Simultaneous Point Count for Steppe Ungulates in Great Gobi B SPA in October 2015 – Preliminary Results

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Photo: P. Kaczensky

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Summary

The second simultaneous point count of steppe ungulates in Great Gobi B Strictly Protected Area was conducted from 29 September - 3 October 2015, using a total of 79 observation points with single observers recruited from four protected areas in western Mongolia: Great Gobi B SPA, Great Gobi A SPA, Munkhairhan PA, Myngan Ugalzat PA.

Khulan and gazelles were counted at 6 time intervals at 19:00 the day of arrival at the observation point, and the next day at 8:00, 10:00, 12:00, 14:00, and 16:00. Over all six survey times, observers counted a total of 7,267 khulan in 274 groups and 7,239 gazelles in 272 groups. For khulan, the number of groups observed decreased and mean group size increased from 8:00 to 16:00. For gazelles, detectability seemed by far the best in the morning at 8:00 and 10:00.

Pooled estimate over all six time intervals suggest a khulan population of 9,337 (95% CI = 5,337-16,334) in the 11,027 km^2 study area. For gazelles the 08:00 and 10:00 count seemed the most accurate and the mean over both times suggests a gazelle population of 13,531 (95% CI = 8.957-20,441). Both estimates are considerably higher than in 2010 and suggest a population increase in khulan and gazelles since 2010. A third survey is planned for late summer 2018 after which we plan to re-analyze all three surveys together.

Steppe ungulate monitoring Great Gobi B SPA

Wildlife populations within protected areas are monitored to assess whether protected area management is able to achieve their management / conservation goals. In Great Gobi B SPA one focus is the conservation and recovery of endangered steppe ungulates, khulan (*Equus hemionus*), Przewalski's horse (*Equus ferus przewalskii*), and goitered gazelle (*Gazella subgutturosa*). Przewalski's horses have been reintroduced since 1992 and individual identification and range residency allow rangers to closely monitor population development and to obtain total counts of all individuals. Khulan and gazelle, on the other hand, roam widely, cannot be individually identified, and populations are much larger making total counts impossible. Bi-monthly wildlife counts along line transects using a distance sampling approach (Buckland et al. 2001, Thomas et al. 2010) have proven important to monitor overall distribution of the species and group size dynamics, but were unsuitable to provide robust population estimates (Kaczensky et al. 2015, Nandintsetseg et al. 2016).

To overcome the shortcomings of the line transect approach, we conducted a simultaneous distance sampling survey using point transects in the Great Gobi B Strictly Protected Area (SPA) in 2010; which we believe provided the first robust baseline population estimate of khulan and gazelle in Great Gobi B SPA. This first point count was conducted from 5-8 August 2010, using a total of 50 observation points, and double observers recruited from park rangers, university students & instructors, and local herders. Resulting population estimates 5,671 (95% CI = 3,611–8,907) for khulan and 5,909 (95% CI = 3,762–9,279) for goitered gazelle within the 11,027 km^2 study area (Ransom et al. 2012). This first count was conducted after the 2009/2010 dzud winter which resulted in a major die-off in local livestock and the small Przewalski's horse population. Khulan, on the other hand, largely moved out of the area most affected by the dzud and seemed to have suffered little mortality (Kaczensky et al. 2011). The impact on gazelles is less well documented, but the small number of carcasses found also suggests gazelles may have moved away like khulan. No quantitative data on reproductive rates exists for khulan and gazelle, but the overall impression in summer 2010 was that khulan foals and gazelles fawns were rare (O. Ganbaatar and N. Altansukh pers. obs.).

Recommendations from the 2010 point count were:

- Repeat the surveys at least every 5 years to obtain population trend data
- Increase the number of observation points to increase the number of observations, but at the same time:
    - Reduce the survey radius to 3000m to allow more rapid scans and avoid fatigue
    - Use a single observer approach with professional rangers to reduce inter-observer variability and logistical constraints resulting from a large number of observers needed for the double observer approach
- Refine intervals used to bin distance measurements of observed animal groups to allow for more flexibility in the analysis when fitting the detection function

Simultaneous point count in Great Gobi B in October 2015

The second, improved simultaneous point count was conducted from 29 September - 3 October 2015, using a total of 79 observation points and single observers recruited from four protected areas in western Mongolia: Great Gobi B SPA, Great Gobi A SPA, Munkhairhan PA, Myngan Ugalzat PA, plus four local people from the nearby villages of Bij and Bugat (Table 1). The timetable included a full day of training (Fig. 1) and four days of surveys, plus a day of traveling to and from Great Gobi B SPA (Table 2).

Table 1: Participants of the second simultaneous point count of steppe ungulates in Great Gobi B SPA in 2015.

