East Kootenay
Rocky Mountain Bighorn Sheep
Inventory: Winter 2001 and 2002

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ABSTRACT

A comprehensive aerial inventory of Rocky Mountain bighorn sheep was initiated during the winter of 2001 and 2002. Aerial surveys were conducted on February 6-8, 2001, March 8, 2001, and February 13 and 26, 2002 by Wildlife Branch and Columbia Basin Fish and Wildlife Compensation Program staff. Five Management Units were aerially surveyed in 2001: 4-02, 4-21, 4-22, 4-24, and 4-25. Management Unit 4-23 was surveyed in 2002 while 4-36 was surveyed on the ground during the winter of 2001. The objectives of the inventory were to determine population status, provide population trend data, age/sex classifications, and winter distribution and habitat use of bighorn sheep within the East Kootenays. The aerial surveys were conducted using RIC standards (RIC 1997).

A total of 1167 bighorn sheep were observed during the winter of 2001 and 2002. The lamb:ewe ratio for the entire survey area was 37.1 lambs:100 ewes, indicating a slightly increasing population. The sex class ratio for the entire survey area was 54.9 rams:100 ewes. When estimates of sightability were applied to each Management Unit, a minimum population estimate of 1476 bighorn sheep was calculated for the survey area.

The entire area within each management unit was not surveyed: only known core winter ranges were surveyed. Therefore, groups of sheep occupying unknown or low capability areas were overlooked. East Kootenay Management Units 4-01, and eastern portion of 4-22 were not surveyed during this inventory flight.

The Premier Ridge, Estella, Wildhorse, Wigwam/Mt. Broadwood, and Maquire/Red Canyon sheep subpopulations have sustained significant population declines since the late 1980's and early 1990's. Two consecutive harsh winters in 1995/96 and 1996/97, forest encroachment and predation have contributed to a significant decline in these subpopulations. All winter ranges are suffering from losses of open habitats due to forest encroachment. Loss of open habitats results in a direct loss of foraging habitat but also increases the probability of predation due to reduced visual capability of sheep (i.e. predators can use forest as cover while stalking). The Phillips Cr., Bull River, Wildhorse, Estella, and Radium/Stoddart herds, in addition, use habitats in close proximity with domestic sheep (Adams and Zehnder 2002). This may jeopardize the overall health of wild bighorn sheep. Stable populations occur in

Radium/Stoddart, Columbia Lake, Bull River, Marmalade, Coyote Cr., Elk Valley, and Lizard (Elko).

East Kootenay Management Units 4-01, and the east side of 4-22 should be surveyed within the next couple of years. Depending on available funding, the entire study area should be resurveyed every 3 years. Volunteers should be encouraged to continue annual winter range ground counts for well-known and accessible herds such as Radium/Stoddart, Columbia Lake, Bull River, and Wigwam Flats.

ACKNOWLEDGEMENTS

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INTRODUCTION

A thorough aerial inventory of Rocky Mountain bighorn sheep has not occurred in the East Kootenays since the early 1990's. Aerial surveys were conducted regularly for major bighorn sheep subpopulations from the early 1970's to early 1990's. However due to budgetary restraints, no aerial surveys were conducted between 1993 and 1999 except for the Elk Valley, Columbia Lake, Mt. Assiniboine Provincial Park, and Radium/Stoddart subpopulations. During the winter of 2000, Columbia Basin Fish and Wildlife Compensation Program conducted an aerial survey of the core bighorn sheep winter ranges in the East Kootenays excluding the Elk Valley and portions of MU 4-22. A general perception exists that bighorn sheep have been declining since the early 1990's. Funding was secured and a comprehensive aerial inventory was initiated during the winter of 2001 and 2002 to address these concerns.

Aerial or ground classification counts were conducted during February and March 2001 in Management Units (MU) 4-02, 4-21, 4-22, 4-24, and 4-25. Management Unit 4-36 was surveyed on the ground during the winter of 2001. An extensive survey of the Elk Valley occurred during the winter of 2002. Therefore, six Management Units in total were surveyed during the winter of 2001, while 1 MU was surveyed in 2002. The objectives of the inventory were to determine population status, provide population trend data, age/sex classifications, and winter distribution and habitat use of bighorn sheep within the East Kootenays.

Full Curl bighorn sheep rams are hunted through General Open Season throughout most Management Units located along the east-side of the Region. Full Curl rams are hunted through Limited Entry in portions of MU 4-02 (Phillips Cr.) and 4-25 (Mt. Assiniboine Provincial Park). Ewes and lambs can be harvested through limited entry in the Stoddart Cr area of MU 4-25.

METHODS

Aerial surveys were conducted on February 6-8, 2001 and March 8, 2001 by Wildlife Branch and Columbia Basin Fish and Wildlife Compensation Program staff. BC Parks conducted an aerial survey in Mt. Assiniboine Provincial Park (MU 4-25) on March 23, 2001. The entire Elk Valley was surveyed on February 13, and 26, 2002.

The aerial surveys were conducted using RIC standards as their basic methodology (RIC 1997). The total count method, recommended by RIC standards, was used for bighorn sheep. Six Management Units were surveyed by air in 2001/02 and include MU 4-02 (Wigwam River), 4-21 (Lussier River), 4-22 (Bull River), 4-23 (Elk Valley (2002 data), 4-24 (White River), and 4-25 (Upper Kootenay). A ground classified count occurred for sheep in the Golden area (MU 4-36). To obtain more accurate age/sex classification data, portions of Management Units 4-22, and 4-25 were resurveyed by ground personnel.

Survey flights were conducted using a Bell 206 helicopter flying at speeds of 60-100 km/hr., depending on tree-cover and terrain. Transects were flown within known core bighorn sheep winter ranges. Winter ranges were delineated using winter habitat capability maps and extensive knowledge of Ministry of Water, Land and Air Protection biologists (Peter Davidson, Anna Fontana, and Bill Warkentin), Columbia Basin Fish and Wildlife Compensation Program biologist (Larry Ingham) and knowledgeable Elk Valley residents. Winter ranges were primarily either high elevation windswept slopes (ESSF or AT) or low elevation open habitats with adjacent escape terrain (IDF). The survey team consisted of four observers: pilot, navigator/observer, and two data recorder/observers.

