British Columbia Grizzly Bear (*Ursus arctos*) Population Estimate 2004

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Prepared for

British Columbia Ministry of Water, Land and Air Protection

BRITISH COLUMBIA

June 14, 2004

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Introduction

This report summarizes the current Grizzly Bear (*Ursus arctos*) population estimates and status for British Columbia. The revision of the provincial population estimate was undertaken in response to the recommendations from the Grizzly Bear Scientific Panel (Peek *et al*. 2003). The Panel was appointed by the Minister of Water, Land and Air Protection in 2001 to investigate and provide recommendations for improvement to the methods currently used by the province to manage Grizzly Bear populations in British Columbia. The Ministry accepted the Panel's final report in March 2003. A small working group of regional and headquarters biologists was then assigned the task of leading the implementation of the Panel's recommendations, including the revision of the provincial population estimate.

Grizzly Bear Population Units

The current range of Grizzly Bears in British Columbia has been divided into Grizzly Bear Population Units (GBPUs) that delineate individual populations. GBPU lines are meant to identify similar behavioural ecotypes and sub-populations of bears. In the south, GBPU boundaries follow natural and human-caused fractures in grizzly bear distribution. In the case of the South Selkirk GBPU, boundaries reflect genetic isolation from other populations (Proctor *et al*. 2002). In northern and coastal British Columbia, GBPU boundaries follow natural and ecological boundaries or transition areas (primarily heights of land between watersheds) and less frequently follow actual barriers to grizzly bear movement.

At the edges of grizzly bear distribution in the province, GBPU boundaries represent the "occupied" line. This line was drawn to reflect the known and predicted distribution of resident adult females. Transient males, particularly subadults, are occasionally sighted outside the occupied line. However, these lines are the expected limits of the areas regularly inhabited by grizzly bears. GBPUs serve as the key units for population objective setting, and for determining allowable human-caused mortality thresholds. They are also used for setting land use priorities during strategic land use planning.

Each GBPU has been assigned a conservation status of either Threatened or Viable (Figure 1). This status is based on the difference between the current population estimate and the estimated habitat capability for the GBPU where habitat capability is defined as the inherent, idealized ability of the land to support a specific density of Grizzly Bears independent of human influence. Where the current estimate is less than 50% of habitat capability, the GBPU is designated as Threatened. The selection of the 50% threshold should not be considered an absolute indication of population status but rather a subjective limit chosen in the context of considerable uncertainty about what constitutes a viable grizzly bear population. In some cases a population may be viable at less than 50% of habitat capability. In others, populations that exceed 50% may still not be viable over the long term. The Panel endorsed the 50% criteria for assigning Threatened Status (Peek *et al*. 2003).
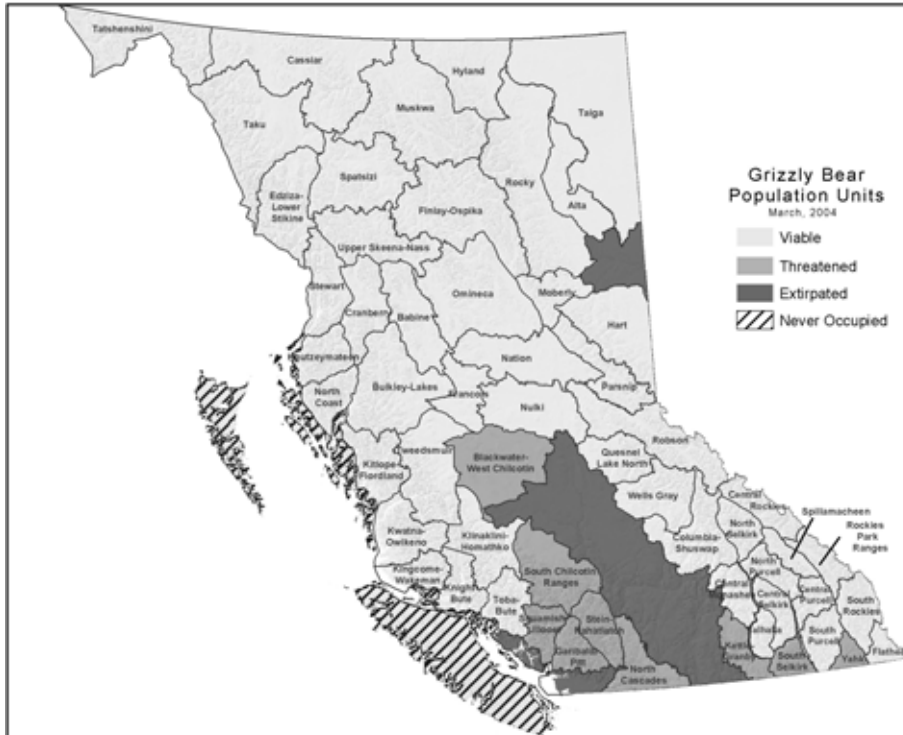
Figure 1. Grizzly Bear Population Units and their conservation status in British Columbia.