Great Gobi B	***Great Gobi A***	***Munkhairhan***	***Myngan Ugalzat***	***Other***
Altansukh Nanjid	Batnasan L	Amgalanbaatar T	Baasandorj Ch	***Bij bag***
Amgalan Yanjmaa	Batsukh Yu	Ariunbat D	Baasandorj U	Batbuyan
Baast Zentger	Davaanym Ts	Batmandah	Barsuren B	Lhagva Lhachin
Batsuuri Borhuu	Dorjsuren B	Batsukh T	Galbadrakh Ch	***Bugat sum***
Chinbat Belegt	Dovchindorj	Baynmunkh G	Gantumur Z	Bunchindagva Altangerel
Ganbaatar Oyunsaikhan	Gansukh P	Baynmunkh O	Munhzul B	Retsendorj Balj
Hatanbaatar Togtoh	Nasanjargal B	Birvaa B	Narmandah	***FIWI - Vienna***
Myagmarjav Baadai	Nymbayar Yanjin	Dalkhaa S	Purevdorj	Petra Kaczensky
Nisehhuu Gaanjuur	Purevdorj N	Lhagvadorj T	Tumurhuyag D	

Table 2: Timetable of the second simultaneous point count of steppe ungulates in Great Gobi B SPA in 2015.

Date	**Activities**
28-Sep-15	Arrival participants at the Takhin Tal headquarter of Great Gobi B SPA
29-Sep-15	Training
30-Sep-15	Training distance estimates in the field. Transfer to observation points in the east part & evening count at 19:00
1-Oct-15	Main count day "East" with counts at 8:00, 10:00, 12:00, 14:00, 16:00 & transfer to Takhi Us supply point
2-Oct-15	Transfer to observation points in the west part & evening count at 19:00
3-Oct-15	Main count day "West" with counts at 8:00, 10:00, 12:00, 14:00, 16:00 & transfer to Takhi Us supply point
4-Oct-15	Departure participants

Fig. 1: Training in theory and practical application with O. Ganbaatar.

Upon arrival of participants, weather conditions deteriorated rapidly with temperatures plummeting, rain turning into snow and high winds. During the training day it snowed, but in the evening high winds finally drove the clouds away, but also resulted in a very cold night (reaching -12°C). After this cold spell, temperatures again rose and the following days saw the return of the autumn weather with daily highs of 12-14°C and night lows of just below freezing. Days were sunny and clear with only moderate winds and thus provided near ideal observation conditions (Fig. 2).

