Mongolian Argali Population Trend 2002-2009

With reference to sustainable-use management

Altai argali, Mongolia, November 2009--Mike Frisina photo.

by

Michael R. Frisina, Baigalmaa Purevsuren, and R. Margaret Frisina

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Gobi argali, Mongolia, November 2009, Mike Frisina photo.

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ABSTRACT

In November 2009 we conducted a country-wide survey for Mongolian argali. The same protocols used in 2002 for a similar survey were repeated in 2009 allowing for the establishment of trend. The November 2009 population estimate of 26,155 is 29.3% higher than 20,226 argali estimated in 2002. A comparison of the 2002 and 2009 population estimates indicates that argali population trend is up or at least stable country-wide. Legal trophy hunting does not appear to be limiting argali populations. The data indicate poaching does not appear to be limiting argali populations on a national scale. Mongolia's climate and highly variable weather patterns appear to be the immediate limiting factors regulating argali populations. It is important that argali population trend be monitored every 3 to 5 years using the protocols reported here. The trend information reported here is the only information of its type, but should be considered an initial effort. The more trend surveys that are conducted the less uncertainty there will be concerning the status of Mongolian argali.

INTRODUCTION

Argali (*Ovis ammon*) wild sheep occur throughout central Asia, including Mongolia's steppe, undulating desert, and rugged mountainous landscapes (Valdez 1982, Geist 1991, Mitchell and Frisina 2007). Shackleton and Lovari (1997) and Feng et al. (2009) are among those who recognize two subspecies of argali as occurring in Mongolia: the Altai argali (*O. a. ammon*) of western Mongolia, and the Gobi argali (*O. a. darwini*) of the Gobi Desert in southern Mongolia. Both are listed as rare by the Mongolian Government (MNEM 1997),

are included in the United States Fish and Wildlife Service National List of Endangered and Threatened Wildlife and Plants (USFWS 2010), and listed as vulnerable and endangered by the IUCN (2010) and in Appendix II of CITES (CITES 2010).

Mongolia, a central Asian landlocked country, encompasses about 16,560,000 sq. km of which about 25% is potential argali habitat (ASM 1990). Limited international sport hunting has been permitted since 1968. The current Mongolian Law on hunting, established in 1995 and administered by the Mongolian Ministry for Nature, Environment and Tourism, regulates the commercial use of wildlife. Hunting fees, regulated by Mongolian Hunting Law, are an important source of foreign currency in a badly depressed economy (MNEM 1995, Wingard and Prevdolgor 2001, Asia Foundation 2009).

Argali populations are believed to have declined in Mongolia and throughout central Asia during the last century (Harper 1945, Mallon 1985, Heptner et al. 1989, Mallon et al. 1997, Reading et al. 1997). Specific and comparable country-wide population status and trend information for this species, a fundamental requirement for conservation (Wegge 1997), is lacking. Our paper provides a population estimate for Mongolia's argali as well as population trend since 2002. While a number of estimates have been published (Amgalanbaatar et al. 2001), Frisina et al. (2007) reported the first population estimate for Mongolian argali using defined repeatable protocols. The survey reported by Frisina et al. (2007) was conducted during November 2002; here we report on a comparable survey conducted during November 2009 using Frisina et al.'s (2007) protocols. Use of

the same methods for both surveys enables us to discuss population trend. We also discuss our findings as they relate to sustainable of argali.

STUDY AREA

Our study area encompassed the entire Mongolian argali range, including the 2,299 sq. km of argali habitat in which the population surveys were conducted (Fig. 1). Frisina et al. (2007) surveyed 2,435 sq. km of argali habitat in 2002.
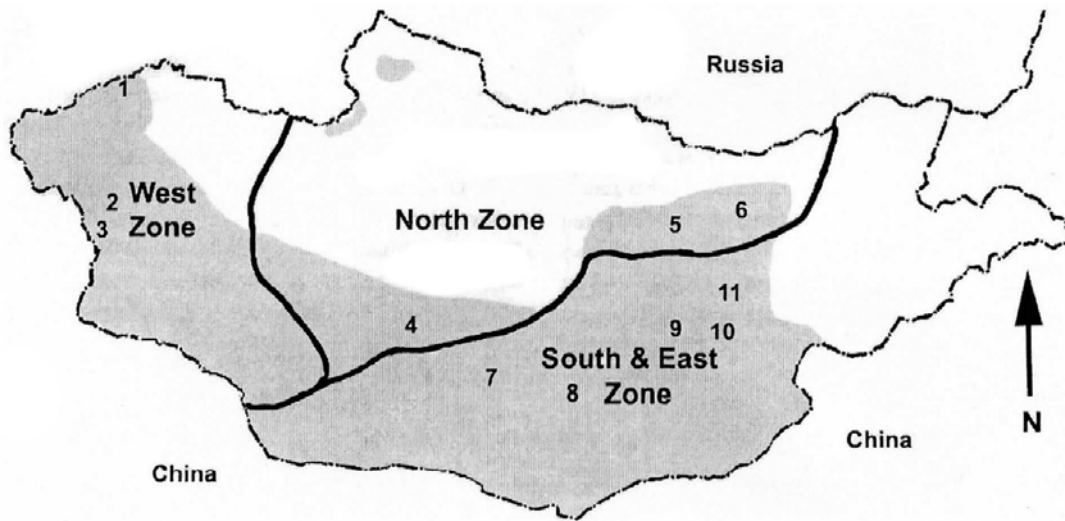

