

**An Analysis of Reported Grizzly Bear  
(*Ursus arctos*) Mortality Data for  
British Columbia from 1978-2003**

by

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## Introduction and Methods

Since 1976, the Province of British Columbia has required hunters to submit harvested Grizzly Bears (*Ursus arctos*) for inspection by government staff, as part of the Compulsory Inspection system. Information collected from inspected harvested Grizzly Bears under this system has included: sex, kill location, skull size and a premolar (extracted for ageing purposes) (Stoneberg and Jonkel 1966; Craighead *et al.* 1970). Reported non-hunting human-caused mortalities, such as illegal kills, animal control kills, roadkills etc., have also been tracked through the same system. Starting in 1982, a questionnaire was sent to some or all Grizzly Bear hunters to determine hunter effort and success. This report analyzes the complete mortality data gathered through the Compulsory Inspection system from 1978–2002, including the most recent figures for reported Grizzly Bear mortalities in British Columbia from 2003. The quality of the data for the first two years of Compulsory Inspection (1976–1977) was believed to be poor, and was excluded from these analyses.

Grizzly Bear hunting in British Columbia is not managed on the basis of any trends or desired harvest characteristics (aside from mortality levels) in the age/sex of the animals killed as these indicators are not considered to be sufficiently reliable as a basis for management (Harris and Metzgar 1987). Instead allowable total and female mortality limits are calculated based on population estimates (Austin *et al.* 2004). In many cases, the same trend can be used to suggest that a population is increasing or declining as a result of over-harvest (Caughley 1974). Instead of relying on harvest trends that may provide a false sense of security in terms of Grizzly Bear population status, this information is only used on an *ad hoc* basis to identify areas where trends in the age and/or sex of harvested bears may indicate excessive mortality. Most commonly, action is taken to reduce hunting opportunities in response to conservation concerns without regard to these indicators.

Mortality and harvest analysis at the provincial level that combines mortality data from British Columbia's 57 Grizzly Bear Population Units (GBPUs), and from different management regimes (i.e., areas with spring-only hunts, as well as those with both spring and fall hunts) is particularly problematic in determining Grizzly Bear population health and in informing management decisions. Analyses for individual populations, or groups of populations, is more appropriate for detecting potential conservation issues.

Interpretation of the mortality data presented in this report should consider the fact that Limited Entry Harvest (LEH) was implemented province-wide in the fall of 1996 (some areas were already using LEH), and that there were no Grizzly Bear hunting seasons in the spring of 2001, due to a provincial hunting moratorium on Grizzly Bears.

