



Population estimates and factors influencing distribution of saiga

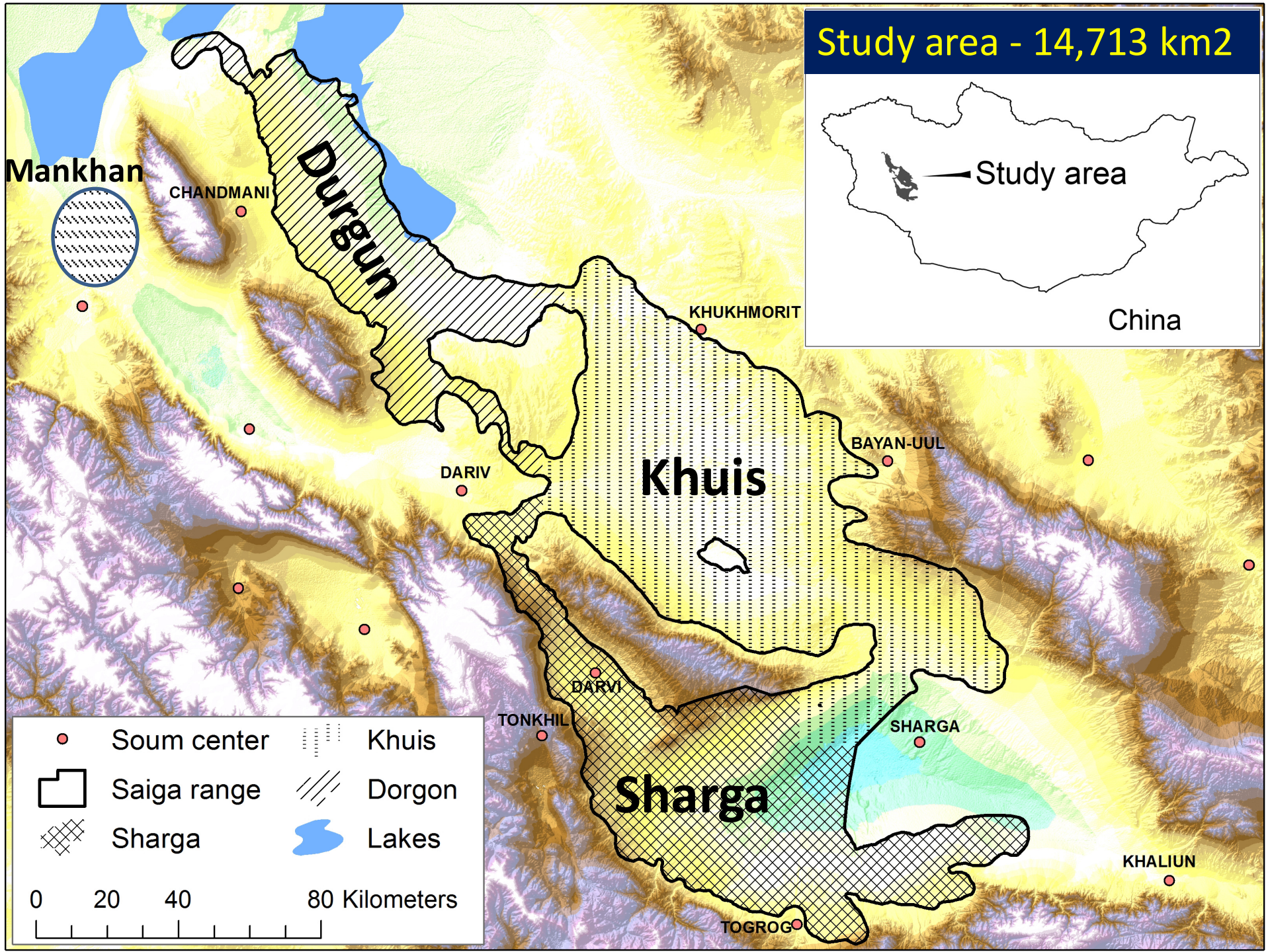
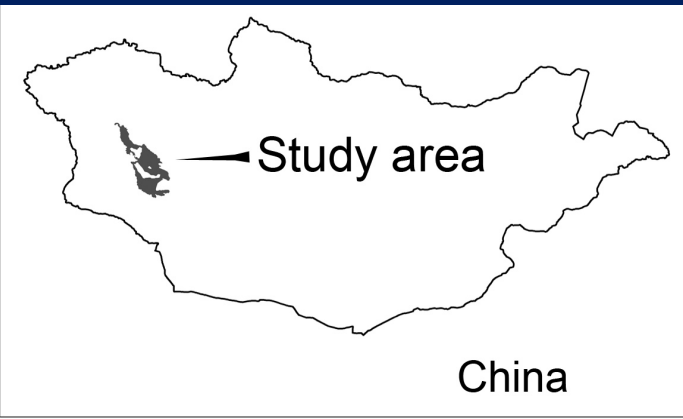