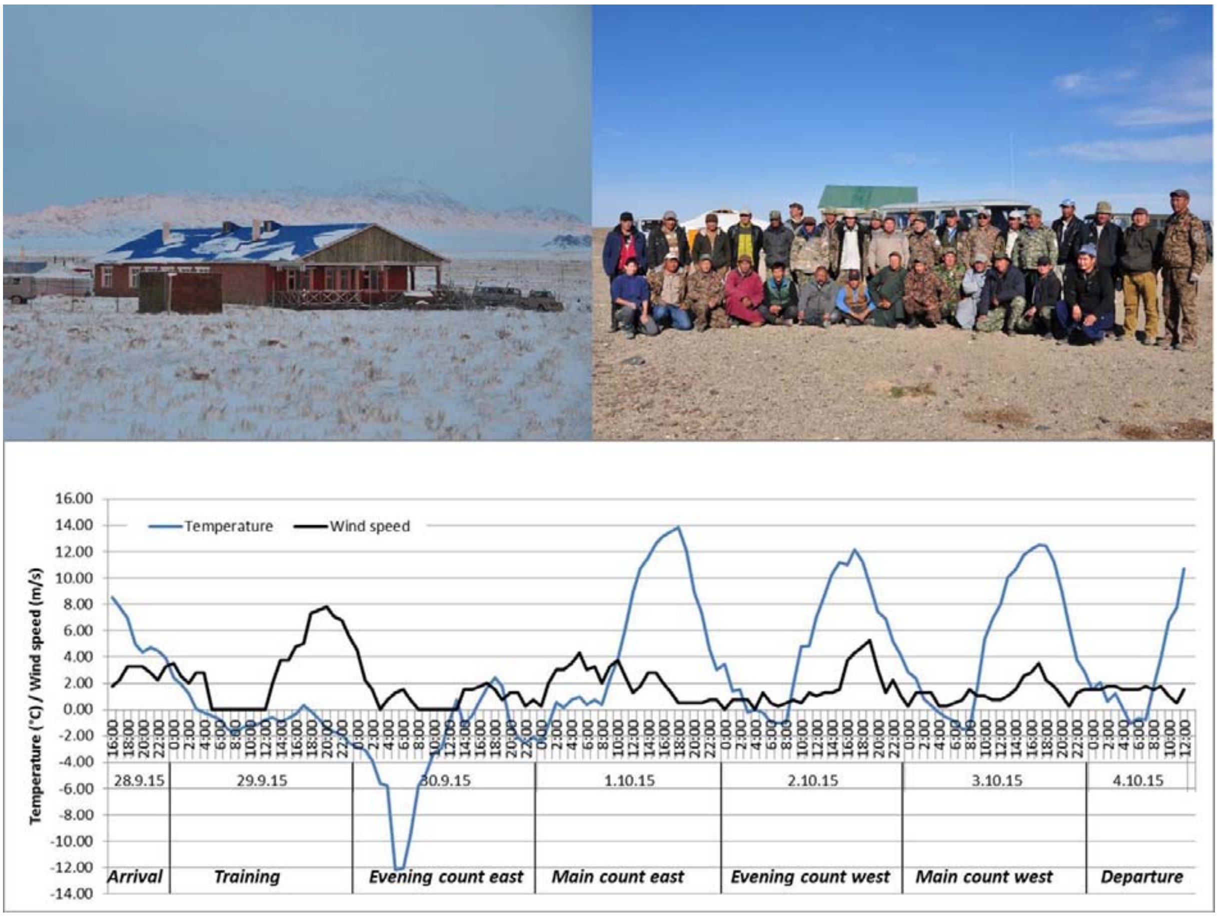

Fig. 2: Weather conditions: left – Takhin Tal headquarter on the evening of 29.09.2025, right: Main count day "West" on the morning of 02.10.2015.

Of the selected 80 points, we were able to reach 79, which were as evenly distributed throughout the SPA as possible. We tried to re-use as many of the 2010 survey points as possible, discarding those that had proven difficult (e.g. limited visibility, difficult to reach, difficult to climb), but had to shift several others to accommodate the additional 29 observation points and still allow a more or less even coverage of the study area (Fig. 3). The total study area was again estimated at 11,027 km^2.

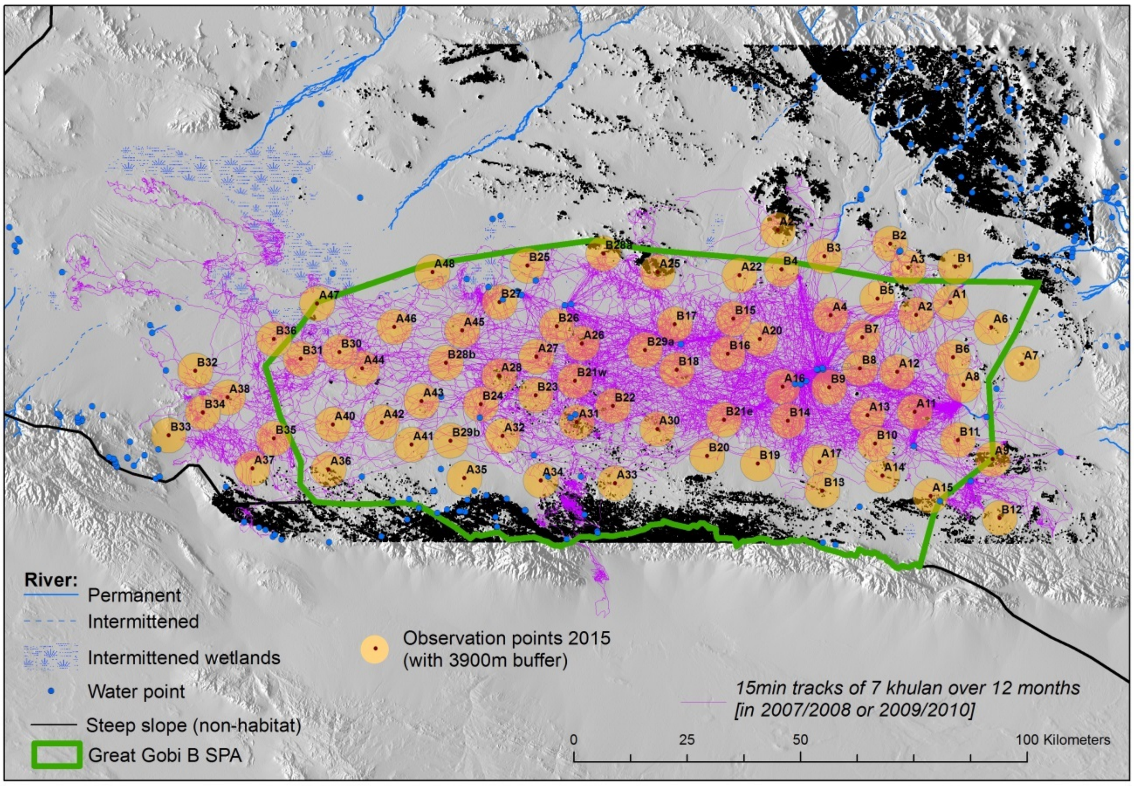

Fig. 3: Overview of the 79 observation points in the October 2015 survey. The 4900m buffer shows the cut-off distance for the observation distances. The purple tracks show movements of 1 khulan in 2007/2008 and 6 khulan in 2009/2010 at 15min intervals.