Age/sex composition was documented to RIC Standards Level 4, which consisted of adult females, juveniles, Class I, Class II, Class III, and Class IV rams. Due to the difficulty of distinguishing between yearling rams and Class I rams, yearling rams were included with the Class I ram classification (< ½ curl). Locations of individuals observed were documented on 1:50,000 scale topographical maps. Animal locations were also recorded by GPS location. The RIC standards data form "Animal Observation Form-Ungulate (Aerial) Sample Block" was used during the survey.

Data was summarized according to age/sex classification for each Management Unit. Juveniles (lambs):100 ewes, and rams:100 ewes ratios were also calculated for each Management Unit.

Sightability indices were calculated for 4 bighorn sheep herds. These indices were calculated by either mark-resight methodology using radio-collared ewes (Columbia Lake, Bull River) or by comparing total numbers of sheep observed at different surveys (Radium/Stoddart, Bull River, Wigwam Flats).

Ground counts of 4 herds (Golden, Radium/Stoddart, Columbia Lake, and Bull River) were used to refine the results obtained during the aerial surveys in 2001. The Wigwam herd was resurveyed during the March 8, 2001 flight in an effort to locate more bighorn sheep. An increased count of lambs occurred in the Wigwam/Mt. Broadwood, Columbia Lake, and Bull River herds during ground counts or second aerial survey. These "extra" lambs were added to the overall total of the herd and the total number of lambs obtained during the aerial survey. Wigwam Flats, Bull River, and Columbia Lake each have 6, 8, 7 radio-collared ewes, respectively.

RESULTS/DISSCUSSION

A total of 1168 bighorn sheep were observed during the winter of 2001 and 2002 (Table 1). The lamb:ewe ratio for the entire survey area was 37.1 lambs:100 ewes, indicating a slightly increasing population. An over-winter lamb:ewe ratio of 30 lambs:100 ewes results in a stable population of bighorn sheep (Demarchi et. al. 2000). The sex class ratio for the entire survey area was 54.9 rams:100 ewes. The greatest number of bighorn sheep was observed within MU 4-23 in 2002. Herds of bighorn sheep winter in alpine windswept habitats in MU 4-02, 4-21, 4-23, 4-24, and 4-25. Approximately 17 hours were required to complete an aerial inventory of MU 4-02, 4-21, 4-22, 4-24, and 4-25. To survey the east side of the Elk Valley required 7 hours of helicopter time, while the west side required 4 hours.

Table 1: Summary of bighorn sheep aerial survey data for each Management Unit: Winters 2001 and 2002

	Observed							
MU	**Total**	**Ewes**	**Juv**	**U/C**	**CL I**	**CL II**	**CL III**	**CL IV**
4-02	169	99	25	0	12	22	10	1
4-21	104	47	17	2	14	17	6	1
4-22	100	53	23	0	14	5	5	0
4-23*	458	226	97	16	54	35	22	8
4-24	59	34	7	0	8	7	3	0
4-25	256	107	42	42	28	20	14	3
4-36**	22	10	3	0	1	2	2	4
Total	**1168**	**576**	**214**	**60**	**131**	**108**	**62**	**17**
Juv:ewes		**100**	**37.2**					
Rams:ewes		**100**	**54.9**					

* aerial survey conducted in 2002 ** ground survey only

When estimates of sightability were applied to each Management Unit, a minimum population estimate of 1476 bighorn sheep was calculated for the survey area (Table 2). Sightability factors were calculated for well known herds (i.e. Radium/Stoddart, Bull River, Wigwam Flats, Columbia Lake) and ranged from 80% (Radium/ Stoddart) - 85% (Bull River). These factors were subjectively decreased to represent the entire management unit depending on forest cover. Therefore, open habitats were assigned 80% sightability factors while forested habitats were assigned 75% sightability factors. These estimates represent a minimum estimate of the bighorn sheep population in the survey area. The entire area within each management unit was not surveyed: only known core winter ranges were surveyed. Therefore, groups of sheep occupying unknown or low capability areas were overlooked. East Kootenay Management Units 4-01, and eastern portion of 4-22 were not surveyed during this inventory.

Table 2: Population estimates of bighorn sheep for each MU

MU	Observed total	Total with 75-80% sightablity
4-02	169	225 (75%)
4-21	104	130 (80%)
4-22	100	133 (75%)
4-23	458	572 (80%)
4-24	59	74 (80%)
4-25	256	320 (80%)
4-36	22	22(100%)
Total	**1168**	**1476**

Bodie et.al. 1995 outlined a sightability model for surveys conducted in June, of bighorn sheep in open, unforested canyon habitats of Idaho. Their model estimated sighting probability as 0.91 for groups of sheep moving on flat/open slope habitats, 0.70 for not moving on flat/open slope habitats, 0.67 for moving on canyon habitats, and 0.33 for not moving on canyon habitats. This model is not recommended where bighorn sheep use timbered habitats. Presently, no sightability model is available to use for bighorn sheep occupying forested habitats.

Loss of winter range habitat due to conifer encroachment, predation, and 2 consecutive harsh winters in 1995/96 and 1996/97 have contributed to an overall decrease in the Rocky Mountain bighorn sheep metapopulation since the early 1990’s. Some populations have experienced greater declines than others. The Elk Valley subpopulation appears to be increasing since the 2002 survey total was the largest ever documented. Stable

populations occur in Radium/Stoddart, Columbia Lake, Bull River, Marmalade, Coyote Cr., and Lizard (Elko). The greatest decrease in sheep numbers have occurred in Wigwam Flats/Mt. Broadwood, Premier Ridge, Wildhorse, Maguire/Red Canyon, and Estella subpopulations.