B. Buuveibaatar
Wildlife Conservation Society
Mongolia Program

Research goals

- Estimate saiga abundance across its entire range in western Mongolia
- Assess the human and environmental factors influencing saiga distribution

Study area - 14,713 km²



Mankhan

CHANDMANI

Dorgon

KHUKHMORIT

DARIV

Khuis

BAYAN-UUL

TONKHIL

DARVI

Sharga

SHARGA

KHALIUN

TOGROG

- Soum center
- Saiga range
- ▣ Sharga
- ⋯ Khuis
- ▨ Dorgon
- 🟦 Lakes

0 20 40 80 Kilometers



Methodology: Distance sampling line transect

- 39 systematic line transects
- Spacing of 10 km
- Survey effort 1,505 km

Survey team

(WCS, WWF, Gobi-Altai EPA)



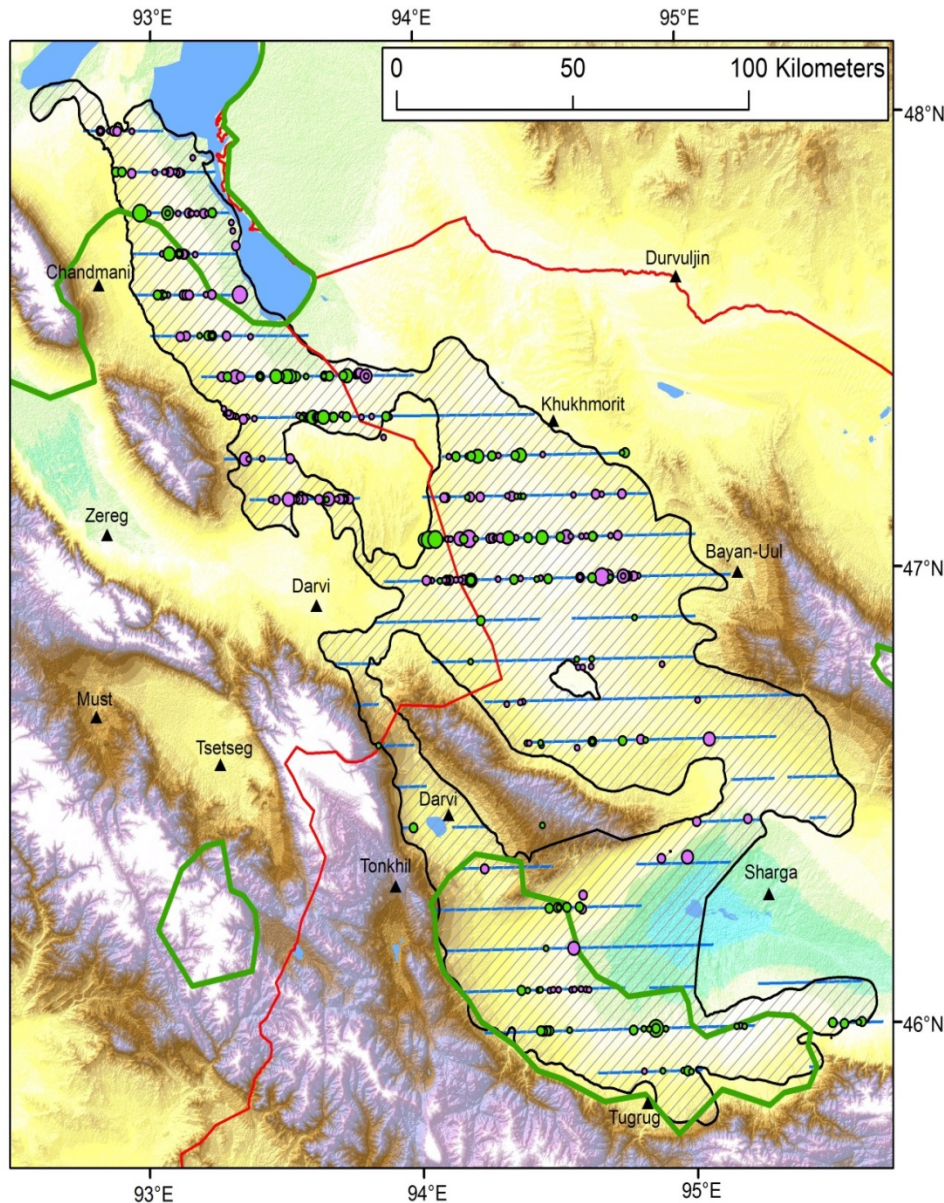
2014 field surveys

Winter (Feb 04-15)