The working group revised the GBPU boundaries in response to a recommendation from the Panel to ensure correspondence between the units used to set allowable mortality levels (GBPUs) and the boundaries of the administrative units used to regulate harvest levels (Peek *et al*. 2003). Boundaries of either administrative units (Limited Entry Hunting Zones) or GBPUs were revised to ensure correspondence between these units. There are now 57 GBPUs, rather than the 59 GBPUs in 2001. The Bowron and Tagish GBPUs were incorporated into adjacent units.

Of these 57 GBPUs, nine are classed as Threatened: Blackwater-West Chilcotin, Garibaldi-Pitt, Kettle-Granby, North Cascades, South Chilcotin Ranges, South Selkirk, Squamish-Lillooet, Stein-Nahatalatch and Yahk (Figure 1.)

Population Estimation

The working group chose three different methods to estimate the current number of Grizzly Bears in different areas of the province (Figure 2). The choice of method was guided by a preference for objectivity and transparency and the potential of the method to be broadly applied. A multiple regression model (Mowat *et al*. 2004a) was preferred over direct inventory results (e.g. Mowat and Strobeck 2000, Boulanger *et al.* 2002), which, in turn, was preferred over the expert-based approach (Hamilton and Austin 2002, Hamilton and Austin 2004).

The multiple regression model was chosen as the estimator for the majority of occupied Grizzly Bear habitat in British Columbia (Mowat *et al*. 2004a). Grizzly Bear densities were predicted using information on mean annual rainfall, salmon presence, population connectivity, human and livestock density and the proportion of the population killed by people for 33 known-density study areas in western North America (Mowat *et al*. 2004a).

Mark-Recapture population inventories have been conducted in British Columbia since 1996 and provide the most reliable population estimates for the various study areas (e.g., Mowat and Strobeck 2000, Boulanger *et al*. 2002, Mowat et al. 2004b) but because study areas were not selected to be representative of a GBPU they may overestimate the grizzly bear density in the entire GBPU. However, extrapolation of these estimates can be problematic. Multiple regression model results for two areas of the province varied more than was acceptable from Mark-Recapture inventories conducted in those areas (Boulanger 2001, Poole *et al*. 2001). As a result, direct extrapolations of Mark-Recapture estimates were applied to two Grizzly Bear Population Units (GBPUs): Alta and Flathead. Habitat capability and effectiveness was calculated for the Alta and the Flathead using the approach described by Mowat *et al*. (2004b) for the multiple regression model.

Hamilton and Austin (2004) updated the expert-based method first developed by Fuhr and Demarchi (1990) by: 1) making the logic behind the capability ratings more transparent; 2) including an explicit estimate of the population density contribution of terrestrial and marine meat sources; 3) reducing some of the subjectivity involved by applying the best available map layers of human influence to "step-down" (refine) habitat capability to suitability and effectiveness; and 4) developing a more objective means of incorporating population-level mortality history into current population estimates.

