

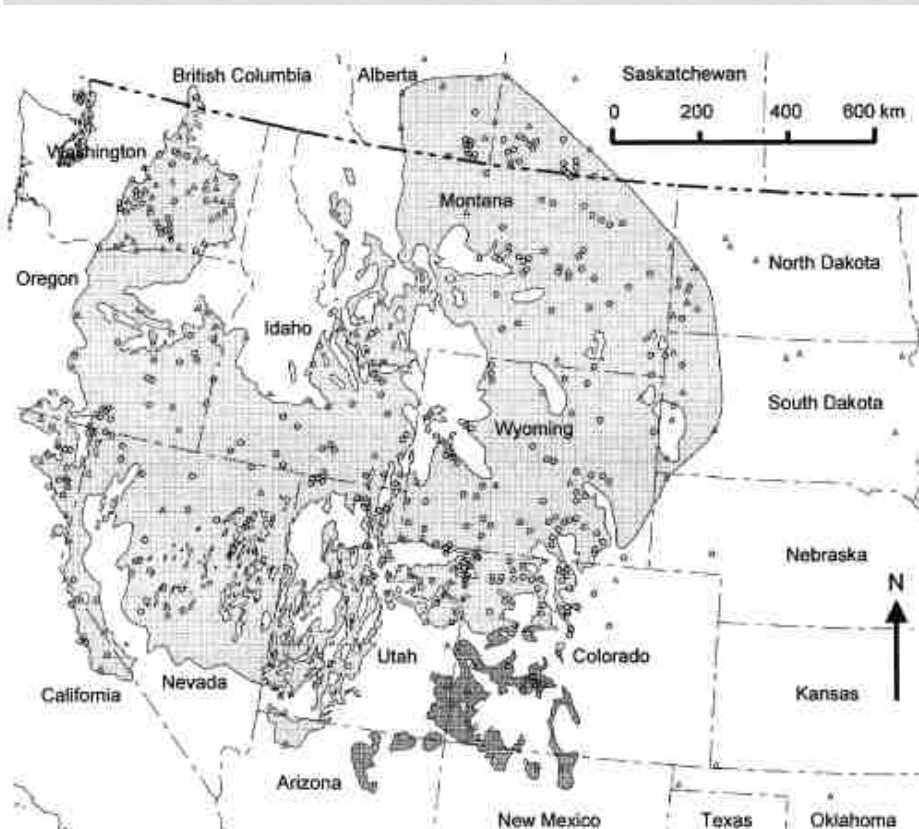
SAGE-GROUSE POPULATION MODELING

COMMUNITY BASED CONSERVATION PROGRAM
UTAHCBP.ORG

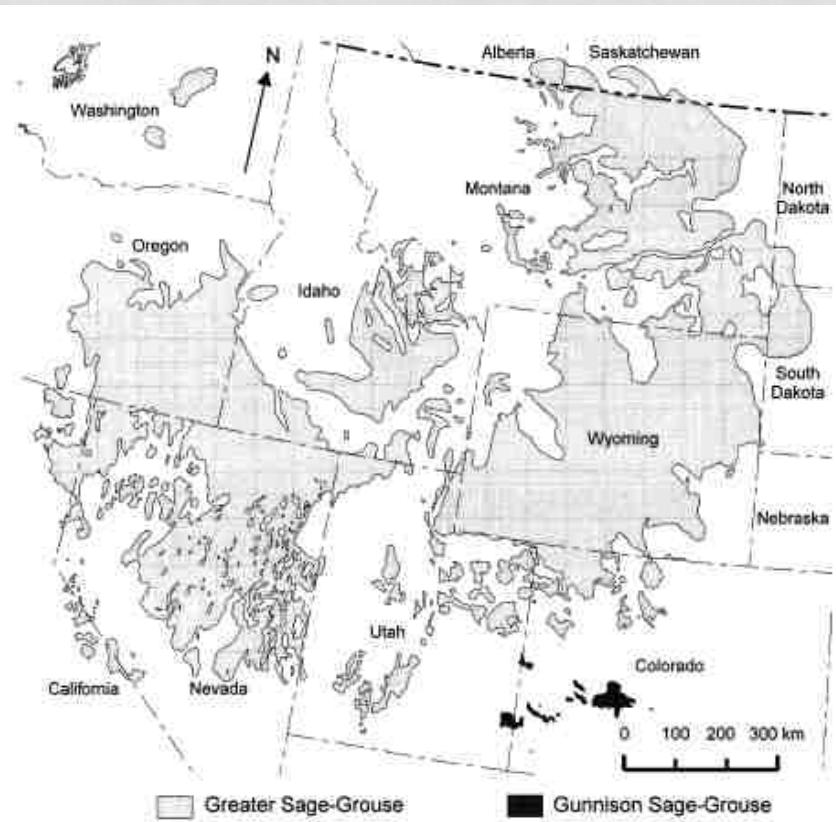
D. Dahlgren, M. Guttery, T. Messmer, and D. Koons



WHAT IS ALL THE FUSS ABOUT SAGE-GROUSE?