Summer (Aug 15 – 27)



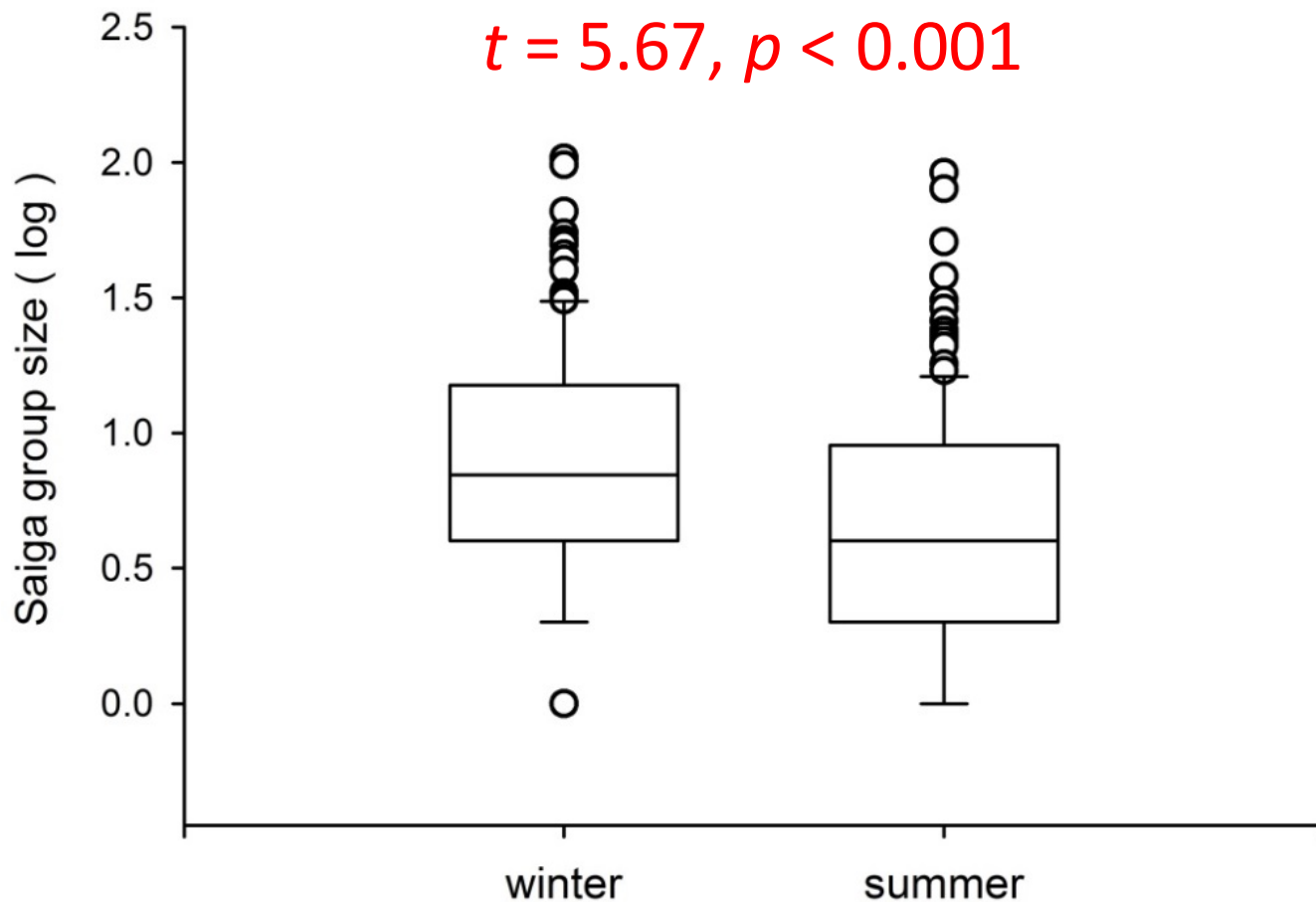
Distribution and grouping patterns of saiga during winter and summer surveys in 2014



