

British Columbia Wildlife Species Distribution Mapping – Meta-Data

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Background

Prior to the early 1970's there were no reliable province-wide species distribution maps in British Columbia. Most maps were very small in scale and general in nature, even for a species such as Mountain Sheep that were of much interest at that time. Examples of such maps include William T. Hornaday's Mountain Sheep distribution map Figure 1 (1914: page 27); Ian McTaggart-Cowan's native sheep of North America distribution map Figure 2 (1940: page 574); Cowan and Charles J. Guiguet's distribution map of Bighorn and Thinhorn Sheep of British Columbia Figure 3 (1956: page 395). There were also three subspecies maps that can be considered as being the first for the BC: Charles Sheldon's Thinhorn Sheep map Figure 4 (1911: after page 299); Lawson G. Sugden's California Bighorn Sheep of the Okanagan Figure 5 (1961: page 11); Ray and Dennis Demarchi's Rocky Mountain Bighorn Sheep of the East Kootenay distribution map Figure 6 (1967: page 11).

After the early 1950's, when university educated biologists were hired for regional offices, winter flights were undertaken to assess game population numbers and status that a more comprehensive documentation of big game distribution in the province. In addition, 1965 an intensive wildlife inventory program was undertaken for the Province, under the Canada Land Inventory (CLI) of the federal Agriculture Rural Development Agreement (ARDA) (Benson, 1981; Cowan 1987; Robinson 1987). In 1961 Lawson G. Sugden's California Bighorn Sheep report was the first to document the distribution and abundance of an entire subspecies in the province (Sugden 1961). Since then it is commonplace for distribution and abundance reports to be produced for entire species in the province and elsewhere. The 27 maps presented here represent a unique view of some of the first province-wide distribution and abundance maps for 12 big game species that occur in the province.

Methodology

In the early and mid- 1970's there were two independent efforts that lead to the preparation of province-wide species distribution maps: one was as part of individual species management plans and the other was as a completion of the British Columbia portion of the Canada Land Inventory surveys and mapping project. There is some overlap, as a few of the maps created for species management plans were completed with Dan Blower's assistance.

The scientific taxonomy and common names has changed since this mapping project was initiated back in 1972. For this project Ian McTaggart-Cowan and Charles J. Guiguet (1956) was the authority; in order to keep current all the names used in the report have been adjusted to meet

the new taxonomy listed in David Shackleton (1999) for ungulates and David F. Hatler, David W. Nagorsen and Alison M. Beal (2008) for carnivores. The major changes are: Mule Deer instead of Black-tailed Deer; *Cervus elaphus* for *Cervus canadensis*; Grey Wolf for Wolf.

Maps for Species Management Plans (Table 1), notably – Elk (Raymond A. Demarchi *et al.* 1972) and Mountain Sheep (Dennis A. Demarchi *et al.* 1973) were created by soliciting input from regional wildlife biologists who had each species in their regions. Input maps were at 1:1,900,800; for the Elk map, biologists were asked to locate winter ranges and summer ranges; for the Mountain Sheep map the biologists were asked to locate winter ranges, summer ranges, as well as population size. Three other maps were prepared for species management plans: Mountain Goat (1977); Elk (1990); and, Grizzly Bear (1993), in these cases the map design outlined by Dan Blower was used.

Table 1. Species Distribution Maps for Provincial Species Management Plans, by Year of Completion (1972 & 1974 at 1:1,900,800, 1977 - 1990 at 1:2,000,000 – all at North American Datum 1927).

Species	Version 1	Version 2
Elk	1972	1990
Mountain Sheep	1974	
Mountain Goat	1977	
Grizzly Bear	1993	

The Other Wild Ungulate Maps (Table 2) that are presented here were completed by Dan Blower as final products that arose from the Canada Land Inventory (which later became the British Columbia Land Inventory (BCLI). Under the CLI/BCLI program 49 of 86 – 1:250,000 map areas (National Topographic Series of mapping) were surveyed, during the period from January 1965 until March 1973. Staff was divided into teams of a biologist and a technician and each year the teams were each given a map area block of from two to four map areas to survey and classify. The biologists were Alan Luckhurst and Bjarne Mide, who was replaced in 1969 by Grant Hazelwood; the technicians were Brian Mathews and Wayne Tremblay.

Each map area was first surveyed by fixed-wing aerial flights (usually a four-seat Cessna 172 was used) during the mid-winter period (January and February); all flight lines were recorded on paper maps along with animal observations and snow-depth estimations, (Figures 7 & 8). Each animal observed was only recorded to species, not to sex or age; snow depths were usually estimated from the air by observing depths to the animals or shrubs and trees, in some cases actual ground measurements were made. In the summer months field work, conducted by ground vehicle, concentrated mainly on the habitat conditions and indications of animal use on known winter ranges in the project area. Interviews were also conducted with regional wildlife staff and individuals with wildlife experience in a given map area. Back in the office all gathered information was transferred onto a draft ungulate capability map using standards set out in Blower (1973).

The basic units were based on topographic features taken from the 1:250,000 NTS maps that related to slope, aspect and elevation and interpreted for snow depths. The final ungulate capability ratings were based on “ungulate units” that is the sum total of biomass of all the ungulates of any species that could be supported on a given area, with up to the three most likely species to occur there noted on each polygon label. Because wild ungulates are most dense on their winter ranges, in British Columbia and elsewhere where snowfall limits their mobility, the higher classes relate to winter ranges and the lower classes to summer ranges, note that winter ranges were designated on the relevant polygon labels.

