

Moose Management in the Peace Region



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Prepared for:
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Prepared by:
Michael Rowe
Canadensis Wildlife Consulting

Executive Summary

Using moose inventory and harvest data from the 1980's to 2007, this report is both a status update on moose populations within the Peace Region of British Columbia and a discussion paper on moose harvest strategies. Moose are a highly valued species within the Peace Region and are hunted by First Nations, resident and non-resident hunters. Moose harvesting regulations vary by region and the Peace Region is unique in British Columbia in its use of a bull harvest strategy referred to as the *SOFT-10* (spike or fork, tripalm, 10-point). This season allows harvest on only spike or fork bulls, tripalm bulls, or bulls with at least 10 legal points on one antler. The strategy was initiated in the mid 1990's in response to what was in many wildlife management units (WMU's) a situation of too few bull moose and too many harvesters (MELP 1995).

Moose are typically managed within the Peace Region at the WMU scale. Moose management subzones (eight in total) were used in this report to summarize moose inventory and harvest within the Peace. Inventory data, consisting of either composition counts or stratified random block (SRB) counts, was used to determine the status of moose in each subzone.

At the time of this report, the *SOFT-10* strategy had been in place in the Peace Region for 12 hunting seasons. Moose inventory projects completed following initiation of this new strategy have mostly suggested an improvement in bull to cow ratio and in most cases minimum suggested provincial management recommendations for bull to cow ratios have been met. Since inventory funds are often lacking, not all areas have been re-surveyed following regulation changes.

Despite an apparent success in limiting the bull harvest, additional research is needed to determine the long-term effects of the *SOFT-10* strategy on moose populations. Alaskan researchers have shown that theoretically this type of harvest could reduce the number of alleles in a moose population that favour the development of a tripalm antler structure (Hundertmark et al. 1993). The question to be answered in the Peace is; has 12 years of this type of hunting pressure had any effect on the proportion of tripalm bulls expressed?

Table of Contents

Executive Summary..... 1

1. Introduction..... 4

 1.1. Objectives..... 5

 1.2. Regional Summary..... 5

2. Management Objectives..... 8

 2.1. Provincial Management Objectives..... 8

 2.2. Regional Moose Harvest Strategies 9

3. Subzone Inventory and Harvest Summary..... 9

 3.1. Subzone A Summary..... 10

 3.2. Subzone B Summary..... 13

 3.3. Subzone C Summary..... 16

 3.4. Subzone D Summary..... 19

 3.5. Subzone E Summary..... 23

 3.6. Subzone F Summary..... 28

 3.7. Subzone G Summary..... 31

 3.8. Subzone H Summary..... 33

4. Peace Region Hunter Harvest Statistics Summary..... 36

5. Moose Inventory and Research Priorities..... 40

 5.1. Inventory Needs..... 40

 5.2. Research needs..... 41

6. Literature Cited..... 42

List of Figures

Figure 1. Map of Peace Region wildlife management units (numbers) and their associated moose game management subzones (A to H)..... 7

Figure 2. Average number of resident hunters and resident harvest for subzone A from 1976 to 2006..... 11

Figure 3. Average number of days per kill for subzone A from 1976 to 2006 with provincial management objectives shown by dotted lines..... 12

Figure 4. The average success rate (kills per hunters) for subzone A from 1976 to 2006..... 12

Figure 5. Average number of resident hunters and resident harvest for subzone B from 1976 to 2006..... 14

Figure 6. Average number of days per kill for subzone B from 1976 to 2006 with provincial management objectives shown..... 14

Figure 7. The average success rate (kills per hunters) for subzone B from 1976 to 2006..... 15

Figure 8. Number of calves and adults estimated during 1998 and 2006 inventories of WMU 7-21..... 15

Figure 9. Average number of resident hunters and resident harvest for subzone C from 1976 to 2006..... 17

Figure 10. Average number of days per kill for subzone C from 1976 to 2006 with provincial management objectives shown..... 17

Figure 11. The average success rate (kills per hunters) for subzone C from 1976 to 2006..... 18

Figure 12. Comparing population demographics within MU 7-45 in 1998 and 2006..... 18

Figure 13. A comparison of moose population estimates from stratified random block counts in WMU 7-32 in 1984, 1996, and 2004..... 20

Figure 14. A comparison of moose cows, bulls and calves as estimated from stratified random block counts in WMU 7-32 in 1984, 1996, and 2004..... 21

Figure 15. Average number of resident hunters and resident harvest for subzone D from 1976 to 2006..... 21

Figure 16. Average number of days per kill for subzone D from 1976 to 2006 with provincial management objectives shown..... 22

Figure 17. The average success rate (kills per hunters) for subzone D from 1976 to 2006..... 22

Figure 18. Average moose harvest by non-resident hunters from 1981 to 2006..... 24

Figure 19. Average number of resident hunters and resident harvest for subzone E from 1976 to 2006..... 25

Figure 20. Average number of days per kill for subzone E from 1976 to 2006 with provincial management objectives shown..... 25

Figure 21. The average success rate (kills per resident hunters) for subzone E from 1976 to 2006..... 26

Figure 22. Average number of non-resident hunters and non-resident harvest for subzone E from 1981 to 2006..... 26

Figure 23. Average number of days per kill for non-resident hunters for subzone E from 1981 to 2006 with provincial management objectives shown..... 27

Figure 24. The average success rate (kills per non-resident hunters) for subzone E from 1981 to 2006..... 27

Figure 25. Average number of resident hunters and resident harvest for subzone F from 1976 to 2006..... 29

Figure 26. Average number of days per kill for subzone F from 1976 to 2006 with provincial management objectives shown..... 29

Figure 27. The average success rate (kills per hunters) for subzone F from 1976 to 2006..... 30

Figure 28. Average number of resident hunters and resident harvest for subzone G from 1976 to 2006..... 31

Figure 29. Average number of days per kill for subzone G from 1976 to 2006 with provincial management objectives shown..... 32

Figure 30. The average success rate (kills per hunters) for subzone G from 1976 to 2006..... 32

Figure 31. Average number of resident hunters and resident harvest for subzone H from 1976 to 2006..... 34

Figure 32. Average number of days per kill for subzone H from 1976 to 2006 with provincial management objectives shown..... 34

Figure 33. The average success rate (kills per hunters) for subzone H from 1976 to 2006..... 35

Figure 34. Average number of resident hunters and resident harvest of moose for the Peace Region from 1976 to 2006..... 36

Figure 35. The total resident moose harvest for each of regions 5-Caribou, 6-Skeena, 7A-Omineca, and 7B-Peace from 1976 to 2006..... 37

Figure 36. The total number of resident moose hunters for each of regions 5-Caribou, 6-Skeena, 7A-Omineca, and 7B-Peace from 1976 to 2006..... 37

Figure 37. Average number of days per kill for the Peace Region from 1976 to 2006 with provincial management objectives shown..... 38

Figure 38. The average success rate (kills per hunters) for the Peace Region from 1976 to 2006..... 38

Figure 39. The total number of hunter days for the Peace Region from 1976 to 2006..... 39

List of Tables

Table 1. Summary of Peace Region Wildlife Management Units (WMU's) and associated moose game Management subzones..... 6

Table 2. Inventory summary estimates for counts conducted within subzone D in 1996..... 20

Table 3. Summary of stratified counts for subzone E from 1979 to 2001..... 24

Table 4. Summary of stratified counts for subzone F from 1984 to 1998..... 28

1. Introduction

Moose (*Alces alces*) within the Peace Region of British Columbia (Region 7B) are a high priority species. As the most abundant cervid (member of the deer family) within the region, moose play an important role. Firstly, moose are of principal importance to the First Nation people of the Peace Region for both food and cultural purposes. Secondly, non-First Nation people including resident and non-resident hunters prize the moose as a hunted species and over the past 10 years, the Peace Region has contributed about 22% to the total provincial moose harvest. In addition, moose are also valued for appeal to wildlife observers, naturalists, and others. Finally, moose play a key role within their ecosystems as a major prey species for large carnivores and as a keystone browser.

The great significance of the moose to the Peace Region has meant that an abundance of research and management has been invested into this species by biologists with the Ministry of Environment. Some of that research was captured and summarized in a report entitled “Moose conservation and harvest management in central and northern British Columbia” (Hatter 1998). A number of other documents have been produced that related to moose management within the Peace Region (Hatter 1994, MELP 1995, MELP 1996). Recent work had not been summarized and a comprehensive report describing the status of moose populations within the Peace Region has been requested by a number of user groups in recent years. This report will serve the function of both a summary of recent moose inventory and a discussion on harvest trends and hunting regulations.

Wildlife managers utilize both inventory data and harvest estimates in their analysis of the effects of hunting on moose populations. Harvest trends are monitored and hunting regulations are periodically adjusted in order to ensure that moose populations are not being over-harvested. The Ministry of Environment uses hunter sample surveys, guide returns, and other means to estimate the number of moose harvested by resident and non-resident hunters each year (Big Game Hunting Statistics 2002). The number of moose harvested by First Nation hunters is not accurately known and is usually taken into account along with rough estimates of natural mortality (MELP 1995).

It is the goal of this paper to describe and review moose management from a regional perspective. The current provincial management objectives will be described in order to determine how appropriately current regional management regimes are meeting those objectives. Recent moose inventory data will be summarized and discussed in relation to previous counts and the status of moose will be inferred for each of 8 management sub zones delineated within the Peace Region. In addition, the known current and historic harvest of moose will be discussed along with statistics such as hunting effort and success. Finally, recommendations will be made in regard to inventory priorities for the next decade and other research needs. The major objectives are summarized in section 1.1.

1.1 Objectives

1. Identify and review moose management objectives
2. Describe current moose harvest management strategies
3. Review and summarize status of moose (population size, composition, trends, recruitment, survival, limiting factors)
4. Review and summarize harvest numbers

1.2 Regional Summary

Within the Peace Region, moose are managed at the wildlife management unit (WMU) scale. There are 27 WMU's within the Peace Region, and all are known to support moose populations (Figure 1). Often, collections of WMU's referred to as Game Management Zones (GMZ's) are used to manage species at a broader scale. There are five GMZ's in the Peace including the South Peace, the North Peace, the Northeast Rockies, Liard, and Fort Nelson. Subdividing the 5 GMZ's based on general habitat type results in a better approximation of the actual moose populations within the region. This has been done in the Peace Region resulting in eight moose game management subzones (listed in Table 1). It is at this level that population and harvest trends will be discussed throughout this report.

Prior to 1996 the Peace Region moose harvest was an any-bull season whose length varied according to hunting pressure (Hatter 1998). Major moose hunting regulation changes were put into effect for the 1996 hunting season in response to a declining moose population (Hatter 1998). The situation was described as too many hunters and too few vulnerable bulls (MELP 1995). It was clear that additional restrictions would be needed in order to improve bull to cow ratios in many management units. At that time the number of moose vulnerable to hunting was thought to have declined from around 67,100 in 1990 to 39,250 in 1995 (MELP 1995). This reduction was attributed to overall population declines and access limitations. To improve bull ratios three options were considered; shorten bull season length, move to limited-entry hunting of bulls, or protect certain bull classes using antler restrictions (MELP 1995).

After discussions with users groups a regulation scheme sometimes referred to as the *SOFT-10* regulation was put into effect. *SOFT-10* is acronym for "spike or fork, tripalm, 10-point", this being an antler restriction that allows harvest on some yearling (spike-fork) bulls and mature bulls (tripalm or at least 10 points on one antler). By restricting the harvest to younger and older age classes, this regulation is meant to protect a large sector of the medium to prime aged bulls. Not all yearling bulls are vulnerable to harvest under this regulations since about 40% to 50% of yearling bulls are thought to exhibit 3 or more legal points (MELP 1995, Hundertmark et al. 1993). Similar antler restrictions were used in areas of Alaska with some success before being implemented within the Peace Region. The moose hunting regulations have remained relatively unchanged in the Peace Region since 1996.

Recent inventory work has suggested an improvement in the bull to cow ratios as was expected when the *SOFT-10* regulation was put into effect (Rowe 2004, Rowe 2006, Rowe 2007

Backmeyer 2004, Harris 1998). The relative success and limitations of this harvest method will be examined in later sections of this report.

Table 1. Summary of Peace Region Wildlife Management Units (WMU's) and associated moose game management subzones.