Fig. 1. A schematic of Mongolia showing observation zones, survey site locations by number, and general area in which the argali distribution is scattered (shaded gray). Survey sites areas follows: 1 = Buraat, 2 = Boorg Nuruu, 3 = Ahuunt, 4 = Ushgug, 5 = Ulanchulu, 6 = Darkhan, 7 = Togrug, 8 = Yurlug, 9 = Argiin Khad, 10 = Ik Nart, 11 = Choir. (From Frisina et al. 2007).

Except for site 1, the same sites as Frisina et al. (2007) (Fig. 1) were surveyed. Site 1 was not accessible due to deep snow.

The argali range in Mongolia is diverse, ranging from alpine communities in the Altai Mountains in western Mongolia, to steppe and desert communities in central and eastern Mongolia. Plant communities in Mongolia are diverse and typical of the central Asian plateau (Hilbig 1995, Guinin et al. 1999). Several of our survey sites were previously described in detail (Frisina and Boldbaatar

1998, Frisina and Gombosuren 1999, Frisina and Gombsuren 2000, Frisina et al. 2004, Frisina et al. 2007).

Mongolia's climate is characterized by long, cold winters and short, humid summers. January is the coldest month with temperatures of -40° C or colder in contrast to >38° C during summer. Rainfall is highly variable, averaging 46 cm in the mountains and 10 cm in the Gobi Desert.

METHODS

Wild sheep were systematically surveyed at 10 sites within Mongolia's occupied argali range (Fig 1.). The total area surveyed was 2,299 sq. km or about 7% of Mongolia's occupied (34,873 sq. km) argali range. Frisina et al. (2007) reported surveying about 7% of Mongolia's occupied argali range in 2002.

Occupied argali range was determined by field sightings during country-wide ground surveys conducted in 1993, 1997, 1998, 1999, 2001, 2002, and 2009. During these years we also interviewed local herders, hunting guides, game guards, and wildlife biologists about argali distribution. Only those areas considered to be well established ranges (habitually used by argali--especially during the rut) were included. Many areas where argali are only occasionally observed, or may occur only in very small numbers, were excluded. Our argali estimate emphasizes the fall range used by wild sheep during the rutting season, the time of year they are most concentrated and readily observed for census purposes. This is why our estimated area of range (34,873 sq. km) is smaller than that reported by some authors. Argali surveys conducted during summer or spring usually result in a relatively lower number of animals observed due to their

habit of dispersing and segregating by sex. A selection of sites where hunting

has occurred in recent years (sites 2, 3, 4, 6, 7, 8) were included in the survey

(Fig. 1). Wegge (1997) emphasized the importance of surveying hunted

populations.

Survey sites were chosen based on accessibility during November, location

within Mongolia's sheep range, and availability of data collected during earlier

surveys for trend evaluation (i.e. Frisina et al. 2007).

Surveys were conducted on foot following ridgeline travel routes and from high

observation points. Sheep were also observed by jeep during travel between

observation points. Drop off points, base camp locations, and observation points

were documented using GPS for future surveys. One or 2 observation groups of

2 to 4 observers went into the field each day. Surveys were conducted November

7-24, 2009 with 12 field days observing argali; the remaining days were spent

traveling between survey sites. Each of the 10 sites was surveyed systematically

and as rapidly as conditions permitted to minimize double counting. When the

possibility existed that the same animals were observed more than once, only the

first observation was recorded. Location and altitude at sheep sightings were

recorded using GPS. Site 1, which was accessible during previous surveys, was

not during 2009. A snow storm on November 6 left the survey area under 1 m of

snow.