The combined effect of applying the multiple regression population estimate and the harvest management process (Austin *et al*. 2004) for the South Rockies GBPU was a maximum allowable harvest of <1 Grizzly Bear over three years. Given that an average harvest level of 10 Grizzly Bears/year has been sustained from 1978-2003 in this GBPU, the working group decided to retain the previous expert-based population estimate (Hamilton and Austin 2002) and allowable harvest level for the 2004-2006 allocation period while further reviews are conducted.

The multiple regression model overestimated the population size in the South Selkirks and Yaak GBPUs likely because of an overestimate of the level of connectivity between these and adjacent Grizzly Bear populations (M. Proctor and G. Mowat, pers. comm.). Again, the working group decided to retain the previous expert-based population estimate (Hamilton and Austin 2002).

The revised Grizzly Bear population estimate for British Columbia in 2004 was 16,887 bears (Table 1). A quantitative estimate of the precision of the final estimate is not possible because the expert-based approach does not estimate uncertainty. The Panel recommended that the Ministry switch from estimating and reporting the *minimum* population estimate and begin reporting the *best* population estimate. The estimate of 13,834 bears in 2002 (Hamilton and Austin 2002) was a *minimum* estimate for the province and therefore cannot be directly compared to the current *best* estimate of almost 17,000 bears. However, the *midpoint* of the 2001 estimate (19,389 bears) and the current estimate can be compared. Although that comparison indicates fewer bears currently, no conclusions about population trend should be drawn because of the uncertainty surrounding both estimates. Similarly, the 13,000 minimum bear estimate of Banci (1991) had an unknown degree of uncertainty and cannot be used for establishing trend. We cannot make any conclusion about the trend in the number of grizzly bears in British Columbia from our data. The current number of grizzly bears in the province is 83% of what the environment is capable of supporting and 84% of the GBPUs have populations that are above 50% of capability.

Table 1. Grizzly Bear Population Estimates for British Columbia by Population Unit, 2004.

Grizzly Bear Population Unit	Population Estimation Method	Area (km2)	Habitat Capability Population Estimate	Habitat Capability Density (bears/1000 km^2)	Habitat Effectiveness Population Estimate	Habitat Effectiveness Density (bears/1000 km^2)	Habitat Effectiveness as a per cent of Habitat Capability	Current Population Estimate	Population Density (bears/1000 km^2)	Current Population Estimate as a per cent of Habitat Capability
ALTA	D	13,256	204	15	204	15	100%	133	10	65%
BABINE	M	14,039	510	36	499	36	98%	487	35	96%
BLACKWATER-WEST CHILCOTIN	M	20,630	396	19	206	10	52%	193	9	49%
BULKLEY-LAKES	E	23,521	549	23	503	21	92%	407	17	74%
CASSIAR	M	36,374	759	21	758	21	100%	730	20	96%
CENTRAL MONASHEE	M	6349	198	31	149	23	75%	143	23	72%
CENTRAL PURCELL	M	4619	162	35	158	34	98%	150	32	93%
CENTRAL ROCKIES	M	6923	246	36	245	35	100%	235	34	95%
CENTRAL SELKIRK	M	5681	214	38	190	33	89%	178	31	83%
COLUMBIA-SHUSWAP	M	14,927	493	33	404	27	82%	396	27	80%
CRANBERRY	E	11,649	405	35	376	32	93%	341	29	84%
EDZIZA-LOWER STIKINE	E	17,122	396	23	388	23	98%	371	22	94%
FINLAY-OSPIKA	M	30,302	721	24	721	24	100%	689	23	95%
FLATHEAD	D	3434	215	63	162	47	75%	151	44	70%
FRANCOIS	M	8087	160	20	148	18	92%	140	17	88%
GARIBALDI-PITT	E	6463	226	35	180	28	80%	18	3	8%
HART	M	19,661	540	27	416	21	77%	386	20	71%
HYLAND	M	17,268	347	20	347	20	100%	326	19	94%
KETTLE-GRANBY	M	6585	167	25	84	13	51%	81	12	48%
KHUTZEYMATEEN	E	8069	475	59	447	55	94%	376	47	79%
KINGCOME-WAKEMAN	E	5442	253	46	239	44	94%	230	42	91%
KITLOPE-FIORDLAND	E	10,336	370	36	365	35	99%	346	33	94%
KLINAKLINI-HOMATHKO	E	13,643	152	11	144	11	95%	109	8	72%
KNIGHT-BUTE	E	6620	235	35	207	31	88%	186	28	80%
KWATNA-OWIKENO	E	10,650	347	33	336	32	97%	316	30	91%
MOBERLY	M	7577	210	28	198	26	94%	174	23	83%
MUSKWA	M	36,108	815	23	815	23	100%	774	21	95%
NATION	M	18,128	502	28	497	27	99%	484	27	96%
NORTH CASCADES	E	9801	319	33	233	24	73%	23	2	7%
NORTH COAST	E	6776	269	40	250	37	93%	214	32	80%
NORTH PURCELL	M	5470	238	44	237	43	99%	228	42	96%
NORTH SELKIRK	M	6003	276	46	271	45	98%	264	44	96%