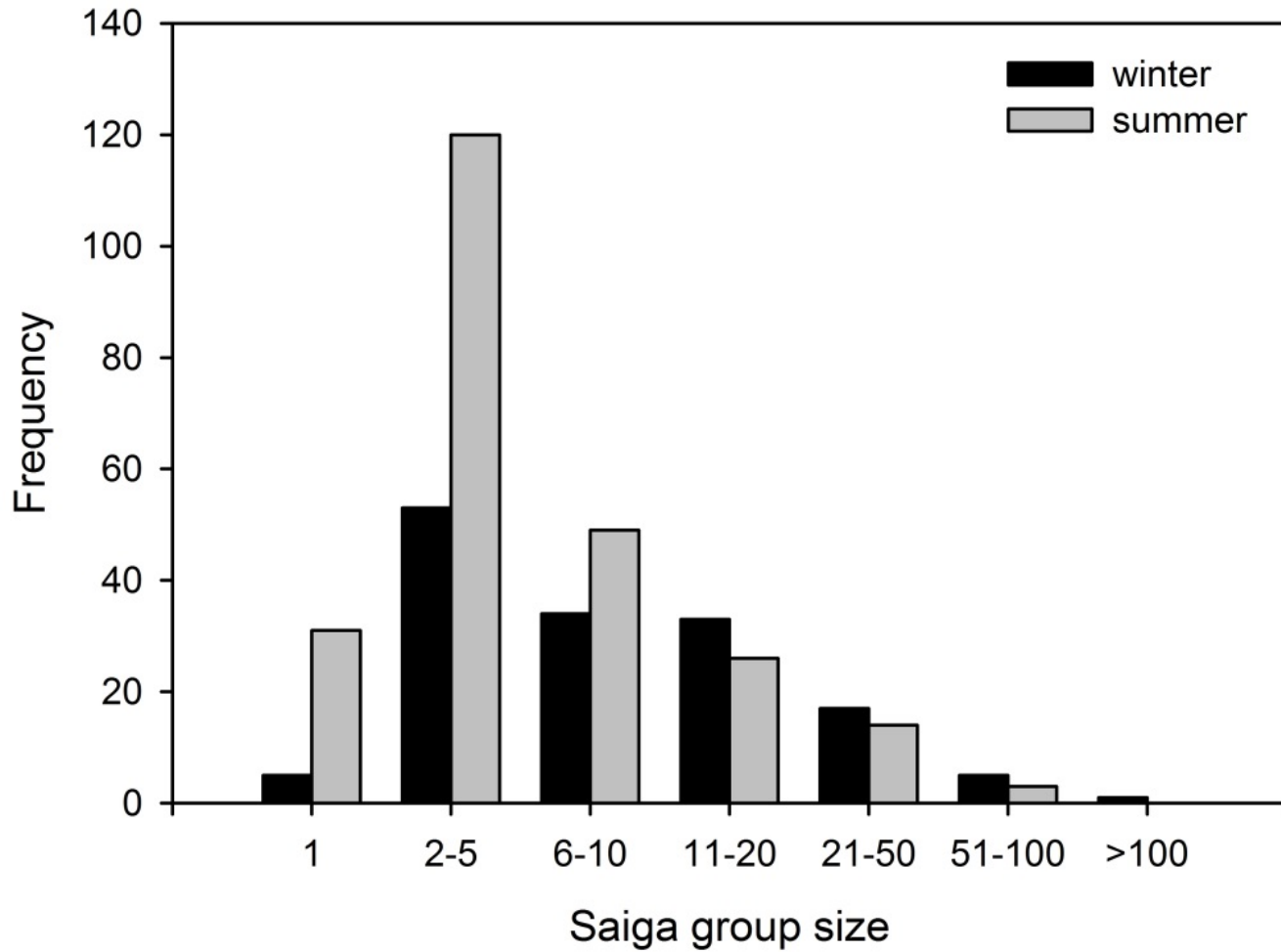
- 148 groups (1,934 individuals) in the winter
- 243 groups (1,738 individuals) in the summer

Saiga distribution and grouping	
Winter	Summer
• 1 - 5	• 1 - 5
• 6 - 20	• 6 - 20
• 21 - 50	• 21 - 50
• > 50	• > 50

Comparison of saiga group sizes between two seasons



Saiga grouping patterns



Data analysis: Distance software 6.2

Distance - Khulan_3Seasons - [Project Browser]

File View Tools Analyses Window Help

Data Maps Designs Surveys Analyses

Set: Set1 Analysis:

