889	Hazard	None

Hedgehogs.

We began our hedgehog study only in September, 2005. In that month, we radio tagged a single long-eared hedgehog. Soon thereafter, the hedgehogs entered hibernation and we reinitiated our study with the June, 2006 Earthwatch team, when we radio tagged 3 more hedgehogs (2 long-eared and 1 Daurian). We have 1 known mortality, probably from an eagle owl (*Bubo bubo*), but very little other data. We hired a student in July to take the lead on the hedgehog research.

Significance/Benefits of Research

a) What is/are the significance/benefits of your research at the following levels? (see below)

b) How do your findings contribute to issues of sustainability?

Our research and conservation efforts promise to provide benefits locally, nationally, and internationally. Overall, our work will improve our understanding of several globally significant species about which very little is currently known. As such, our work should contribute to conservation efforts in our area, but also throughout the range of the species. For example, we are the first and only long-term research project that extensively studies argali sheep, ibex, corsac foxes, Daurian hedgehogs, and long-eared hedgehogs using radio telemetry. The insight gleaned through this work is already significant, as we have identified an important and previously unrecognized source of mortality for argali – domestic guard dogs and identified over-harvesting of small carnivores as a significant threat to those species. We are also elucidating several other

important ecological traits and threats that should help wildlife managers in Ikh Nart, in Mongolia, and throughout the range of these species in Central Asia to better manage them (for example, by better estimating the potential impacts of pastoralism, animal harvests, and the size of protected areas required to conserve each species).

Currently, little is understood about several species of global conservation concern that we study, including argali, cinereous vultures, corsac foxes, and Pallas' cats. Even the species that are secure from a conservation perspective and have been studied elsewhere, have received little research attention in Mongolia, including Eurasian badgers, red foxes, hedgehogs, and ibex. Yet, the pressures on the species we study continue to grow in and outside of Mongolia. Some of that pressure relates to increasing demands by growing livestock herds, while other pressures relate to natural resources exploitation (especially unregulated mining) and to supply pelts and body parts for traditional Chinese medicine. This increases the importance of management, which should be based on sound science.

We conduct our work as if it is one large training program for our Mongolian colleagues. As such, the project is already benefiting the local area and Mongolia in general by training Mongolian ecologists and conservation biologists who will be better able to take these skills and use them to advance wildlife management and conservation in the area and nationally (if not internationally). Over the past year, we have trained 7 Mongolian undergraduate students, 3 Mongolian graduate students, 3 researchers with the Mongolian Academy of Sciences, 1 Mongolian researcher with a Mongolian NGO, and 1 Mongolian graduate student in the U.S. One of the Mongolian researchers at the Academy is also pursuing his Ph.D. Several of our colleagues are already involved in conservation management planning on the national level. All of this bodes well for the sustainability of our work, because it is our Mongolian colleagues who will continue our research and conservation initiatives into the future. It is they who are in the best positions to meld our research results with the local culture to develop sounder, more sustainable management plans.

Hopefully, the benefits of a better managed nature reserve will extend beyond the animals and plants inhabiting the reserve to the people living in and around Ikh Nart. Our work is already demonstrating benefits in terms of growing wildlife populations that are more habituated to humans. This work increases the opportunities for nature-based tourism and associated job opportunities, which we are promoting through our project to develop better, more active, and sustainable management of Ikh Nart. Our project already employs 2 local people full time, 12 local people part time, and has created an additional 8 positions through our Ikh Nart management project. As such, our project enjoys the full support of the county governor and the local community. Luckily, we work in a region where the local people strongly value a healthy environment and support our efforts to ensure a sustainable future for them, their families, and the myriad of plants and animals that co-inhabit Ikh Nart with them.

Dissemination of Results

a) Have you provided details of results from your research to or within:

- **Scientific papers (indicate status; e.g., peer reviewed or in progress/press)**

Reading, R. P., S. Amgalanbaatar, G. J. Wingard, D. Kenny, and A. DeNicola. 2005. Ecology of argali in Ikh Nartiin Chuluu, Dornogobi Aimag. Erforschung Biologischer Ressourcen der Mongolei (Halle/Saale) 9: 77-89. (peer reviewed).

Reading, R. P., S. Amgalanbaatar, D. Kenny, and B. Dashdemberel. 2005. Cinereous vulture nesting ecology in Ikh Nartyn Chuluu Nature Reserve, Mongolia. Mongolian J. Biol. Sci. 3(1): 13-19. (peer reviewed).