Table 3: Population estimates for each significant subpopulation

Herd	Total	Pop. est.	Ewes	Juv	U/C	CL 1	CL 2	CL 3	CL 4	Ewe: lamb
Wigwam Flats	116	155	67	15	0	10	15	8	1	22.4
Maquire/ Phillips	53	71	32	10	0	2	7	2	0	31.3
Lizard	35	47	19	8	0	6	1	1	0	42.1
Bull R.	65	76	34	15	0	8	4	4	0	44.1
Premier	12	16	9	2	0	1	0	0	0	22.2
Estella	14	20	8	4	0	1	0	1	0	50.0
Wildhorse	11	15	7	2	0	2	0	0	0	28.5
Coyote/ Marmalade	67	90	23	9	2	10	17	5	1	39.1
Elk Valley	458	572	226	97	16	54	35	22	8	43.8
Nine Mile	59	74	34	7	0	8	7	3	0	20.6
Columbia Lk	87	116	46	15	12	5	5	4	0	32.6
Radium/Stod	118	140	38	20	30	10	11	8	1	34.5
Mt. Assiniboine	51	62	23	7	0	13	4	2	2	30.0
Golden	22	22	10	3	0	1	2	2	4	30.0
Total	**1168**	**1476**	**576**	**214**	**60**	**131**	**108**	**62**	**17**	

Wigwam River Management Unit (4-02)

The Wigwam River survey area (MU 4-02) consisted primarily of the Wigwam Flats/Mt Broadwood, the Maguire Cr/Red Canyon Cr., and the Phillips Cr. bighorn sheep subpopulations. A total of 169 sheep were observed in MU 4-02, with 99 ewes, 25 juveniles, 2 unclassified adults, 12 CL I, 20 CL II, 10 CL III, and 1 CL IV rams. The midwinter lamb:ewe ratio was 25.3 juveniles :100 ewes indicating a declining population for this MU. The sex class ratio was 43.4 rams:100 ewes.

The Wigwam Flats/Mt. Broadwood subpopulation consisted of a total of 116 bighorn sheep, with 67 ewes, 15 juveniles, 10 CL I, 15 CL II, 8 CL III, and 1 CL IV rams. The lamb:ewe ratio was 22.4 juveniles:100 ewes, indicating a declining population. The ram:100 ewe ratio was 50.7 rams:100 ewes.

The Wigwam Flats/Mt. Broadwood subpopulation was surveyed twice during this winter. Only traditional core winter range was

surveyed for this subpopulation. Due to the low snow accumulations this winter, sheep using moderate to high elevation habitat (>5300 ft) were overlooked during both surveys. A sightability factor of 85% was calculated when the two totals obtained were compared. This resulted in a minimum estimate of 137 sheep, with 78 ewes, 18 lambs, 12 CL I rams, 18 CL II rams, 9 CL III rams, and 1 CL IV ram using the core low elevation winter range. At 75% sightability, the minimum estimate of this subpopulation is 155 sheep.

The core winter range of the Wigwam/Mt. Broadwood subpopulation was surveyed regularly from 1968 to 1996. A maximum total of 423 sheep were observed in 1981 (Table 3; MELP inventory data). A decrease in sheep numbers occurred between 1982 and 1988 primarily due to a pneumonia die-off which occurred in 1982. A total of 213 sheep were observed in 1990. This decreased to 116 observed in 2001. No aerial survey data exists from 1993-2000. This population has decreased substantially since the early 1980's. Two consecutive harsh winters occurred in 1995/96 and 1996/97, which may have caused a decline of sheep after 1995. This subpopulation also experienced deep snow conditions the winter of 1999/2000 with >50 cm snow depth throughout most of winter. Conifer encroachment and predation have also contributed to a decline in the population. Historical carrying capacity appears to be reached at approximately 350-400 sheep. The average number of sheep observed during surveys from 1968 – 2001 (n=24) was 138.9 ± 20.5 sheep. A population goal of 250 sheep appears to be realistic for this subpopulation.

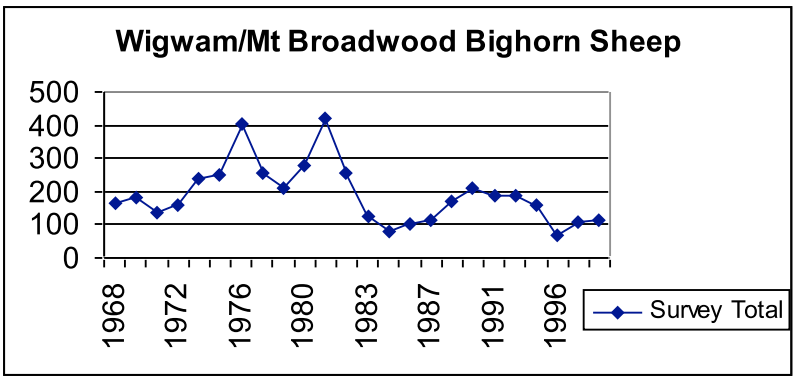

Figure 1: Uncorrected aerial survey totals for the Wigwam/Mt. Broadwood bighorn sheep herd from 1968-2001. Average total = 138.9 ± 20.5 sheep (n=24)

Lambing surveys were conducted using radio-collared ewes in 1999, and 2000. In 1999, the percentage of ewes (collared and associated uncollared) with lambs in June/July was 45% (pers. comm. M. Jalkotzy). Lambing surveys and winter ground classifications using radio-collared ewes are only a portion of a larger analysis currently being conducted by the East Kootenay Wildlife Association and Arc Wildlife Services ("Rocky Mountain Bighorn Sheep Habitat and Population Assessment for the East Kootenay Trench").

Maguire Cr./Red Canyon Cr./Phillips Cr. herds were combined for this analysis. Population surveys for bighorn sheep peaked in 1992 with 100 sheep observed (Figure 2). The 2001 survey total was 53 sheep for this area (40 sheep in Phillips Cr. (BC and Montana), and 13 sheep in Maquire Cr./Red Canyon Cr (Table 3). The lamb:ewe ratio in 2001 was 31.3 lambs:100 ewes, indicating a stable population. The average total sheep observed during an aerial survey from 1972-2001 was 54.4 sheep $\pm$ 8.6 (n=11). Historical carrying capacity appears to be at approximately 100 sheep. No aerial surveys were conducted between 1993 and 2000. The population goal for this subpopulation is 70 sheep.

While reviewing the historical inventory database, the Phillips Creek herd appears to be stable while the Maquire/Red Canyon Cr. subpopulation appears to be decreasing since the early 1990's. Decreases in population from 1992 could be attributed to 2 consecutive bad winters in 1995/96 and 1996/97, forest ingrowth, and predation.

