

Status of Mountain Goats in Washington

Cliff Rice

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Approach

I developed an estimate of the number of mountain goats in Washington based on aerial surveys conducted 2004-2007 and expert guessing for areas not surveyed. To determine geographic units for estimation I started with 2007 WDFW hunting units, added areas not covered in 2007 units from 2002 units, and then added ad hoc polygons for areas not included by either. For surveys, I adjusted counts and calculated 90% confidence intervals based on our sightability model and averaged across years for units with multiple surveys. For non-surveyed locales, I solicited opinion (guestimates) as to best guess, likely minimum and likely maximum for designated ad hoc units.

In some cases units were partially surveyed, where I generally added the survey estimate and the guestimate for the remaining areas, but in some cases the guestimate included the surveyed area, in which case I used the guestimate for that unit. For the total estimate range, I took the simple expedient of adding the upper and lower confidence intervals from the surveys with the likely minimum and likely maximum guestimates.

I summarized unit level estimates in 2 hierarchical groupings, Area and Zone. Survey estimates and guestimates were added separately within each Area and Zone. For surveys, I added the variances and recalculated confidence intervals based on the total variance. For guestimates, I simply added likely minimum and likely maximum guestimates. Hence, precision increased with broad scale estimation for surveys, but not for guestimates.

Special Cases

Lake Chelan: Our few surveys of Lake Chelan were limited in scope, few and lower than the Chelan PUD estimates. For the North and South shores of Lake Chelan I took the 2004-2006 PUD estimates, assigned the minimum to the likely minimum guestimate, the maximum to the likely maximum guestimate and the intermediate PUD estimate to the best guess.

Olympics: Olympic National Park estimated the mountain goat population for the Olympic Peninsula in 2004. I guessed that 17 (13-25) of these were in the Olympic National Forest.

Okanogan: Mountain goats visiting Hancock Ridge (Methow unit) appear to spend the majority of their time on Mt. Ballard and Majestic Mountain (East Ross Lake unit). Consequently, I used survey results from Hancock Ridge as a basis for the guestimate for East Ross Lake. I also included peripheral areas surveyed along with the Methow unit (near Washington Pass) in the Methow estimate.

Glacier Peak: Mountain goats visiting Gamma Ridge appear to be entirely visitors from the east side of the Cascades. So, I used the Gamma Ridge surveys as a basis for estimation in the Chiwawa River ad hoc unit and guestimated the number of residents in the rest of the Glacier Peak unit.

Results

Mountain goat population were estimated for 56 units, 40 areas, and 21 zones (Table 1, Figures 1 and 2), yielding a total 2,815 (2,401-3,184). Of these, about 60% have been covered in aerial

surveys, the rest guestimated, with the exception of Lake Chelan where routine ground counts are preformed. About 25% of Washington's mountain goats are in National Parks. About 42% of Washington's mountain goats were in the 10 units which had permits in 2007 (or 50% of those outside national parks).

Remarks

Aerial survey coverage of Mt. Adams (primarily on Yakama tribal lands), Mount Rainier National Park, the North Wenatchee Mountains, and the Chiwawa River area would improve our knowledge of mountain goat status in Washington.

There is a large degree of uncertainty about mountain goat populations in unsurveyed areas (703-1402). However, the costs of completely surveying all these areas would be prohibitive. A random stratified survey design would probably be called for.

Table 1. Estimated number of mountain goats by Zone, Area, and Unit, based on survey, guesstimation, and combined with 90% confidence intervals (CI) and guesstimate range. MGU = mountain goat unit (2002 and 2007).