Observed argali densities were determined by dividing the number of animals

seen by the size of the survey area. Each sheep observed was classified into

one of the following categories: adult ewe, lamb, ram, or unclassified. Rams were

further classified into age classes based on horn length (Geist 1966, Fedosenko et al. 1995) as follows: Class I (1-2 years old), Class II (3-4 years old), Class III (5-6 years old), and Class IV (>6 years old).

An estimate of argali population size was made by multiplying the average observed density of each zone by that zone's size (Fig. 1, Table 1). To adjust for size differences between zones, the number of argali estimated for each of the 3 zones was summed and divided by 34,873 sq. km (the total amount of occupied argali habitat in Mongolia), which provided an adjusted density. The adjusted density was then multiplied by 34,873 sq. km for a November 2009 population estimate.

Table 1. Summary of observed argali (*Ovis ammon*) density zonewise, November 2002 & 2009.

Zone[1]	Zone Size (sq. km)	Avg. Density[2]	2002 Range	#Survey Sites	Avg. Density[2]	2009 Range	# Survey Sites
West	25,046	.11	.02-.17	3	.35	.15-.54	2
North	2,646	.51	.47-0.8	3	.92	.84-1,05	3
South & East	7,181	2.24	.32-5.78	5	2.06	.69-3.19	5
Totals	34,873	1.19	.02-5.78	11	1.38	.15-3.19	10

[1] See Fig. 1.
[2] Number of argali observed per sq. km

Uncertainty is an inevitable factor in the census of free-ranging ungulate populations. We allowed for uncertainty through a conservative approach; our census emphasized fall-winter range areas where argali concentrate during the rut. These areas can de depended upon as argali concentration areas most years, far more efficient than randomly surveying areas where argali normally do not concentrate for the rut. We also limited the overall argali habitat used in our calculations (34,873 sq. km) to well-documented fall-winter range areas.

Our analysis emphasizes monitoring population status through trend based on several different important population parameters including lambs:100 ewes, proportion of rams by age class, and observed densities by area, etc. (Krausman 2002, Boyd et al. 1986). We provide a population estimate; however because of the inherent uncertainty in census efforts, regardless of the approach employed, the most accurate way to assess population status is by monitoring trend. In reality we will never know exactly how many argali there are, but we can monitor trend, which provides a "picture" of population change.

Monitoring survival of young is particularly important because the inability of populations to maintain themselves is often a result of failure of the young-of-the-year to survive (Allen 1962). Monitoring trend in ram age structure and survival is obviously important for species like Mongolian argali when sustainable-use trophy hunting is the emphasis of management.

We chose our approach over those that rely on extensive use of mathematics. Thomas and Verner (1986) warned that "*Oversophisticated mathematics may shed great darkness on the subject."* Our approach is consistent with Ockham's Razor (Galilean Library 2010)--the simplest explanation or strategy tends to be the best one. In the end dependence upon mathematics does little more than document the uncertainty that we already know exists; it does not significantly reduce or eliminate that uncertainty. Adjusting data collection to fit a statistical approach may hamper the observers' ability to accurately classify animals, especially when the observer is limited to predetermined observation points rather than being allowed to move freely throughout the defined census area.

With freedom of movement one is able to get closer to the animals and can therefore more accurately classify them.

It is important to use survey protocols that fit with the local or country situation. In other words, "*Biologists still need to design studies based on local needs, while taking advantage of the experiences of others.*" (Thomas and Verner 1986).

RESULTS AND DISCUSSION

A total of 1,694 argali were observed during the survey; 1,576 were classified by sex and age (Appendix A). Ewes comprised 46% of argali classified, lambs 27%, and rams 27%.

During the November 2009 survey 726 ewes and 433 lambs were counted, yielding a ratio of 60 lambs:100 ewes which is within the range of 10 to 63 lambs:100 ewes reported for fall surveys by other authors (Frisina and Boldbaatar 1998; Frisina and Gombosuren 1999; Frisina et al. 2004, Frisina et al. 2007). The 60 lambs:100 ewes observed during this survey is higher than the 29 lambs:100 ewes observed during the 2002 survey (Frisina et al. 2007)

The 27% rams observed during the 2009 survey is within the range of 17% to 37% observed for five fall surveys (Frisina and Gombosuren 1999; Frisina and Onon 2000, Frisina et al. 2007). As with the improved ewe: lamb ratio, the higher proportion of rams in 2009 is likely a result of relatively less winter mortality and improved habitat conditions during the summers and winters for at least some of the years from 2003 through 2008. Drawing from published reports, Frisina et al. (2007) summarized climatic conditions immediately preceding 2002 as follows:

The 1999-2000 winter was the most severe in 30 years and was preceded the previous summer by the most severe drought in 60 years (Tsend-Ayushin 2000); Horekens and Missri 2002). During the 3-year period of 1999-2001, one-third of Mongolia's domestic livestock (11 million) died due to severe prolonged climatic conditions.