Grizzly Bear Population Unit	Population Estimation Method	Area (km2)	Habitat Capability Population Estimate	Habitat Capability Density (bears/1000 km²)	Habitat Effectiveness Population Estimate	Habitat Effectiveness Density (bears/1000 km²)	Habitat Effectiveness as a per cent of Habitat Capability	Current Population Estimate	Population Density (bears/1000 km²)	Current Population Estimate as a per cent of Habitat Capability
NULKI	M	16,796	369	22	205	12	56%	192	11	52%
OMINECA	M	29,171	739	25	739	25	100%	726	25	98%
PARSNIP	M	10,999	487	44	486	44	100%	473	43	97%
QUESNEL LAKE NORTH	M	9100	365	40	322	35	88%	317	35	87%
ROBSON	M	20,078	716	36	706	35	99%	689	34	96%
ROCKIES PARK RANGES	M	5850	184	31	177	30	97%	164	28	89%
ROCKY	M	38,085	822	22	788	21	96%	730	19	89%
<mark>SOUTH CHILCOTIN RANGES</mark>	E	16,125	237	15	218	14	92%	104	6	44%
SOUTH PURCELL	M	6898	198	29	169	25	85%	158	23	80%
SOUTH ROCKIES	M	8306	402	48	338	41	84%	304	37	76%
<mark>SOUTH SELKIRK</mark>	M	4074	131	32	113	28	86%	58	14	44%
SPATSIZI	M	21,702	562	26	562	26	100%	540	25	96%
SPILLAMACHEEN	M	4069	148	36	146	36	98%	141	35	95%
<mark>SQUAMISH-LILLOOET</mark>	E	5689	165	29	134	24	81%	56	10	34%
<mark>STEIN-NAHATLATCH</mark>	E	7710	217	28	173	22	80%	61	8	28%
STEWART	E	11,342	360	32	340	30	94%	319	28	89%
TAIGA	E	50,046	128	3	123	2	96%	92	2	72%
TAKU	E	32,315	650	20	642	20	99%	595	18	92%
TATSHENSHINI	E	19,216	395	21	392	20	99%	360	19	91%
TOBA-BUTE	E	7606	99	13	86	11	87%	75	10	76%
TWEEDSMUIR	E	18,458	323	17	306	17	95%	279	15	86%
UPPER SKEENA-NASS	M	16,999	673	40	673	40	100%	661	39	98%
VALHALLA	M	3479	111	32	98	28	89%	96	28	87%
WELLS GRAY	M	12,837	430	33	380	30	88%	374	29	87%
<mark>YAHK</mark>	M	2719	101	37	73	27	72%	44	16	44%
TOTALS		791,182	20,381		18,766			16,887		