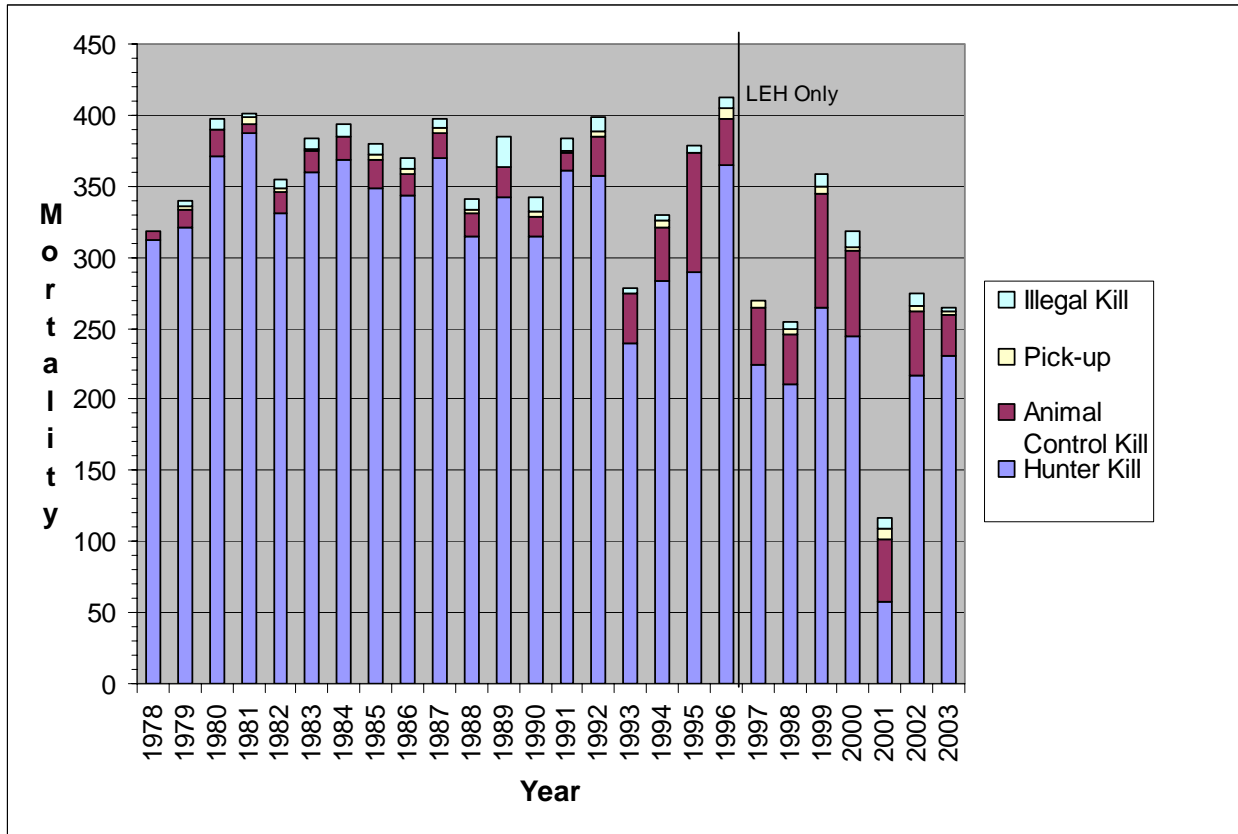
## Results and Discussion

### *Total Known Mortality and Kill Types*

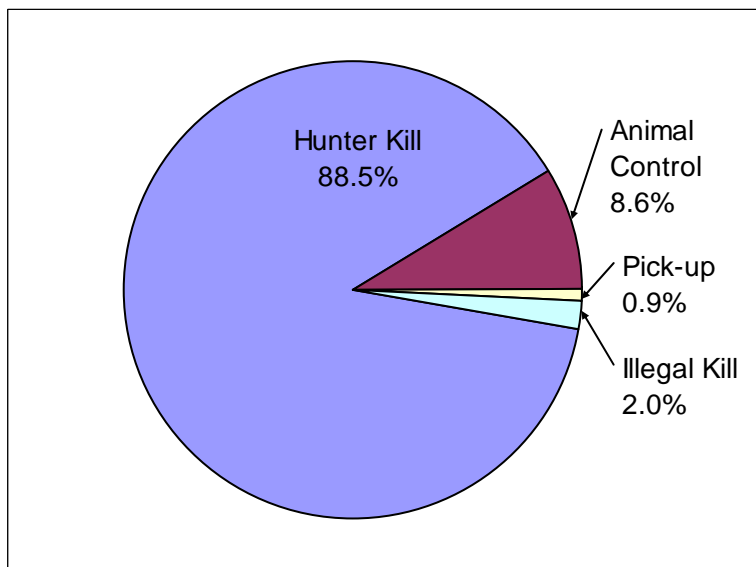
Human-caused Grizzly Bear mortalities are categorized into four kill types: Hunter Harvest, Animal Control, Illegal Kill and Pick-up. Pick-up mortalities include road and train kills, as well as any Grizzly Bears found dead of unknown causes (in some cases these may be natural mortalities). For the 26 year period from 1978–2003, there was a total of 8840 Grizzly Bears recorded killed by all kill types (Table 1, and Figure 1). An average of 340 Grizzly Bear mortalities was recorded annually through the Compulsory Inspection system, ranging from 117 in 2001 to 413 in 1996. Of those mortalities, 88.5% were from hunting, 8.6% from animal control, 0.9% from pick-up and 2% from illegal kills (Figure 2).

**Table 1. The number of Grizzly Bear mortalities recorded by year and kill type in British Columbia, from 1978–2003.**

<b>Year</b>	<b>Hunter Harvest</b>	<b>Animal Control</b>	<b>Pick-up</b>	<b>Illegal Kill</b>	<b>Total</b>
1978	312	6	0	0	318
1979	321	13	2	4	340
1980	371	19	0	7	397
1981	387	7	5	2	401
1982	331	15	2	7	355
1983	360	15	1	8	384
1984	369	16	0	9	394
1985	348	20	4	8	380
1986	344	14	4	8	370
1987	370	17	4	6	397
1988	314	17	3	7	341
1989	342	21	1	21	385
1990	314	15	3	10	342
1991	361	13	1	8	383
1992	357	28	4	9	398
1993	239	35	1	3	278
1994	283	38	5	4	330
1995	289	84	1	5	379
1996	365	32	8	8	413
1997	224	41	4	1	270
1998	210	36	3	5	254
1999	264	81	5	8	358
2000	244	60	3	11	318
2001	58	43	8	8	117
2002	217	45	4	8	274
2003	231	28	3	2	264
<b>Total</b>	<b>7825</b>	<b>759</b>	<b>79</b>	<b>177</b>	<b>8840</b>