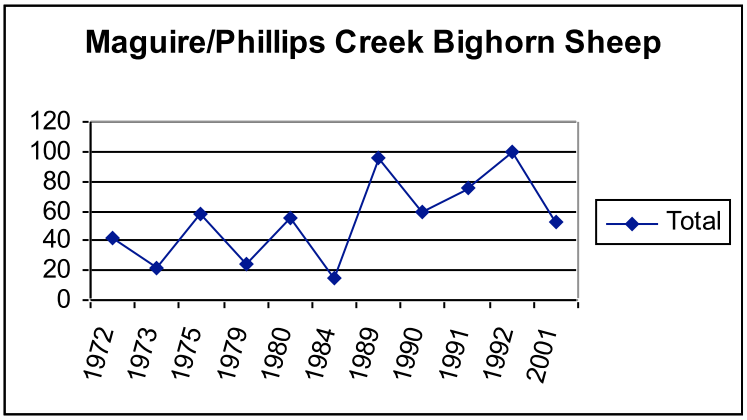

Figure 2: Uncorrected aerial survey totals for the Maquire Cr/Phillips Cr bighorn sheep herd from 1972 – 2001. Average total = 54.4 $\pm$ 8.6 sheep (n=11)

Table 4: Survey totals (uncorrected)for MU 4-02 sheep

Herd	Date	Survey	Total	Lambs:100 ewes	Comments
Wigwam/Mt. Broadwood	Mar 1970	Aerial	135	19.0	
	Feb 1972	Aerial	157	29.5	Bad winter 72/73
	Feb 1973	Aerial	238	39.4	
	Feb 1975	Aerial	249	62.1	
	Feb 1976	Aerial	403	52.1	
	Feb 1978	Aerial	253	-	
	Feb 1980	Aerial	280	61.1	
	Mar 1981	Aerial	423	25.9	
	Feb 1982	Aerial	254	43.1	Pre-dieoff
	Mar 1983	Aerial	127	17.3	Post-dieoff
	Feb 1986	Aerial	102	27.9	
	Jan 1989	Aerial	173	46.5	67 transplanted sheep
	Feb 1990	Aerial	213	47.0	
	Mar 1992	Aerial	187	38.6	
	Dec 1996	Aerial	71	26.5	Bad winter 95/96
	Apr 1999	Ground	74	45.9	Bad winter 96/97
	Jan 2000	Ground	63	34.2	
	Feb 2000	Aerial	110	22.0	Bad winter 2000/01
	Feb 2001	Aerial	116	22.4	
Maguire/Phillips Cr.	Feb 1972	Aerial	42	-	
	Feb 1975	Aerial	58	42.9	
	Feb 1980	Aerial	55	-	Pre-dieoff
	Mar 1984	Aerial	15	57.1	Post-dieoff
	Jan 1989	Aerial	96	59.3	36 transplanted sheep
	Mar 1991	Aerial	76	50.0	
	Jan 1992	Aerial	100	41.5	
	Feb 2001	Aerial	53	31.3	

Lussier River (4-21)

The following bighorn sheep subpopulations occupy this management unit: Marmalade, Coyote, Estella, Premier Ridge, and Wildhorse. A total of 104 sheep were sighted, with 47 ewes, 17 juveniles, 2 unclassified adults, 14 CL I, 17 CL II, 6 CL III, and 1 CL IV rams. The lamb:ewe ratio was 36.2 lambs:100 ewes indicating a slightly increasing population for this management unit. The ram:ewe ratio was 80.9 rams:100 ewes. When an 80%

sightability factor is applied to the observed total, the population estimate is 130 sheep.

During the 2001 aerial survey, 14 sheep were observed in the Estella herd, 12 in the Premier herd, 41 in the Marmalade herd, 26 sheep in the Coyote herd, and 11 in the Wildhorse herd (Table 3). No sheep were observed utilizing Premier Ridge itself.

Historically, the Estella herd varied from 26 sheep in 1975 to 64 sheep in 1993 (Table 4; Figure 3). Only 14 sheep were observed within the Estella herd in 2001. The area is overgrown with conifers thereby reducing habitat suitability and observer sightability, and increasing the potential for predation due to reduced visual capability of sheep. Escape terrain is also limiting. The average number of sheep observed during a survey was 42.8 $\pm$ 5.8 sheep (n=11). After intensive habitat restoration, a realistic population goal would be 40 sheep for the Estella herd.

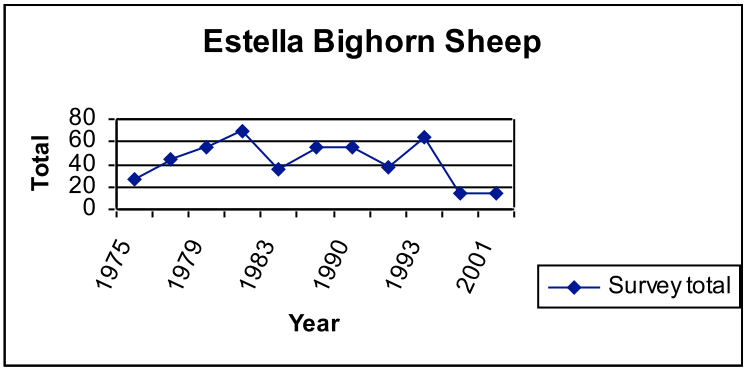

Figure 3: Uncorrected aerial survey totals for the Estella bighorn sheep herd from 1975 – 2001. Average total = 42.8 sheep $\pm$ 5.8 (n=11)

Premier Ridge subpopulation suffers from the same problems as the Estella subpopulation. The number of observed sheep in the Premier Ridge subpopulation varied from 17 in 1978 (many missed animals) to 120 in 1990. Only 12 sheep were observed during the 2001 aerial survey (Table 3). No sheep were observed occupying Premier Ridge itself. The average number of sheep observed during a survey between 1975 and 2001 was 63.2 $\pm$ 12.7 (n=11). This herd has declined dramatically since the early 1990's (Figure 4) and may have now completely abandoned Premier Ridge itself. Escape terrain is limiting on Premier Ridge but is available in the Wolf Creek area. Predators may be limiting the use of Premier Ridge regardless of habitat improvements within

the area. Wintering elk may also be competing with bighorn sheep for foraging opportunities on Premier Ridge. With habitat restoration within the Wolf Creek area, a goal of 100 sheep may be achieved.