<mark>YELLOW SHADING</mark> = CURRENTLY THREATENED
M= MULTIPLE REGRESSION ESTIMATE
D= DIRECT INVENTORY ESTIMATE
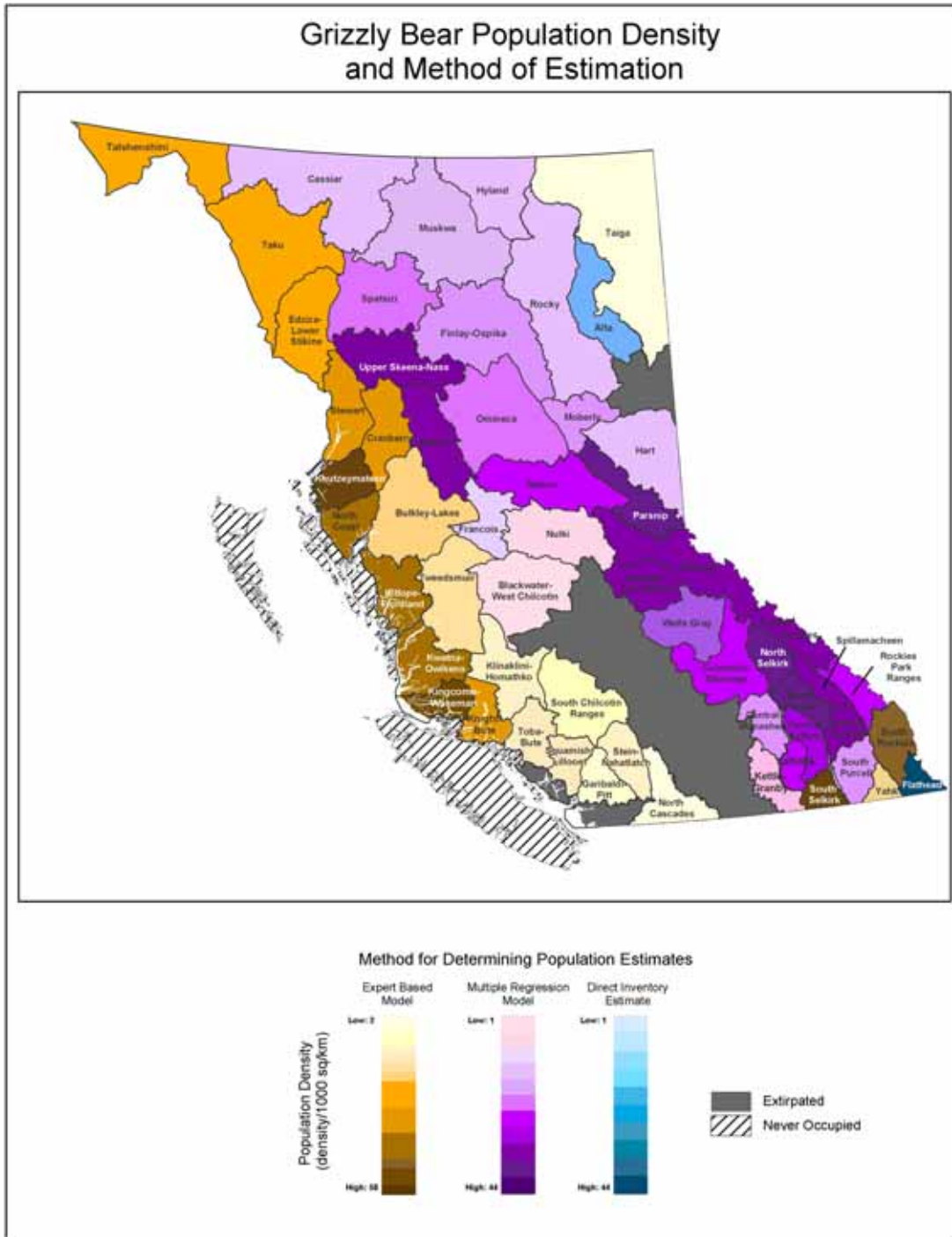E= EXPERT - BASED ESTIMATE

Figure 2. Grizzly Bear population density and method of estimation.

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