**Figure 1. The number of Grizzly Bear mortalities recorded by year and kill type in British Columbia, from 1978–2003.**



**Figure 2. Proportion of reported British Columbia Grizzly Bear mortalities by kill type, 1978–2003.**

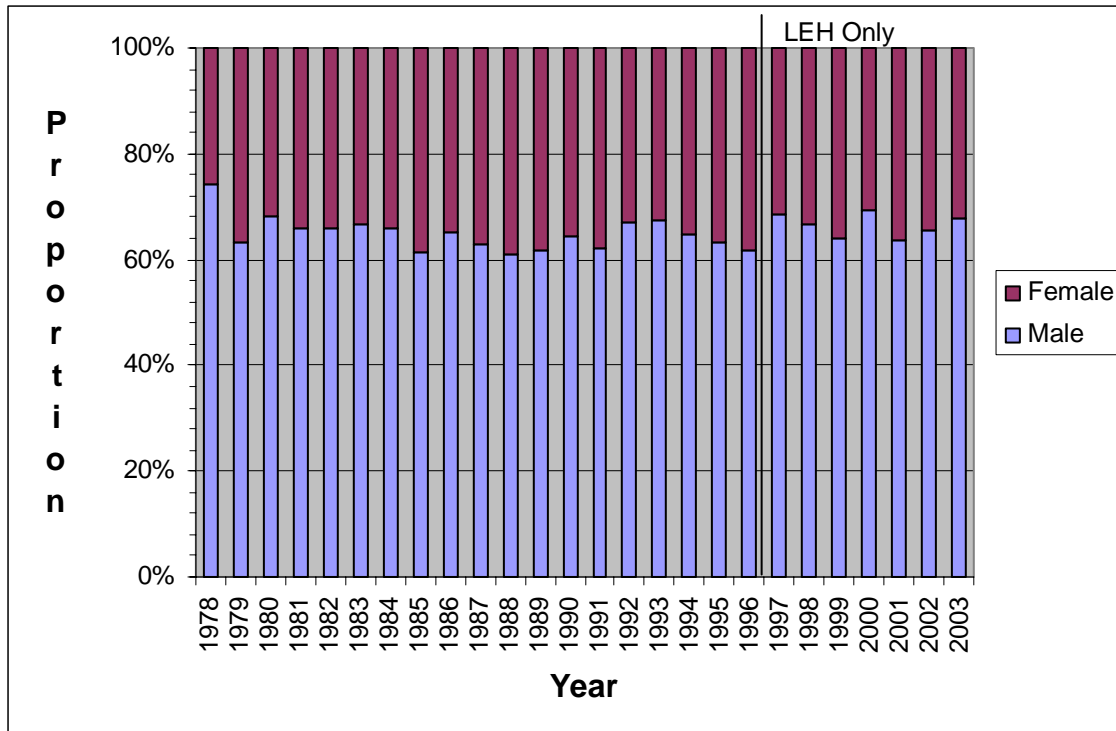
The low level of animal control mortalities in the late 1970s and early 1980s may reflect incomplete reporting. Relatively high numbers of animal control mortalities in the mid-1990s was related to the elimination of access by Grizzly Bears to many landfills, which brought more bears into contact with humans, as bears attempted to replace this artificial food source (Davis *et al.* 2002).

***Proportion by Sex for Hunter Harvest***

The sex of hunter-harvested Grizzly Bears from 1978–2002 is available for 7760 of the total of 7825 Grizzly Bears harvested or 99.2% (Table 2, and Figure 3). There were no trends evident in the proportion by sex of hunter-harvested Grizzly Bears from 1978–2003. With the exception of 1978, the hunter harvest has consistently exceeded 30% female, which means that the female mortality limits should be expected to be more limiting to Grizzly Bear harvest than the total mortality limits (the known female human-caused mortality limits are the equal to 30% of the total human-caused mortality limit for a GBPU) (Austin *et al.* 2004).

**Table 2. Proportion of hunter harvest by sex, 1978–2003.**

Year	Male	Female	Total	%	
				Male	% Female
1978	226	78	304	74.3%	25.7%
1979	200	117	317	63.1%	36.9%
1980	249	117	366	68.0%	32.0%
1981	250	129	379	66.0%	34.0%
1982	215	112	327	65.7%	34.3%
1983	238	119	357	66.7%	33.3%
1984	240	125	365	65.8%	34.2%
1985	211	133	344	61.3%	38.7%
1986	223	120	343	65.0%	35.0%
1987	231	137	368	62.8%	37.2%
1988	190	121	311	61.1%	38.9%
1989	210	130	340	61.8%	38.2%
1990	200	111	311	64.3%	35.7%
1991	222	135	357	62.2%	37.8%
1992	240	117	357	67.2%	32.8%
1993	160	77	237	67.5%	32.5%
1994	181	99	280	64.6%	35.4%
1995	182	105	287	63.4%	36.6%
1996	226	139	365	61.9%	38.1%
1997	154	70	224	68.8%	31.3%
1998	140	70	210	66.7%	33.3%
1999	169	95	264	64.0%	36.0%
2000	168	74	242	69.4%	30.6%
2001	37	21	58	63.8%	36.2%
2002	142	75	217	65.4%	34.6%
2003	156	74	230	67.8%	32.2%
<b>Total</b>	<b>5060</b>	<b>2700</b>	<b>7760</b>	<b>65.2%</b>	<b>34.8%</b>