Severe climatic conditions for a 3-year period immediately prior to the 2002 survey are likely the reason for relatively low age ratios.

Prior to the 2009 survey indications were that climatic conditions were much improved compared to prior to the 2002 survey (Bayarmaa 2009). The 2008 summer was relatively rainy with good growing conditions and livestock losses were minimal (Bayarmaa 2009).

Class IV comprised the largest male segment (30.1%), followed by Class III (25%), Class I (25.2%), and Class II (19.7%). However, the 30.1% obseved during our survey is lower than the range of 54.5% to 75% reported by Frisina and Gombosuren (1999) and Frisina and Onon (2000) for five previous fall surveys in Mongolia. Frisina et al. (2007) observed 45% Class IV rams during the 2002 survey. The lower percentage of Class IV rams observed during this survey is partially a result of the higher percentage of Class I rams observed in 2009 (25.2%) compared to 2002 (10%). The higher percentage of Class I rams reported for this survey indicates improved over-winter survival of lambs compared to 2002. The lower percentage of Class IV rams observed in 2009 compared to 2002 may also be a result of winter losses resulting from severe winter and summer drought prior to the 2002 survey (see page 10 and Frisina et

al. 2007). Surviving ram lambs born in 2003 were just entering the Class IV category when the 2009 survey was conducted.

Population Size

For purposes of determining population size, Mongolia was divided into the 3 zones described by Frisina et al. (2007) (Fig. 1, Table 1). These divisions were based on differences in topography, access, and distribution of argali that affect ones ability to observe argali while conducting ground surveys. The West Zone includes the steep, rugged Altai Mountains, where argali normally inhabit elevations as high as 3,600+ m. The Altai argali habitat is a vast, open landscape of interconnecting mountain ridges over which argali are widely dispersed. Much of the Altai sheep range can only be accessed by foot and/or horseback; jeep access is very limited. The Altai Mountains have very little tree cover enabling argali to spot potential predators from long distances. Thus, argali survey efficiency is the most difficult in this zone, partially explaining why the lowest density (.35 per sq. km) occurred in the Western Zone. Compared to the Western Zone, the Northern zone is at lower elevation; the topography is less severe, and jeep access is less restricted. The Northern Zone includes the Ovorkhangai Mountains and is intermediate between Western Zone and the South & East Zone for ability to survey argali (.92 per sq. km). The South and East Zone includes the vast Gobi Desert; it is the lowest in elevation, is the least severe in topography, and is highly accessible by jeep. Argali tend to concentrate within rocky areas or small mountain ranges within the desert during fall, and they tend

to be more concentrated, making them more observable than within the other zones (2.06 per sq. km).

The adjusted density, allowing for differences in zone size was .75 argali per sq. km. The adjusted density was used to calculate the November 2009 population estimate of 26,155 argali for Mongolia. This estimate is conservative; it only includes those specific areas determined to be well-established argali ranges. Areas of marginal habitat incidentally used by argali were excluded. The numbers of argali counted per unit of area were assumed to be the total number inhabiting the area, although probably not all argali within the survey area were observed. Even aerial surveys underestimate population density (Pollock and Kendall 1987). When conducting fall surveys utilizing a helicopter--the most accurate census method--one can only expect to observe 20 to 50% of the population (Remington and Welsh 1989).

Population Trend

The 2009 population estimate of 26,155 argali is 29.3% higher than the Frisina et al. (2007) 2002 population estimate of 20,226 argali. The same protocols were used in conducting the 2002 and 2009 surveys making the population estimates appropriate for establishing population trend. While other population estimates have been made for Mongolia, the use of differing or undefined survey protocols render them unsuitable for establishing trend (Frisina et al. 2007). A comparison of the November 2002 and 2009 population estimates indicates that country-wide argali population trend is likely up or at least stable.

Average density data (Table 1) indicate population trend is up in the West and North Zones and stable in the South & East Zone compared to 2002.