Distances were estimates based on previous training with people and motorbikes at known distances at 100m, 500m, 1000m, 2000m, 3000m, and 5000m. Six distance bins were given on the datasheets as: 0-100m, 101-500m, 501-1000m, 1001-2000m, 2001-3000m, and >3000m.

Observations of khulan and gazelles

Over all six survey times, observers counted a total of 7,267 khulan in 274 groups and 7,239 gazelle in 272 groups. For khulan, the number of groups observed decreased and mean group size increased from 8:00 to 16:00. For gazelle, detectability seemed by far the best in the morning at 8:00 and 10:00 (Table 3).

Table 3: All observations of khulan and gazelle, and those used for best model fit in the final DISTANCE analysis.

	Survey time (hours)					
	19:00	**08:00**	**10:00**	**12:00**	**14:00**	**16:00**
Effort (N observation points)	78	78	79	79	78	76
Khulan						
All observations						
Total observed	900	810	881	1,186	1,555	1,935
Number of groups	47	51	50	47	43	36
Mean group size	19.1	15.9	17.6	25.2	36.2	53.8
Minimum group size	1	1	1	1	1	1
Maximum group size	200	300	300	300	350	350
DISTANCE model (100m left truncation; max 4,900m)						
Total observed	897	785	881	1,186	1,555	1,935
Number of groups	46	50	50	47	43	36
Mean group size	**19.5**	**15.7**	**17.6**	**25.2**	36.2	**53.8**
Standard error of mean	4.8	6.1	6.2	8.9	11.5	14.0
Expected group size	17.9	14.6	11.7	20.2	**13.6**	61.2
Standard error of mean	5.6	4.0	6.2	6.7	5.7	35.7
Encounter rate	0.59	0.64	0.63	0.59	0.55	0.47
Effective detection radius (m)	2,244					
Goitered gazelles						
All observations						
Total observed	454	1,179	801	398	357	315
Number of groups	59	122	83	62	41	36
Mean group size	7.7	9.7	9.7	6.4	8.7	8.8
Minimum group size	1	1	1	1	1	1
Maximum group size	34	45	34	20	40	52
DISTANCE model (100m left truncation; max 2,900m)						
Total observed	326	825	521	306	217	291
Number of groups	46	95	55	47	25	31
Mean group size	7.1	8.7	**9.5**	**6.5**	**8.7**	9.4
Standard error of mean	1.0	0.9	1.0	0.7	1.9	1.9
Expected group size	**4.1**	**5.7**	8.2	6.9	11.5	**4.9**
Standard error of mean	0.6	0.7	1.2	1.0	2.7	1.1
Encounter rate	0.59	1.22	0.70	0.59	0.32	0.41
Effective detection radius (m)	1,343					

Khulan and gazelle were not evenly distributed, with most observations of khulan occurring in the central and western part (Fig. 4) and most gazelle observations occurring in the central and eastern part (Fig. 5).