Historic Range



Current Range

Figures from Schroeder et al. 2004

PARKER MOUNTAIN



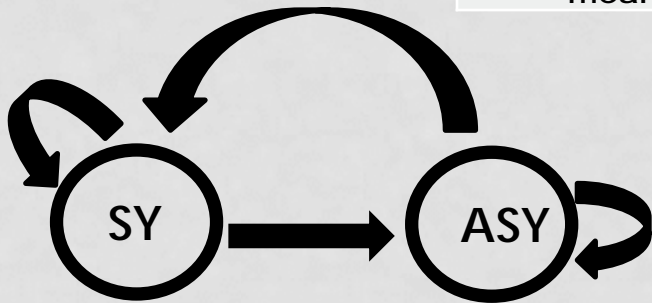
VITAL RATES FROM TELEMETRY



POPULATION MODELING



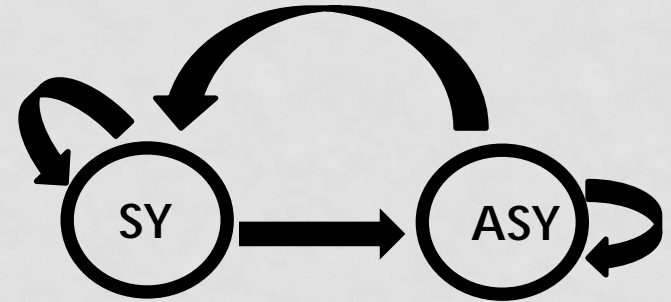
Year	Sample Size (n)		HS ^c		NI ^d		ECS ^e		NS ^f		CS ^g		FS ^h
	SY ^a	ASY ^b	SY ^a	ASY ^b	SY ^a	ASY ^b	SY ^a	ASY ^b	SY ^a	ASY ^b	SY ^a	ASY ^b	
1998	19	10	0.51	0.65	0.55	0.78	6.68	6.99	0.65	0.75	0.64	0.59	0.63
1999	17	26	0.49	0.64	0.54	0.78	6.04	6.32	0.31	0.45	0.66	0.61	0.63
2000	8	19	0.54	0.68	0.78	0.92	6.41	6.71	0.76	0.83	0.54	0.50	0.67
2001	15	10	0.50	0.64	0.76	0.90	6.60	6.90	0.36	0.50	0.62	0.58	0.63
2002	14	15	0.52	0.66	0.71	0.88	5.80	6.07	0.32	0.46	0.55	0.51	0.65
2003	13	13	0.33	0.49	0.76	0.90	5.55	5.81	0.34	0.48	0.64	0.60	0.48
2004	0	9	0.62	0.74	0.40	0.67	6.69	7.00	0.60	0.71	0.56	0.50	0.73
2005	38	17	0.77	0.85	0.62	0.83	5.22	5.46	0.46	0.59	0.61	0.55	0.84
2006	13	46	0.41	0.57	0.62	0.83	5.59	5.85	0.46	0.59	0.61	0.55	0.56
2007	22	21	0.25	0.41	0.42	0.69	5.05	5.28	0.33	0.47	0.43	0.37	0.40
2008	12	32	0.39	0.54	0.41	0.68	6.17	6.45	0.55	0.67	0.76	0.72	0.42
2009	8	31	0.27	0.43	0.56	0.79	5.74	6.00	0.19	0.32	0.77	0.73	0.61
	mean		0.47	0.61	0.59	0.80	5.96	6.24	0.44	0.57	0.62	0.57	0.60



ANALYSIS

Prospective:

- Sensitivity – Unit Change
- Elasticity – Proportional Change



Retrospective:

- Life Table Response Experiment (LTRE)



RESULTS

k	s_k	s_k Rank	e_k	e_k Rank	Process Variance	LTRE ₁	LTRE ₁ Rank	LTRE ₂	LTRE ₂ Rank
SY HS	0.485	3	0.238	3	0.01473	0.00088	6	0.00346	1
ASY HS	0.656	1	0.418	1	0.00025	0.00018	8	0.00011	5
SY NI	0.170	8	0.106	4	0.00024	0.00006	10	0.00001	11
ASY NI	0.282	6	0.238	3	0.00015	0.00010	9	0.00001	9
SY ECS	0.034	11	0.106	4	0.04208	0.00876	4	0.00005	6
ASY ECS	0.073	10	0.238	3	0.04208	0.01555	1	0.00022	4
SY NS	0.227	7	0.106	4	0.00025	-0.00010	9	0.00001	8
ASY NS	0.399	5	0.238	3	0.00025	-0.00024	7	0.00004	7
SY CS	0.164	9	0.106	4	0.00028	0.00136	5	0.00001	10
ASY CS	0.400	4	0.238	3	0.01549	0.01188	3	0.00248	3
JS	0.543	2	0.344	2	0.00953	0.01282	2	0.00281	2
Overall Fecundity ^a			0.688			0.02447		0.00029	
Offspring Survival ^b			0.688			0.0129		0.00254	
Recruitment to Fall ^c			1.376			0.03737		0.00283	
Recruitment to AFR ^d			1.72			0.05019		0.00564	
Female Survival ^e			0.656			0.00106		0.00357	