After the completion of the BCLI program in 1973 the resultant 1:250,000 capability maps were condensed down to 1:1,000,000 maps (Blower 1976).

From all that information as well as personal observations for areas not covered by the CLI/BCLI program, Dan Blower then generated species specific polygons and with input from regional wildlife biologists and some Conservation Officers, density estimates were generated for each polygon. The higher ungulate densities are typically for the winter ranges, except for Mountain Goats where winter and summer ranges are often not distinguishable at 1:2,000,000. After the first versions were printed they were sent out to all the regional offices; several biologists reviewed these final products and sent comments and sent suggested revisions back to Blower. He compiled all these comments, plus he was able to gather additional information in the field from which he was able to update both the polygons as well as the density figures for some of the polygons.

The regional big game population estimates were the result of consultation between Dan Blower and regional biologists.

The noted compiler(s) of the individual maps varies depending on the date of completion although Dan Blower was involved in all of them. Maps prepared in 1977 are attributed to DB/KB which translates to Dan Blower and an unknown drafts person. Maps prepared in 1978 are attributed to DB/LW which translates to Dan Blower and draftsman Larry Wells. Maps prepared in 1988 are attributed to Dan Blower, except for the Grey Wolf map which was compiled by Dan Blower and Raymond Demarchi. Maps prepared in 1990 were attributed to the Wildlife Branch, but were actually compiled by Dan Blower; the one exception is the Moose map which is attributed to Dan Blower. Finally, the Grizzly Bear map that was prepared in 1993 is attributed to Raymond Demarchi, Dennis Demarchi and Dan Blower.

Table 2. Ungulate Species Distribution Maps Prepared For the Fish and Wildlife Branch by Year of Completion (All at 1:2,000,000 & NAD 27)).

Versions	First Version	Second Version	Third Version
Caribou	1977	1988	1990
Black-Tailed Deer	1978	1988	-
White-Tailed Deer	1978	1988	1990
Fallow Deer	1978	-	-
Elk	1977	1988	1990
Moose	1977	1990	-
Mountain Goat	1977	1988	-

Mountain Sheep	1978	1988	-
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Carnivore Species Maps (Table 3)

In addition to mapping ungulates and while not part of the CLI/BCLI program Dan Blower used his recently acquired knowledge of the province and his contacts with Fish and Wildlife branch staff to map the distribution of four carnivore species (Table 3).

Table 3. Carnivore Species Distribution Maps Prepared for the Fish and Wildlife Branch by Year of Completion (1:2,000,000 - All at NAD 27).

Versions	First Version	Second Version
Black Bear	1978	1988
Grizzly Bear	1977	-
Cougar	1978	1988
Grey Wolf	1977	1988

Map Specific Information

Caribou (*Rangifer tarandus*) Versions 1.0 - 1977, 1.1 - 1988, 1.2 - 1990

- Maps all at 1:2,000,000 NAD 27;
- Polygons were based on topographic details (slope, aspect, elevation);
- The maps refer only to Caribou (*Rangifer tarandus*), ecotypes were not indicated;
- David Shackleton (1999, pages 174 – 176) discusses two ecotypes of the Woodland Caribou (*Rangifer tarandus caribou*), the Northern and the Mountain ecotypes; he does not mention the Boreal ecotype; in addition, Shackleton mentions the extinct Dawson Caribou (*Rangifer tarandus dawsoni*) on pages 178 and 180.
- The data for the 1977 map was derived from information gathered during the CLI/BCLI field inventories and from input from regional wildlife staff;
- For the 1977 map regional Ministry of Environment boundaries are overlain on the habitat polygons as well, a general reliability map at a much reduced scale to the main map, showing the levels of data confidence has been set into the lower right corner;
- The data for the 1988 and 1990 versions came from input from regional wildlife staff and additional observations made by the author, Dan Blower.
- The mapping classification codes and descriptions and the density calculations used for each of the three years in which they were mapped is shown in Table 4;
- Caribou population estimates by region are presented in Table 5 they were calculated from the 1977 relative abundance classification from Table 4, and the respective map polygons and in consultation with respective regional wildlife staff.

Table 4. Distribution and Relative Abundance Codes and Classification for the Three Caribou Maps (Area per Caribou).

Map Code	Description	Version 1.0 – 1977*	Version 1.1 - 1988	Version 1.2 - 1990
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N	Not Present	Nil	Nil	Nil
F	Few	1/25 – 250 Km ²	1/25 – 250 Km ²	1/25 – 250 Km ²
M	Moderate	1/3.4 – 25 Km ²	1/3.4 – 25 Km ²	1/3.4 – 25 Km ²
P	Plentiful	1/<3.4 Km ²	1/<3.4 Km ²	1/<3.4 Km ²
E	Extirpated Population	Used	Not Indicated	Not Indicated

*The original area figures for 1977 were in Mi²

Table 5. Caribou Population Estimates from the 1977 Version 1.0 Caribou Map, the numbers in this table have been greatly rounded.