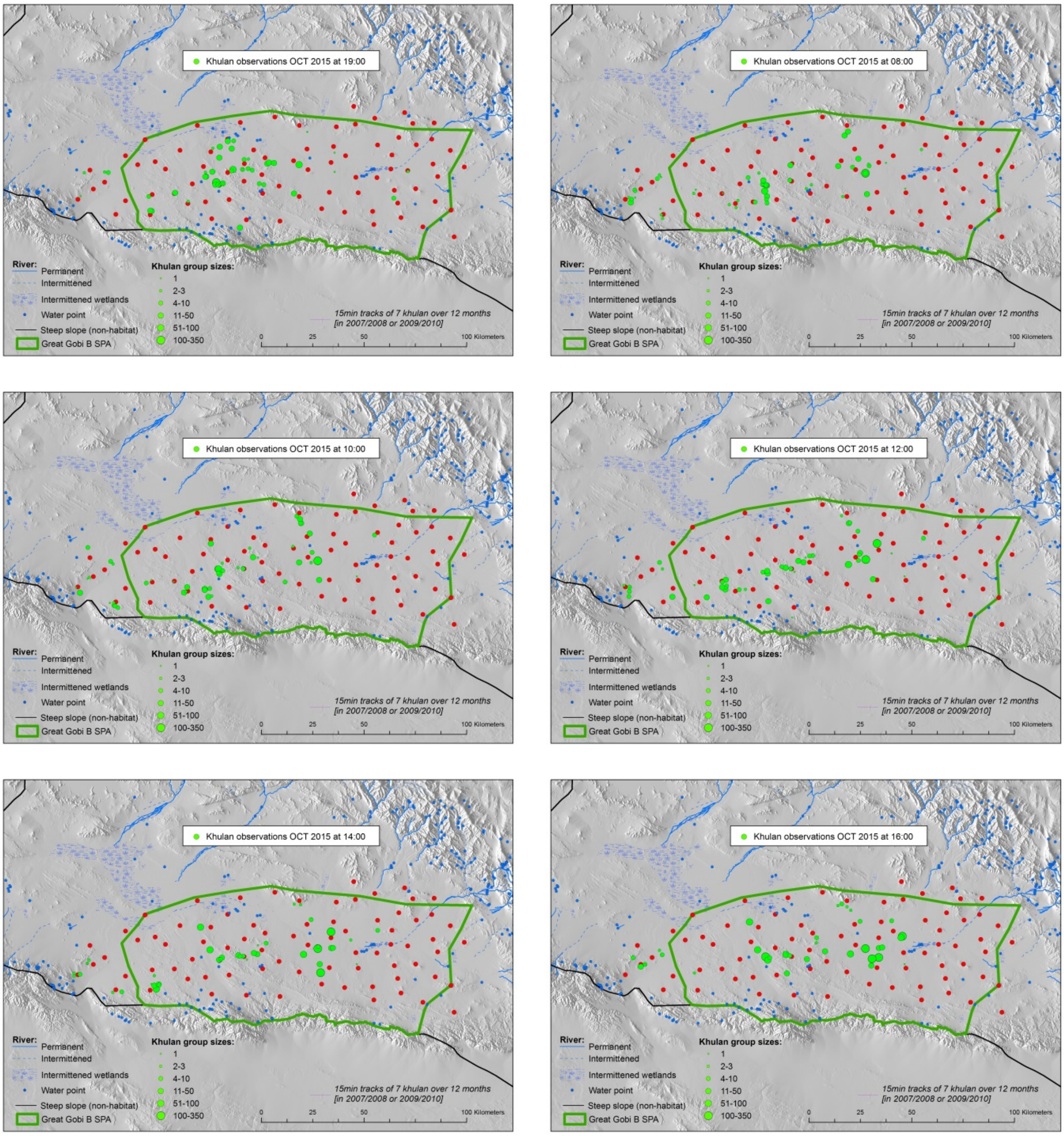

Fig. 4: Khulan observations at different times.