GAME MANAGEMENT SUBZONE	PEACE REGION WMU	AREA (km ²)	GAME MANAGEMENT ZONE	SUBZONE AREA (km ²)	SUBZONE % of REGION
A	7-19	4376.93	7Pa – South Peace	13934.20	7.29%
A	7-22	4159.52	7Pa – South Peace		
A	7-31	5397.75	7Pa – South Peace		
B	7-20	4366.35	7Pa – South Peace	11097.68	5.81%
B	7-21	6731.33	7Pa – South Peace		
C	7-44	2369.07	7Pb – North Peace	14729.13	7.70%
C	7-45	6213.90	7Pb – North Peace		
C	7-46	6146.16	7Pb – North Peace		
D	7-32	3683.44	7Pb – North Peace	13348.73	6.98%
D	7-33	5780.51	7Pb – North Peace		
D	7-34	1509.27	7Pb – North Peace		
D	7-35	2375.51	7Pb – North Peace		
E	7-36	3389.49	7Pc – Northeast Rockies	22606.87	11.83%
E	7-42	6065.82	7Pc – Northeast Rockies		
E	7-43	3033.44	7Pc – Northeast Rockies		
E	7-50	6807.04	7Pc – Northeast Rockies		
E	7-57	2522.79	7Pc – Northeast Rockies		
E	7-58	788.29	7Pc – Northeast Rockies		
F	7-51	18491.00	7Pd – Liard	53422.27	27.95%
F	7-52	17530.50	7Pd – Liard		
F	7-53	9884.14	7Pd – Liard		
F	7-54	7516.63	7Pd - Liard		
G	7-55	18167.00	7Pe – Fort Nelson	34072.00	17.82%
G	7-56	15905.00	7Pe – Fort Nelson		
H	7-47	9886.09	7Pe – Fort Nelson	27958.35	14.62%
H	7-48	7042.26	7Pe – Fort Nelson		
H	7-49	11030.00	7Pe – Fort Nelson		

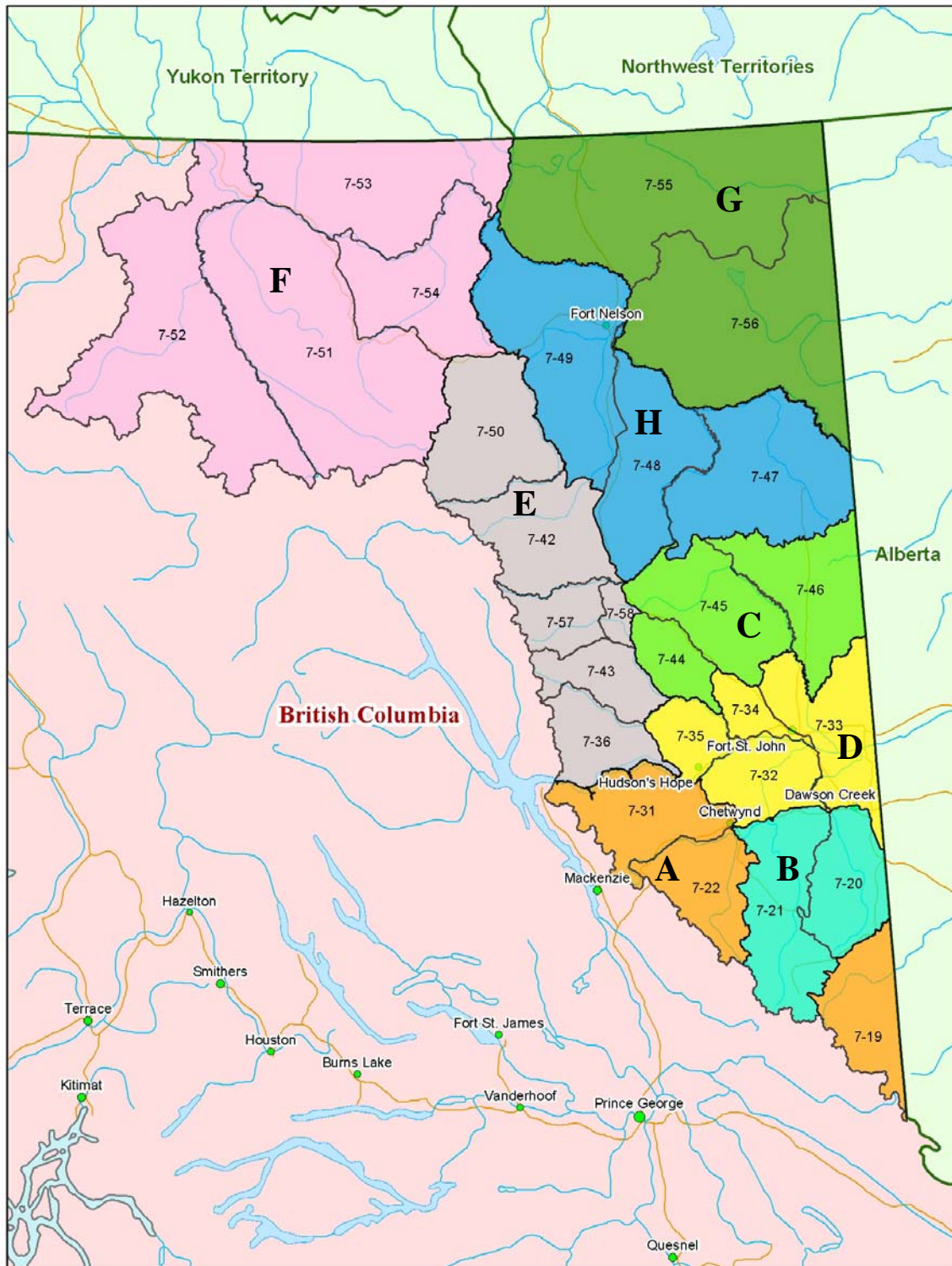


Figure 1. Map of Peace Region wildlife management units (numbers) and their associated moose game management subzones (A to H).

2. Management Objectives

Throughout British Columbia, wildlife managers use hunting regulations in an attempt to sustain a harvest of moose within their natural ecosystems. Harvest strategies vary by provincial regions but consist of either general open seasons (GOS), limited entry hunting seasons (LEH), hunting seasons limited to specific antler architecture, or some combination of these. Each management regime aims to provide sustainable hunting opportunity while managing moose populations. In most cases, moose management is aimed at sustaining or recovering moose populations, but in some instances a reduction to the moose population is desired such as in cases where reduction of moose may help facilitate recovery of caribou (MWLAP 2002).

2.1 Provincial Moose Management Objectives:

Although harvest regimes may vary by provincial region, there are management objectives that apply to every region. The following moose management objectives have been adapted from "Moose Conservation and Harvest Management in Central and Northern British Columbia" (Hatter 1998).

1. Conserve moose populations, habitats, and ecosystem function

Moose are an important part of functioning ecosystems and an integral component of biodiversity. Moose are important because they have the potential to impact sympatric animal species as well as plant communities and the ecosystems that sustain them. They play an integral role in large-mammal predator-prey systems. They alter plant growth via browsing and therefore impact plant communities. Moose populations should be conserved within their natural habitats and play a role in ecosystem functions.

2. Manage for Sustainable Harvest Rates

The AAH (annual allowable harvest) will change periodically since moose populations fluctuate. The AAH should be conservative to allow a safety margin in harvesting, especially where inventory data is lacking. The AAH should also be conservative in declining populations or populations where adult sex ratios are skewed. Harvest levels should be examined by GMZ and re-assessed every 3-5 years. Harvest rates should usually fall within 0% to 10% of the pre-hunt population.

3. Manage for Sustainable Sex Ratios

A post-hunting season bull ratio of 30 bulls/100 cows (and 50 bulls/100 cows in low density zones) should be a management goal in order to ensure pregnancy rates are high and synchronous breeding occurs.

4. Maintain Hunting Opportunity and Success Rate

Regulations should provide diverse hunting experiences and opportunities. The number of days per kill should range between 25 and 35 days per harvested moose.

2.2 Regional Moose Harvest Strategies

As mentioned previously, hunting regulations have remained relatively unchanged in the Peace Region since the initiation of the *SOFT-10* season in 1996. The regulations as they exist today are a combination of a general open season and a *SOFT-10* season. The any-bull GOS opens on August 15th and is 17 days in length for most WMU's. Following the final day of the GOS, the *SOFT-10* season opens for spike, fork, tripalm, or 10 point bulls. In some of the more easily accessible (and heavily hunted) management units, the moose rifle season is closed during the peak of the rut (bow only season from October 1 to October 15 in WMU's 7-20, 7-21, 7-32 to 7-35). The moose hunting season closes in all Peace Region WMU's on October 31.

In addition to these main seasons, an age-restricted hunt is available for hunters under the age of 19 when supervised by an adult. In 2007, authorizations were made for calf moose in each of WMU's 7-32, 7-33, and 7-34. This harvest is intended to provide opportunity to young hunters to harvest what is typically their first moose. Despite 80 authorizations being made available, an average of only about 32 kills per year were estimated per year for 2002-2006.

3. Subzone Inventory and Harvest Summary

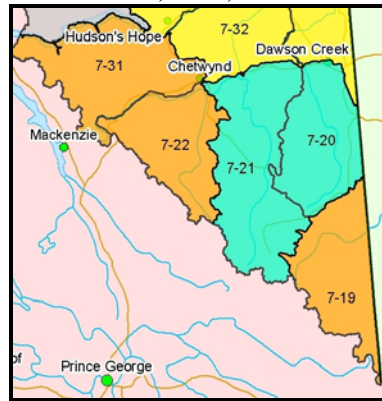
Periodic inventory of moose populations are a necessary part of the management of this highly utilized species and are ideally carried out every 3 to 5 years (MELP 1996). In reality, inventories are rarely repeated as often as liked due to a lack of stable, long-term funding. In the Peace Region, two main inventory techniques have been utilized; composition counts and stratified random block (SRB) counts. Composition counts are usually completed through the use of helicopter transects and are conducted to determine the demographics of a moose population within a predefined area. Moose encountered while flying transects are classified by sex and age. Stratified counts, on the other hand, provide researchers with additional information. Not only do SRBs result in a breakdown of moose population demographics, they also provide an estimate of absolute abundance, usually at the WMU scale. This is achieved by dividing the WMU into survey blocks, stratifying (rating) all the blocks according to their potential to contain moose, and sampling a section of each stratum to produce an estimate for the entire area. This methodology results in a density estimate as well as estimates of bull and calf ratios. If these counts are conducted prior to about mid-December (typically when antler casting begins) it can also provide ratios related to the different classes of bulls present in a population. Unless stated otherwise, all confidence limits reported here are at the 90 percent level.

The methodology described above is based on the Gasaway method (Gasaway et al, 1986). In addition to delineating, stratifying, and counting, Gasaway suggests a fourth step in order to estimate the sightability error (the number of moose overlooked in counted blocks). Sightability correction has not been used extensively within the Peace Region, therefore estimates are usually conservative in nature (an underestimate). The Gasaway method was originally designed for fixed-wing aircraft but helicopters have been used in the Peace Region to allow more accurate classification and increased safety in low level flying.

3.1 Subzone A Summary

Subzone A – Southwest Peace (Orange)

7-19, 7-22, 7-31



This subzone includes the 2 WMU's to the north and east of Mackenzie (7-22 and 7-31) as well as the WMU in southern corner of the Peace Region (7-19). Of all the Peace Region moose subzones, this is the one that has seen the least amount of inventory work over the past few decades. There have been no stratified counts completed within the subzone by Peace Region biologists and only a limited amount of transect work. With this lack of data, the status of the moose population within the zone remains somewhat uncertain. We can make some conclusions based on the harvest that the zone has sustained over recent years.

As seen in Figure 2, the number of harvested moose peaked in the early nineties for this subzone. This is a trend that will be seen for most subzones. This has been interpreted as an over-harvest in the early nineties, and was the primary reason for the initiation of the *SOFT-10* regulations. Following a sharp decline of hunters and harvest in 1996 (the year *SOFT-10* was implemented), numbers of both hunters and kills have seemed to rebound close to the levels seen in the 1980's. The harvest has varied quite a bit since the initiation of *SOFT-10*, but does not appear to be increasing or declining within this subzone despite a decline in the number of hunters.

Figures 3 and 4 show a drop in hunter success and an increase in days per kill for the 1996 hunting season. This is most likely attributed to hunters being somewhat unfamiliar with the *SOFT-10* strategy or uncomfortable with identifying legal moose in the field. A similar drop in hunters and hunter success was observed in Alaska when they first instituted a strategy similar to the *SOFT-10* (Swartz et al. 1992). Again, these measures have stabilized in the years following 1996.