Region	Estimated Number of Caribou	Estimated Outside Limits	Percent of Provincial Total
1 – Vancouver Island	Nil	Nil	0%
2 - Lower Mainland	Nil	Nil	0%
3 – Thompson - Okanagan	400	300 - 500	2%
4 - Kootenays	500	300 - 700	2%
5 – Cariboo - Chilcotin	600	500 - 700	3%
6 - Omineca- Peace	9,500*	4,000 – 15,000	40%
7 – Skeena - Cassiar	13,000**	5,000 – 25,00	54%
Provincial Total	24,000	10 – 50,000	100%

*Based Primarily on Projection from Relative Abundance Categories

**Based Partially on Projection from Relative Abundance Categories

Mule Deer (*Odocoileus hemionus*) Versions 1.0 - 1978, 1.1 - 1988

- Maps all at 1:2,000,000 NAD 27;
- Polygons were based on topographic details (slope, aspect, elevation);
- Note that Dan Blower refers to this species as Black-tailed Deer, while David Shackleton (1999, Pages 136 – 154) classifies them as Mule Deer, the term used here;
- The maps indicate three subspecies of Mule Deer: Rocky Mountain Mule Deer (*Odocoileus hemionus hemionus*); Columbian Black-tailed Deer (*Odocoileus hemionus columbianus*); and, Sitka Black-tailed Deer (*Odocoileus hemionus sitkensis*); plus a zone of hybridization between the Mule Deer in the interior and the Black-tailed Deer on the coast;
- The data for the 1978 map was derived from information gathered during the CLI/BCLI field inventories and from input from regional wildlife staff;
- For the 1978 map regional Ministry of Environment boundaries are overlain on the habitat polygons as well, a general reliability map at a much reduced scale to the main map, showing the levels of data confidence has been set into the lower right corner;
- The data for the 1988 version came from input from regional wildlife staff and additional observations made by the author, Dan Blower;
- The mapping classification codes and descriptions and the density calculations used for Mule Deer in each of the two years that they were mapped is shown in Table 6;

- Mule Deer population estimates by region are presented in Table 7 they were calculated from the 1978 relative abundance classification from Table 6, and the respective map polygons and in consultation with respective regional wildlife staff.

Table 6. Distribution and Relative Abundance Codes and Classification for the Two Mule Deer Maps (Area per Mule Deer).

Map Code	Description	1978*	1988
N	Not Present	Nil	Nil
F	Few	1/2 - 200 Km ²	1/2 - 200 Km ²
M	Moderate	1/0.2 – 2 Km ²	1/0.2 – 2 Km ²
P	Plentiful	1/<0.2 Km ²	1/<0.2 Km ²
I	Introduced Population	Used	Not Indicated

*The original area figures for 1978 were in Mi²

Table 7. Mule Deer Population Estimates from the 1978 Version 1.0 Mule Deer Map, the numbers in this table have been greatly rounded.

Region	Estimated Number of Mule Deer*	Estimated Outside Limits	Percent of Provincial Total
1 – Vancouver Island	200,000	150,000 – 300,000	4.3%
2 - Lower Mainland	15,000	12,000 – 18,000	3%
3 – Thompson - Okanagan	65,000	30,000 - 90,000	14%
4 - Kootenays	60,000	30,000 – 90,000	13%
5 – Cariboo - Chilcotin	35,000**	20,000 – 50,000	7%
6 - Omineca- Peace	80,000**	50,000 – 100,000	17%
7 – Skeena - Cassiar	35,000	10,000 – 20,000	3%
Provincial Total	470,000	350,000 – 650,000	100%

*Based Partially on Projection from Relative Abundance Categories

**Based Primarily on Projection from Relative Abundance Categories

White-tailed Deer (*Odocoileus virginianus*) Versions 1.0 - 1978, 1.1 - 1988, 1.3 – 1990 And European Fallow Deer (*Dama dama dama*) on Version 1.0 – 1977.

- Maps all at 1:2,000,000 NAD 27
- Polygons based on topographic details (slope, aspect, elevation).
- The maps do not indicate the two subspecies of White-tailed Deer that occur in the province;
- David Shackleton (1999, pages 161 – 165) discuss the distribution of the two White-tailed Deer subspecies in British Columbia: Dakota White-tailed Deer (*Odocoileus virginianus dacotensis*) that occur east of the Rocky Mountains and the Northwestern White-tailed Deer (*Odocoileus virginianus ochrourus*), that occur elsewhere in the province;

- European Fallow Deer were included on version 1.0 of the White-tailed Deer map but not on the two subsequent versions, nor on any other species maps in this series;
- The data for the 1978 map was derived from information gathered during the CLI/BCLI field inventories and from input from regional wildlife staff;
- For the 1978 map regional Ministry of Environment boundaries are overlain on the habitat polygons as well, a general reliability map at a much reduced scale to the main map, showing the levels of data confidence has been set into the lower right corner;
- The data for the 1988 and 1990 versions came from input from regional wildlife staff and additional observations made by the author, Dan Blower;
- The mapping classification codes and descriptions and the density calculations used for White-tailed Deer each of the three years that they were mapped is shown in Table 8;
- White-tailed Deer population estimates by region are presented in Table 9 they were calculated from the 1978 relative abundance classification from Table 8, and the respective map polygons and in consultation with respective regional wildlife staff;
- The mapping classification codes and descriptions and the density calculation used for Fallow Deer in 1978 is shown in Table 10.

Table 8. Distribution and Relative Abundance Codes and Classification for the Three White-Tailed Deer Maps (Area per White-Tailed Deer).