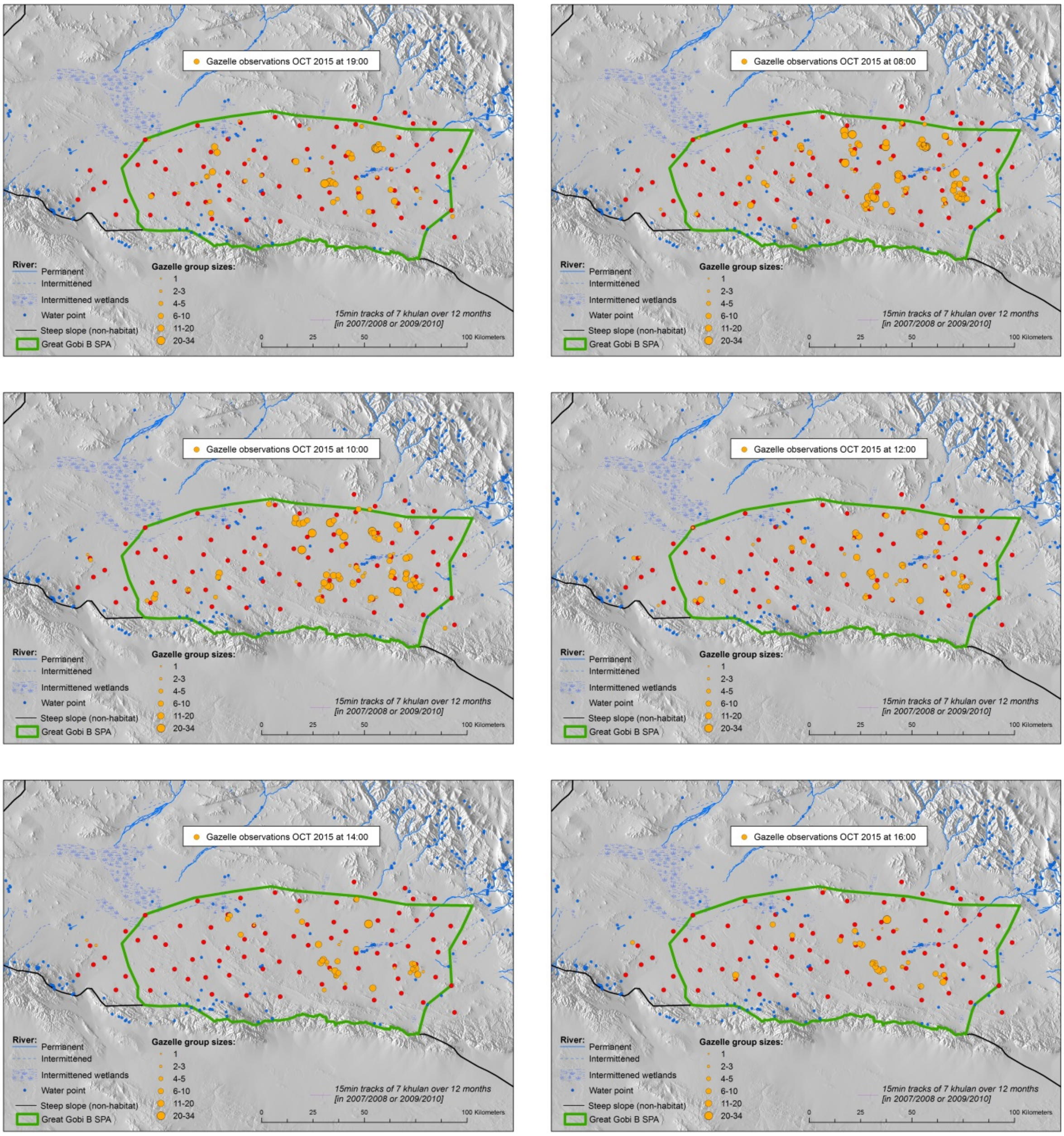

Fig. 5: Gazelle observations at different times.

DISTANCE analysis parameters

Observation points were all located within the known khulan habitat and very few were so steep that khulan or gazelle are unlikely to avoid them. Nevertheless, GPS tracking data of khulan have shown that khulan tend to often circumnavigate isolated hills and the presence of a human may also cause some disturbance. We assumed a mean area of 100m around the observer to best represent the "combined avoidance effect" and left truncated our data accordingly; this resulted in discarding 2 khulan observations and 6 gazelle observations within the distance bin 0-100m (also see Table 3).

Left truncation and assignment of all observations to mid-point values of bins resulted in observation distances of 200m, 650m, 1,400m, 2,400m, 3,900m with corresponding intervals of 0-400m; 401-900m; 901-1,900m; 1,901-2,900m; 2,901-4,900m, respectively. The last distance is the result of the estimated maximum sighting distance of 5,000m (also see Ransom et al. 2012) post left truncation.

The Distance software was used to conduct the analyses (Thomas et al. 2010). We calculated population density and ultimately population size for each species and each time specific survey (temporal "Stratum") by fitting the detection function over all observations ("Global"), but using the group sizes ("Cluster size") and the number of observation points with khulan/gazelle observations ("Encounter rate") of each time specific survey ("Stratum"). We additionally estimated the overall estimate ("Global") as the mean of the stratum estimates weighted by total effort (number of points with active observers) of each stratum with strata defined as replicates for khulan and the mean over the 8:00 and 10:00 survey for gazelle. To correct for a potentially higher probability of detecting larger groups, especially at far distances, we used the size bias regression method: ln(cluster size) against estimated g(x). If the regression was significant at an alpha-level of 0.15, we used the expected group size; else the average observed cluster size.

Population estimates

Khulan

The final model used to estimate detectability of khulan was a uniform detection function with cosine adjustments of orders: 1, 2, 3 with four distance bins of 0-900m; 901-1,900m; 1,901-2,900m; and 2,901-4,900m (Fig. 6).