Wingard, G. 2005. Seasonal food habits of argali and dietary overlap with domestic livestock in Mongolia. M.S. Thesis, University of Montana, Missoula, MT.

Management plans and reports (in progress or completed)

- **By who, for whom, and used by which agencies**

We currently drafting a management plan for the Ikh Nartiin Chuluu Nature Reserve (where our research is conducted) in collaboration with local people, government officials, and other private interests (e.g., tourism operators, educators, nomadic pastoralists). The plan will be use by the Soum Government, who is responsible for managing the protected area.

- **Presentations (given or planned)**

Murdoch, J., T. Munkhzul, and R. Reading. 2006. Ecology and conservation of steppe carnivores in Dornogobi, Mongolia. National Avian Research Centre, March 1, 2006, Abu Dhabi, United Arab Emirates.

Murdoch, J., Ts. Munkhzul, and R. P. Reading. 2006. Ecology and conservation of Pallas' cats and other sympatric small carnivores in the Northern Gobi. Felid TAG 2006 Mid-Year Meeting, April 7-9, 2006, Denver Zoo. Denver, CO.

Murdoch, J., Ts. Munkhzul, and R. P. Reading. 2006. Ecology and conservation of steppe carnivores in Dornogobi, Mongolia. Felid SSP Meetings, April 5-6, 2006, Denver Zoo, Denver, CO

- **Popular articles or films (in progress or completed)**

Sukh Amgalanbaatar also assisted in the production of a Mongolian popular nature film that partially covered our work during the past year and which airs on all Mongolian Airline flights (and is narrated by a former Earthwatch volunteer to our project!).

S. Amgalanbaatar also responded to several requests for newspaper interviews and the press in Mongolia has written at least 1 newspaper story about our work over the past year.

Murdoch, J. and R. Reading. 2005. Conserving the elusive Pallas' cat. Zoo Review, Spring: 16-17.

Murdoch, J., T. Munkhzul, and R. Reading. 2006 (In press). Pallas' cat (*Otocolobus manul*) ecology and conservation in the semi-desert steppes of Mongolia. Cat News.

Reading, R. P. and D. Kenny. 2006. Conservation in Mongolia: The Denver Zoo's Mongolian Wildlife Conservation Program. Communiqué May: 10-12.

Reading, R., J. R. Wingard, and S. Amgalanbaatar. 2005. Trophy hunting of argali: An example of unsustainable legal and illegal hunting and trade. P. 12, in: Going, going, gone…The illegal trade in wildlife in East and Southeast Asia. The World Bank, Environment and Social Development East Asia & Pacific Region Discussion Paper, World Bank, Washington, D.C.

- **Books, chapters, illustrations**

Reading, R. P., D. Kenny, G. Wingard, B. Mandakh, & B. Steinhauer-Burkart. 2006. Ikh Nartiin Chuluu Nature Reserve: Argali Stronghold. Nature-Guide No. 4, Mongolia. ECO Nature Edition Steinhauer-Burkart OHG, Oberaula, Germany.

We would appreciate copies of any relevant materials you can make available to us.

SECTION II: VOLUNTEERS

Earthwatch will send Section II to the volunteers who worked on your project. It will **not** be used on the UNEP-WCMC web site.

Cover Letter to Volunteers

Please write a brief, informal, and signed letter to your volunteers. Please express your thanks, and outline news and any anecdotes.

Volunteer Tasks and Accomplishments

a) How did the volunteers contribute ideas, skills, expertise and motivations beyond that which you anticipated?

Earthwatch volunteers contributed significantly to our work over the past year; although we were drastically short-handed (we even had to cancel 1 team). Luckily, we enjoyed high productivity by the few, excellent volunteers that assisted us. We continued to enjoy a relatively high rate of repeat visits by previous volunteers, which greatly increases their and our capacity to conduct fieldwork. This is not surprising, because after 2 weeks, most of our volunteers made decent, if not excellent, field technicians. Some already possessed skills obtained from previous projects. Advice from past volunteers improved our training program and increased the comfort of the stay for new recruits. Advice on data sheet formats led to improvements that both volunteers and researchers enjoyed. One volunteer provided excellent advice on setting up our equipment in a new and improved manner.

b) How have volunteers helped you to achieve your research or educational objectives? Please give specific and quantitative measures of the volunteers' contribution to your data collection.