This subzone is on the interface of invading mountain pine beetles and therefore may face some large-scale habitat changes over the next few decades. Mountain caribou ranges exist within this subzone and their status is an immediate conservation concern. If an abundance of early seral vegetation is created by the management of pine beetle in the area, moose populations may have the potential to expand (Triton 2005). Any habitat change that favours moose may have an indirect effect on caribou populations through increased predator abundance (Seip 1992). With that in mind, it would be beneficial to gain some understanding of absolute abundance of moose

within the subzone, ideally before large-scale habitat changes occur. In the future, the moose population will have to be managed in conjunction with caribou recovery efforts.

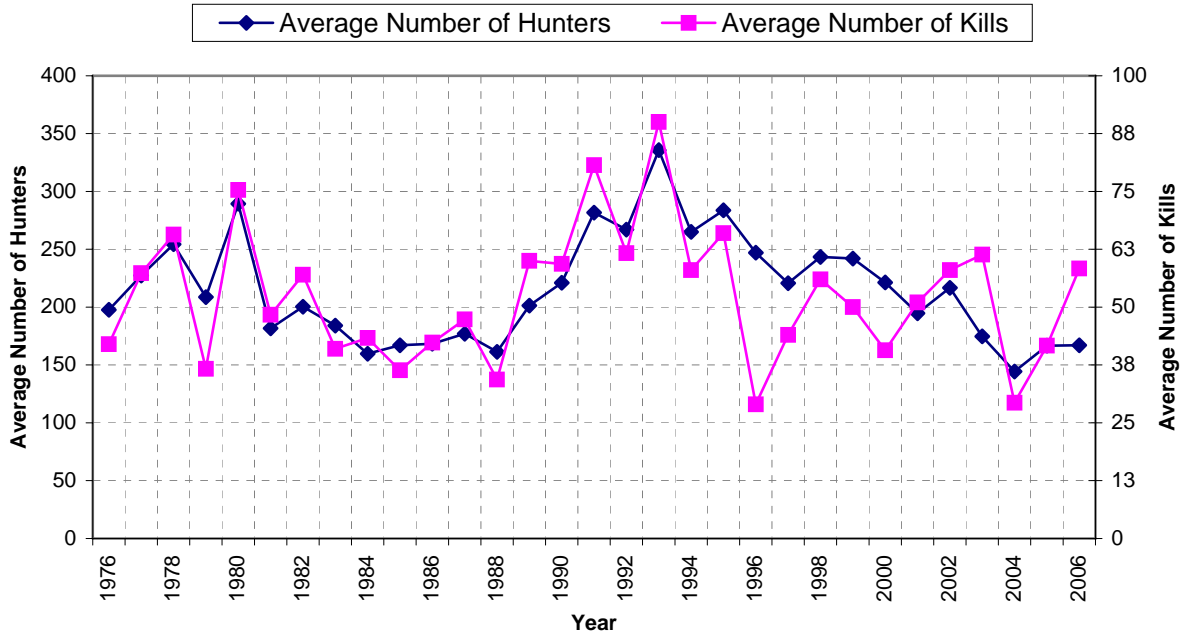


Figure 2. Average number of resident hunters and resident harvest for subzone A from 1976 to 2006.

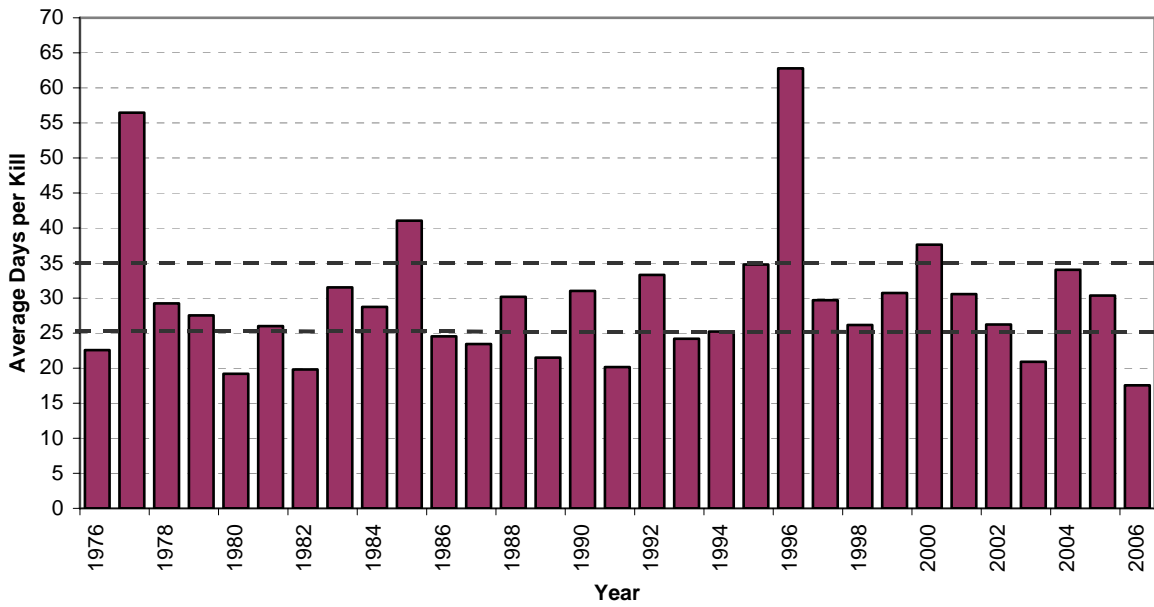


Figure 3. Average number of days per kill for subzone A from 1976 to 2006 with provincial management objectives shown by dotted lines.

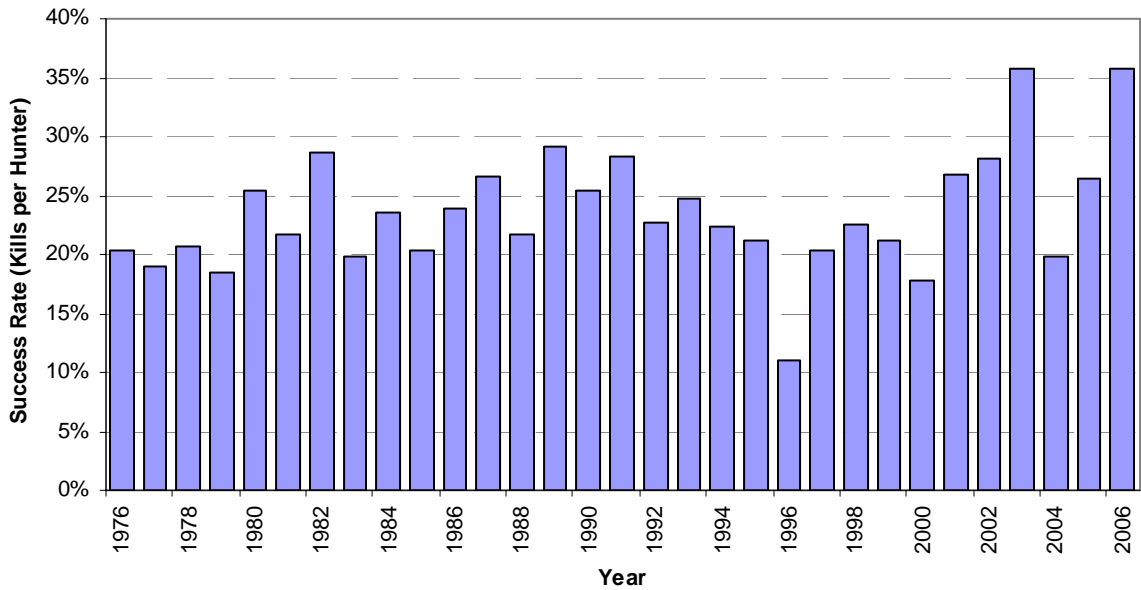
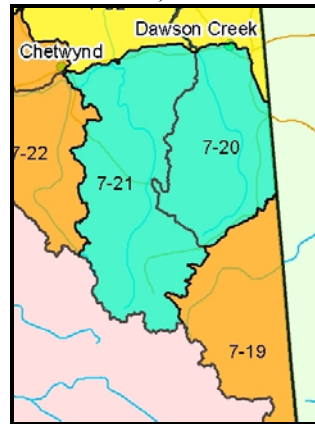


Figure 4. The average success rate (kills per hunters) for subzone A from 1976 to 2006.

3.2 Subzone B Summary

Subzone B – Tumbler Ridge and Area (Teal)

7-20, 7-21



This subzone is south of Dawson Creek and roughly centred on the Tumbler Ridge area. Stratified counts were conducted for both WMU's 7-20 and 7-21 in 1998 and repeated for WMU 7-21 in 2006 (Rowe 2006). The 1998 counts did not classify bulls and cows, instead focusing on total density and only classifying moose to adult or calf. In 2006, the number of moose in 7-21 was considered to be either unchanged or slightly higher than the 1998 estimate. Both bull and calf ratios were considered to be well within population objectives at 51 bulls/100 cows +/- 19% and 34 calves/100 cows +/- 21%. The density estimate was 0.30 moose/km² +/- 19% in 2006 compared to 0.24 +/- 19% in 1998. Transect counts carried out in the subzone in December of 2003 resulted in similar bull and calf numbers. There were 195 moose classified and ratios of 47.2 bulls/100 cows and 36.8 calves/100 cows were observed.

Resident harvest has averaged 149 moose within this subzone since 1976. The number of kills dipped sharply in 1996, as in other subzones, but has recovered to levels similar to those in the 1980's (Figure 5). The number of hunters in this subzone looks to have been declining since about 1990. In contrast, the number of days per kill has been decreasing (Figure 6) and hunter success has been increasing since 1996 (Figure 7). This appears to be a situation of a stable or slowly increasing moose population (Figure 8) and a declining hunter population. It is unclear what is the ultimate cause of declining hunter numbers in this subzone.

This is another subzone that has been greatly influenced by invading mountain pine beetles over recent years. With increasing infestation has come an increased rate of conversion from mature pine stands to early seral populations through cut and burn programs. This may have an indirect effect on caribou populations since a larger moose population supports a larger predator base (Seip 1992). A moose inventory within this subzone in the next 5 to 7 years may aid researchers in determining how moose populations respond to changing habitat conditions with the 7-21 inventory used as a baseline.

Consistently strong bull to cow ratios have been observed recently, but additional research such as early winter transects counts could be used to determine bull age structures and availability of harvestable moose under the *SOFT-10* regulation.

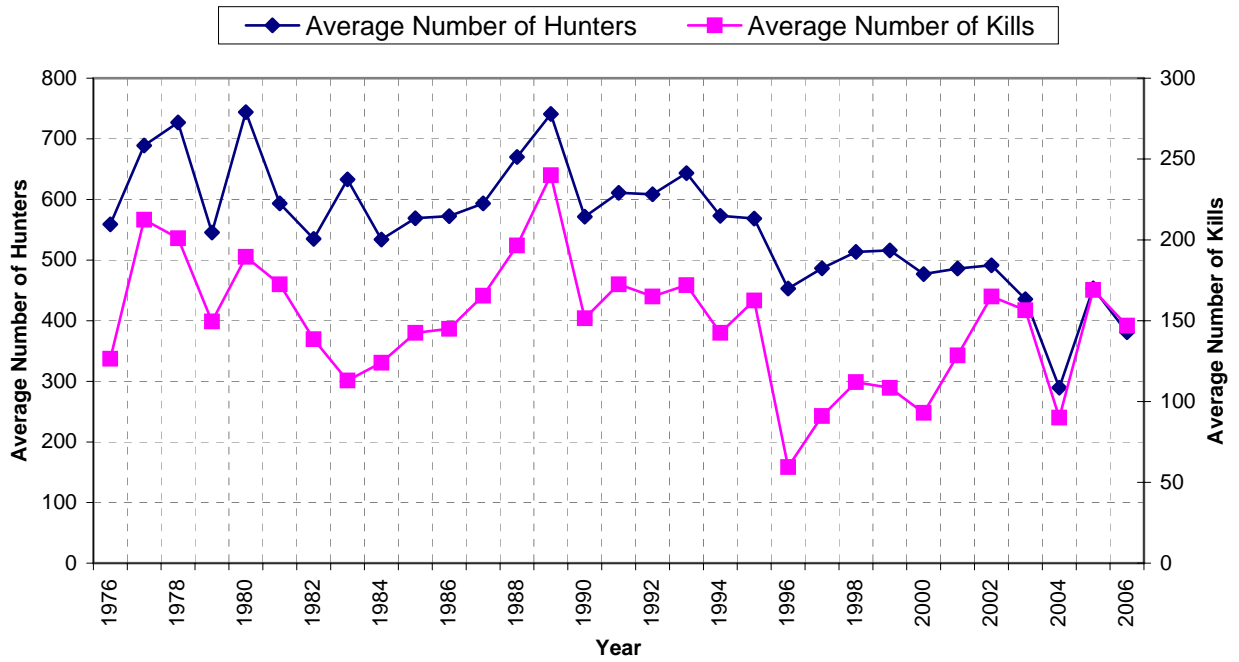


Figure 5. Average number of resident hunters and resident harvest for subzone B from 1976 to 2006.