Map Code	Description	1978*	1988	1990
N	Not Present	Nil	Nil	Nil
F	Few	1/5– 525 Km ²	1/5– 525 Km ²	1/5– 525 Km ²
M	Moderate	1/0.5 – 5 Km ²	1/0.5 – 5 Km ²	1/0.5 – 5 Km ²
P	Plentiful	1/<0.5 Km ²	1/<0.5 Km ²	1/<0.5 Km ²
X	Rare or Occasional Sighting	Since 1970	Since 1980	Since 1980

*The original area figures for 1978 were in Mi²

Table 9. White-tailed Deer Population Estimates from the 1978 Version 1.0 White-Tailed Deer Map, the numbers in this table have been greatly rounded.

Region	Estimated Number of White-tailed Deer	Estimated Outside Limits	Percent of Provincial Total
1 – Vancouver Island	Nil	-	0%
2 - Lower Mainland	Nil	-	0%
3 – Thompson - Okanagan	2,500*	1,500 – 4,500	7%
4 - Kootenays	33,000**	20,000 – 40,000	86%
5 – Cariboo - Chilcotin	Nil	-	0%
6 - Skeena – Cassiar	Nil	-	0%
7 - Omineca- Peace	2,500*	1,000 – 5,000	7%

Provincial Total	38,000	25,000 – 50,000	100%
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*Based Partially on Projection from Relative Abundance Categories

**Based Primarily on Projection from Relative Abundance Categories

Table 10. Distribution and Relative Abundance Codes and Classification for the Fallow Deer Information that was included on the 1978 White-tailed Deer Map (Area/Fallow Deer).

Map Code	Description	1978*
IP	Introduction Site	Present Numbers Plentiful (Over 1 Deer/ 0.5 Km ²)
IE	Introduction Site	Population Failed To Establish
R	Rare Fallow Deer Sightings	Since 1975

*The original area figures were in Mi²

Elk Version 1.0 - 1972

- Map at 1:1,900,800 NAD 27;
- Polygons based on watersheds and Wildlife Management Units;
- Species separated into Rocky Mountain Elk (*Cervus elaphus nelsoni*) and Roosevelt Elk (*Cervus elaphus roosevelti*);
- Data derived from regional wildlife biologists, namely: Ian Smith (Vancouver Island), Bryan Gates (Lower Mainland), Ralph Ritcey (Southern Interior), David Spalding (Okanagan), Raymond Demarchi (Kootenay); Harold Mitchell (Cariboo-Chilcotin), Ken Sumanik (Central BC, North Coast and Queen Charlotte Islands), Fred Harper (Peace and Northern BC).

Elk Versions 2.0 - 1977, 2.1 - 1988, 2.2 - 1990

- Maps all at 1:2,000,000 NAD 27;
- polygons based on topographic details (slope, aspect, elevation);
- Species separated into Rocky Mountain Elk (*Cervus canadensis nelsoni*) and Roosevelt Elk (*Cervus canadensis roosevelti*);
- Note that David Shackleton (1999: Pages 110 – 111) designate the species name as *C. elaphus* and not *C. canadensis*;
- The data for the 1977 map was derived from information gathered during the CLI/BCLI field inventories and from input from regional wildlife staff;
- For the 1977 map regional Ministry of Environment boundaries are overlain on the habitat polygons as well, a general reliability map at a much reduced scale to the main map, showing the levels of data confidence has been set into the lower right corner;
- The data for the 1988 and 1990 versions came from input from regional wildlife staff and additional observations made by the author, Dan Blower;
- The mapping classification codes and descriptions and the density calculations used for Elk in each of the three years that they were mapped is shown in Table 11;

- Elk population estimates by region are presented in Table 12 they were calculated from the 1977 relative abundance classification from Table 11 and the respective map polygons and in consultation with respective regional wildlife staff.

Table 11. Distribution and Relative Abundance Codes and Classification for the Three Elk Maps (Area per Elk).

Map Code	Description	1977*	1988	1990
N	Not Present	Nil	Nil	Nil
F	Few	1/10 - 250 Km ²	1/10 - 250 Km ²	1/10 - 250 Km ²
M	Moderate	1/2.5 - 10 Km ²	1/2.5 - 10 Km ²	1/2.5 - 10 Km ²
P	Plentiful	1/ <2.5 Km ²	1/ <2.5 Km ²	1/ <2.5 Km ²
R	Rare or Occasional Sightings	Since 1970	Since 1980	Since 1980
I	Introduced Population	Used	Not Indicated	Not Indicated
E	Extinct or Failed To Establish	Used	Not Indicated	Not Indicated

*The original area figures for 1977 were in Mi²

Table 12. Elk Population Estimates from the 1977 Version 2.0 Elk Map, the numbers in this table have been greatly rounded.