Volunteers greatly increase our capacity to collect data and are vital to our drive netting exercise. When Earthwatch volunteers are not in the field, we usually have 1 team (rarely 2 teams) of researchers collecting data on argali, 1 team collecting data on vultures, and 1 team collecting data on small carnivores and their prey. A full team of volunteers enables us to use 3 teams for the argali work, 1-2 teams for the vulture work, and 2 teams for the small carnivore and small mammal work. As such, we collected substantially more data in the months with volunteers than in months without volunteers. In addition, we are only able to collect vegetation data when we have volunteers to assist us. Even with incomplete volunteer teams we are able to collect more data.

We also could not drive net as effectively without volunteers. Indeed, when we lack complete teams of volunteers, we must recruit other volunteers to enable us to net drive effectively (we used some Peace Corps and Denver Zoo volunteers to "fill-out" our teams in autumn, 2005). Volunteers increase the effective size of our nets by forming a human barrier extending past the end of the nets. They also greatly decrease our processing time for each captured animal (by about 50%). Finally, having volunteers has increased the comprehensiveness of our data collection (in the past we always forget to collect at least 1 datum, but this rarely occurred when we used volunteers).

Volunteers helped increase the visibility of our work indirectly, by contributing high quality art, photographs, and video of our work. We use these to develop or maintain support for our project within our cooperating organizations.

Project Development

a) What logistical or scientific challenges have you encountered in the past season and how will you address them during the next field season?

Overall, our project ran fairly smoothly, although we did encounter a few logistical and scientific challenges. A continuing logistical challenge is the changing schedule of the Mongolian Railway. Alterations in their schedule force us to be flexible in our travel plans, and for some teams this meant driving back to Ulaanbaatar rather than taking the train. However, with the newly paved road most of the way to our camp, this trip is actually faster than the train and relatively easy.

Another logistical consideration was the condition of the Orgoo Hotel, especially by the time we got to Team III. The hotel was simply filthy (and has been degrading in quality). We resolved this by moving the team to a rest house, that we may well use more in the future, as it is clean and very close to the apartment our project rents in Ulaanbaatar. Otherwise, we will search for another hotel.

At camp, things went well for the most part, but some volunteers do not like sharing their ger (yurt) with so many fellow volunteers. The ger certainly was not crowded, but we are considering the purchase of an additional ger (we planned to do this in the spring, but we only filled 3 of 20 slots, and so had insufficient resources). However, camping tents are available for volunteers who would like more privacy and some volunteers availed themselves of this opportunity

The lack of volunteers (not just in spring) created problems for our project, as we require a certain number of people – in the autumn, in particular. Drive netting requires a relatively large number of personnel, yet we recruited insufficient volunteers in the autumn of 2005. We resolved this problem by recruiting additional volunteers from the U.S. and from the Peace Corps in Mongolia. We also recruited a few additional local Mongolian pastoralists. We will continue to try to recruit full teams, particularly in autumn, and to rely on alternate volunteers when our teams are too small.

A continuing scientific challenge is the communication barrier that exists between some researchers and some volunteers. Our researchers enjoy varying levels of English proficiency. Although they are all improving, many researchers retain only rudimentary English skills. To address this concern, we have been paying for English lessons, working to encourage greater interaction between the volunteers and the researchers (to increase their exposure to and practice in the English language), and are working to ensure that we always schedule at least one Mongolian with good English skills to accompany volunteers.

An additional scientific challenge to our work has been an increase in poaching of small carnivores, especially during winter. As demand from China has increased, so have the prices paid for animal parts. This led to the poaching of all of our study animals (small carnivores) over this past winter. This obviously compromised our ability to collect ecological data on these species. We are working to increase the capacity of the protected area to thwart poaching and hope to then compare the mortality rates and ecology of small carnivores living inside and outside the protected area.

b) Have you used any additional methods/strategies to meet your research objectives? If so, please describe them.

During the spring or 2006 (Team III), we capitalized on the presence of our experienced Earthwatch team by engaging them in more activities associated with some of the other (non-

argali) projects we are conducting in Ikh Nart. In particular, volunteers assisted with line transect surveys for lizards for the first time to estimate abundance. We also used volunteers to help track hedgehogs and small mammals at night for the first time (on a voluntary basis). Finally, we used volunteers more intensively in our cinereous vulture project, as June is an excellent time to assist with nest monitoring and collecting data on nestling development.

c) How will you develop your research in the coming field season?