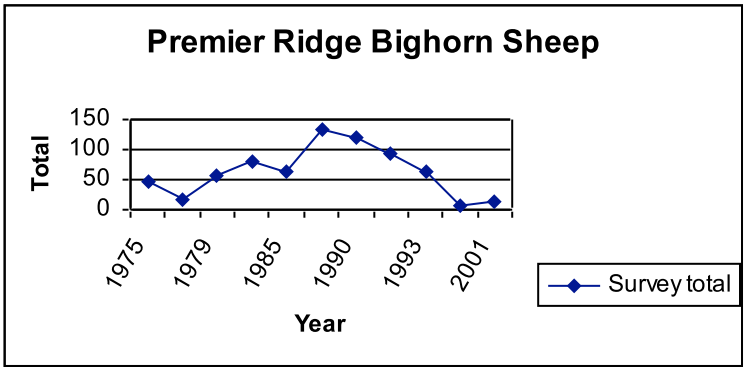

Figure 4: Uncorrected aerial survey totals for the Premier Ridge bighorn sheep herd from 1975 – 2001. Average total = 63.2 sheep ± 12.7 sheep (n=11)

The Wildhorse herd was estimated at 25 sheep in 1981. From 1986-1988, 54 sheep were translocated into the Wildhorse herd. This translocation appeared not to have been successful due to survey total of 20 in 1991 (Table 5). A total of 11 sheep were observed in 2001 (Table 3). Habitat remains in an early seral condition due to an intense wildfire in 1985, however escape terrain is limiting. A goal of maintaining a population of 30 sheep is proposed.

The Marmalade, and Coyote subpopulations were not surveyed regularly in the past however, they appear to have maintained relatively stable numbers of sheep. The goal will be to maintain a population of approximately 90 sheep for Marmalade/Coyote winter ranges.

Table 5: Survey totals (uncorrected) for MU 4-21 bighorn sheep

Herd	Date	Survey	Total	Lambs:100 ewes	Comments
Estella	1975	Aerial	26	50.0	
	1978	Aerial	45	52.4	
	1979	Aerial	56	73.7	
	1981	Ground	70	-	Davidson 1994; pre-dieoff
	1983	Aerial	35	40.9	Post-dieoff
	1986	Aerial	55	58.6	
	1990	Aerial	55	38.7	

	1991	Aerial	37	42.9	
	1993	Aerial	64	45.5	
	2000	Aerial	14	22.0	Ingham 2000
	2001	Aerial	14	50.0	
Premier Ridge	1975	Aerial	48	48.3	
	1978	Aerial	17	30.0	
	1979	Aerial	57	56.5	
	1981	Aerial	71	42.5	Pre-dieoff
	1983	Aerial	80	33.3	Post-dieoff
	1985	Ground	62	18.0	Davidson 1994
	1988	Ground	134	48.0	Davidson 1994
	1990	Aerial	120	37.1	
	1991	Aerial	95	31.1	
	1993	Aerial	62	51.6	
	2000	Aerial	8	33.0	Ingham 2000
	2001	Aerial	12	22.2	
Marmalade	1980	Aerial	41	44.0	Pre-dieoff
	1984	Aerial	23	26.7	Post-dieoff
	1990	Aerial	32	41.7	
	1991	Aerial	24	12.5	
	1993	Aerial	79	55.2	
	2000	Aerial	30	62.0	Ingham 2000
	2001	Aerial	41	46.7	
Coyote	1990	Aerial	29	43.8	
	1991	Aerial	29	44.4	
	2001	Aerial	26	25.0	
Wildhorse	1981	Ground	25	-	Pre-dieoff; Davidson 1994
	1982	Ground	14	-	Post-dieoff
	1988	estimate	50	-	Including 28 transplanted sheep
	1991	Aerial	20	33.3	Transplant unsuccessful
	2000	Aerial	15	30.0	
	2001	Aerial	11	28.5	

A total of 39 goats were also observed using high elevation habitats in the Coyote Cr. area.

Bull River (4-22)

The following bighorn sheep subpopulations occupy this management unit: Bull River and Elko (Lizard). A total of 100 sheep were observed, with 53 ewes, 23 juveniles, 14 CL I rams, 5 CL II rams, 5 CL III rams, and 0 CL IV rams. The lamb:ewe ratio was 43.4 juveniles/100 ewes indicating an increasing population for this management unit. The sex ratio was 45.3 rams/100 ewes.

The Bull River herd was surveyed twice: once from the air, and once from the ground. All radio-collared ewes were located. During the survey flight, the helicopter landed to allow observers to classify sheep more accurately. Only the primary winter range was surveyed. The largest number of sheep observed was 65, with 34 ewes, 15 lambs, 8 CL I rams, 4 CL II rams, and 4 CL III rams. A sightability factor of 85% was calculated by comparing the two observed totals. When this index was applied to the population, an estimate of 76 bighorn sheep currently occupy the Bull River winter range area.

Historically, survey counts for Bull River varied from 15 (many missed sheep) in 1969 to 90 in 1993 (Table 6; Figure 5). No adults died during the 1982 dieoff however, lamb survival was <15% until 1984 (Davidson 1994). The average survey count from 1982-2001 is 60.1 ± 7.2 bighorn sheep (n=8). The population goal for this subpopulation is close to being achieved at 90 sheep.