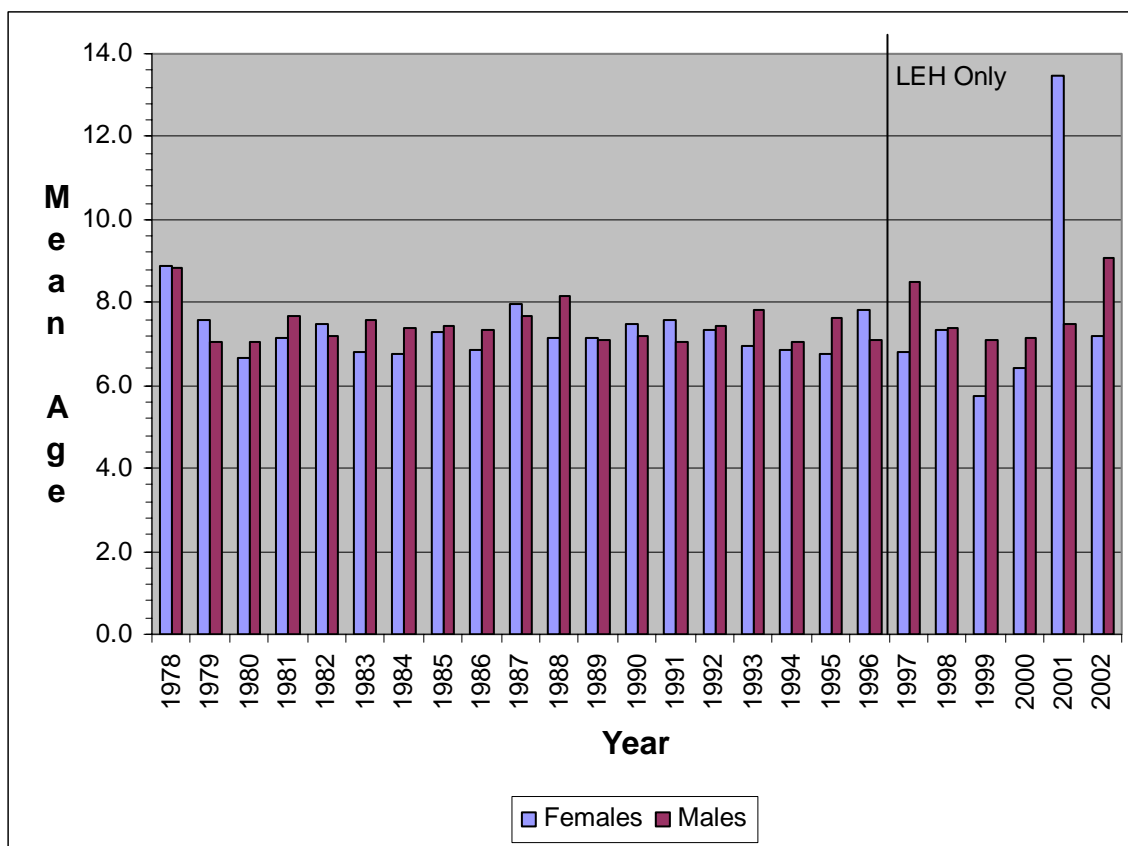
**Figure 3. Proportion of hunter harvest by sex, 1978–2003.**

***Average Age by Sex for Hunter Harvest***

Of the 7594 Grizzly Bears taken by hunters from 1978–2002, age is available for 6870 bears, or 90.5% of the total number harvested. There were no trends evident in the average age of hunter-harvested Grizzly Bears from 1978–2002 (Table 3, and Figure 4). The high average age of harvested females in 2001 may not be representative because it was based on an unusually small sample size (21) due to the cancellation of the spring hunting season that year.

**Table 3. Mean age by sex of hunter harvested grizzly bears, 1978–2002.**

Year	Females	Males	Year	Females	Males
1978	8.9	8.8	1991	7.6	7.1
1979	7.6	7.0	1992	7.3	7.4
1980	6.7	7.1	1993	7.0	7.8
1981	7.2	7.7	1994	6.9	7.0
1982	7.5	7.2	1995	6.8	7.6
1983	6.8	7.6	1996	7.8	7.1
1984	6.8	7.4	1997	6.8	8.5
1985	7.3	7.4	1998	7.3	7.4
1986	6.9	7.3	1999	5.7	7.1
1987	8.0	7.7	2000	6.4	7.1
1988	7.2	8.1	2001	13.5	7.5
1989	7.1	7.1	2002	7.2	9.1
1990	7.5	7.2			



**Figure 4. Mean age by sex of hunter harvested grizzly bears, 1978–2002.**

***Proportion by Age Class for Hunter Harvested Females and Males***

There are no trends evident in the age distribution of the female or male components of the Grizzly Bear harvest from 1978–2003. The age distribution of both the female and male components of the Grizzly Bear harvest has followed a general pattern of an increasing proportion from age class 0-2 years old (note animals that are 2 years old can be legally harvested while those < 2 years old cannot), to age class 3-4 years old, and again to age class 5-9 years old, followed by a decreasing proportion in age class 10-14 years old and again to age class 15+ years old (Table 4, and Figure 5; Table 5, and Figure 6).



**Table 4. Proportion of hunter-harvested female Grizzly Bears by age class, 1978–2002.**

<b>Year</b>	<b>0-2</b>	<b>3-4</b>	<b>5-9</b>	<b>10-14</b>	<b>15+</b>
1978	6.6%	26.3%	27.6%	22.4%	17.1%
1979	9.9%	26.7%	32.7%	21.8%	8.9%
1980	13.7%	25.5%	38.2%	16.7%	5.9%
1981	11.0%	26.3%	35.6%	20.3%	6.8%
1982	18.0%	28.0%	30.0%	11.0%	13.0%
1983	13.5%	34.2%	28.8%	13.5%	9.9%
1984	16.4%	25.5%	30.0%	22.7%	5.5%
1985	9.7%	27.4%	35.5%	16.1%	11.3%
1986	13.4%	23.2%	39.3%	18.8%	5.4%
1987	12.2%	17.6%	37.4%	22.1%	10.7%
1988	15.2%	22.3%	36.6%	15.2%	10.7%
1989	14.5%	27.4%	30.8%	16.2%	11.1%
1990	11.9%	20.8%	35.6%	21.8%	9.9%
1991	11.6%	28.1%	33.9%	14.0%	12.4%
1992	15.7%	29.4%	26.5%	12.7%	15.7%
1993	21.7%	21.7%	29.0%	17.4%	10.1%
1994	8.6%	32.3%	37.6%	9.7%	11.8%
1995	10.5%	26.7%	41.9%	12.8%	8.1%
1996	11.1%	24.1%	34.3%	15.7%	14.8%
1997	8.6%	34.5%	31.0%	15.5%	10.3%
1998	9.5%	31.7%	34.9%	11.1%	12.7%
1999	12.1%	36.3%	39.6%	5.5%	6.6%
2000	8.5%	25.4%	52.1%	8.5%	5.6%
2001	10.0%	15.0%	40.0%	20.0%	15.0%
2002	5.9%	23.5%	50.0%	10.3%	10.3%