Our upcoming year will be abbreviated (only 1 autumn teams), as we will switch to a calendar year schedule (pending approval of our fourth year). Both our autumn teams will focus primarily on argali and ibex captures, using the same basic procedures we have been using in past years. To facilitate training for this work, we developed a PowerPoint presentation with still slides and video clips that we hope will increase the effectiveness of our work. Of course, to the extent possible, we will utilize volunteers in other tasks as well. The only new task may be radio tracking animals (argali, ibex, and small carnivores) continuously using fixed stations. We will use 3 eight hour shifts to constantly monitor animals, taking bearings from at least 2 fixed stations every 10 minutes to get more data on micro-movements. Our capture success rate will determine whether or not we will have time to devote to this work.

Rich Reading will be absent during the vast majority of Team II's stay in Mongolia. This intentional absence will test the ability of the rest of our crew to manage an Earthwatch team on its own. There will be at least 1 American present the entire stay, as well as PI Ganchimeg Wingard and co-PI Sukhiin Amagalanbaatar. In future years, we hope to vary the presence of PIs in the field (i.e., not all PIs will be present with all teams) and this will serve as a good "test" case. We do not envision any difficulties, as by now our team is well experienced, but we will maintain contact with the team using the satellite phone during this period if necessary.

Educational Opportunities

a) Does your project directly or indirectly involve the following groups in your research topic?

- **Local communities**
- **Students**
- **Early career scientists**
- **Other groups**

Our project works with local people, students, early career scientists, and researchers with the Mongolian Academy of Sciences and Mongolian non-governmental organizations (NGOs). We have established a very good relationship with the local government (the Soum – like a county). That relationship has resulted in 1) a cooperative partnership to monitor the reserve with a ranger, whose salary and training we provide, 2) improved law enforcement, especially with respect to poaching and illegal mining, as the Soum responds rapidly to information we provide them about illicit activities, and 3) the development of a protected areas management project funded by the Open Forum of Mongolia, Trust for Mutual Understanding, Denver Zoological Foundation, and other cooperators. The latter project includes components on law enforcement (we now have 5 new rangers), natural resources management, ecotourism, and education. We established a new office in the Soum Center (like a county seat) and have hired several local people. This work will continue in close cooperation with our research.

We have developed good relationships with most of the local, nomadic pastoralists. We employ several of these pastoralists as horseback or motorcycle riders to assist with our net driving operations. They thoroughly enjoy this experience and also earn additional income. In addition, we have helped hire and equip several new rangers from among the local pastoralists. Finally, we have developed strong friendships whereby local nomads will often store equipment and even charge equipment batteries for us. In return, we often provide transportation, mechanical assistance, and similar support for them. Most local people are happy that we have stemmed poaching and are working to do the same with illegal mining (both of which are mostly conducted by people from towns and cities) in the region, as they enjoy watching wildlife.

As described throughout this report, we work with a large number of Mongolian students from several different universities. This work provides students with on-the-ground training on real projects. In some cases, students are prepared well for future employment, while in other cases students realize that fieldwork is not enjoyable to them (also an important outcome). Since student involvement is covered in greater detail elsewhere, we will not expand on this here.

We employ both early career scientists and established scientists at the Mongolian Academy of Sciences and local NGOs (see list below). This provides career development in both cases (you are never too old to learn, as I am constantly finding out!). Tenure with our project varies considerably. Some scientists have been with us from the beginning, others have worked a couple of years, others just a season, and some come down for just for a few weeks or days to learn about our work and how we conduct it. We do not maintain detailed numbers, but we have influenced dozens of research biologists from Mongolia, the U.S., Germany, Russia, and Britain.

b) Please tell us the ways your research helps these groups better understand the conservation of a sustainable environment (see the UNESCO definition above).

In addition to learning about our field conservation efforts, we are committed to developing sustainable practices that permit the co-existent of local people and the natural world upon which they depend. Mongolian pastoralists have inhabited Ikh Nart with local wildlife for millennia. That is perhaps the best definition of sustainable practice. New pressures, including a rising human population and greater demands for wildlife products from China and other Asian countries (in particular) and natural resources by both Western nations and new Asian "tiger" economies, threaten to disrupt this balance. Many, if not most, local people recognize these new threats, as do several of the students and most of our collaborating scientists. Nevertheless, most of the local people, students, and our collaborators do not have as good an understanding of how their activities contribute to these problems. Through our project we hope to better educate all of these stakeholder groups, as well as demonstrate how we can maintain a sustainable co-existence.