ID	Name	Created	Run	# params	Delta AIC	AIC	ESW/EDR	P	D	D LCL	D UCL	D CV	N	N LCL	N UCL
15	HNorm+10intTrunc1000	11/10/2014 1:55:56 PM	11/10/2014 1:56:27 PM	2	0.00	2063.05	497.53	0.50	0.682	0.364	1.277	0.181	66971	35757	125433
13	HNorm+10intTrunc1500m	11/10/2014 1:52:48 PM	11/10/2014 1:53:56 PM	2	11.70	1967.28	527.91	0.35	0.642	0.266	1.547	0.223	63028	26147	151928
20	HNorm+5intTrunc2000	11/10/2014 2:04:59 PM	11/10/2014 2:06:00 PM	2	15.95	1039.95	559.95	0.28	0.612	0.251	1.492	0.221	60073	24627	146538
18	HNorm+6intTrunc3000	11/10/2014 2:02:28 PM	11/10/2014 2:03:03 PM	2	27.25	917.97	664.89	0.22	0.530	0.203	1.388	0.231	52098	19907	136340
16	HNorm+7intTrunc1400	11/10/2014 1:57:03 PM	11/10/2014 1:57:33 PM	2	9.40	1621.68	523.72	0.37	0.648	0.265	1.589	0.230	63666	25980	156019
14	HNorm3Season+10intTrunc1500m	11/10/2014 1:54:29 PM	11/10/2014 1:55:13 PM	5	0.00	1955.59			0.625	0.237	1.645	0.228	61372	23313	161567
21	HNorm3Season+5intTrunc2000	11/10/2014 2:06:25 PM	11/10/2014 2:06:40 PM	6	0.00	1024.00			0.594	0.298	1.186	0.162	58371	29250	116483
19	HNorm3Season+6intTrunc3000	11/10/2014 2:03:31 PM	11/10/2014 2:03:45 PM	5	0.00	890.72			0.535	0.264	1.083	0.165	52539	25958	106336
17	HNorm3Season+7intTrunc1400	11/10/2014 1:58:21 PM	11/10/2014 1:58:43 PM	5	0.00	1612.00									
8	HNorm(0)2Seasons	11/7/2014 4:02:41 AM	11/7/2014 4:03:41 AM	6	26.25	7582.00									
9	HNorm(0)2SeasonsTrunc10%	11/7/2014 4:04:19 AM	11/7/2014 4:04:43 AM	2	12.06	6419.00									
10	HNorm(0)2SeasonsTrunc5%	11/7/2014 4:06:24 AM	11/7/2014 4:06:44 AM	3	10.59	6928.00									
5	HNorm(0)3Seasons	11/7/2014 3:53:21 AM	11/7/2014 3:55:09 AM	6	0.00	7559.00									
6	HNorm(0)3SeasonsTrunc10%	11/7/2014 3:56:53 AM	11/7/2014 3:57:27 AM	3	0.00	6407.00									
7	HNorm(0)3SeasonsTrunc5%_FINAL	11/7/2014 4:00:24 AM	11/7/2014 4:00:50 AM	5	0.00	6919.00									
1	HNormPooled	11/6/2014 1:08:26 PM	11/6/2014 1:20:37 PM	5	23.26	7582.00									
3	HNormPooledTrunc10%	11/6/2014 1:23:07 PM	11/6/2014 1:23:20 PM	1	10.33	6417.00									
4	HNormPooledTrunc5%	11/6/2014 1:24:04 PM	11/6/2014 1:24:26 PM	2	12.80	6928.00									
11	HRatef(0)3SeasonsTrunc5%	11/7/2014 4:08:21 AM	11/7/2014 4:09:17 AM	6	2.83	6918.00									
12	Unitf(0)3SeasonsTrunc5%	11/7/2014 4:11:04 AM	11/7/2014 4:12:10 AM	7	4.42	6920.00									

Distance - Amakihi

File View Tools Analysis - Results Window Help

Project Browser

Set: AUK paper reported anal Analysis:

ID	Name	Created	Run	# params	Delta AIC	AIC	ESW/EDR	D	D LCL	D UCL
139	e1 - HN by strat f0 pooled w82.5	20/12/2005 10:38:48	10/07/2009 13	5	7.22	10799.12	43.85	7.824	6.004	10.15
151	b2 - Unicos by strat f0 pooled w82.5	20/12/2005 14:47:55	15/07/2009 09	2	10.93	10802.83	44.30	7.666	7.003	8.39
138	c3 - HR by strat f0 pooled w82.5	20/12/2005 10:37:59								
150	d4 - Unicos by strat w82.5	20/12/2005 14:47:04								