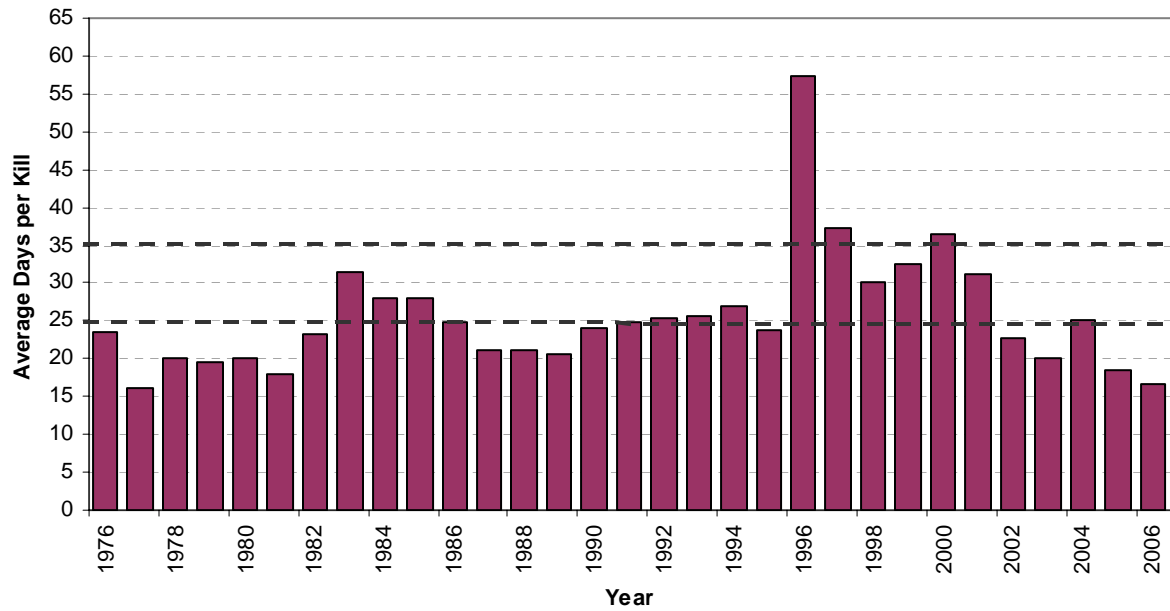


Figure 6. Average number of days per kill for subzone B from 1976 to 2006 with provincial management objectives shown.

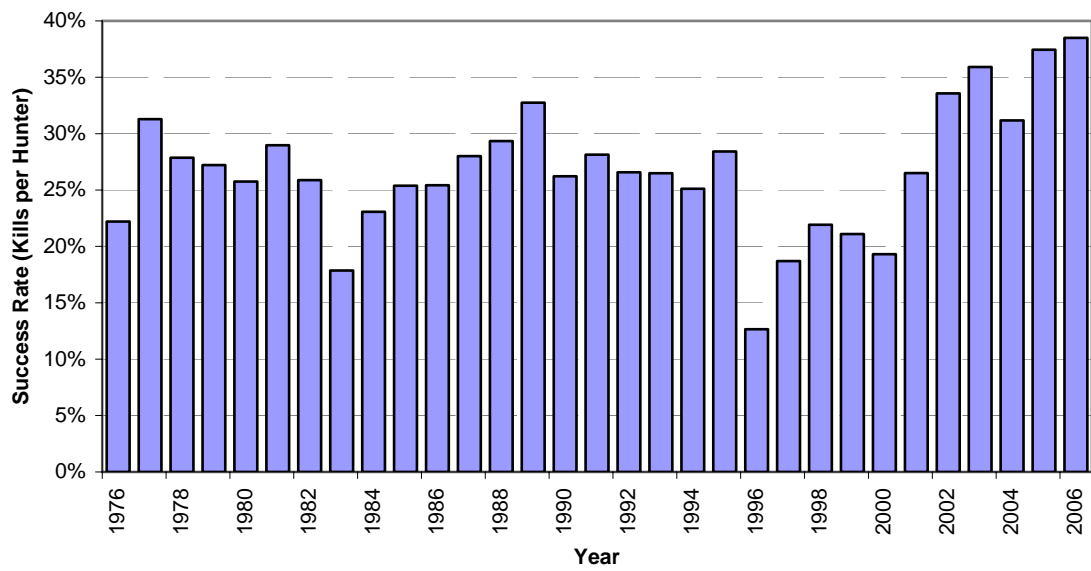


Figure 7. The average success rate (kills per hunters) for subzone B from 1976 to 2006.

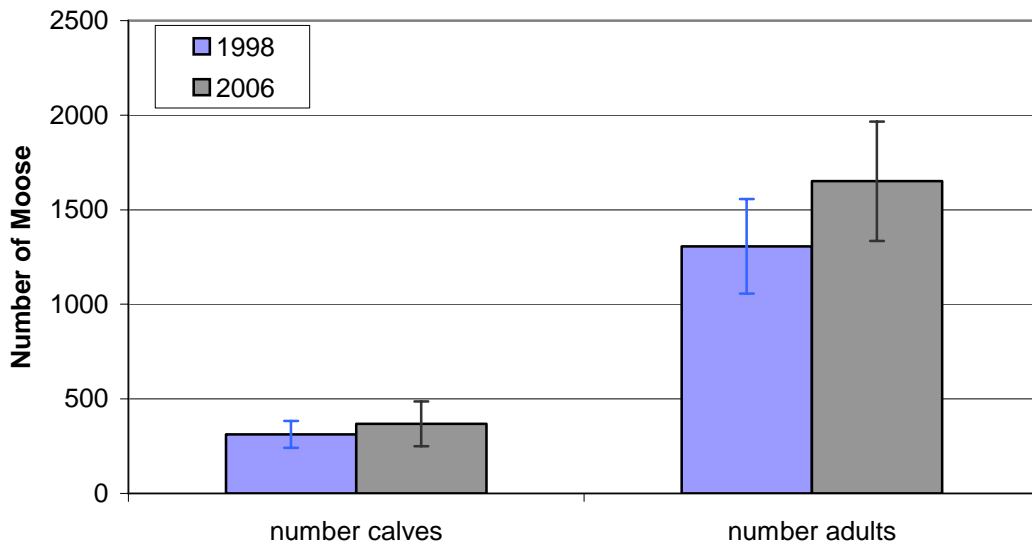
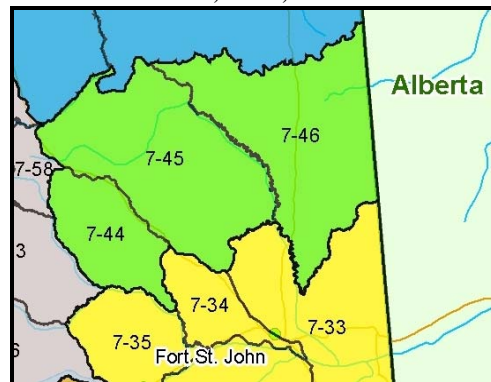


Figure 8. Number of calves and adults estimated during 1998 and 2006 inventories of WMU 7-21.

3.3 Subzone C Summary

Subzone C – Central Peace (Light Green)

7-44, 7-45, 7-46



North of Fort St. John and east of Pink Mountain, this subzone contains different types of moose habitat. There is a transition from the agricultural areas in the south and west to wetter and poorer quality habitat in the north-eastern portion of the subzone. Generally, moose populations reflect this gradient in habitat quality from east to west. The density of 0.05 moose/ km² +/- 28.39% as measured in 2005 in WMU 7-46 is one of the lowest measured in the region. In contrast, one of the highest densities measured in the region was observed in WMU 7-44 in 1996 when 1.26 moose/ km² +/- 23.6% was recorded. In the central management unit, WMU 7-45, a density of 0.65 moose/ km² +/- 20% was measured in 2006.

The only WMU within this subzone that has been subject to more than one SRB is WMU 7-45 (1998 and 2006). Each of density, bull to cow ratio, and calf to cow ratio had improved in 2006 over 1998 numbers (Figure 12), but 2006 numbers may be slightly inflated due to stratification inaccuracies (Rowe 2007). For a moderate density WMU, 7-45 was thought to be exceeding minimum provincial management goals for bulls (56.70 bulls/100cows +/- 23.17%) and calves (45.59 calves/100cows +/- 11.94%) in during the 2007 count.

A transect count was conducted within the subzone in 2003 and at that time 36 calves/100 cows were observed along with 37 bulls/100 cows. These values are within provincial management goals for calves and bulls in moderate density populations. The management goal for bulls in WMU 7-46 is higher since this is a low density population. Inventory data suggests WMU 7-46 is achieving the goal of at least 50 bulls per 100 cows for low density population since 53.7 bulls/100 cows were observed in 2005 (Rowe 2005), but the confidence around this estimate is low at +/- 38.19%. Transect counts in 7-46 could help verify that an adequate bull population exists within the WMU to ensure high pregnancy rates continue to be observed.

The number of hunters has been generally declining since 1988 within this subzone and has declined 10-fold since 1977 (Figure 9). Days per kill and success rate appear to be varying independently of hunting pressure for this subzone (Figures 10 and 11).

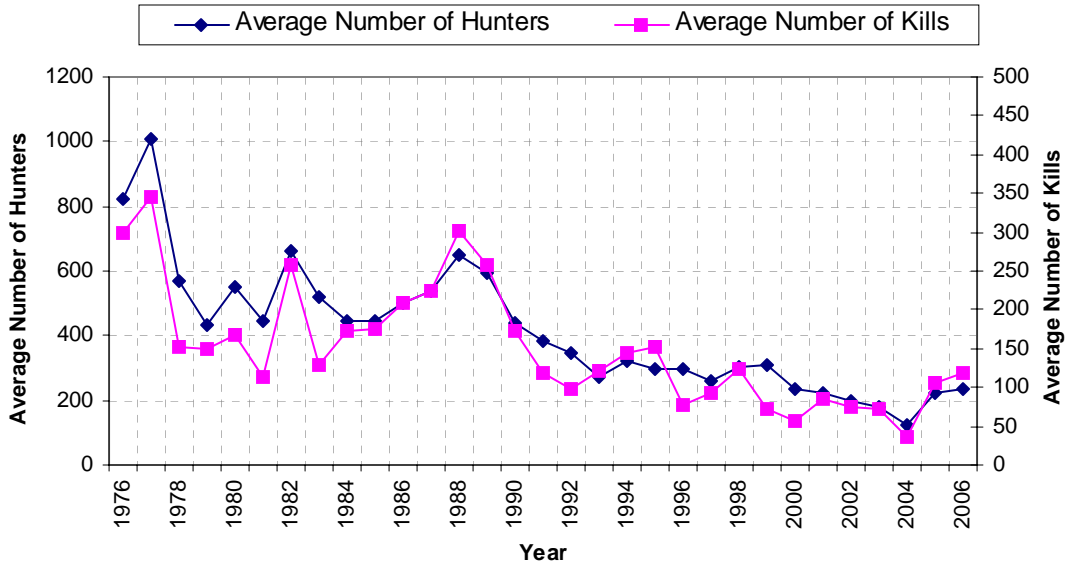


Figure 9. Average number of resident hunters and resident harvest for subzone C from 1976 to 2006.

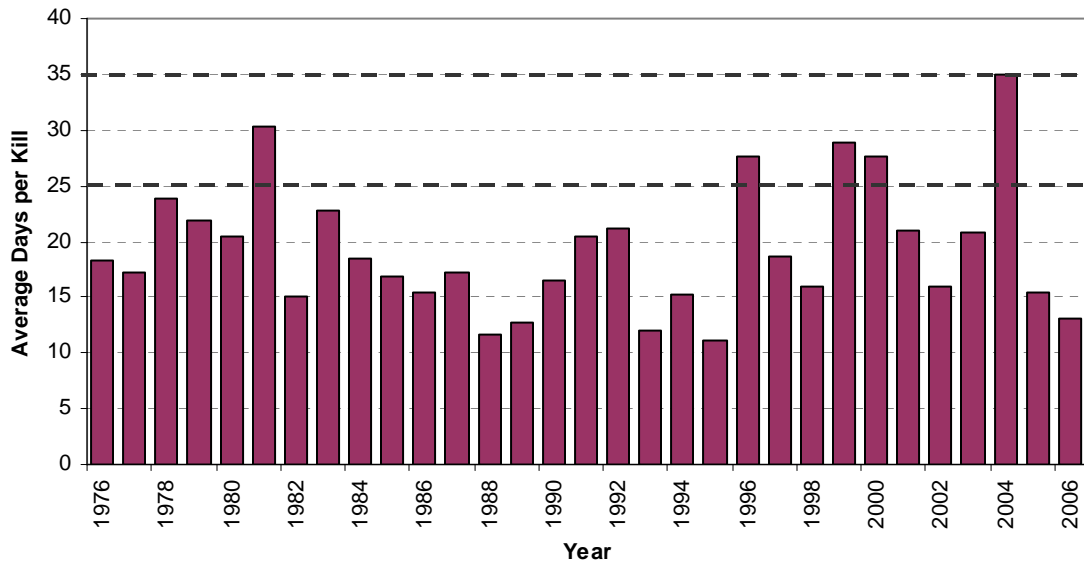


Figure 10. Average number of days per kill for subzone C from 1976 to 2006 with provincial management objectives shown.