This effort has developed in a protected areas management project that is striving for sustainability in both local livelihoods (pastoralists have the legal right for at least some, limited grazing in Nature Reserves in Mongolia) and the nature of the region. This likely will require greater management of human uses in the area. To pay for that management, we hope to develop eco-tourism to fund sustainable park management. As we have elaborated on elsewhere in this report, we have already garnered external funding to begin this process and much progress has been made over the past 6 months, including 1) hiring 5 more rangshing a eco-tourism guidebook for Ikh Nart, 4) creating an Ikh Nart Conservation Committee that includes all local

stakeholders (including pastoralists and mining interests), 5) establishing a protected areas office in the local Soum, and 6) initiating an environmental education program.

In addition to these activities, our project provides much needed income for the region; something greatly appreciated by the Soum governor and local people. And, because of the international attention and especially the visitation of Earthwatch volunteers, all of these groups are beginning to recognize how special and internationally significant Ikh Nart is. This generates a sense of pride and desire to maintain a healthy environment.

c) Has your project helped lead to the completion of Masters' theses, or other educational research findings?

Our project has benefited from the involvement of 1 American and several Mongolian students. The majority of students (n = 7) participated as undergraduates, using this opportunity to learn about field work and produce their undergraduate honors theses at the Mongolian National University and Mongolian Pedagogical University. An additional 3 Mongolian students are pursuing Master's degrees at the Mongolian National University while working on our project. One of the PIs, Ganchimeg Wingard, completed her Master's of Science degree at the University of Montana (PI Rich Reading served on her committee) and much of the work we are doing was incorporated into her thesis. Another Mongolian graduate student, Orgiltuya, completed her Master's degree at the University of Colorado-Denver in June 2006 working on management of Ikh Nart as her professional project. She has also been working as a DZF intern with Rich Reading and is required to continue her professional development for 1 more year. Co-PI Sukh Amgalanbaatar is working toward his Ph.D. at the Mongolian National University using much of the data collected by this project. He hopes to defend his dissertation in late 2006. American researcher, Jed Murdoch is working toward his Ph.D. at Oxford University in England studying the ecology and relationships between the small carnivores at Ikh Nart (Rich Reading serves on his committee) and will use data collected by Earthwatch volunteers for part of his degree. We envision additional students working with us in future years as well.

Partnerships

a) List partnerships or collaborations with other organizations that you have developed or maintained in the past season.

Argali Wildlife Research Center (AWRC)
Colorado College (CC)
Denver Zoological Foundation
Mongolian Academy of Sciences (MAS)
Mongolian Conservation Cooperative (MCC)
Mongolian National University (MNU)
Mongolian Pedagogical University (MPU)
Oxford University (OU)
University of Colorado-Denver (UCD)
University of Montana (UM)
White Buffalo, Inc. (WB)

b) How have these organizations contributed to your project objectives?

AWRC: Assists with publicizing our work in Mongolia; involved in developing the national management plan for the species; and active with Ikh Nart management activities.
CC: Provides financial assistance, expertise, and students.
DZF: Provides logistical and administrative support; researchers and expertise; equipment; and financial support.

MAS: Provides logistical and administrative support; researchers and expertise; financial support; and office space.
MCC: Provides logistical and administrative support and financial support.
MNU & MPU: Provide students.
OU: Provides a student researcher with expertise; advice; and financial support.
UCD: Provides a graduate student working on Ikh Nart management and expertise in GIS.
UM: Provides a student researcher with expertise and advice.
WB: Provides researchers; expertise; and financial support.

c) How do you anticipate these organizations will use the results generated by the project, and in what timeframes?

AWRC: They will use the results to produce additional public relations pieces (newspaper stories, T.V., and nature shows in Mongolia) and to develop the national and Ikh Nart conservation management plans.
CC: They will use the results to draw in additional students who want international experience (although 2006 will be their last year of involvement).
DZF & MCC: They will use the results to publicize what they are doing for conservation, for fund raising, and in scientific and popular publications and presentations.
MAS: They will publish the results.
MNU & MPU: They will use the results to draw in additional students and provide real-world, practical training and experience for their students.
OU, UCD, & UM: They will use the results to draw in additional students who want international experience and in scientific and popular publications and presentations.
WB: They will use the results to publicize what they are doing for conservation and in scientific and popular publications and presentations.

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