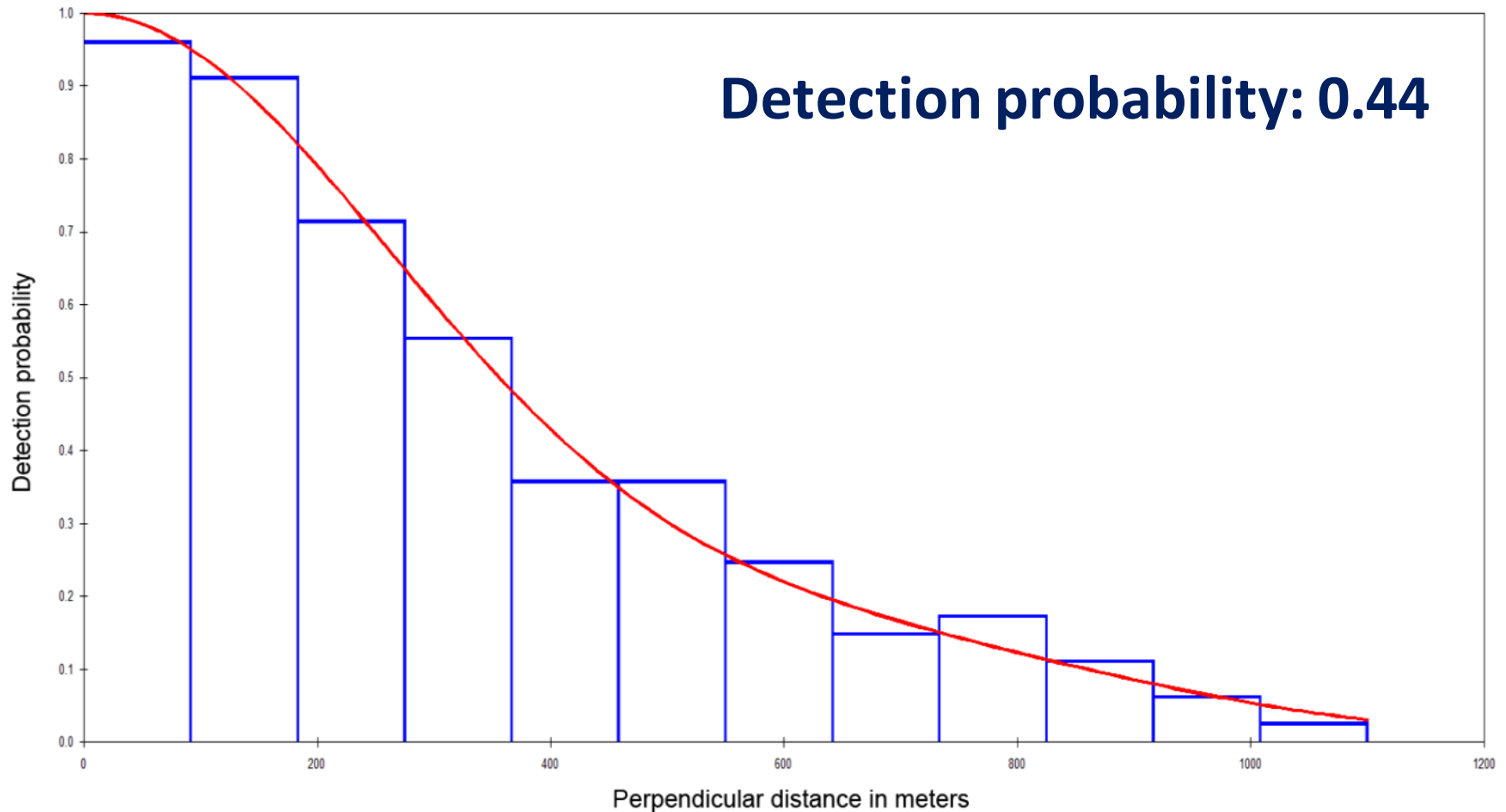
Analysis 139: [a1 - HN by strat f0 pooled w82.5]

Detection Fct/Global/Plot: Detection Probabi

Analysis 180: [o15 - HR MAS w82.5] Set: [AUK pa...

Detection Fct/Global/Plot: Detection Probabi

Detection probability functions derived from pooled data for saiga groups



Estimates of saiga density (D per km²) and abundance (N)