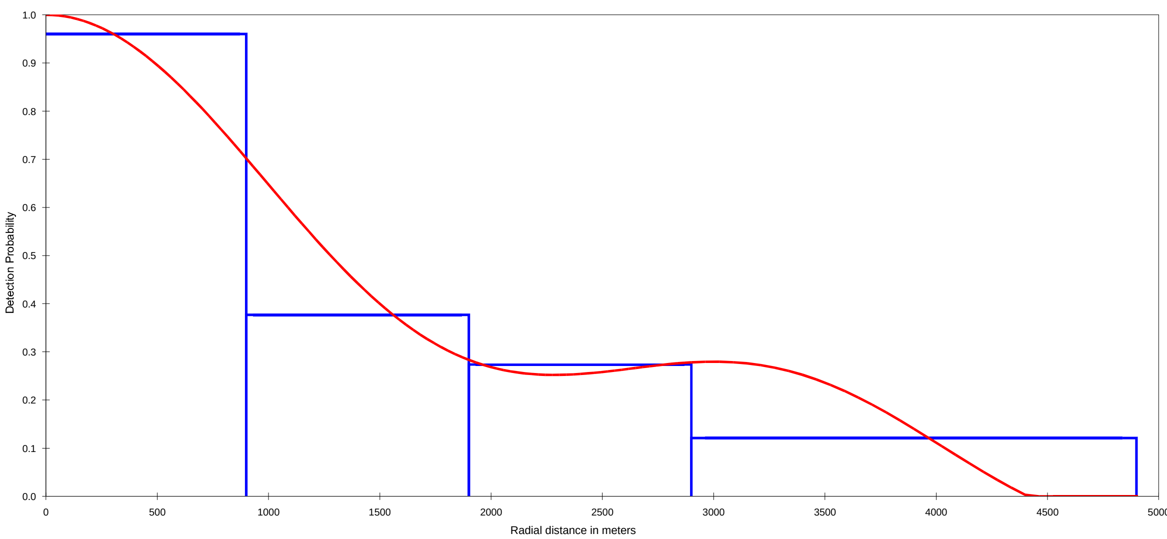

Fig. 6: Khulan data final model fit.

Population estimates vary considerably over the different time periods due to changes in grouping patterns and encounter rate. However, there was no good reason to exclude any specific survey and variations are due to khulan movement relative to the observation points and changes in encounter rates and group sizes at the different observation times. We are therefore reasonably confident that the pooled estimate of 9,337 (95% CI = 5,337-16,334), provides the most robust population estimate for khulan (Table 4).

Table 4: Population estimates for khulan.

	Estimate	%CV	df	95% Confidence Interval	
Stratum: 19:00					
DS	0.0373	19.67	283.97	0.0254	0.0547
D	0.7268	31.46	113.84	0.3955	1.3357
N	8,014	31.46	113.84	4,361	14,729
Stratum: 8:00					
DS	0.0405	19.60	280.34	0.0276	0.0594
D	0.6360	43.31	76.60	0.2786	1.4523
N	7,014	43.31	76.60	3,072	16,014
Stratum: 10:00					
DS	0.0400	19.60	280.54	0.0273	0.0586
D	0.7048	40.35	82.57	0.3255	1.5260
N	7,772	40.35	82.57	3,589	16,827
Stratum: 12:00					
DS	0.0376	19.74	287.48	0.0256	0.0552
D	0.9488	40.25	78.47	0.4387	2.0520
N	10,462	40.25	78.47	4,838	22,627
Stratum: 14:00					
DS	0.0348	19.66	283.47	0.0237	0.0511
D	0.4750	46.38	60.50	0.1965	1.1484
N	5,238	46.38	60.50	2,167	12,663
Stratum: 16:00					
DS	0.0299	19.59	279.72	0.0204	0.0439
D	1.6091	32.56	82.62	0.8558	3.0256
N	17,743	32.56	82.62	9,436	33,363
Global over all Strata					
DS	0.0367	19.86	279.72	0.0249	0.0541
D	0.8467	27.30	19.98	0.4840	1.4813
N	9,337	27.30	19.98	5,337	16,334

DS=estimate of density of clusters, D=estimate of density of animals, N=estimate of number of animals in the 11,027 km^2 study area.

Goitered gazelles

Gazelles are much smaller than khulan and visibility is lower. The final model used to estimate detectability for the gazelle was a half-normal detection function with cosine adjustments of order: 2 with four distance bins of 0-400m; 401-900m; 901-1,900m; and 1,901-2,900m (Fig. 7).

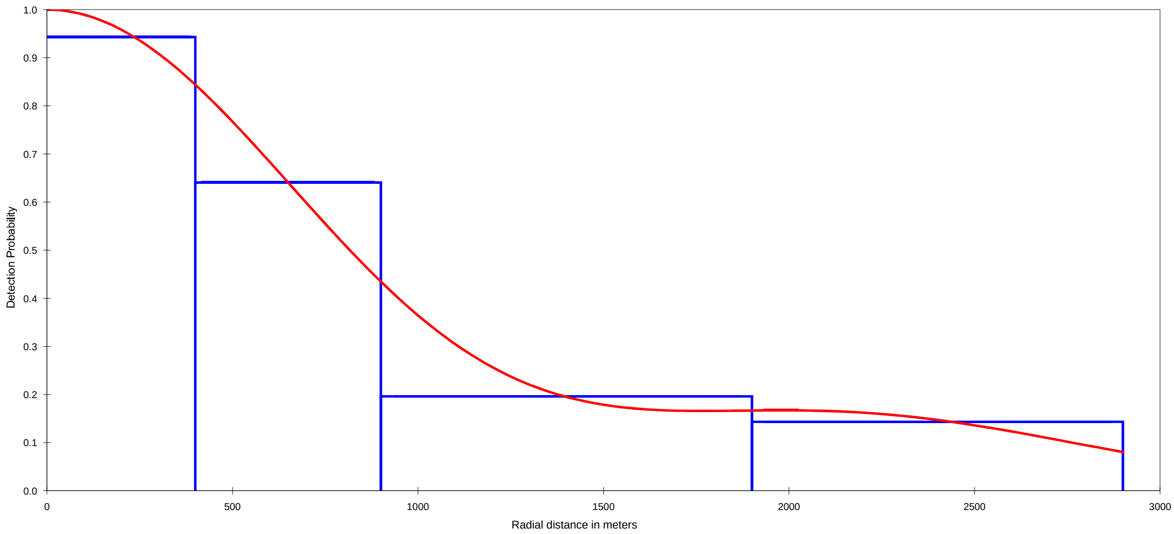

Fig. 7: Gazelle data final model fit.