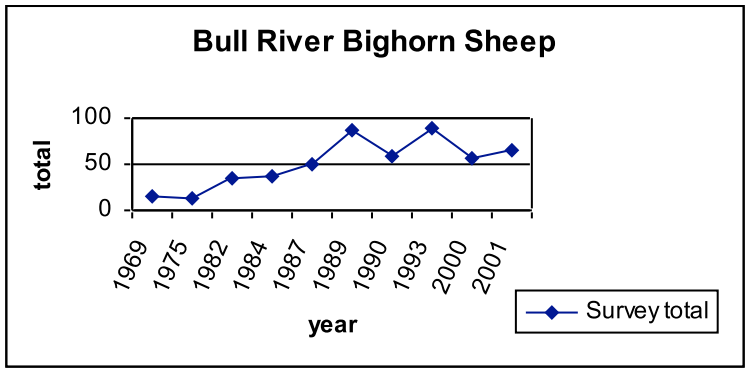

Figure 5: Uncorrected aerial survey totals for the Bull River bighorn sheep herd from 1969 – 2001. Average total = 60.1 ± 7.2 sheep (n=8)

Table 6: Survey Totals (uncorrected) for MU 4-22 bighorn sheep

Herd/subpopulation	Date	Survey	Total	Lambs:100 ewes	Comments
Bull River	Feb 1969	Aerial	15	33.3	
	Feb 1975	Aerial	14	28.5	

	Mar 1982	Aerial	35	68.4	partial dieoff; 16 transplanted sheep
	Dec 1984	Aerial	38	59.3	
	Jan 1987	Ground	50	81.3	Davidson 1994
	Jan 1989	Aerial	87	47.3	
	Feb 1990	Aerial	59	37.8	
	Mar 1993	Aerial	90	38.3	
	Mar 1998	Ground	40	20.8	
	Mar 1999	Ground	46	40.0	
	Jan 2000	Ground	57	31.4	
	Feb 2000	Aerial	37	50.0	
	Feb 2001	Ground/ aerial	65	44.1	
Lizard (Elko)	Dec 1987	Aerial	49	60.9	39 transplanted sheep
	Feb 1990	Aerial	24	33.3	
	Feb 1994	Aerial	15	11.1	
	Feb 2000	Aerial	10	25.0	Ingham 2000
	Feb 2001	Aerial	35	42.1	

Lambing surveys conducted in June/July 1999 revealed 29% of observed ewes (radio-collared and uncollared) had lambs (pers.comm. M. Jalkotzy).

During the 2001 sheep survey, 35 sheep were observed within the Lizard herd, northeast of Elko (Table 3, 6). Historically, the highest survey total was 49 in 1987. Currently, this herd is probably at carrying capacity at 40 sheep.

Elk Valley (4-23)

During the winter of 2002, a collaborative flight was conducted of Landscape Units 20 and 21 (east side) and a separate survey was conducted along the west side of the Elk Valley. A total of 458 sheep were observed consisting of 212 ewes, 97 lambs, 16 unclassifieds, 29 yearlings, 39 CL I, 35 CL II, 22 CL III, and 8 CL IV rams with a lamb: ewe ratio of 43.8 lambs : 100 ewes.

The east side survey occurred on February 13, 2002. The duration of the flight was 6.5 hours. A total of 300 bighorn

sheep was observed consisting of 131 ewes, 58 lambs, 16 unclassifieds, 5 yearling rams (1/4 curl or less), 14 yearling ewes, 24 CL I (> 1/4 curl < 1/2 curl), 26 CL II, 18 CL III, and 8 CL IV rams. The lamb:ewe ratio was 43.8 lambs: 100 ewes, while the ewe:ram ratio was 61.8 rams: 100 ewes.

The west side flight was conducted on February 26, 2002. The west side of the Elk Valley was not surveyed for bighorn sheep since 1991. The duration of the flight was 4 hours. A total of 158 sheep were observed along the west side of the Elk Valley between Brûle Creek and Quarrie Creek and along Tobermory Creek on the east side. A total of 81 ewes, 39 lambs, 10 yearling rams, 15 CL I, 9 CL II and 4 CL III rams were observed. The lamb:ewe ratio was 48.1 lambs: 100 ewes. The ram: ewe ratio was 46.9 rams: 100 ewes.

The greatest number of sheep observed during an aerial survey of the east and west sides of the Elk Valley occurred this year with a total of 458 sheep (Table 3, 7). Historically, the greatest number of sheep observed on both east and west sides of the Elk Valley was in 1981 with 412 sheep (Table 7; Figure 6). From 1981 – 2002 the average number of sheep observed on the east side was 211.5 ± 19.2 sheep (n=11). On the west side, the average number of sheep sighted during the same time period was 94.1 ± 13.6 sheep (n=9).

Since 1973, lamb:ewe ratios have been above 30 lambs: 100 ewes indicating healthy mid-winter survival. Presently, the Elk Valley sheep population is thriving and has surpassed our population goal of 400 sheep.

Table 7: Survey totals (uncorrected) for Elk Valley bighorn sheep

Herd/subpopulation	Date	Survey	Total	West	East	Lamb:ewe	Comments
Elk Valley	Feb 1973	Aerial	228	51	177	35.4	
	Mar 1975	Aerial	189	29	160	58.2	
	Mar 1979	Aerial	167	57	110	30.5	
	Mar 1981	Aerial	412	89	323	54.0	No die-off
	Feb 1983	Aerial	358	130	228	45.8	
	Mar 1985	Aerial	298	81	217	40.8	
	Mar 1986	Aerial	230	65	165	48.1	
	Jan 1987	Aerial	280	84	196	31.9	
	Mar 1988	Aerial	251	143	108	48.2	
	Mar 1990	Aerial	193	39	154	35.6	

	Mar 1991	Aerial	224	58	166	32.7	
	Feb 1998	Aerial	253	n/a	253	50.0	east only
	Feb 1999	Aerial	217	n/a	217	41.5	east only
	Feb 2002	Aerial	458	158	300	43.8	

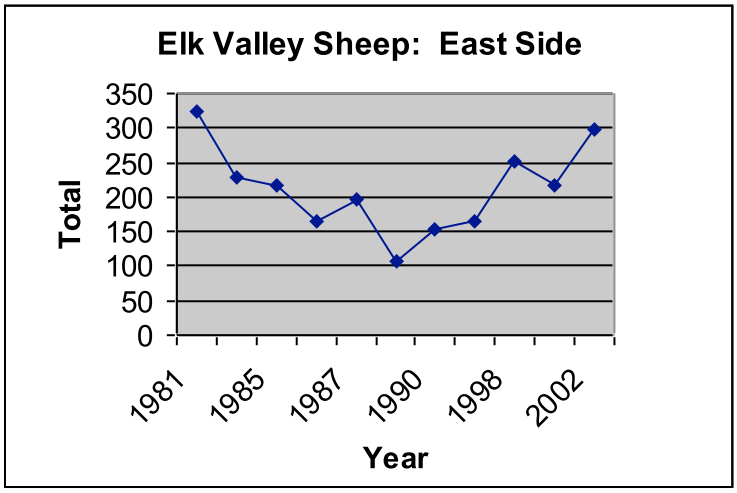

Figure 6: Uncorrected aerial survey totals for the Elk Valley (east side) bighorn sheep herd from 1981 – 2002. Average total = 211.5 ± 19.2 sheep (n=11)