Region	Estimated Number of Elk	Estimated Outside Limits	Percent of Provincial Total
1 – Vancouver Island	2,700	1,500 – 4,000	15%
2 - Lower Mainland	10*	5 – 30	1%
3 – Thompson - Okanagan	400	300 – 600	2%
4 - Kootenays	11,000**	8,000 – 14,000	59%
5 – Cariboo - Chilcotin	20***	10 – 50	<1%
6 - Skeena - Cassiar	100***	50 – 150	<1%
7 - Omineca- Peace	4,400***	2,500 – 6,500	24%
Provincial Total	18,500	12,000 – 30,000	100%

*All Transients, Estimates Based Entirely On Projected From Abundance Categories

**Based Partially on Projection from Relative Abundance Categories

***Based Primarily on Projection from Relative Abundance Categories

Moose (*Alces alces*) Versions 1.0 - 1977, 1.1 - 1990

- Maps all at 1:2,000,000 NAD 27
- Polygons based on topographic details (slope, aspect, elevation).
- The maps do not indicate the distribution of the three Moose subspecies, that occur in the province;
- David Shackleton (1999, pages 127 – 133) discusses the distribution of the three moose subspecies in British Columbia: Northwestern Moose (*Alces alces andersoni*) that occur

throughout most of BC; Alaskan Moose (*Alces alces gigas*) that occur in the Cassiar and Tatshenshini districts; and the Shiras' Moose (*Alces alces shirasi*) that occur in the East Kootenay;

- The data for the 1977 map was derived from information gathered during the CLI/BCLI field inventories and from input from regional wildlife staff;
- For the 1977 map regional Ministry of Environment boundaries are overlain on the habitat polygons as well, a general reliability map at a much reduced scale to the main map, showing the levels of data confidence has been set into the lower right corner;
- The data for the 1990 version came from input from regional wildlife staff and additional observations made by the author, Dan Blower;
- The mapping classification codes and descriptions and the density calculations used for Moose is each of the two years that they were mapped is shown in Table 13;
- Moose population estimates by region are presented in Table 14 they were calculated from the 1977 relative abundance classification from Table 13, and the respective map polygons and in consultation with respective regional wildlife staff.

Table 13. Distribution and Relative Abundance Codes and Classification for the Three Moose Maps (Area per Moose)

Map Code	Description	1977*	1990
N	Not Present	Nil	Nil
F	Few	1/10 – 260 Km ²	1/10 – 260 Km ²
M	Moderate	1/1.3 – 10 Km ²	1/1.3 – 10 Km ²
P	Plentiful	1/<1.3 Km ²	1/<1.3 Km ²

*The original area figures for 1977 were in Mi²

Table 14. Moose Population Estimates from the 1977 Version 1.0 Moose Map, the numbers in this table have been greatly rounded.

Region	Estimated Number of Moose	Estimated Outside Limits	Percent of Provincial Total
1 – Vancouver Island	50*	20 – 80	<1%
2 - Lower Mainland	100*	70 -130	<1%
3 – Thompson - Okanagan	6,500	4,500 – 8,500	3%
4 - Kootenays	3,500*	2,000 – 5,000	2%
5 – Cariboo - Chilcotin	30,000**	20,000 – 40,000	12%
6 - Skeena - Cassiar	80,000**	60,000 – 100,000	33%
7 – Omineca- Peace	120,000	90,000 – 150,000	50%
Provincial Totals	240,000	180,000 – 300,000	100%

*Based Partially on Projection from Relative Abundance Categories

**Based Primarily on Projection from Relative Abundance Categories

Mountain Goat (*Oreamnus americanus*) Versions 1.0 – 1977, 1.1 – 1988.

- Maps all at 1:2,000,000 NAD 27;
- Polygons were based on topographic details (slope, aspect, elevation);
- The maps refer only to Mountain Goat, subspecies or ecotypes were not indicated;
- David Shackleton (1999, pages 208-8) discusses historic subspecies classifications.
- The data for the 1977 map was derived from information gathered during the CLI/BCLI field inventories and from input from regional wildlife staff including the Kootenay Region Goat Management Plan (David Phelps *et al.* 1975);
- The 1977 map regional Ministry of Environment boundaries are overlain on the habitat polygons as well, a general reliability map at a much reduced scale to the main map, showing the levels of data confidence has been set into the lower right corner;
- The data for the 1988 version came from input from regional wildlife staff and additional observations made by the author, Dan Blower; The mapping classification codes and descriptions and the density calculations used for Mountain Goats in each of the three years that they were mapped is shown in Table 15;
- Mountain Goat population estimates by region are presented in Table 16 they were calculated from the 1977 relative abundance classification from Table 15 and the respective map polygons and in consultation with respective regional wildlife staff.

Table 15. Distribution and Relative Abundance Codes and Classification for the Three Mountain Goat Maps (Area per Mountain Goat).

Map Code	Description	1977*	1988	1990
N	Not Present	Nil	Nil	Nil
F	Few	1/13 – 260 Km ²	1/13 – 260 Km ²	1/13 – 260 Km ²
M	Moderate	1/3 – 13 Km ²	1/3 – 13 Km ²	1/3 – 13 Km ²
P	Plentiful	1/<3 Km ² .	1/<3 Km ²	1/<3 Km ² .
I	Introduced Population	Used	Not Indicated	Not Indicated
E	Population Extinct or Failed to Establish	Used	Not Indicated	Not Indicated
R	Rare	Not Indicated	Since 1980	Since 1980

*The original area figures for 1977 were in Mi²

Table 16. Mountain Goat Population Estimates from the 1977 Version 1.0 Mountain Goat Map, the numbers in this table have been greatly rounded.