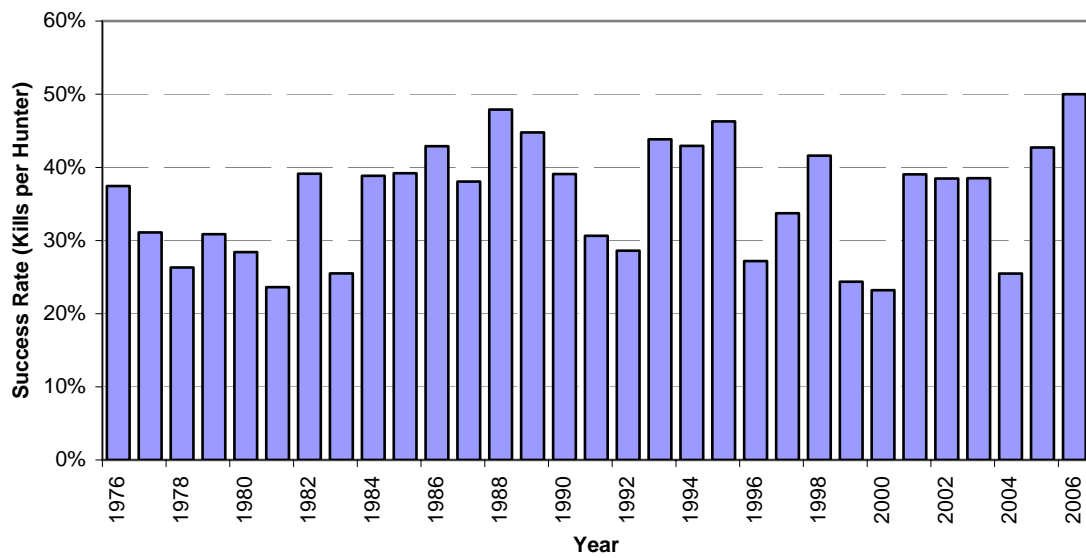


Figure 11. The average success rate (kills per hunters) for subzone C from 1976 to 2006.

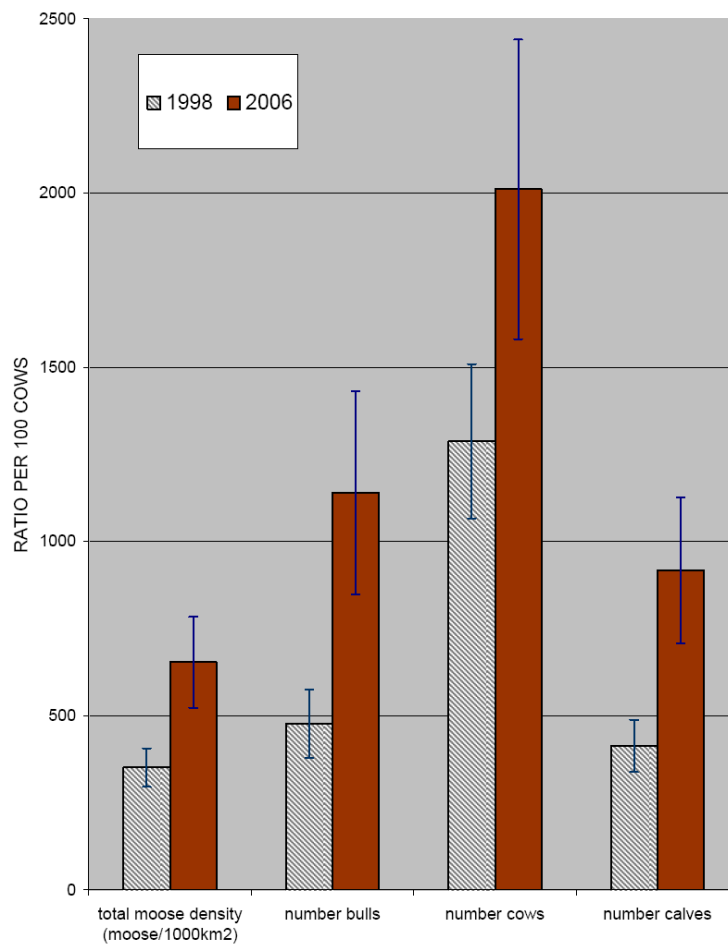
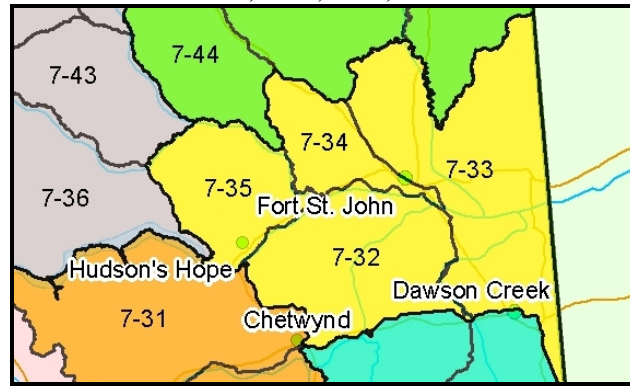


Figure 12. Comparing population demographics within MU 7-45 in 1998 and 2006.

3.4 Subzone D Summary

Subzone D – Agricultural Core (Yellow)

7-32, 7-33, 7-34, 7-35



This subzone is centred on both the population core and agricultural core of the Peace Region. Much debate has surrounded these management units in recent years as far as interaction of wildlife with agriculture. Mostly, the discussions have dealt with deer and elk damage to crops and haystacks, rather than interactions with moose. Nevertheless, this subzone has the highest moose harvest of for all subzones by resident hunters in the Peace Region. This is the most easily accessible Peace Region GMZ for hunters and moose densities are relatively high here in part due to the lack of natural predators throughout most of the zone.

A number of inventory projects have taken place within this subzone. In December of 1994 a transect count was conducted centred around WMU 7-32 with transects extending north and south of this WMU (moose, elk, mule deer, and whitetail deer classifications were completed concurrently). At that time, ratios of 29.3 bulls/100cows and 44.4 calves/100 cows were observed. Block counts were conducted within the subzone in 1996 (Table 2) and the mean sex/age ratios for the entire subzone were 34 calves/100 cows and 34 bulls/100 cows. 2003 transects within the subzone resulted in an estimate of 42.6 calves/100 cows and 37.0 bulls/100 cows (Table 2).

Stratified counts have been conducted in WMU 7-32 in 1984, 1996, and 2004 (Figures 13 and 14). The 2004 count suggested that moose numbers may have slightly increased over 1996 values and a median bull ratio estimate was considered high at 59.5 bulls/100 cows (but with low confidence around this estimate at +/- 44.4%). Calf estimates in 2004 were also thought to be meeting provincial management goals for this WMU and the calf ratio was estimated at 37.27 +/- 19.10% calves/100 cows (Rowe 2004).

The number of hunters and the harvest has been relatively stable since 1991 (Figure 15). The introduction of *SOFT-10* regulations did not appear to deter hunters in this subzone or drastically affect effort needed to harvest a moose or hunter success rate (Figures 16 and 17). A higher than average effort (days/kill) was observed in 1999, but it is unclear whether this was attributed to weather or some other factor during that hunting season since the years prior and following did not experience above normal effort as measured (Figure 16).

Table 2. Inventory summary estimates for counts conducted within subzone D in 1996.

WMU	Population	Density	90% CI	Bulls	Cows	Calves	Bulls/100 cows	Calves/100 cows
7-32	2520	0.70	17.75	480	1467	574	33	39
7-34	1838	1.23	19.25	337	1088	413	31	38
7-35	1195	0.51	17.83	281	727	176	39	24

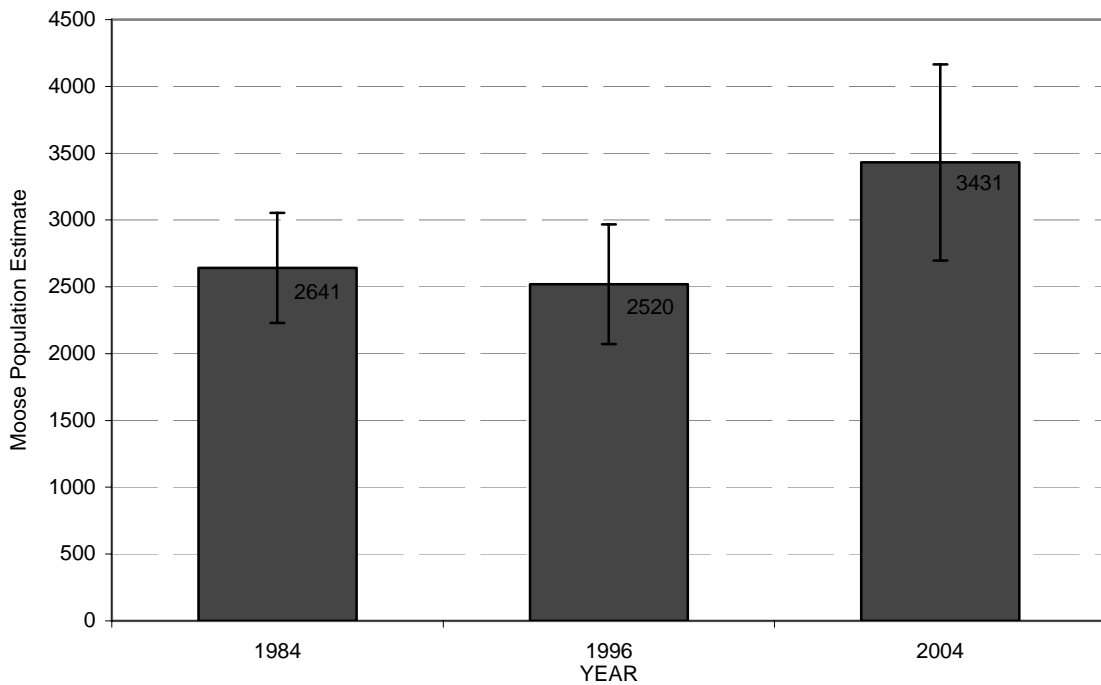


Figure 13. A comparison of moose population estimates from stratified random block counts in WMU 7-32 in 1984, 1996, and 2004.

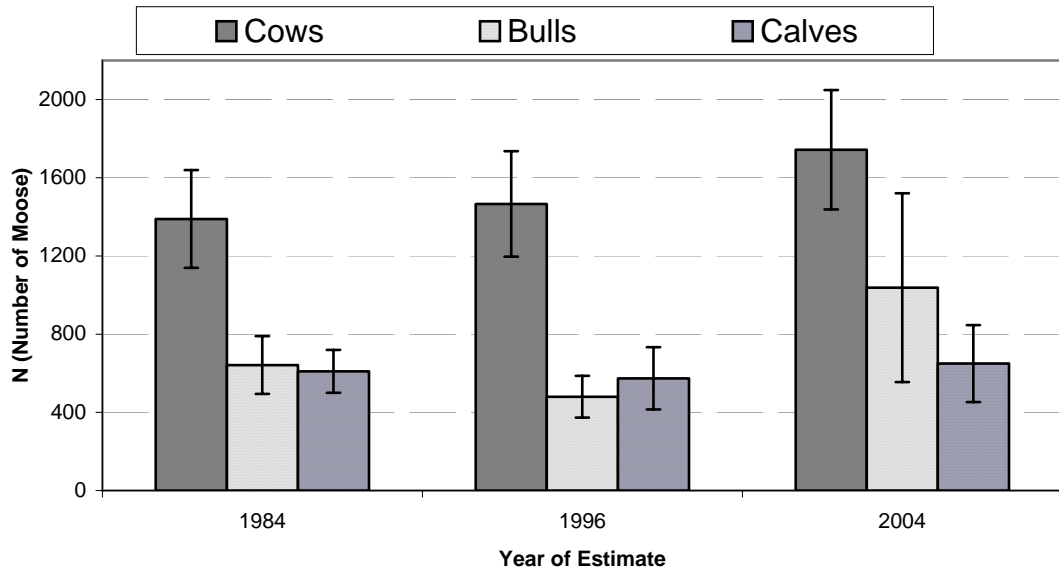


Figure 14. A comparison of moose cows, bulls and calves as estimated from stratified random block counts in WMU 7-32 in 1984, 1996, and 2004.