Zone	Area	Unit	MGU	Survey		Guesstimate		Combined	
				Est	CI	Est	Range	Est	Range
Mt. Baker	Ruth Creek	Ruth Creek	4-1	58	50-66	.		58	50-66
	Mt. Baker	Lincoln Creek	4-4	53	49-56	.		53	49-56
		Chowder Ridge	4-3	97	92-103	.		97	92-103
		Avalanche Gorge	4-7	222	207-237	.		222	207-237
		Dillard Creek	4-6	.		0	0-0	0	0-0
		All		372	356-388	0	0-0	372	356-388
	Loomis Mtn.	Loomis Mtn.		12	9-15	.		12	9-15
All		442	424-461	0	0-0	442	424-461		
North Cascades NP	North Cascades NP	North Cascades NP		50	41-59	25	20-40	75	61-99
Okanogan	East Ross Lake	East Ross Lake	4-8	.		30	25-35	30	25-35
	Jack Mtn.	Jack Mtn.	4-9	.		10	5-15	10	5-15
	Majestic Mtn.	Majestic Mtn.	4-10	.		0	0-0	0	0-0
	Okanogan	Methow	2-2	66	61-70	.		66	61-70
	All		66	61-70	40	30-50	106	91-120	
Pasayten	Eastern Pasayten	Central Pasayten		.		10	5-15	10	5-15
		Eastern Pasayten		.		15	11-20	15	11-20
		All		.		25	16-35	25	16-35
Mt. Chopaka	Mt. Chopaka	Mt. Chopaka	2-1	.		20	10-30	20	10-30
Linton Mtn.	Linton Mtn.	Linton Mtn.		.		0	0-0	0	0-0
Snowking Mtn.	Mt. Tommy Thompson	Mt. Tommy Thompson	4-12	.		5	0-10	5	0-10
	Mt. Buckindy	Mt. Buckindy	4-14	.		25	20-30	25	20-30
	All		.		30	20-40	30	20-40	
Darrington	Boulder River	Liberty Mtn.	4-21	55	47-63	.		55	47-63
		North Lake		0	0-0	.		0	0-0
		Twin Peak	4-23	8	5-11	.		8	5-11
		All		63	54-71	.		63	54-71
	E. of Sauk R.	White Chuck		7	5-10	.		7	5-10
		Mt. Pugh		0	0-1	.		0	0-1
		Sauk River	4-18	2	1-3	.		2	1-3
		Sloan Peak	4-24	2	1-3	30	20-50	30	20-50
		All		10	7-13	30	20-50	40	27-63
		All		75	66-84	30	20-50	105	86-134

Table 1. continued.

Zone	Area	Unit	MGU	Survey		Guestimate		Combined	
				Est	CI	Est	Range	Est	Range
Glacier Peak	Glacier Peak	Glacier Peak	4-16	53	44-62	10	0-20	10	0-20
		Lime Ridge		.		5	0-10	5	0-10
		All		.		15	0-30	15	0-30
East Central Cascades	Chiwawa River	Chiwawa River		.		75	50-100	75	50-100
	Nason Ridge	East Stevens Pass	3-1	24	15-34	.		24	15-34
	Wenatchee Mts.	North Wenatchee Mts.	3-2	.		60	50-75	60	50-75
		Cle Elum	3-5	.		10	5-15	10	5-15
	All	All		.		70	55-90	70	55-90
	All		24	15-34	145	105-190	169	120-224	
Lake Chelan	Stehekin	Stehekin		.		20	15-30	20	15-30
	East Sawtooth Ridge	East Sawtooth Ridge		.		15	10-20	15	10-20
	Chelan North	Chelan North	2-1	41	35-47	90	75-115	90	75-115
	Chelan South	Chelan South		21	17-25	57	50-100	57	50-100
	All	All		.		182	150-265	182	150-265
Sultan River	Sultan River	Mt. Pilchuck		.		6	8-10	6	8-10
		Vesper Peak	4-25	.		10	5-25	10	5-25
		Mt. Stickney		.		3	1-5	3	1-5
		All	All		.		19	14-40	19
Olympics	Olympic NP	Olympic NP				273	251-291	273	251-291
	East Olympics	East Olympics		.		17	13-25	17	13-25
	All	All		290	264-316	.		290	264-316
Snoqualmie	Snoqualmie	Snoqualmie		.		50	24-75	50	24-75
East Alpine Lakes	Kachess Ridge	Chikamin Ridge		.		10	5-15	10	5-15
		Goat & Davis Mts.	3-3	.		15	10-20	15	10-20
		Kachess Ridge	3-11	39	33-46	.		39	33-46
		All	All	39	33-46	25	15-35	64	48-81
Cedar & Green Rivers	Cedar & Green Rivers	Cedar & Green Rivers		.		20	16-28	20	16-28

Table 1. continued.

Zone	Area	Unit	MGU	Survey		Guestimate		Combined	
				Est	CI	Est	Range	Est	Range
Southeast Cascades	Blazed Ridge	Blazed Ridge	3-10	92	84-99	.		92	84-99
	Naches Pass	Naches/Corral Passes	3-6	101	91-112	.		101	91-112
	Bumping River	Bumping River	3-7	67	63-71	.		67	63-71
		Timberwolf Mtn.			8	5-10	20	8-25	20
	All				72	64-81	20	8-25	87
All				267	254-281	20	8-25	287	262-306
Mt. Rainier	Mt. Rainier NP	Mt. Rainier NP		111	101-121	224	130-164	335	231-285
	Tatoosh	Tatoosh	5-2	.		10	5-15	10	5-15
	All			111	101-121	234	135-179	345	236-300
Packwood	Goat Rocks	Goat Rocks/Tieton R.	5-4	282	273-292	.		282	273-292
	Smith Creek	Smith Creek	5-3	32	25-38	.		32	25-38
	Dark Divide	Dark Divide		64	56-71	.		64	56-71
	All			378	364-391	.		378	364-391
Mt. St. Helens	Mt. St. Helens	Mt. St. Helens		.		20	15-25	20	15-25
Mt. Adams	Mt. Adams	Mt. Adams		.		150	90-225	150	90-225
	Klickitat River	Klickitat River		.		25	15-40	25	15-40
	All			.		175	105-265	175	105-265
All				1740	1698-1782	1075	703-1402	2815	2401-3184

Figure 1. Estimated number of mountain goats in Washington by Zone.