**Female Age-Class
Development**

Chick > Juvenile >
Yearling > Adult

$$\lambda = 0.95 \text{ (CI: } 0.85 - 1.05\text{)}$$

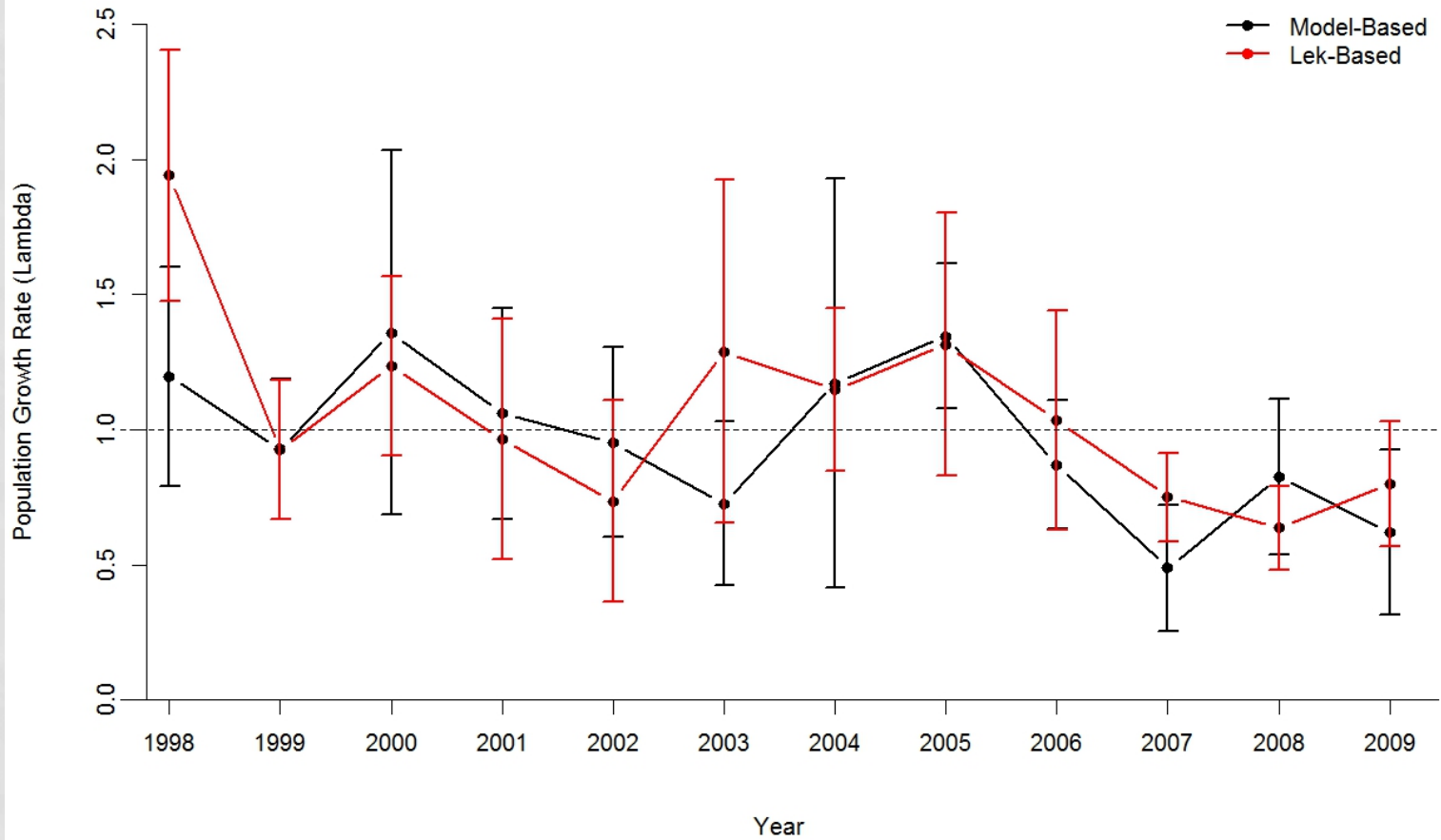
CLUTCH SIZE



Pre-Laying Habitat???