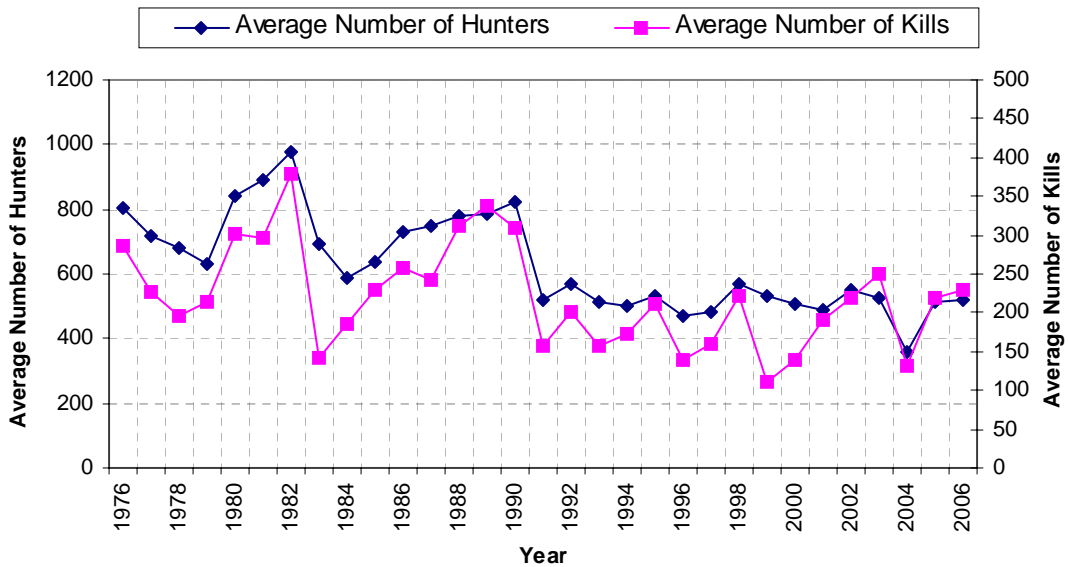


Figure 15. Average number of resident hunters and resident harvest for subzone D from 1976 to 2006.

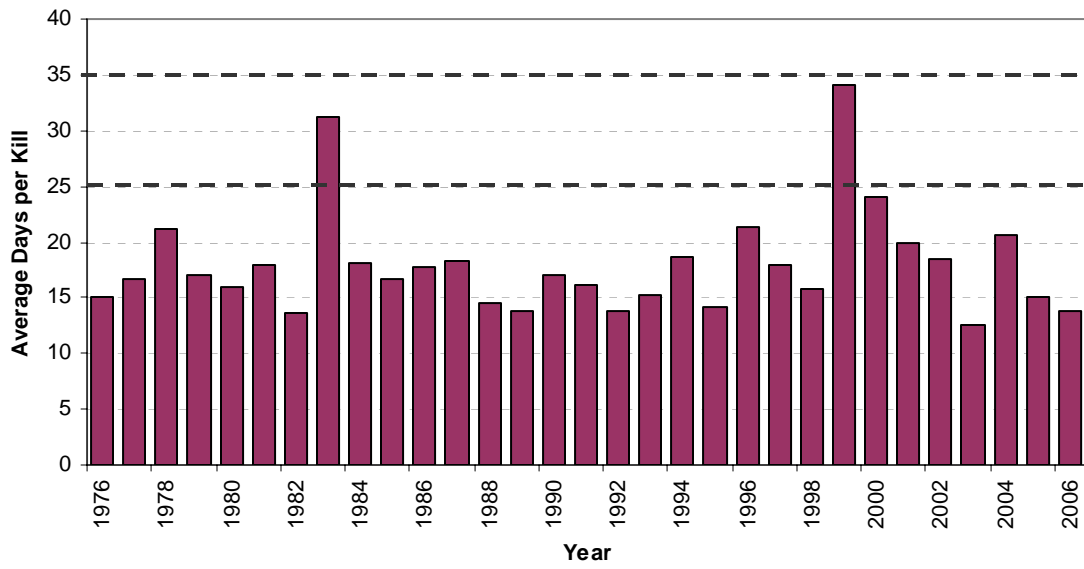


Figure 16. Average number of days per kill for subzone D from 1976 to 2006 with provincial management objectives shown.

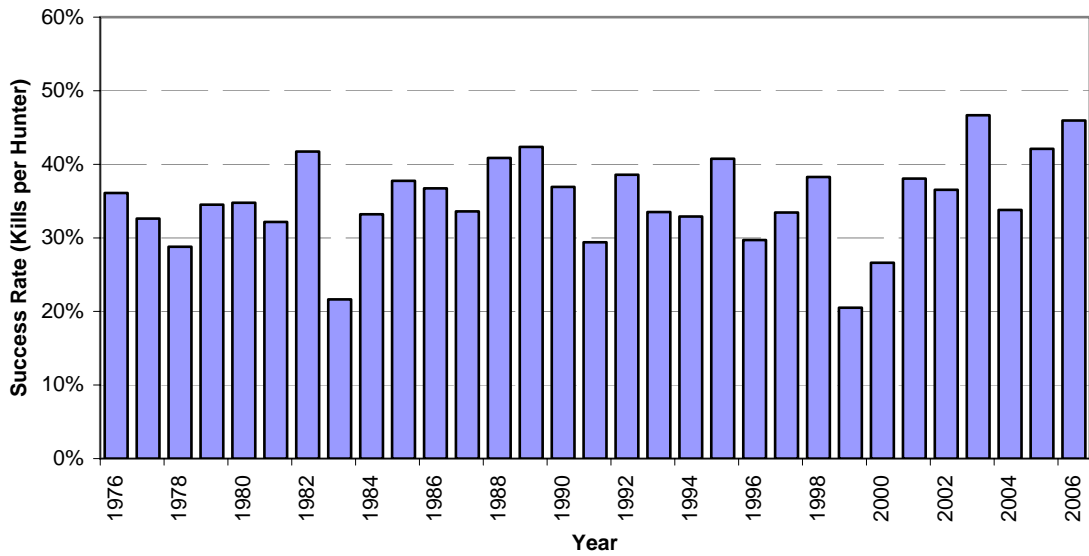
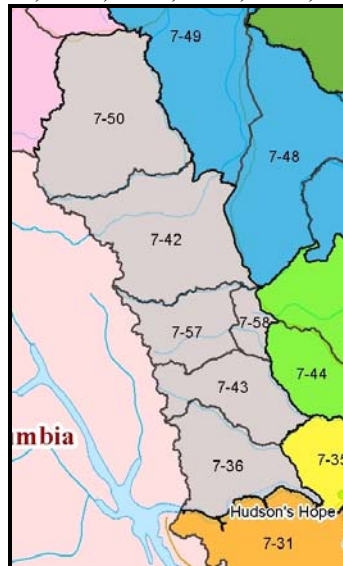


Figure 17. The average success rate (kills per hunters) for subzone D from 1976 to 2006.

3.5 Subzone E Summary

Subzone E – East Slopes (Grey)

7-36, 7-42, 7-43, 7-50, 7-57, 7-58



Subzone E runs north from the Peace Reach of Williston Reservoir up the east slope of the Rocky Mountains. Surveys conducted within this subzone in the 1990's indicated widespread population declines (Hatter1998) and changes to the hunting regulations were needed to help improve bull to cow ratios. Predation is an important source of moose mortality within this subzone and is thought to be limiting the recovery of moose numbers. The winter of 1995-1996 was severe within this subzone and likely contributed to increased moose mortality during that year (Hatter 1998). This subzone has been responsible for an average of 57% of the non-resident moose harvest in the Peace since 1981 (Figure 18), therefore the non-resident hunting statistics will also be discussed in this section.

A number of transect counts have been conducted within this subzone. In February of 1990 transect counts were carried out within WMU's 7-42, 7-57, and 7-58. Elk, caribou, and sheep were also classified during this count and moose ratios were estimated at 37.8 bulls/100 cows and 26.5 calves/100 cows. In an area west of Pink Mountain in 1992 slightly lower ratios were observed with 21.0 bulls/100 cows and 20.5 calves per 100 cows. In 1993 west of Pink Mountain the bull ratio was 21.5/100 cows and the calf ratio had declined to 14.7/100 cows. In 1994 transects were conducted to the west and north of Pink Mountain. With 350 moose classified, ratios of 23.8 bulls/100 cows and 22.6 calves per 100 cows were estimated.

Stratified counts generally indicated declining populations in the 1990's with poor calf ratios and bull ratios (Table 3). Not enough survey work has been completed since the initiation of *SOFT-10* regulations to determine how populations have responded in this subzone. Resident harvest has continued to decline over recent years while non-resident harvest has stabilized at a level below that observed in the 1980's (Figures 19 and 22 respectively). Resident days per kill

(Figure 20) and kills per hunter (Figure 21) are still higher than management objectives for this subzone. Non-resident effort and success has stabilized since 1996 (Figures 23 and 24).

Additional bull antler information was collected during the 1993 Pink Mountain transect flights. For that count information was collected on the number of brow tines per adult bull. It would be interesting to repeat transects such as these to see if the number of tripalm bulls has changed since the institution of antler restricted harvest. Conclusions would be limited here by the fact that only 260 total moose and 41 bulls were classified during the count. Other transect or stratified counts may have included brow palm information, but were not identified during research for this report. If information exists, transects could be repeated and information on the effects of tripalm harvesting regulations may be inferred.

Table 3. Summary of stratified counts for subzone E from 1979 to 2001.

Survey Area	Subzone	Year	Density		Calf Ratio	+/- SD	Bull Ratio	+/- SD
			(Moose/km ²)					
7 42 (Sikanni-Prophet)	E	1989	1.35	16.6	31.3	17.6	34.0	34.1
7 42 (Sikanni-Prophet)	E	1993	0.83	31.4	22.2	17.1	21.8	32.3
7 42 (South of Prophet)	E	2001	0.74	15.4	17.4	19.7	25.4	29.4
Pink Mountain	E	1979	1.71		29		41	
Pink Mountain	E	1985	1.19		39		50	
Pink Mountain	E	1989	0.58	14.5	27.8	30.0	35.2	69.8
Pink Mountain	E	1993	0.42	19.2	16.6	30.1	26.6	37.8
Tierney Creek	E	1985	1.69	21.3	28.7	23.9	58.6	18.7
Tierney Creek	E	1989	1.43	12.4	26.7	19.4	37.7	17.2
Tierney Creek	E	1993	1.13	23.9	16.8	26.3	38.9	19.9
Core (MU 7-50)	E	1989	1.44		34		37	
Core (MU 7-50)	E	1993	0.67		23		52	

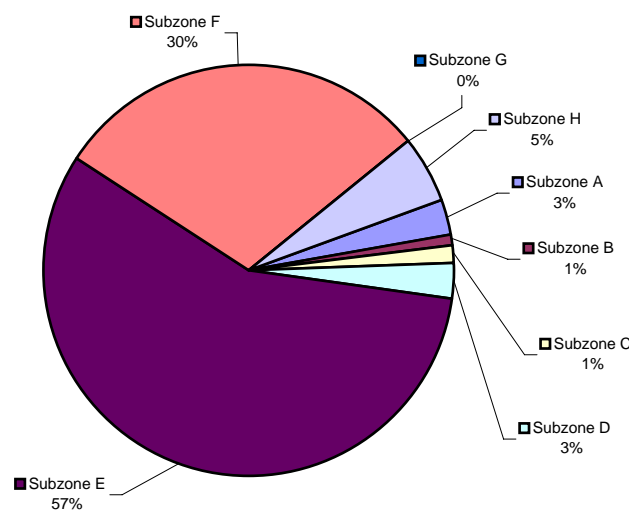


Figure 18. Average moose harvest by non-resident hunters from 1981 to 2006.