White River (4-24)

The Whiteswan, Ninemile, and White River bighorn sheep subpopulations are located in this management unit. We did not survey the White River subpopulation in 2001. Bighorn sheep were primarily located utilising windswept alpine slopes in this management unit. A total of 59 sheep were observed, with 34 ewes, 7 lambs, 8 CL I rams, 7 CL II rams, 3 CL III rams, and 0 CL IV rams (Table 3). The lamb:ewe ratio was 20.6 lambs:100 ewes indicating a declining population for this management unit. No sightability index was determined in the field. Seven mountain goats were also sighted using similar habitats. When an 80% sightablity factor is applied, the estimated total is 74 sheep.

Historically these herds were not surveyed regularly, therefore a population carrying capacity estimate cannot be suggested. The population goal is to maintain or improve current population estimate of 74 sheep.

Upper Kootenay (4-25)

The Radium/Stoddart/Swansea, Columbia Lake and Mt. Assiniboine subpopulations occur within this management unit. A Management Unit total of 256 sheep were observed during this survey, with 107 ewes, 42 juveniles, 42 unclassified, 28 CL I, 20 CL II, 14 CL III and 3 CL IV rams. The lambs:100 ewes ratio was 39.3 lambs :100 ewes indicating an increasing population for this management unit. The sex ratio was 60.7 rams:100 ewes.

Bighorn sheep in the Radium area are being monitored in association with the volunteer program "Bighorns in Our Backyard" (pers. comm. Bill Swan). A maximum total ground count of sheep in the Radium/Stoddart area during the winter of 2000/2001 was 137 unclassified sheep (pers. comm. Bill Swan). After 4 years of observations, 140 bighorn sheep are estimated to winter in the Radium/Stoddart area (pers. comm. Bill Swan).

During the aerial survey conducted in February 2001, 118 sheep were observed within the Radium/Stoddart/Mt. Swansea area. They consisted of 38 ewes, 20 lambs, 30 unclassifieds, 10 CL I, 11 CL II, 8 CL III, and 1 CL IV rams. Thirty sheep were not classified during the aerial survey since they were occupying the Radium Golf Course located within town limits. If 20 of the 30 unclassified sheep were ewes, which isn't unlikely, the ewe:lamb ratio would be 34.5 lambs:100 ewes.

A sightability factor of 76% was calculated for this herd by comparing the maximum ground count of the Radium/Stoddart herd (137) with the aerial count of 104 sheep.

The Radium/Stoddart/Mt Swansea bighorn sheep subpopulation was surveyed regularly since 1982 (Table 8; Figure 7). The average survey count from 1982 to 2001 is 126.7 ± 9.3 sheep (n=16). The highest count was in 1986 with 194 sheep attracted to bait sites (Davidson 1994). In 2001, the survey total for this herd was 118 sheep well within the average. The ewe:lamb ratio in 2001 was 34.5 lambs:100 ewes indicating a slightly increasing population. This subpopulation has reached the goal of 150 sheep.

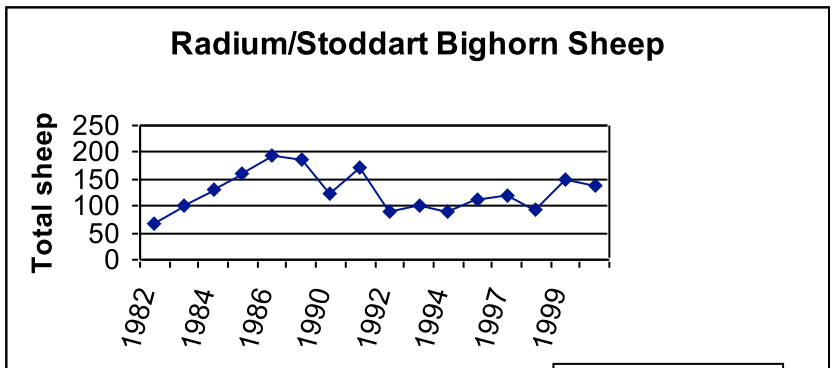

Figure 7: Uncorrected aerial survey totals for the Radium/Stoddart bighorn sheep herd from 1982 – 2001. Average total = 126.7 ± 9.3 sheep (n=16)

Bindernagel *et al*. 1991 documented an ungulate survey of the area from Radium to Canal Flats. During this survey, 232 bighorn sheep were observed. Ten years later 289 sheep were observed in this same area indicating that the population has remained relatively stable over the last ten years.

The Columbia Lake herd was surveyed three times this winter: once from the air and twice on the ground. The greatest number of sheep sighted for the main Columbia Lake sheep herd was 75 sheep, with 46 ewes, 15 lambs, 5 CL I, 5 CL II, and 4 CL III rams. When the Tatley Cr. band is added to the main Columbia Lake herd, the total number of sheep observed is 87, with 46 ewes, 12 unclassified, 15 lambs, 5 CL I, 5 CL II and 4 CL III rams. The lamb:ewe ratio for this subpopulation is 32.6 lambs: 100 ewes. When a sightability index of 80% was applied to the population, a total of 110 bighorn sheep are estimated to occupy the East Columbia Lake winter range area. At 75% sightability, the population estimate for this herd is 116 bighorn sheep.

The Columbia Lake herd was surveyed regularly between 1979 and 1994 (Table 8; Figure 8). No aerial surveys were conducted between 1995 and 2000. The highest survey count occurred in 1988 with 162 sheep attracted to bait sites (Davidson 1994). The average number of sheep observed during a survey from 1979 to 2001 was 100.6 ± 7.1 sheep (n=12). This subpopulation is slightly below the target population of 130 sheep.