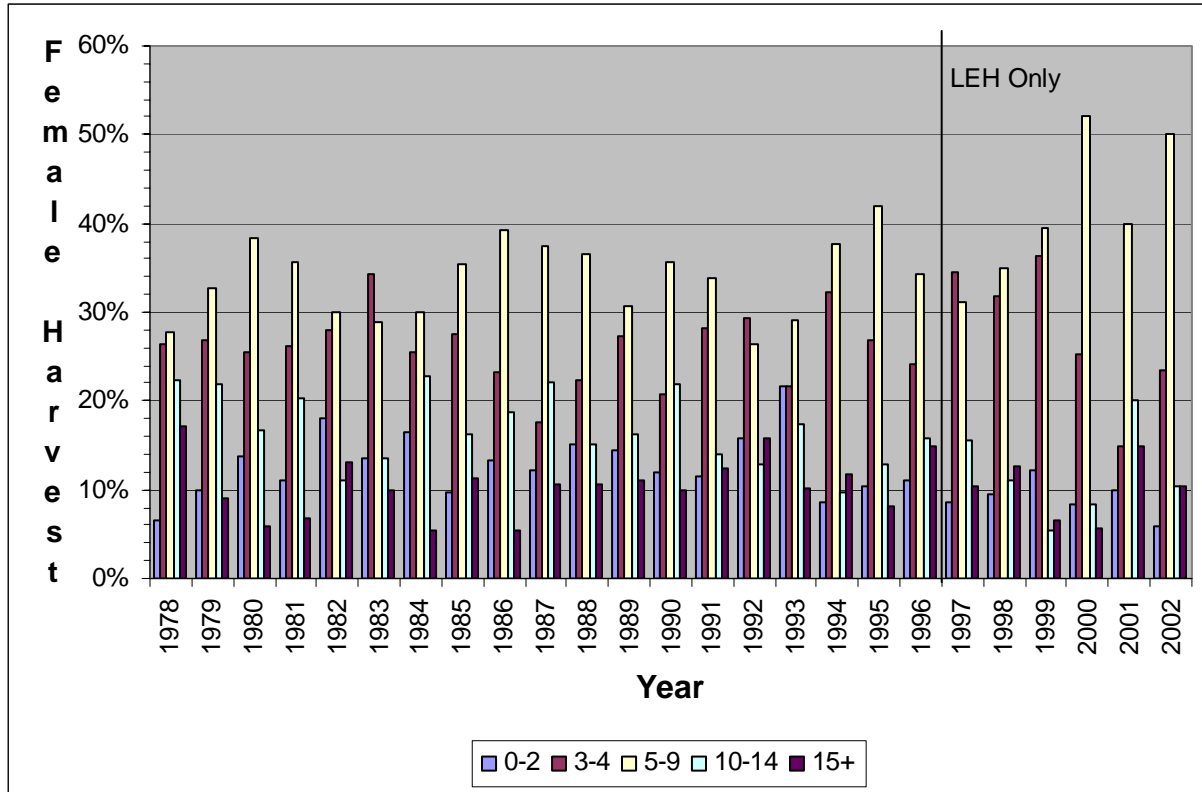
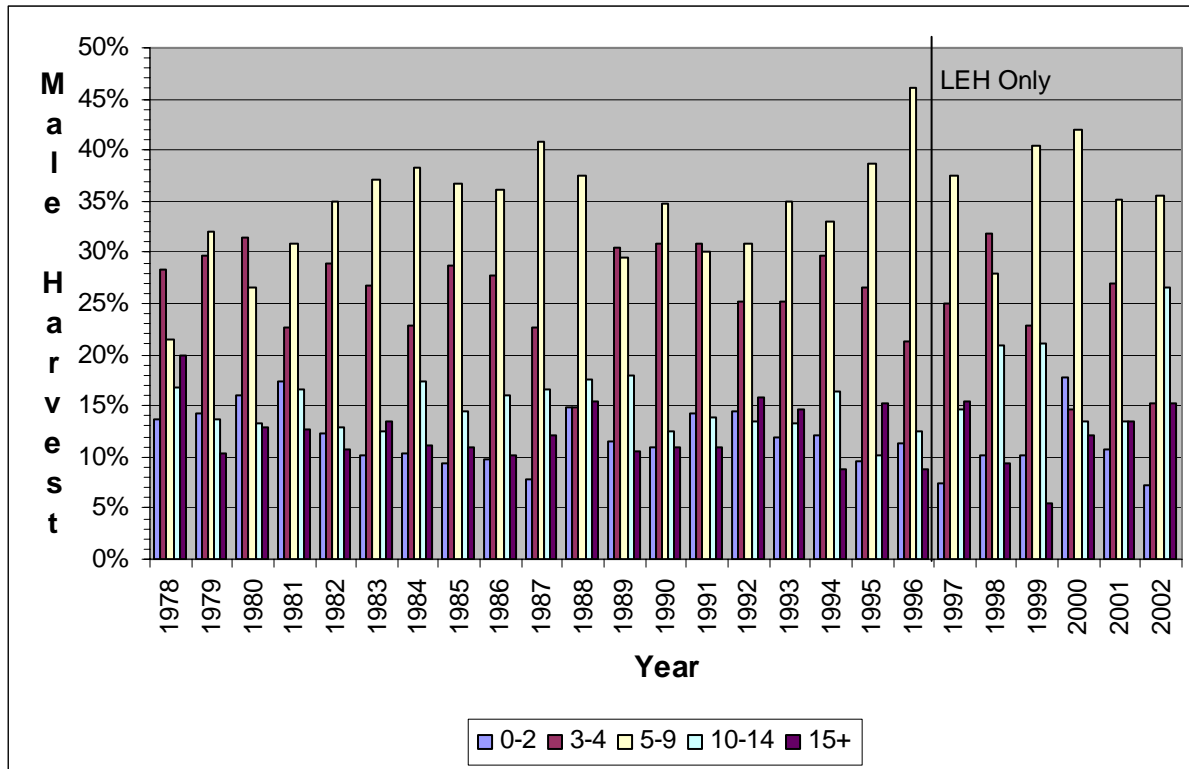