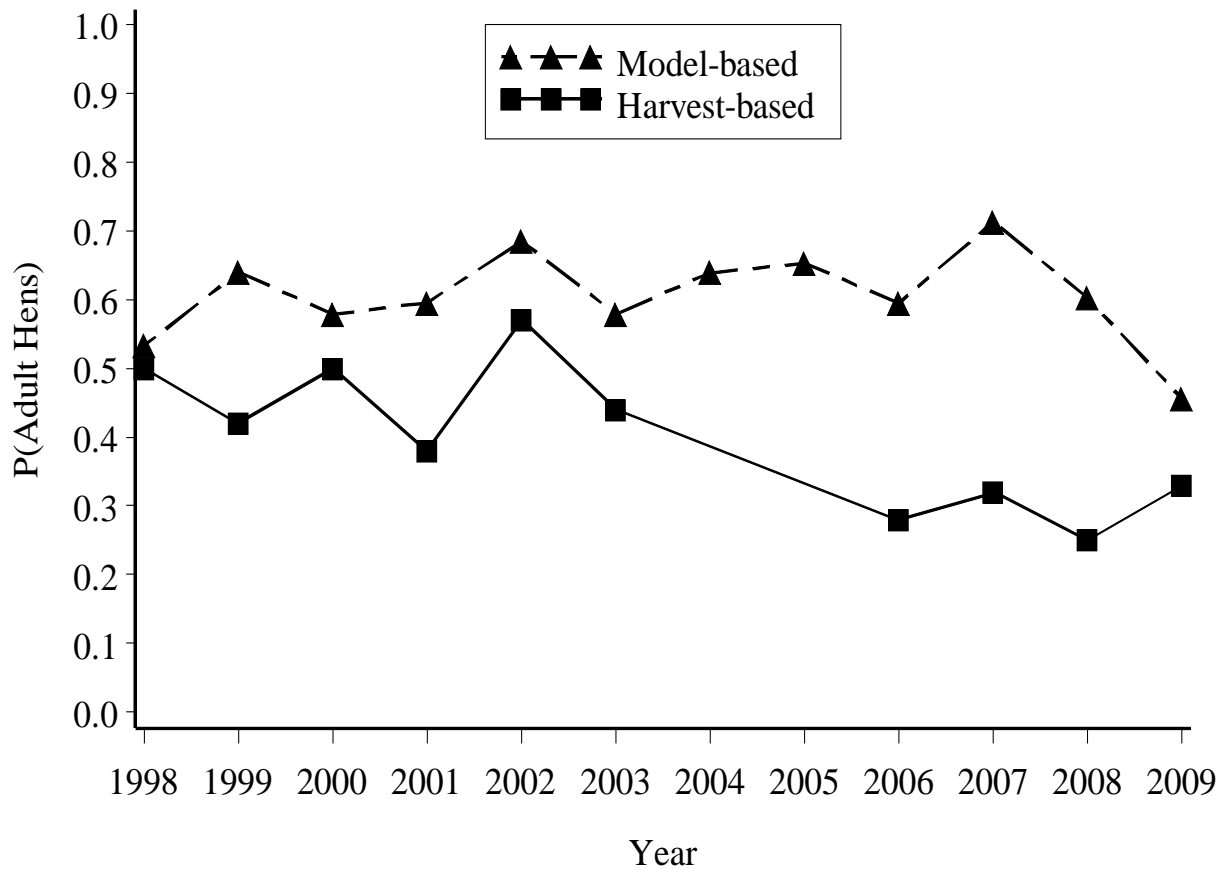
Year	n (nest fate=1)	n(<u>inf</u> nest \geq 1 egg)	<u>Inf</u> Rate nests	n(eggs)	n(<u>inf</u> eggs)	<u>Inf</u> Rate Eggs	comments
1998	8	2	0.25	59	4	0.07	
1999	8	2	0.25	52	2	0.04	
2000	12	1	0.08	80	1	0.01	
2001	8	0	0.00	54	0	0.00	
2002	9	2	0.22	55	2	0.04	
2003	9	3	0.33	56	4	0.07	
2004	3	0	0.00	21	0	0.00	
2005	17	5	0.29	104	20	0.19	Included one nest had 7 infertile eggs (the entire nest)
2006	20	3	0.15	128	9	0.07	
2007	14	3	0.21	76	3	0.04	
2008	18	3	0.17	119	4	0.03	
2009	13	5	0.38	86	8	0.09	
Totals	139	29	0.21	890	57	0.06	

LEK VS. MODEL LAMBDA



HARVEST WING VS. MODEL

AGE DISTRIBUTIONS



QUESTIONS