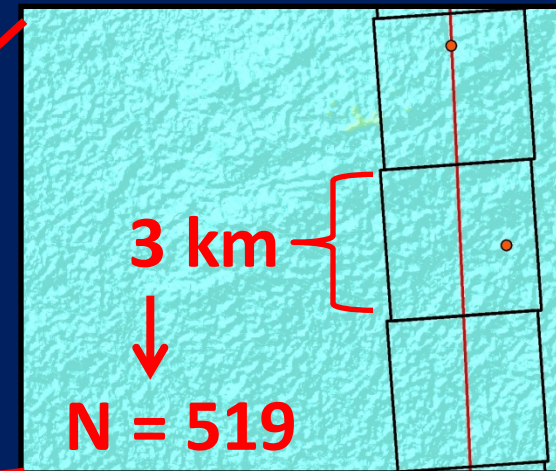
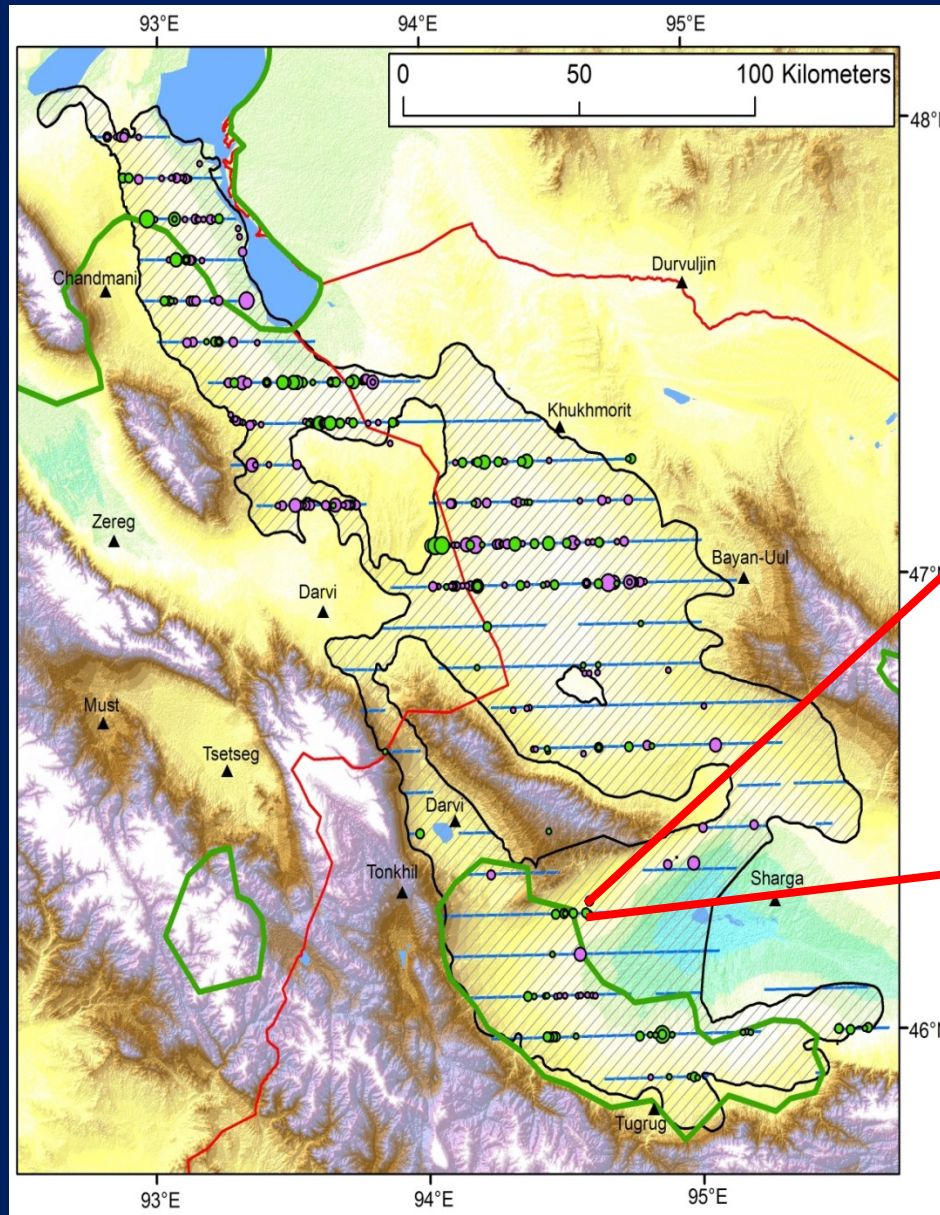
Season	D	95% CI	N	95% CI	(%CV)
Winter	1.20	0.78 – 1.83	17,696	11,584 – 27,034	21.50
Summer	0.81	0.56 – 1.17	12,202	8,371 – 17,265	18.24
Average	1.01	0.75 – 1.35	14,869	11,066 – 19,978	15.00

A person wearing a white hat and dark clothing is riding a brown horse across a grassy field in the foreground. In the background, there are dark, rugged mountains with a large, snow-capped peak under a blue sky with some clouds. The scene is set in a high-altitude, mountainous region.