Population estimates were low for any time period other than the early morning. This phenomenon is consistent with the 2010 survey results (Ransom et al. 2012). The smaller gazelles are best seen in the early morning light and it also seems to coincide with a period of high activity. Contrary to khulan which are hind-gut fermenters and primarily rest while standing, gazelles are ruminants and lay down (often in the shade of bushes or other patches of higher vegetation) while ruminating. This latter behavior, together with their much smaller body size, results in dramatically reduced visibility (Fig. 8). We thus feel that the morning count with the lowest %CV provides the best estimate of gazelle abundance, whereas mid-day and evening counts are flawed by many gazelles not seen even at close distances. We are therefore reasonably confident the mean of the estimates from the 8:00 and 10:00 survey with 13,531 (95% CI = 8,957-20,441) provides the most accurate estimate (Table 5).

Fig. 8: Bedded gazelle at 401-900m distance interval.

Table 5: Population estimates for gazelle.

	Estimate	%CV	df	95% Confidence Interval	
Stratum: 19:00					
DS	0.1040	12.51	334.61	0.0814	0.1329
D	0.4254	19.16	124.71	0.2921	0.6195
N	4,691	19.16	124.71	3221	6831
Stratum: 08:00					
DS	0.2148	13.57	374.00	0.1647	0.2802
D	1.2304	18.24	337.67	0.8621	1.7562
N	13,568	18.24	337.67	9,506	19,366
Stratum: 10:00					
DS	0.1228	12.49	332.67	0.0961	0.1569
D	1.1633	16.42	232.70	0.8436	1.6042
N	12,827	16.42	232.70	9,302	17,689
Stratum: 12:00					
DS	0.1049	12.36	322.36	0.0824	0.1337
D	0.6832	16.75	184.37	0.4921	0.9486
N	7,534	16.75	184.37	5,427	10,460
Stratum: 14:00					
DS	0.0565	12.55	337.23	0.0442	0.0723
D	0.4907	24.96	42.65	0.2989	0.8057
N	5,411	24.96	42.65	3,296	8,884
Stratum: 16:00					
DS	0.0719	13.02	362.83	0.0558	0.0928
D	0.3488	26.71	49.49	0.2058	0.5911
N	3,846	26.71	49.49	2,270	6,518
Mean over 8:00 and 10:00 Strata					
DS	0.1729	20.21	252.93	0.0249	0.2563
D	1.2271	21.22	421.82	0.8123	1.8538
N	13,531	21.22	421.82	8,957	20,441

DS=estimate of density of clusters, D=estimate of density of animals, N=estimate of number of animals in the 11,027 km^2 study area.

Discussion

The 2015 point count strongly suggests that both species have increased in population size (Fig. 9, Table 6). The suggested increases in population size are also in line with observations of large groups (up to 3,000 animals) of khulan and the impression of encountering more gazelle in recent years.

There are also no signs of dramatically increased poaching rates as khulan carcasses are not frequently encountered. The difference in the point estimates between 2010 and 2015 would suggest an average annual increase of 10-11% and 17% over the last 5 years for khulan and gazelles, respectively. Both rates are well within the range of population increase possible for the species.

The 2010 survey did not left truncate the data and thus may have produced somewhat more conservative estimates as the 2015 survey and consequently the rate of increase may have been somewhat slower.

We are anticipating the next point count in 2018 and will use the same overall sampling design as in 2015, which should allow an even more direct comparison. We will, however, try to further improve distance estimations by providing observers with 1:200,000 topographic maps of the surrounding of each observation point. After the 2018 survey, we plan to re-analyze all three surveys within the same DISTANCE sampling analysis frame.

Table 6: Abundance estimates for khulan and gazelle in Great Gobi B SPA.

Parameters	**Khulan**		**Gazelle**	
	2010	***2015***	***2010***	***2015***
N	5,671	9,337	5,909	13,531
%CV	23.3	27.30	31.8	21.22
95% Lower	3,611	5,337	3,762	8,957
95% Upper	8,907	16,334	9,279	20,441
EDR (m)	2,142	2,244	1,488	1,343

Acknowledgements

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