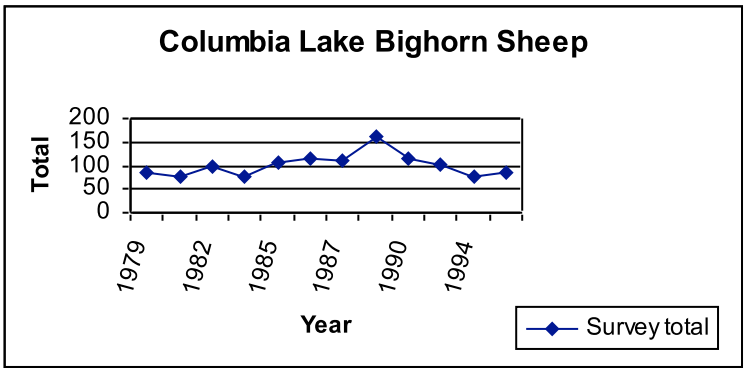

Figure 8: Uncorrected aerial survey totals for the Columbia Lake bighorn sheep herd from 1979 – 2001. Average total = 100.6 ± 7.1 sheep (n=12)

Mt. Assiniboine Provincial Park bighorn sheep have been inventoried since 1992. The 10 year average totals 54 sheep with 36 lambs:100 ewes. The highest count was in 1994, with 72 bighorn sheep observed during that survey flight (Tables 3, 8).

Table 8: Survey totals (uncorrected) for MU 4-25 sheep

Herd/subpopulation	Date	Survey	Total	Lambs:100 ewes	Comments
Columbia Lake	Mar 1979	Aerial	87	36.5	
	Feb 1981	Aerial	75	51.2	
	Mar 1982	Aerial	96	48.8	No dieoff
	Mar 1983	Aerial	76	40.8	
	1985	Ground	107	38.5	Davidson 1994; 65 sheep removed
	1986	Ground	114	-	Davidson 1994; 16 sheep removed
	1987	Ground	110	37.7	Davidson 1994; 40 sheep removed
	1988	Ground	162	54.4	Davidson 1994
	Feb 1990	Aerial	117	58.3	
	Mar 1991	Aerial	101	53.5	
	Apr 1994	Aerial	75	-	
	Mar 1999	Ground	47	58.3	
	Apr 2000	Ground	56	41.2	
	Feb 2000	Aerial	36	-	Ingham 2000; Tatley included
	Feb 2001	Aerial/ ground	87	32.6	Tatley included
Radium-Columbia Lk	Mar 1991	Aerial	232	-	
Radium-Columbia Lk	Feb 2001	Aerial/ ground	289	-	*Pers.comm. B. Swan + data
Mt Assiniboine	Mar 1992	Aerial	55	27	BC Parks
	Mar 1994	Aerial	72	38	BC Parks
	Mar 1997	Aerial	69	15	BC Parks
	Mar 2001	Aerial	51	30	BC Parks
Radium/Stoddart/ Swansea	Mar 1982	Aerial	66	46.2	No dieoff
	Mar 1983	Aerial	102	-	
	Mar 1984	Aerial	130	-	
	Mar 1985	Aerial	162	-	
	1986	Ground	194	45.5	Davidson 1994; 47 sheep removed
	1988	Ground	186	42.7	Davidson 1994

	Feb 1990	Aerial	122	51.1	39 sheep removed
	Mar 1991	Aerial	172	36.4	
	Mar 1992	Aerial	91	52.8	22 sheep removed
	Mar 1993	Aerial	100	54.3	27 sheep removed
	Mar 1994	Aerial	90	56.5	10 sheep removed
	Mar 1995	Aerial	112	-	
	Mar 1997	Aerial	120	35.1	
	Mar 1998	Aerial	94	27.6	
	Mar 1999	Aerial	149	27.4	
	Feb 2001	Aerial	118	34.5	

* maximum ground count in 2001 conducted by Bighorns in Our Backyard in Radium/ Stoddart area was 137 sheep (33 more than aerial count)

Blaeberry River (MU 4-36)

The Golden chapter of the BC Wildlife Federation conducted ground counts of the sheep occupying the Golden area (pers. comm. Andy Pezderic). A total of 22 sheep were observed this winter, with 10 ewes, 3 lambs, 1 CL I, 2 CL II, 2 CL III, and 4 CL IV rams. The lamb: ewe ratio was 30.0 lambs : 100 ewes. No aerial surveys were conducted in this management unit.

CONCLUSIONS/RECOMMENDATIONS

The Premier Ridge, Estella, Wildhorse, Wigwam/Mt. Broadwood, and Maquire/Red Canyon sheep subpopulations have sustained significant population declines since the 1980's and early 1990's. All areas suffer from loss of open habitats due to forest encroachment. Loss of open habitats results in a direct loss of foraging habitat but also increases the probability of predation due to reduced visual capability of sheep (i.e. predators can use forest as cover while stalking). Premier Ridge does not have suitable escape terrain on the Ridge itself. Habitat restoration needs to be focussed on areas adjacent to good escape terrain such as Wolf Creek. Estella and Wildhorse also do not contain areas with adequate escape terrain. Predators likely play a significant role in limiting the size of these subpopulations.

The Phillips Cr., Bull River, Wildhorse, Estella, and Radium/ Stoddart herds, in addition, use habitats in close proximity with domestic sheep (Adams and Zehnder 2002). This may

jeopardize the overall health of wild bighorn sheep in these areas.

Arc Wildlife Services Ltd. will be providing a final report outlining conclusions and recommendations regarding data collected during their assessment ("Rocky Mountain Bighorn Sheep Habitat and Population Assessment for the East Kootenay Trench"). Every effort will be made to implement these recommendations to improve bighorn sheep populations in the East Kootenay Trench.

Sightability factors for the survey area should be recalculated and refined. East Kootenay Management Units 4-01 and the east side of 4-22 should be surveyed within the next few years. Depending on available funding, the entire study area should be resurveyed every 3 years. Volunteers should be encouraged to continue annual winter range ground counts for well-known and accessible herds such as Radium/Stoddart, Columbia Lake, Bull River, and Wigwam Flats.

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Appendix 1: Map of Region 4 Management Units. Rocky Mountain Bighorn Sheep Inventory 2001/2002 occurred in MU 4-02, 4-21, 4-22, 4-23, 4-24, 4-25, and 4-36.