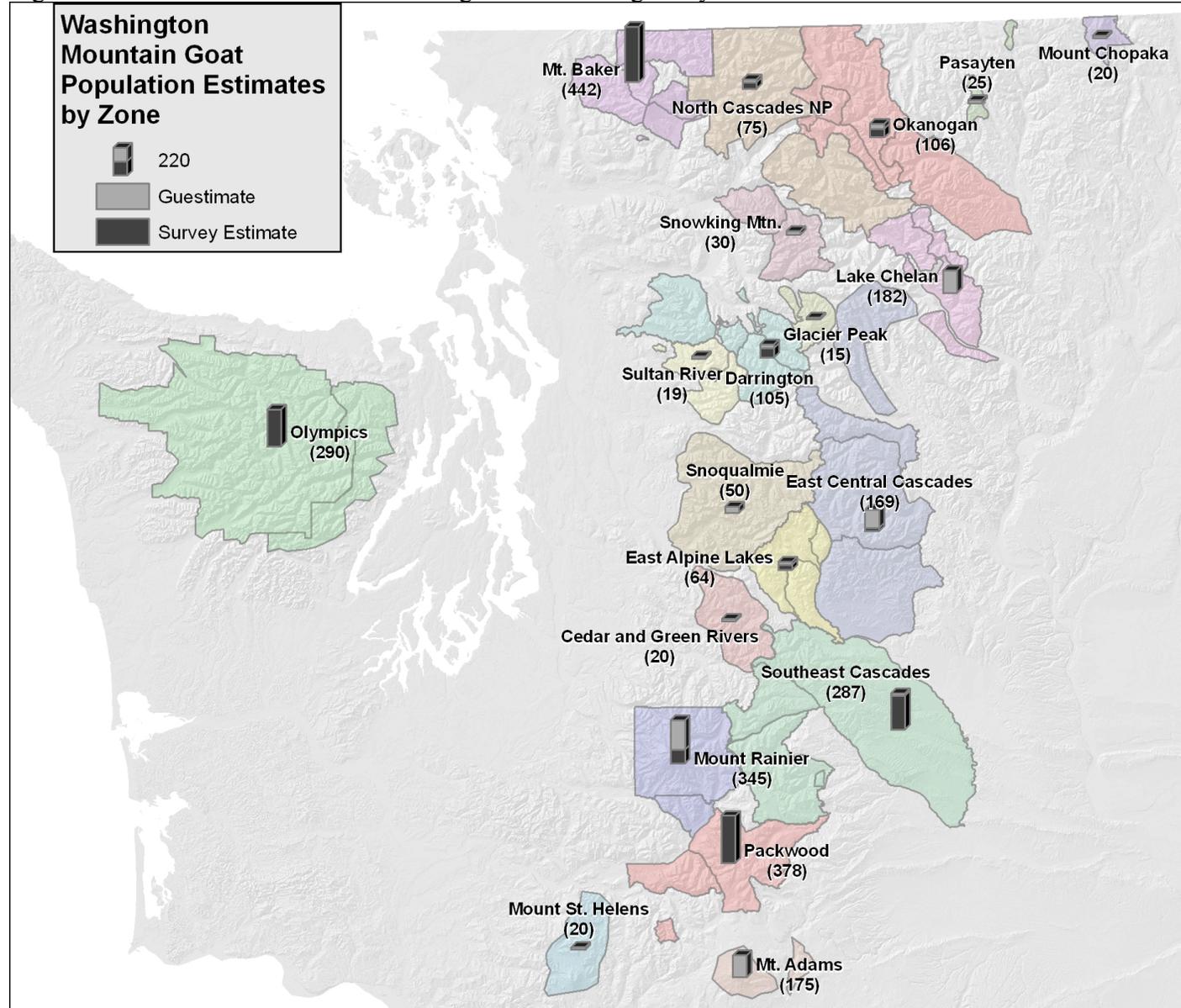


Figure 2. Estimated number of mountain goats in Washington. Large font labels are for Zones with the combined estimate in parenthesis. Smaller font labels are for units, with the survey estimate, guestimate, and combined estimate in parenthesis.