Region	Estimated Number of Mountain Goats	Estimated Outside Limits	Percent of Provincial Total
1 – Vancouver Island	1,300*	800 – 1,800	3%
2 - Lower Mainland	2,500*	1,500 – 4,000	5%
3 – Thompson - Okanagan	2,500*	1,500 – 4,000	5%
4 - Kootenays	5,000*	3,500 – 6,500	11%
5 – Cariboo - Chilcotin	3,000**	1,500 – 4,500	6%
6 - Skeena - Cassiar	24,000**	15,000 – 35,000	52%

7 - Omineca- Peace	8,000*	4,000 – 12,000	17%
Provincial Total	46,500	30,000 – 65,000	100%

*Based Partially on Projection from Relative Abundance Categories

**Based Entirely on Projection from Relative Abundance Categories

Mountain Sheep (*Ovis spp.*) Versions 1.0 - 1974

- Map at 1:1,900,800 NAD 27
- Polygons were based on known distribution of Mountain Sheep for both the winter and summer periods;
- The map shows the distribution of the two species of Mountain Sheep, Bighorn Sheep (*Ovis canadensis*) and Thinhorn Sheep (*Ovis dalli*), as well it shows the location of two subspecies of Bighorn Sheep - Rocky Mountain Bighorn Sheep (*Ovis canadensis canadensis*) and California Bighorn Sheep (*Ovis canadensis californiana*); and the location of the two subspecies of Thinhorn Sheep – Dall’s Sheep (*Ovis dalli dalli*) and Stone’s Sheep (*Ovis dalli stonei*); David Shackleton (1999, page 230) discusses the classification of the California Bighorn subspecies suggesting that it may only be a ecotype of the Rocky Mountain Bighorn;
- Population estimates were made for each herd or sub-population;
- This map was part of the Mountain Sheep management plan, Dennis Demarchi (chairman 1973).
- This map represents the first best population estimate for each herd or subpopulation for all the Mountain Sheep in British Columbia and as such it remains a historical document for that purpose;
- Data was derived from regional wildlife biologists, namely: for Rocky Mountain Bighorn - Ralph Ritcey (Southern Interior), Raymond Demarchi (Kootenay); and Fred Harper (Peace); for California Bighorn David Spalding (Okanagan), Ralph Ritcey, Harold Mitchell (Cariboo-Chilcotin); for Stone’s Sheep - Ken Sumanik (Central BC) Fred Harper, conservation officer Leroy (Bud) Ward (Liard & Northern BC); for Dall’s Sheep Raymond Demarchi, Wendel Parsons (guide outfitter).

Mountain Sheep (*Ovis spp.*) Versions 2.0 – 1978, 2.1 - 1988.

- Maps all at 1:2,000,000 NAD 27;
- polygons based on topographic details (slope, aspect, elevation);
- Species separated into Bighorn Sheep (*Ovis canadensis*) and Thinhorn Sheep (*Ovis dalli*), each species was further subdivided into subspecies, for Bighorn Sheep – Rocky Mountain Bighorn Sheep (*Ovis canadensis canadensis*) and California Bighorn Sheep (*Ovis canadensis californiana*) and for Thinhorn Sheep - Dall’s Sheep (*Ovis dalli dalli*) and Stone’s Sheep (*Ovis dalli stonei*);
- The data for the 1978 map was derived from information gathered during the CLI/BCLI field inventories and from input from regional wildlife staff;
- For the 1978 map regional Ministry of Environment boundaries are overlain on the habitat polygons as well, a general reliability map at a much reduced scale to the main map, showing the levels of data confidence has been set into the lower right corner;
- The data for the 1988 version came from input from regional wildlife staff and additional observations made by the author, Dan Blower;

- The mapping classification codes and descriptions and the density calculations used for Bighorn Sheep in each of the two years that they were mapped is shown in Table 17;
- The mapping classification codes and descriptions and the density calculations used for Thinhorn Sheep each of the two years that they were mapped is shown in Table 18;
- Bighorn Sheep population estimates by region are presented in Table 18 they were calculated from the 1978 relative abundance classification from Table 17, and the respective map polygons and in consultation with respective regional wildlife staff;
- Thinhorn Sheep population estimates by region are presented in Table 19 they were calculated from the 1978 relative abundance classification from Table 17, and the respective map polygons and in consultation with respective regional wildlife staff.

Table 17. Distribution and Relative Abundance Codes and Classification for the Two Mountain Sheep Maps (Area per Mountain Sheep).

Map Code	Description	1978*	1988
N	Not Present	Nil	Nil
F	Few	1/5 - 250Km ²	1/5 - 250Km ²
M	Moderate	1/1.3 - 5Km ²	1/1.3 - 5Km ²
P	Plentiful	<1.3Km ²	<1.3Km ²
R	Rare Or Occasional Sighting	Since 1975	Since 1980

*The original area figures for 1978 were in Mi²

Table 18. Bighorn Sheep Population Estimates from the 1978 Version 2.0 Mountain Sheep Map, the numbers in this table have been greatly rounded.

Region	Estimated Number of Bighorn Sheep	Estimated Outside Limits	Percent of Provincial Total
1 – Vancouver Island	Nil	-	0%
2 - Lower Mainland	Nil	-	0%
3 – Thompson - Okanagan	1,000	800 – 1,400	30%
4 - Kootenays	1,500	1,300 – 1,700	45%
5 – Cariboo - Chilcotin	750	600 – 900	22%
6 - Skeena - Cassiar	Nil	-	0%
7 - Omineca- Peace	100	70 - 130	3%
Provincial Total	3,350	2,800 – 4,000	100%

Table 19. Thinhorn Sheep Population Estimates from the 1978 Version 2.0 Mountain Sheep Map, the numbers in this table have been greatly rounded.