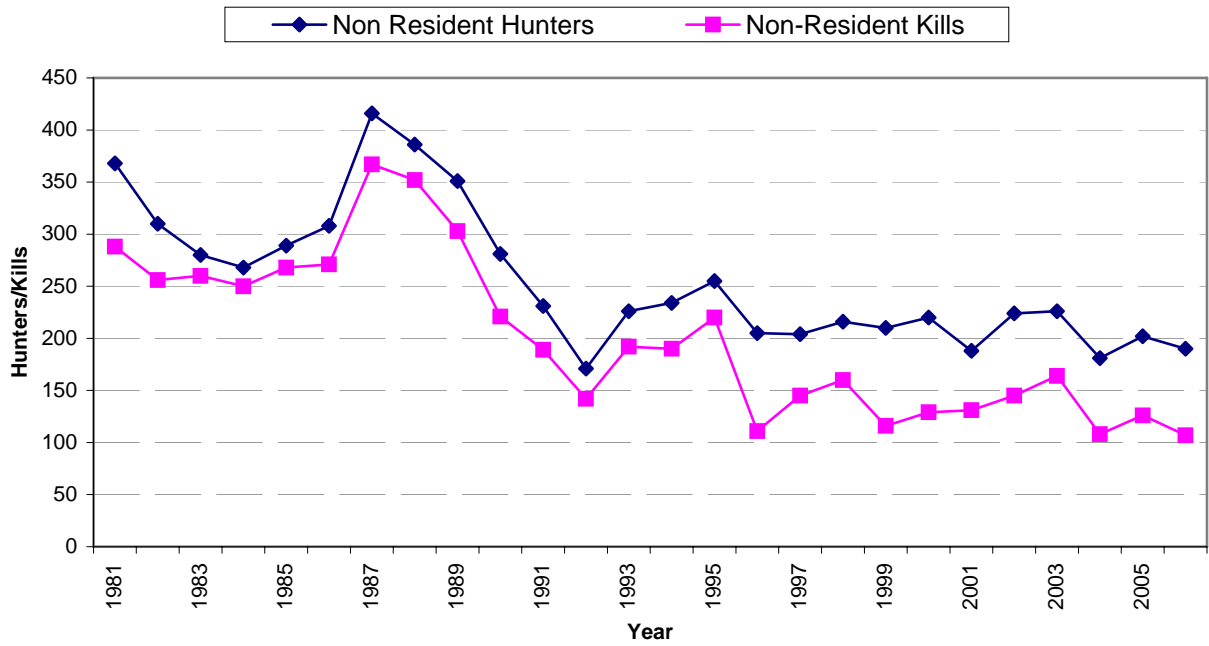


Figure 19. Average number of resident hunters and resident harvest for subzone E from 1976 to 2006.

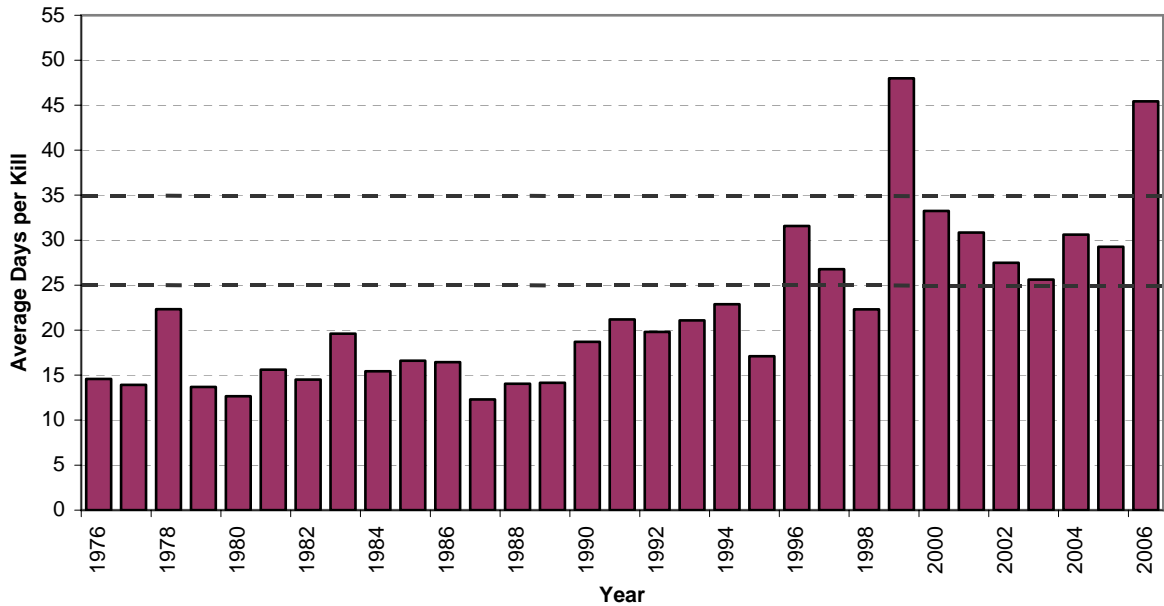


Figure 20. Average number of days per kill for subzone E from 1976 to 2006 with provincial management objectives shown.

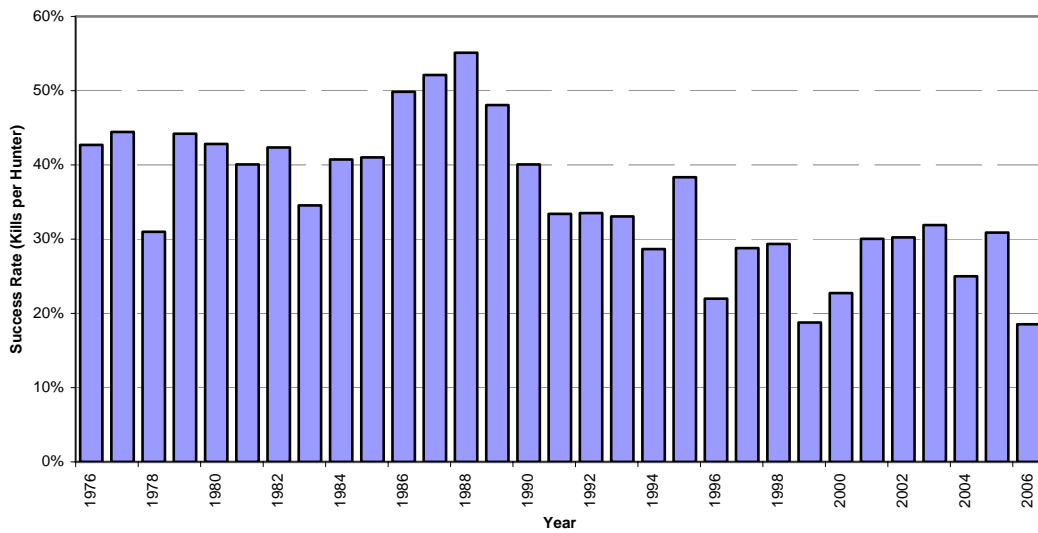


Figure 21. The average success rate (kills per resident hunters) for subzone E from 1976 to 2006.

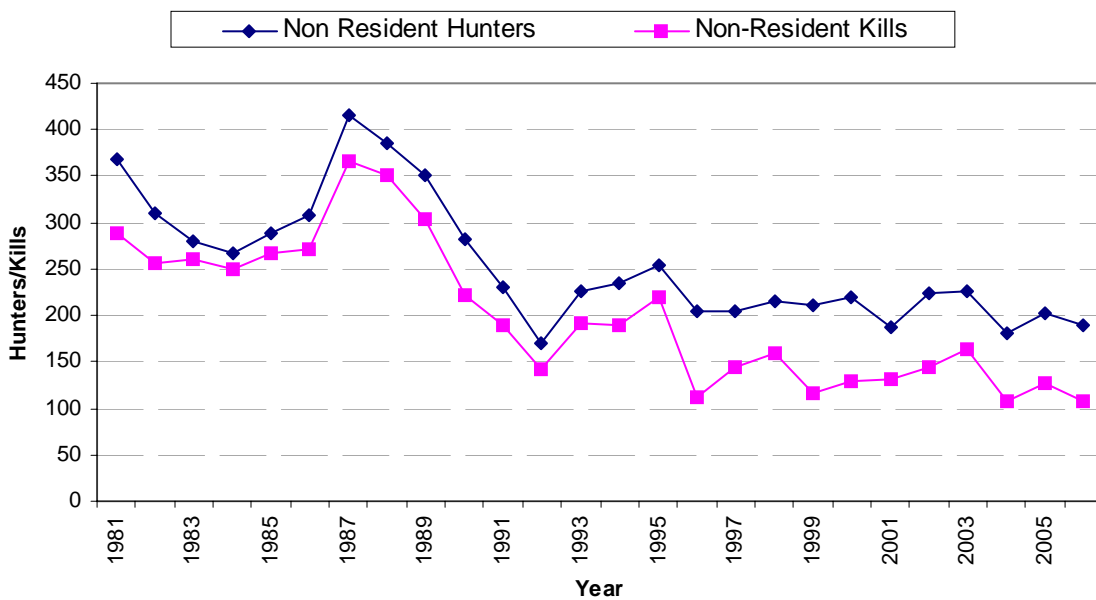


Figure 22. Average number of non-resident hunters and non-resident harvest for subzone E from 1981 to 2006.

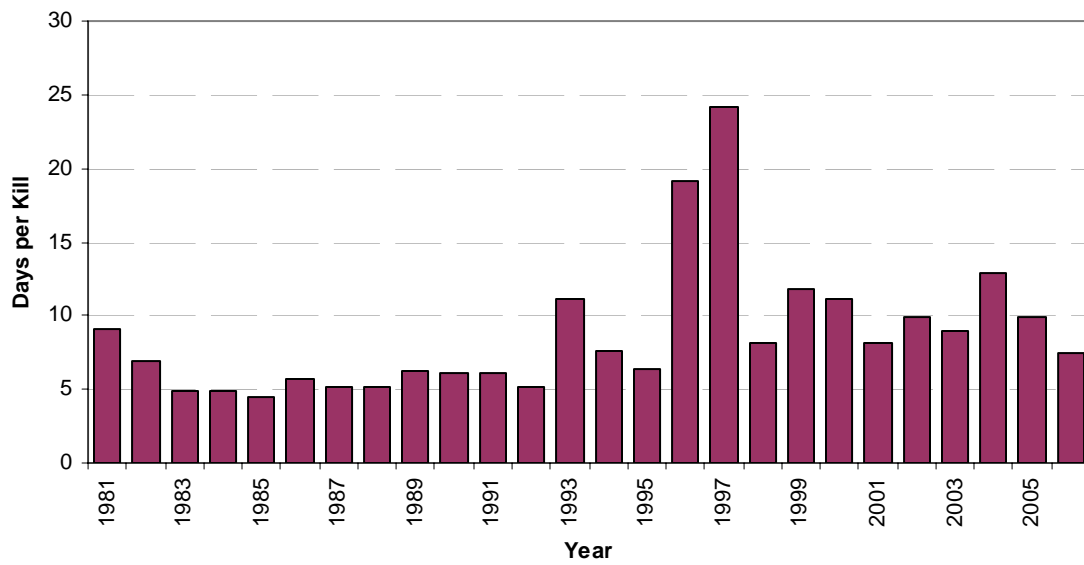


Figure 23. Average number of days per kill for non-resident hunters for subzone E from 1981 to 2006 with provincial management objectives shown.