Figure 5. Proportion of hunter-harvested female Grizzly Bears by age class, 1978–2002.

**Table 5. Proportion of hunter-harvested male Grizzly Bears by age class, 1978–2002.**

<b>Year</b>	<b>0-2</b>	<b>3-4</b>	<b>5-9</b>	<b>10-14</b>	<b>15+</b>
1978	13.6%	28.3%	21.5%	16.8%	19.9%
1979	14.3%	29.7%	32.0%	13.7%	10.3%
1980	15.9%	31.4%	26.5%	13.3%	12.8%
1981	17.4%	22.6%	30.9%	16.5%	12.6%
1982	12.4%	28.9%	35.1%	12.9%	10.8%
1983	10.2%	26.9%	37.0%	12.5%	13.4%
1984	10.3%	22.9%	38.3%	17.3%	11.2%
1985	9.4%	28.7%	36.6%	14.4%	10.9%
1986	9.8%	27.8%	36.1%	16.1%	10.2%
1987	7.9%	22.7%	40.7%	16.7%	12.0%
1988	14.8%	14.8%	37.5%	17.6%	15.3%
1989	11.5%	30.5%	29.5%	18.0%	10.5%
1990	10.9%	30.9%	34.9%	12.6%	10.9%
1991	14.3%	31.0%	30.0%	13.8%	11.0%
1992	14.5%	25.2%	30.8%	13.6%	15.9%
1993	11.9%	25.2%	35.0%	13.3%	14.7%
1994	12.0%	29.7%	32.9%	16.5%	8.9%
1995	9.5%	26.6%	38.6%	10.1%	15.2%
1996	11.4%	21.2%	46.1%	12.4%	8.8%
1997	7.4%	25.0%	37.5%	14.7%	15.4%
1998	10.1%	31.8%	27.9%	20.9%	9.3%
1999	10.2%	22.9%	40.4%	21.1%	5.4%
2000	17.7%	14.6%	42.1%	13.4%	12.2%
2001	10.8%	27.0%	35.1%	13.5%	13.5%
2002	7.3%	15.3%	35.5%	26.6%	15.3%



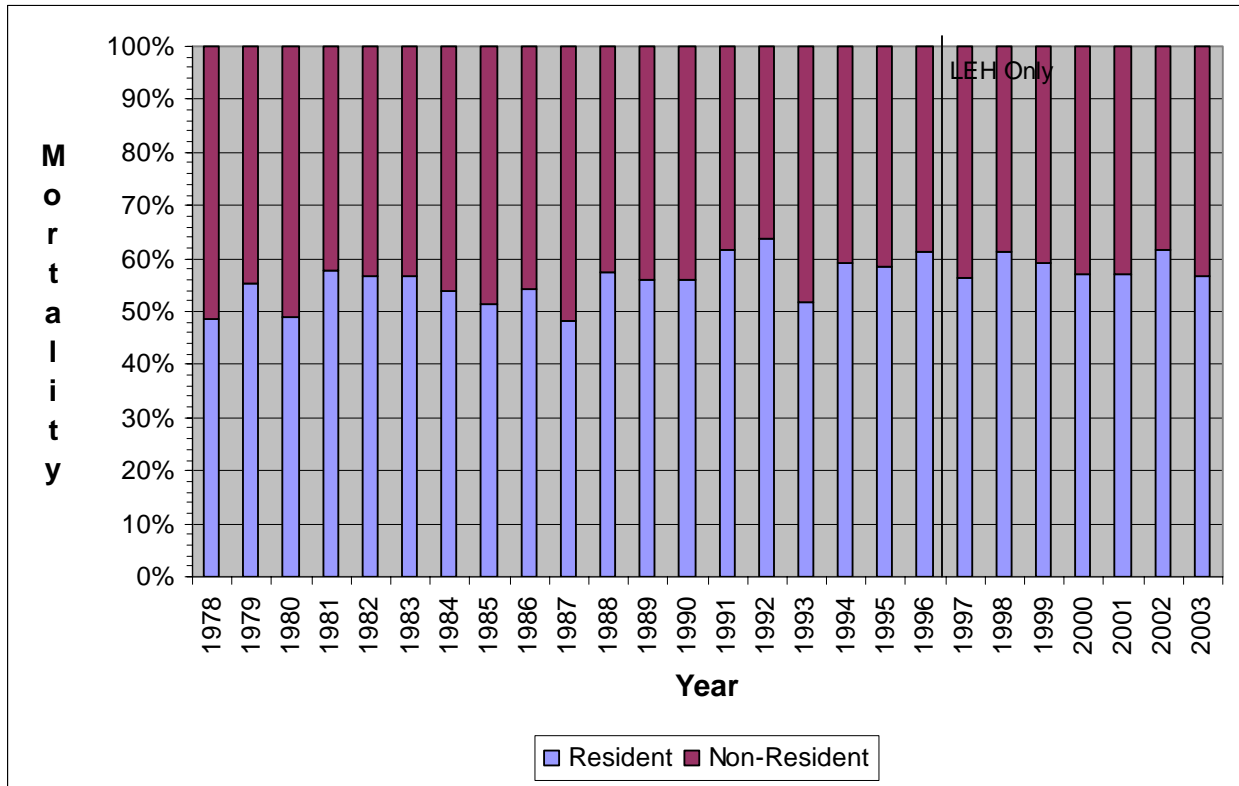
**Figure 6. Proportion of hunter-harvested male Grizzly Bears by age class, 1978–2002.**