Spatial modeling

- NDVI (vegetation biomass)
- Elevation
- Slope
- Distance to settlement
- Distance to water

Spatial modeling approaches



Model development

- **Generalized Linear Model**
- **Poisson error distribution**
- **Model selection: AIC**



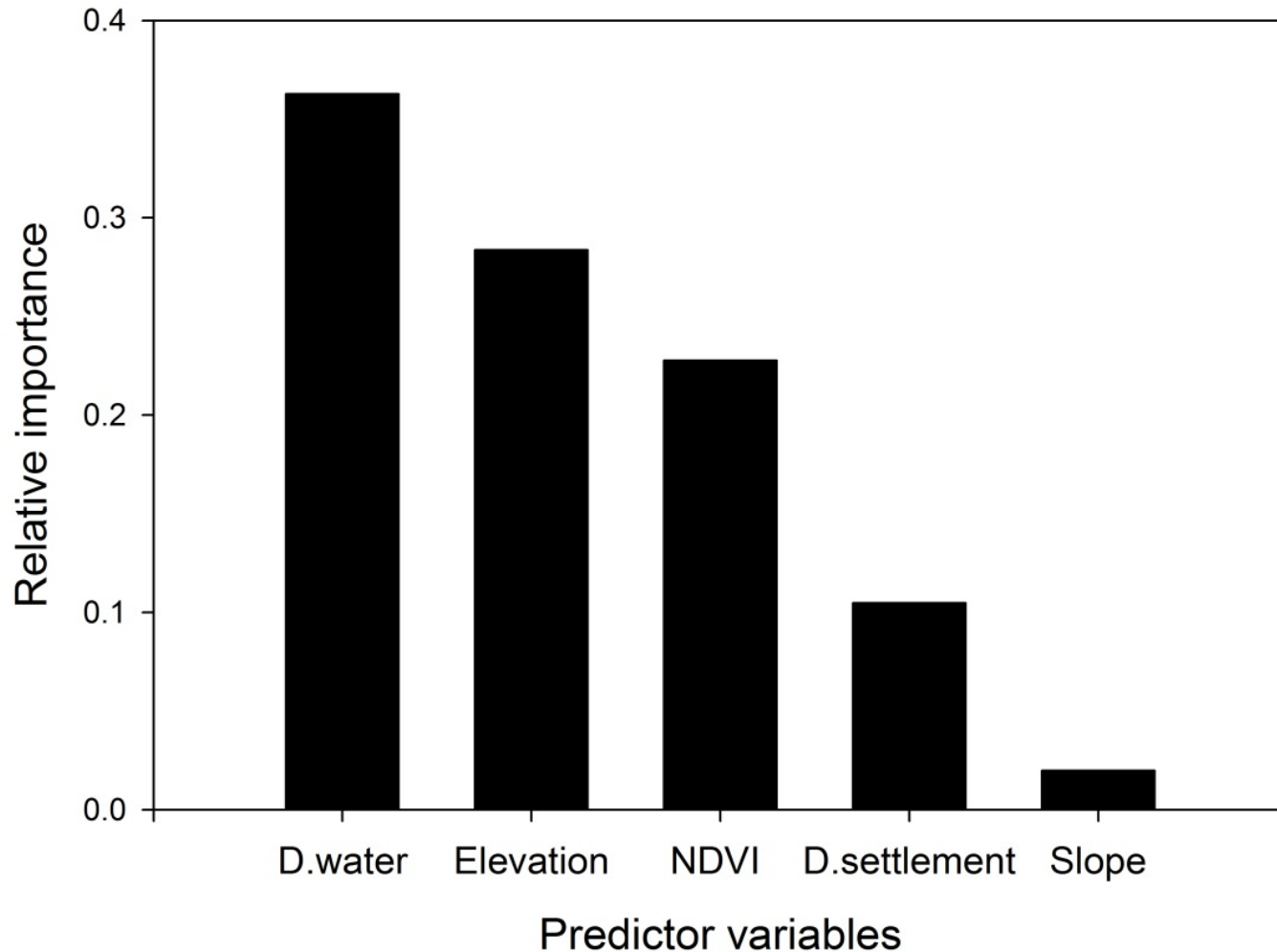
Factors affecting distribution of saiga (Generalized Linear Model)

Factors	Estimates
NDVI	+++
Elevation	---
Distance to water	+++
Distance to water2	---

Significant codes: +++ Positive Estimates <0.001

--- Negative Estimates <0.001

Importance of predictor variables explaining spatial distribution of saiga



Summary

Population estimates

- The average estimate was 14,869 animals across the saiga's entire range of 14,713 km² area, or a density of about 1 saiga/km².

Spatial modeling

- Spatial distribution of saiga best explained by the model included covariates of NDVI, elevation, and distances to water.

Acknowledgement

Saiga Conservation Alliance, U.S. Fish & Wildlife Service