Region	Estimated Number of Thinhorn Sheep	Estimated Outside Limits	Percent of Provincial Total
1 – Vancouver Island	Nil	-	0%

2 - Lower Mainland	Nil	-	0%
3 - Thompson - Okanagan	Nil	-	0%
4 - Kootenays	Nil	-	0%
5 - Cariboo - Chilcotin	Nil	-	0%
6 - Skeena - Cassiar	4,000*	2,000 – 6,000	40%
7 - Omineca- Peace	6,000*	3,000 – 9,000	60%
Provincial Total	10,000	5,000 – 15,000	100%

*Based Primarily on Projection from Relative Abundance Categories

American Black Bear (*Ursus americanus*) Versions 1.0 - 1978, 1.1 - 1988.

- Maps all at 1:2,000,000 NAD 27;
- polygons based on broad topographic features;
- This species was not separated into subspecies;
- David Hatler *et al.* (2008: pages 127-8) discuss the current status and distribution of the five subspecies recognized in British Columbia, (*Ursus americanus altifrontalis*, *U. a. carlottae*, *U. a. cinnamomum*, *U. a. kermodei*, *U.a. vancouveri*);
- The data for the 1978 map was derived from summer field information gathered during the CLI/BCLI field inventories and from input from regional wildlife staff;
- For the 1978 map regional Ministry of Environment boundaries are overlain on the habitat polygons as well, a general reliability map showing there levels of data confidence at a much reduced scale to the main map, has been set into the lower right corner;
- The data for the 1988 version came from input from regional wildlife staff and additional observations made by the author, Dan Blower;
- The mapping classification codes and descriptions and the density calculations used for Black Bear in each of the two years that they were mapped is shown in Table 20;
- Black Bear population estimates by region are presented in Table 21 they were calculated from the 1978 relative abundance classification from Table 20 and the respective map polygons and in consultation with respective regional wildlife staff.

Table 20. Distribution and Relative Abundance Codes and Classification for the Two Black Bear Maps (Area per Black Bear).

Map Code	Description	1978*	1988
N	Not Present	Nil	Nil
F	Few	1/50 – 500 Km ²	1/50 – 500 Km ²
M	Moderate	1/8 – 50 Km ²	1/8 – 50 Km ²
P	Plentiful	1/<8 Km ²	1/<8 Km ²
?	Status Unknown	Used	Not Indicated

*The original area figures for 1978 were in Mi²

Table 21. American Black Bear Population Estimates from the 1978 Version 1.0 Black Bear Map, the numbers in this table have been greatly rounded.

Region	Estimated Number of Black Bear	Estimated Outside Limits	Percent of Provincial Total
1 – Vancouver Island	7,000*	5,000 – 12,000	12%
2 - Lower Mainland	5,000*	2,500 – 7,500	8%
3 – Thompson - Okanagan	5,500*	2,500 – 8,000	9%
4 - Kootenays	5,500*	2,500 – 8,000	9%
5 – Cariboo - Chilcotin	5,000*	2,500 – 7,500	8%
6 - Skeena - Cassiar	14,000**	8,000 -20,000	24%
7 - Omineca- Peace	18,000*	12,000 – 25,000	30%
Provincial Totals	60,000	40,000 – 90,000	100%

*Based Partially on Projection from Relative Abundance Categories

**Based Primarily on Projection from Relative Abundance Categories

Grizzly Bear (*Ursus arctos*) Versions 1.0 - 1977, 1.1 – 1993.

- Maps all at 1:2,000,000 NAD 27;
- For the 1977 and 1993 maps polygons based on topographic features;
- There is only one subspecies of Grizzly Bear on the mainland of North America *Ursus arctos horribilis* was not separated into subspecies;
- David Hatler *et al.* (2008: pages 150 -1) discuss the current status and distribution of the three recognized subspecies that occur in North America;
- The data for the 1977 map was derived from summer field information gathered during the CLI/BCLI field inventories and from input from regional wildlife staff;
- For the 1977 map regional Ministry of Environment boundaries are overlain on the habitat polygons;
- The 1993 version was produced for the British Columbia Grizzly Bear Conservation Strategy (BC Ministry of Environment, Lands and Parks 1995a and 1995b);
- The data for the 1993 version came from input from regional wildlife staff, provincial species experts and correlated by Raymond Demarchi, Dennis Demarchi and Dan Blower;
- The mapping classification codes and descriptions and the density calculations used for Grizzly Bears in each of the two years that they were mapped is shown in Table 22;
- There were no population estimates made from either the 1977 or the 1993 maps.

Table 22. Distribution and Relative Abundance Codes and Classification for the Two Grizzly Bear Maps (Area per Grizzly Bear).

Map Code	Description	1977*	1993
N	Not Present	Nil	Generally Not Present
F	Few	1/140 – 1000 Km ²	1/140 – 1000 Km ²
M	Moderate	1/65 – 140 Km ²	1/65 – 140 Km ²

P	Plentiful	1/<65 Km ²	1/<65 Km ²
E	Extirpated Population	Not Indicated	Used

*The original area figures for 1977 were in Mi²

Cougar (*Puma concolor*) Versions 1.0 – 1978, 1.1 – 1988.