***Hunter Harvest by Residency Group***

The proportion of harvested Grizzly Bears taken by resident hunters has increased slightly during the 1978–2003 period (Table 6, and Figure 7). Resident hunters accounted for 53% of the Grizzly Bear harvest from 1978 to 1981, compared with 58% of the total harvest from 1997 to 2000. This reflects changes in the allocation of hunting opportunities to resident and non-resident hunters during this time.

**Table 6. Proportion of hunter harvest by residency group, 1978–2003.**

<b>Year</b>	<b>Resident</b>	<b>Non-Resident</b>
1978	48.7%	51.3%
1979	55.5%	44.5%
1980	49.1%	50.9%
1981	57.9%	42.1%
1982	56.8%	43.2%
1983	56.7%	43.3%
1984	53.9%	46.1%
1985	51.4%	48.6%
1986	54.4%	45.6%
1987	48.1%	51.9%
1988	57.3%	42.7%
1989	56.1%	43.9%
1990	56.1%	43.9%
1991	61.8%	38.2%
1992	63.9%	36.1%
1993	51.9%	48.1%
1994	59.0%	41.0%
1995	58.5%	41.5%
1996	61.1%	38.9%
1997	56.3%	43.8%
1998	61.4%	38.6%
1999	59.1%	40.9%
2000	57.0%	43.0%
2001	56.9%	43.1%
2002	61.8%	38.2%
2003	56.7%	43.3%



**Figure 7. Proportion of hunter harvest by residency group, 1978–2003.**

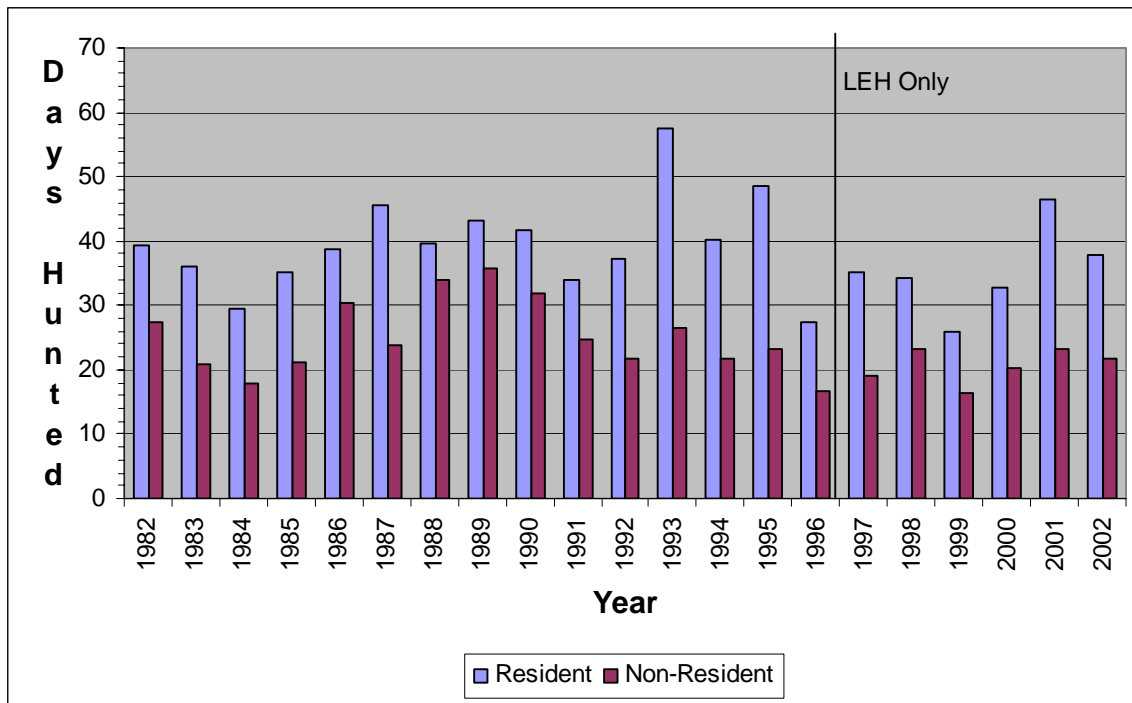
***Hunter Effort and Success***

The average number of days hunted for each Grizzly Bear harvested by resident hunters from 1982–2002 has ranged between 26.0 days (in 1999) and 57.5 days (in 1993), and has consistently been higher than that of non-resident hunters (Table 7, and Figure 8).