CONCLUSIONS AND RECOMMENDATIONS

The 2009 population estimate of 26,155 argali is 29.3% higher than the Frisina et al. (2007) 2002 population estimate of 20,226 argali. The proportion of lambs observed (60 lambs:100 ewes) was higher than the 29 lambs:100 ewes observed during the 2002 survey (Frisina et al. 2007). Frisina et al. (2010) reported relatively good survival of lambs (47 lambs:100 ewes) over the 2008-2009 winter. These data indicated improved lamb survival in 2008 and 2009 compared to 2002.

The increase in Class I rams observed (10% in 2002 compared to 25.2% in 2009) indicates improved over-winter survival of lambs occurred during the 2008-2009 winter compared to the 2001-2002 winter. The Class I rams observed during this survey were born in the spring of 2008. The relative abundance of older rams in the population (Class III and Class IV) indicates trophy hunting has not been excessive and poaching is not limiting argali populations on a national scale. From 2002 through 2009 an average of 73 argali hunting licenses were issued each year as part of Mongolia's sustainable-use hunting program (range 60-80) (Baasanhu Jantzen personal communication). This number of trophy hunting licenses does not appear to be limiting argali populations; mortality associated with trophy hunting is more compensatory than additive. In other words, mortality resulting from the legal hunting program is likely less than mortality that occurs naturally. For the mortality to be additive the number of

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harvested argali would have to exceed the number of trophy rams that die naturally (Allen 1962, Krausman 2002). Legal argali harvest levels from 2002 to present are consistent with the Precautionary Principle (Cooney 2004, Cooney and Dickson 2005).

   To accurately monitor population trend and maintain sustainable harvest quotas it is important that argali population trend be monitored by repeating the protocols established by this survey at least once every 3 to 5 years. Less intensive late-winter or spring surveys to monitor over-winter survival should be considered during years when winter conditions are particularly severe. Conducting frequent population assessment is the best way to address Mongolia's highly variable weather (Jacoby et. al 2003). While habitat degradation due to anthropogenic causes is a matter for long term concern, in the short term Mongolia's climate and highly variable weather patterns appear to be the immediate limiting factors regulating argali numbers. Coulson et al. (2000) found variation in fecundity rates of ungulate populations is associated with density and winter weather. Additionally Mongolian law requires the government to conduct a game species survey every 4 years (Breitenmoser et al. 2006).

    The trend information reported here is the only information of its type available for Mongolian argali, but should only be considered an initial effort. The more trend surveys that are conducted the less uncertainty there will be concerning the status of Mongolian argali.

ACKNOWLEDGEMENTS

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AUTHORS

Michael R. Frisina, PhD., CWB, Most Distinguished Mongolian Conservationist, Adjunct Professor of Range Sciences Montana State University, Executive Director August L. Hormay Wildlands Institute, Inc. P. O. Box 4712, Butte, Montana USA 59702. habitat@bresnan.net

Baigalmaa Purevsuren, M. S. Range Sciences. Consultant. Ulaanbaatar Mongolia.

R. Margaret Frisina, M. H. S., Member Rocky Mountain Outdoor Writers and Photographers. Naturalist. Butte, Montana USA

Appendix A.

Number of argali and population structure as observed by survey site, November 2009.

Site[1]	Total	CLASSIFICATION				RAM CLASSIFICATION				
		Female	Lamb	Ram	Unclassified	Class I (1-2yrs)	Class II (3-4 yrs)	Class III (5-6 yrs)	Class IV (>6 yrs	Unclassified Rams
1.Buraat	Unable to survey this site because of fresh snow approximately 1 meter in depth.									
2.Boorg Nuru	113	37	30	46	0	6	13	13	14	0
3.Ahuunt	220	73	43	104	0	30	26	30	13	5
4.Ushgug	439	203	130	102	4	36	13	28	25	0
5.Ulanchulu	67	34	13	12	8	1	2	2	7	0
6. Darkhan	138	81	30	24	3	2	1	5	16	0
7. Togrug	15	7	6	2	0	0	1	1	0	0
8. Yurlug	101	45	26	20	10	5	5	4	6	0
9. Argiin Khad	79	36	22	10	11	3	2	3	2	0
10. Ik Nart	464	185	117	80	82	16	17	17	30	0
11. Choir	58	25	16	17	0	5	1	0	11	0
Totals	**1,694**	**726**	**433**	**417**	**118**	**104**	**81**	**103**	**124**	**5**

[1]See Fig. 1.