- Maps all at 1:2,000,000 NAD 27;
- Polygons based on broad topographic features;
- This species was not separated into subspecies;
- David Hatler *et al.* (2008: pages 335-6) discuss the taxonomy of Cougar in North America including British Columbia, stating that there is only one recognized subspecies (*Puma concolor puma*) in North America;
- The data for the 1978 map was derived from summer field information gathered during the CLI/BCLI field inventories and from input from regional wildlife staff;
- For the 1978 map regional Ministry of Environment boundaries are overlain on the habitat polygons as well, a general reliability map at a much reduced scale to the main map, showing the levels of data confidence has been set into the lower right corner;
- The data for the 1988 version came from input from regional wildlife staff and additional observations made by the author, Dan Blower;
- The mapping classification codes and descriptions and the density calculations used for Cougar in each of the two years in which they were mapped is shown in Table 23;
- Cougar population estimates by region are presented in Table 24 they were calculated from the 1978 relative abundance classification from Table 23, and the respective map polygons and in consultation with respective regional wildlife staff.

Table 23. Distribution and Relative Abundance Codes and Classification for the Two Cougar Maps (Area per Cougar).

Map Code	Description	1978*	1988
N	Not Present	Nil	Nil
F	Few	1/ 26 – 1300 Km ²	1/ 26 – 1300 Km ²
M	Moderate	1/65 – 260 Km ²	1/65 – 260 Km ²
P	Plentiful	1/<8 Km ²	1/<8 Km ²
X	Rare Sightings	Since 1970	Used – No Year Given
?	Status Unknown	Used	Not Indicated

*The original area figures for 1978 were in Mi²

Table 24. Cougar Population Estimates from the 1978 Version 1.0 Cougar Map, the numbers in this table have been greatly rounded.

Region	Estimated Number of Cougar	Estimated Outside Limits	Percent of Provincial Total
1 – Vancouver Island	1,200*	800 – 3,000	34%
2 - Lower Mainland	200*	100 - 400	5%

3 – Thompson - Okanagan	900*		26%
4 - Kootenays	600*	500 – 1,500	17%
5 – Cariboo - Chilcotin	400*	100 - 600	11%
6 - Skeena - Cassiar	100**	50 – 200	3%
7 - Omineca- Peace	150*	50 - 300	4%
Provincial Totals	3,500	2,000 – 7,000	100%

*Based Partially on Projection from Relative Abundance Categories

**Based Primarily on Projection from Relative Abundance Categories

Grey Wolf (*Canis lupus*) Versions 1.0 – 1978, 1.1 - 1988.

- Maps all at 1:2,000,000 NAD 27;
- Polygons based on broad topographic features;
- This species was not separated into subspecies;
- David Hatler *et al.* (2008: pages 92-3) discuss the taxonomy of Wolf in western North America including British Columbia, stating that there are only two possible currently recognized subspecies (*Canus lupus nubilus* and *C.L occidentalis*) in British Columbia;
- The data for the 1978 map was derived from winter aerial surveys and summer field information gathered during the CLI/BCLI field inventories and from input from regional wildlife staff;
- For the 1978 map regional Ministry of Environment boundaries are overlain on the habitat polygons as well, a general reliability map at a much reduced scale to the main map, showing the levels of data confidence has been set into the lower right corner;
- The data for the 1988 version came from input from regional wildlife staff and additional observations made by the author, Dan Blower and by regional wildlife biologist Raymond Demarchi;
- The mapping classification codes and descriptions and the density calculations used for Grey Wolf in each of the two years which they were mapped is shown in Table 25;
- Grey Wolf population estimates by region are presented in Table 26 they were calculated from the 1978 relative abundance classification from Table 24, and the respective map polygons and in consultation with respective regional wildlife staff.

Table 25. Distribution and Relative Abundance Codes and Classification for the Two Grey Wolf Maps (Area per Grey Wolf)

Map Code	Description	1978*	1988
N	Not Present	Nil	Nil
F	Few	1/300 – 1300 Km ²	1/300 – 1300 Km ²
M	Moderate	1/100 – 300 Km ²	1/100 – 300 Km ²
P	Plentiful	1/<100 Km ²	1/<100 Km ²
R	Rare Sightings	Not Indicated	Since 1980
?	Status Unknown	Used	Used

*The original area figures for 1978 were in Mi²

Table 26. Grey Wolf Population Estimates from the 1978 Version 1.0 Grey Wolf Map, the numbers in this table have been greatly rounded.

Region	Estimated Numbers of Grey Wolf	Estimated Outside Limits	Percent of Provincial Total
1 – Vancouver Island	400*	200 – 1,500	6%
2 - Lower Mainland	80*	40 - 300	1%
3 – Thompson - Okanagan	70**	35 - 110	1%
4 - Kootenays	20**	10 - 40	1%
5 – Cariboo - Chilcotin	200*	100 - 300	3%
6 - Skeena - Cassiar	2,500*	1,500 – 10,000	40%
7 - Omineca- Peace	3,000*	2,000 – 11,000	48%
Provincial Totals		4,000 – 20,000	100%

*Based Primarily on Projection from Relative Abundance Categories

**Based Partially on Projection from Abundance Categories

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List of Figures

Figure 1. Distribution of mountain sheep in North America. Showing the approximate range of five races of Bighorn Sheep and four races of Thinhorn Sheep with actual locations of where sheep have been observed. Source: W.T. Hornaday 1914: page 27, scale approx. 1:46,000,000.

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Figure 7. The upper Turnagain River valley portion of Cry Lake 104I map sheet showing the notations and results of an aerial inventory, typical of the type used in the Canada Land Inventory for Ungulates in British Columbia. D.A. Demarchi et al. 1983, page 40, scale 1:250,000.

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