Resident hunter success rate from 1982–2002 has ranged from 13.7% (in 1993) to 32.1% (in 1999) (Table 8, and Figure 9). Non-resident hunter success has ranged from 26.1% (in 1988) to 43.8% in 1996.

**Table 7. Mean hunter days per hunter-harvested Grizzly Bear by residency group, 1982–2002.**

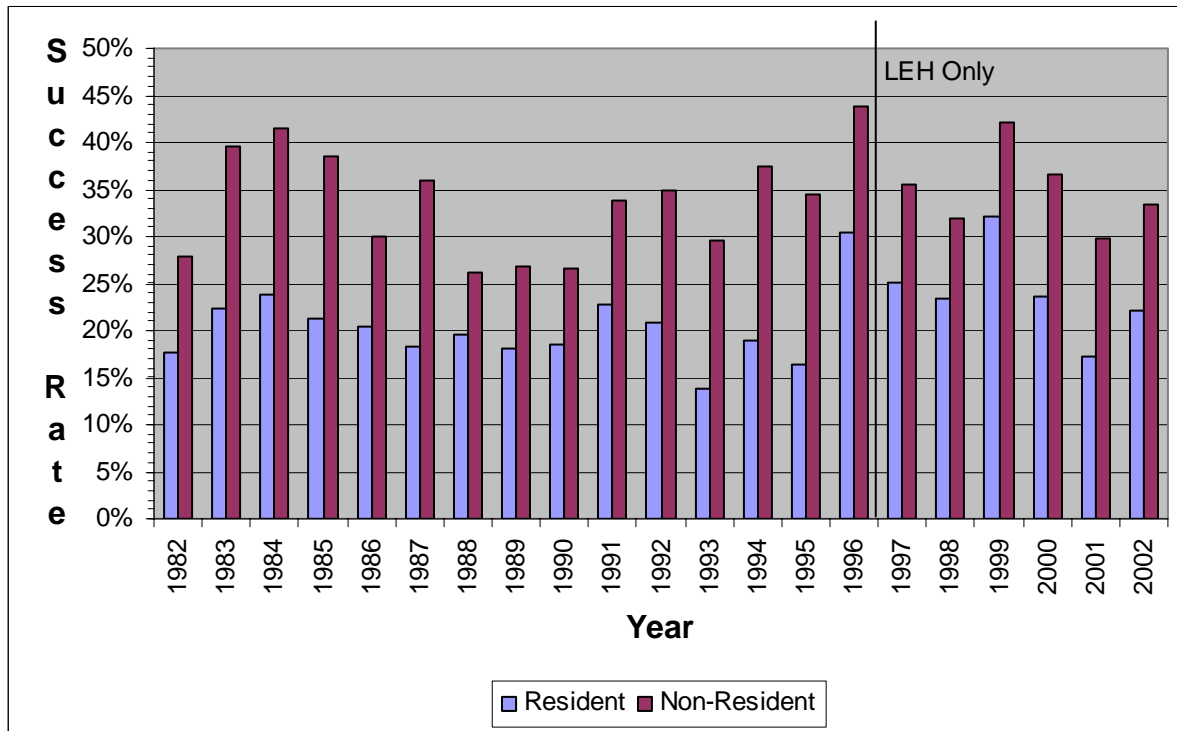
<b>Year</b>	<b>Resident</b>	<b>Non-Resident</b>
1982	39.2	27.4
1983	36.0	20.8
1984	29.6	18.0
1985	35.1	21.0
1986	38.6	30.5
1987	45.6	23.7
1988	39.6	33.9
1989	43.3	35.7
1990	41.8	31.8
1991	33.9	24.9
1992	37.1	21.7
1993	57.5	26.4
1994	40.2	21.8
1995	48.6	23.4
1996	27.4	16.7
1997	35.1	19.1
1998	34.2	23.3
1999	26.0	16.3
2000	32.8	20.2
2001	46.6	23.3
2002	37.8	21.7



**Figure 8. Mean hunter days per hunter-harvested Grizzly Bear by residency group, 1982–2002.**

**Table 8. Hunter success rate by residency group, 1982–2002.**

<b>Year</b>	<b>Resident</b>	<b>Non-Resident</b>
1982	17.6%	27.8%
1983	22.4%	39.6%
1984	23.9%	41.5%
1985	21.3%	38.4%
1986	20.5%	30.0%
1987	18.3%	36.0%
1988	19.6%	26.1%
1989	18.1%	26.8%
1990	18.5%	26.5%
1991	22.8%	33.7%
1992	20.9%	34.9%
1993	13.7%	29.6%
1994	19.0%	37.4%
1995	16.3%	34.5%
1996	30.3%	43.8%
1997	25.0%	35.5%
1998	23.3%	32.0%
1999	32.1%	42.0%
2000	23.7%	36.6%
2001	17.2%	29.8%
2002	22.0%	33.5%



**Figure 9. Hunter success rate by residency group, 1982–2002.**



## **Conclusions**

Although harvest data provide insufficient information to determine population trends in all cases (Caughley 1974; Harris and Metzgar 1987), these data may provide some insight into identifying potential areas where the populations may be declining from over-harvest. These analyses, however, demonstrate that no aspects of the Grizzly Bear harvest data for British Columbia suggest a province-wide Grizzly Bear population decline due to over-harvest. Analyses of mortality data for each individual GBPU should be conducted to inform the development of specific population objectives (Austin *et al.* 2004).

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