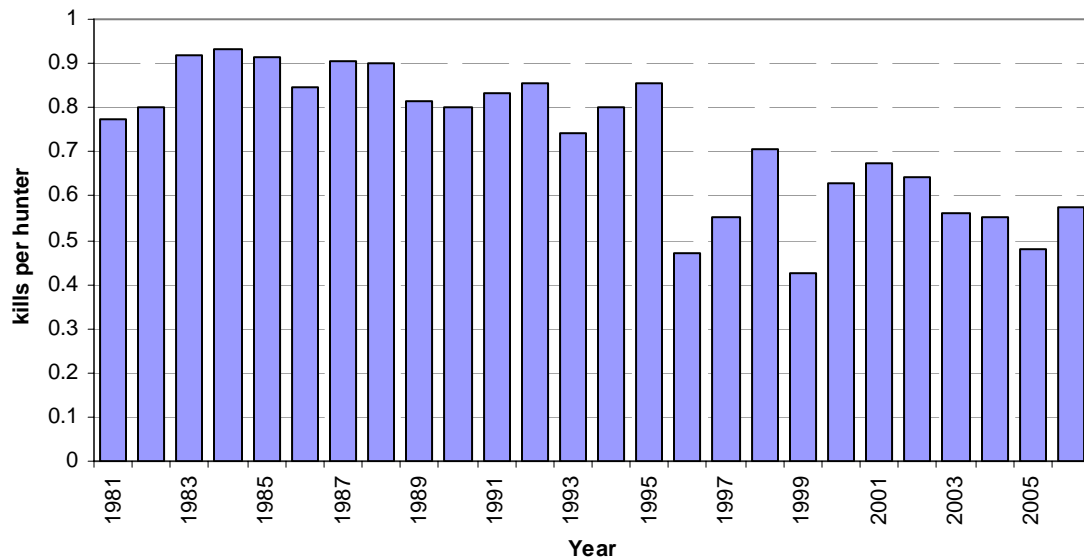
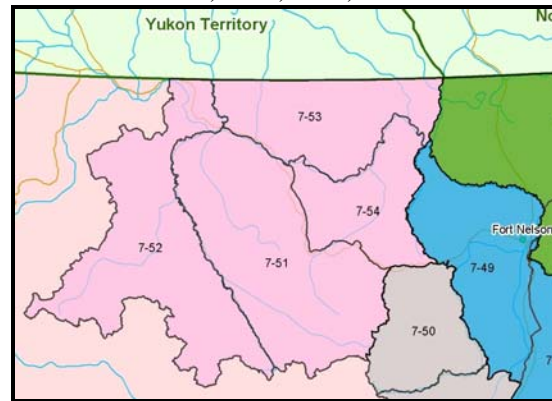


Figure 24. The average success rate (kills per non-resident hunters) for subzone E from 1981 to 2006.

3.6 Subzone F Summary

Subzone F – Northern Rockies (Pink) 7-51, 7-52, 7-53, 7-54



Located in the extreme northwest portion of the Peace Region, this zone is relatively unpopulated and undeveloped. Wolf impact greatly on moose populations here. A multi-year and multi-species inventory project was completed within this the largest of subzones in the 1990's. Table 4 summarizes some of the inventory details from that project.

The number of resident hunters and the resident harvest dropped after the initiation of the SOFT-10 season (Figure 25) and since that time days/kill has remained significantly higher than prior to the initiation of this regulation (Figure 26). Success rates have not recovered in this subzone as they have in some others subzones (Figure 27).

Additional research is required within this subzone to determine if bull and cow ratios are meeting provincial management guideline levels. This could be completed through transect analysis.

Table 4. Summary of stratified counts for subzone F from 1984 to 1998.

Area	Subzone	Year	Density	Calves/100 cows	Bulls/100 cows
CLIB Middle Creek	F	1984	0.690	41.0	35.0
CLIB Middle Creek	F	1997	0.459	9.6	48.0
7 53	F	1997	0.064	21.0	116.0
Red River	F	1997	0.065	77.0	48.0
Kechika	F	1998	0.349	17.1	60.6

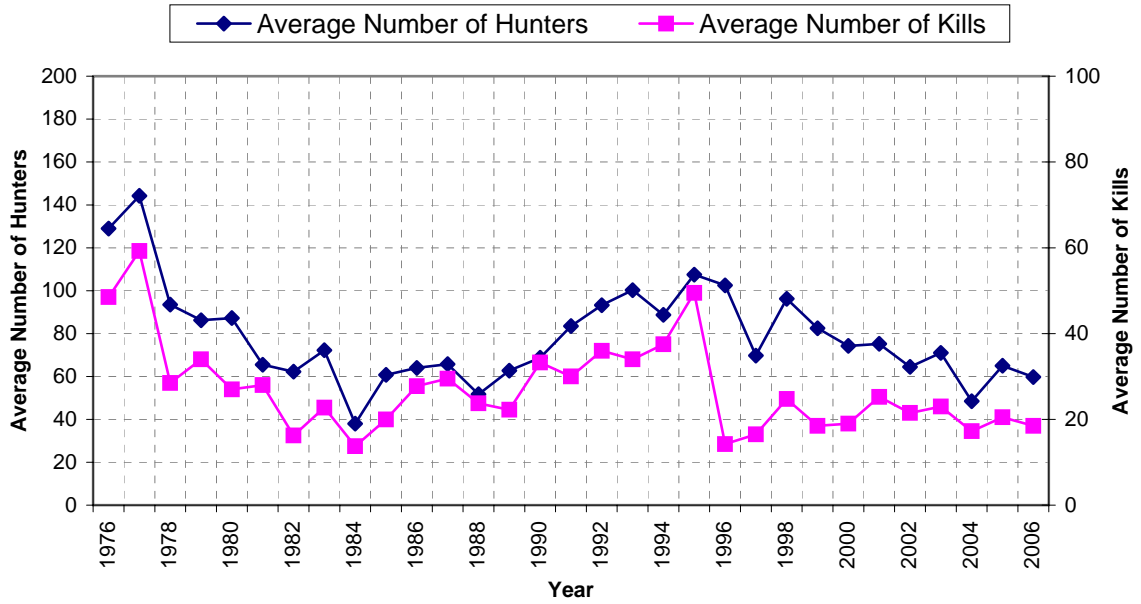


Figure 25. Average number of resident hunters and resident harvest for subzone F from 1976 to 2006.

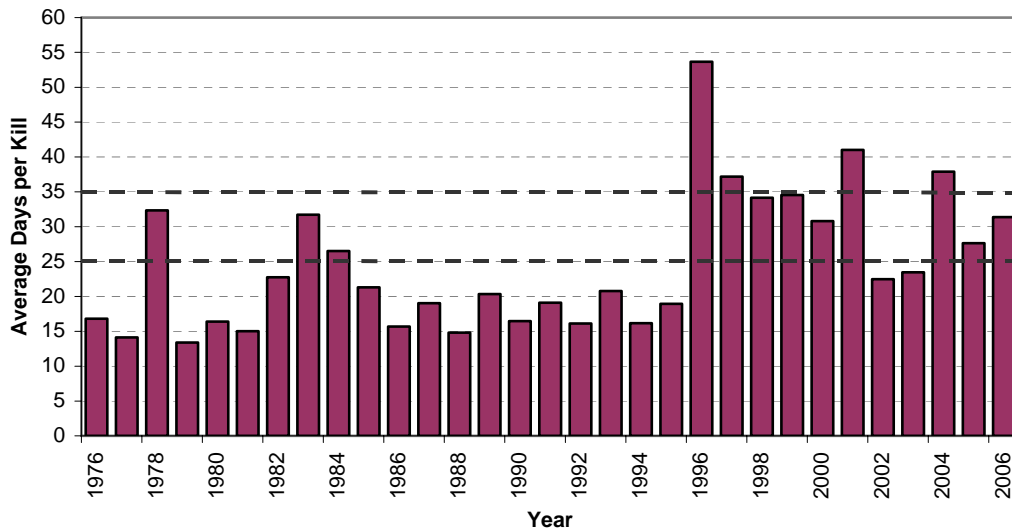


Figure 26. Average number of days per kill for subzone F from 1976 to 2006 with provincial management objectives shown.

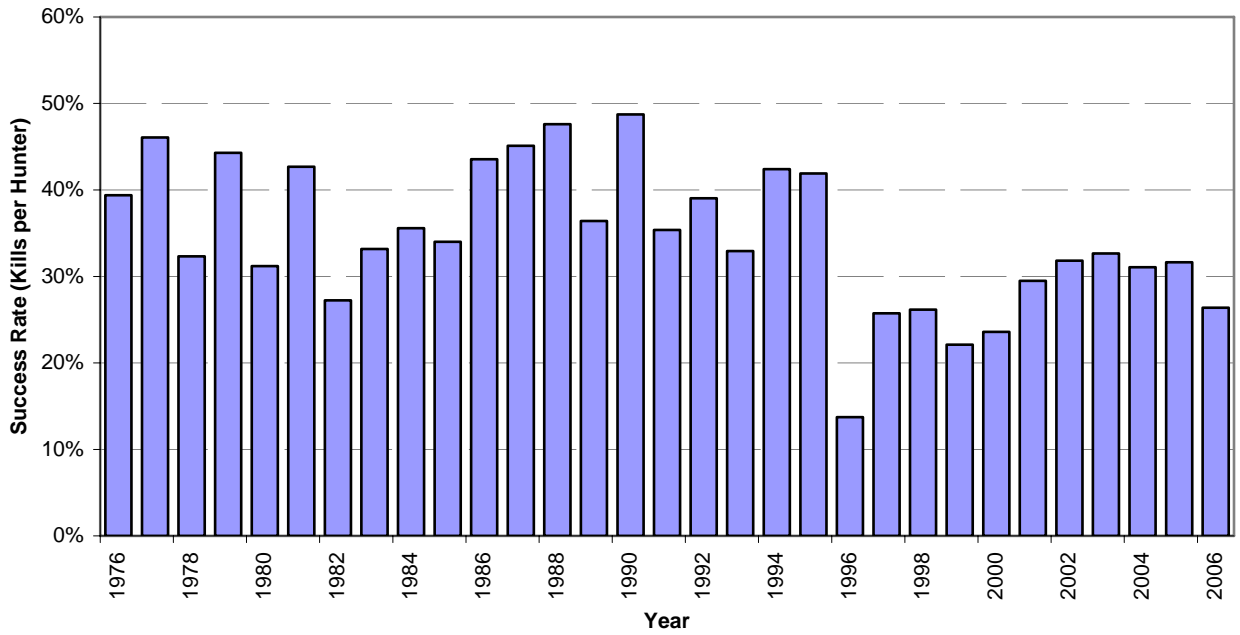
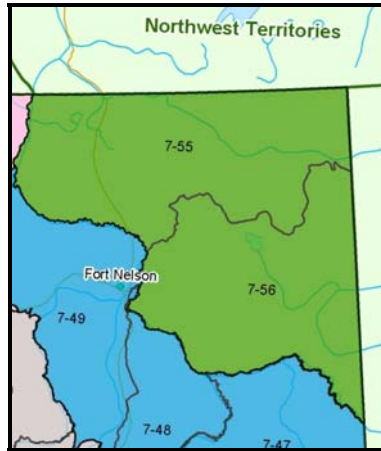


Figure 27. The average success rate (kills per hunters) for subzone F from 1976 to 2006.

3.7 Subzone G Summary

Subzone G – Northeast Plateau (Dark Green)

7-55, 7-56



This subzone is located in the extreme northeast corner of British Columbia. A comprehensive moose count was conducted within this subzone in 2004. The two target species for that count were moose and boreal caribou. Across the subzone a density of 0.087 moose/ km² was estimated. The ratios observed during that count were 76.3 bulls/100 cows and 23.7 calves/100 cows. In 1988 a moose survey within the same general area resulted in an estimate of 0.09 moose/km² (Backmeyer 2004).

Compared to other subzones, the hunting pressure and harvest has been relatively stable within this subzone since the early 1990’s (Figure 28). Fluctuations in effort and success may be more due to weather conditions (Figure 29 and 30). Periodic transects could be utilized here to ensure that bull ratios remain high in this relatively low density subzone and that calf recruitment is adequate.

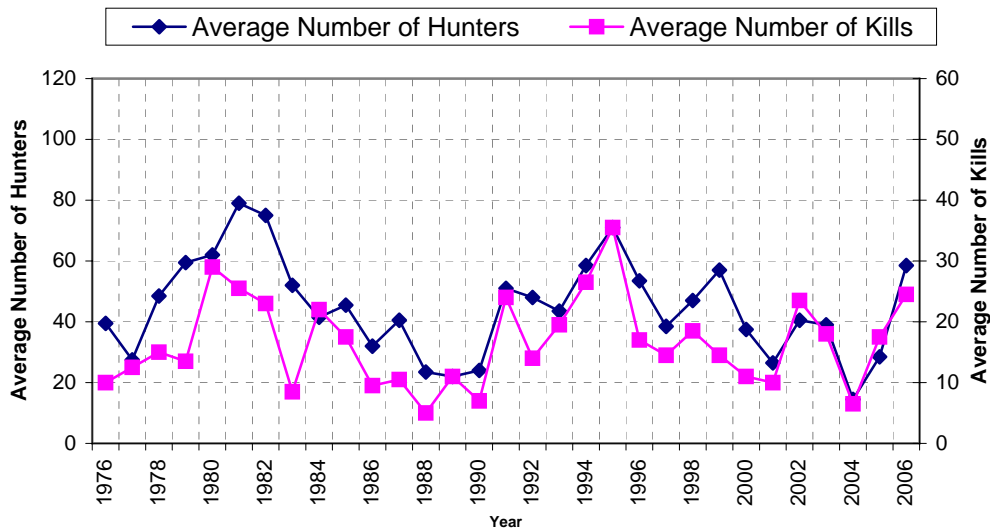


Figure 28. Average number of resident hunters and resident harvest for subzone G from 1976 to 2006.

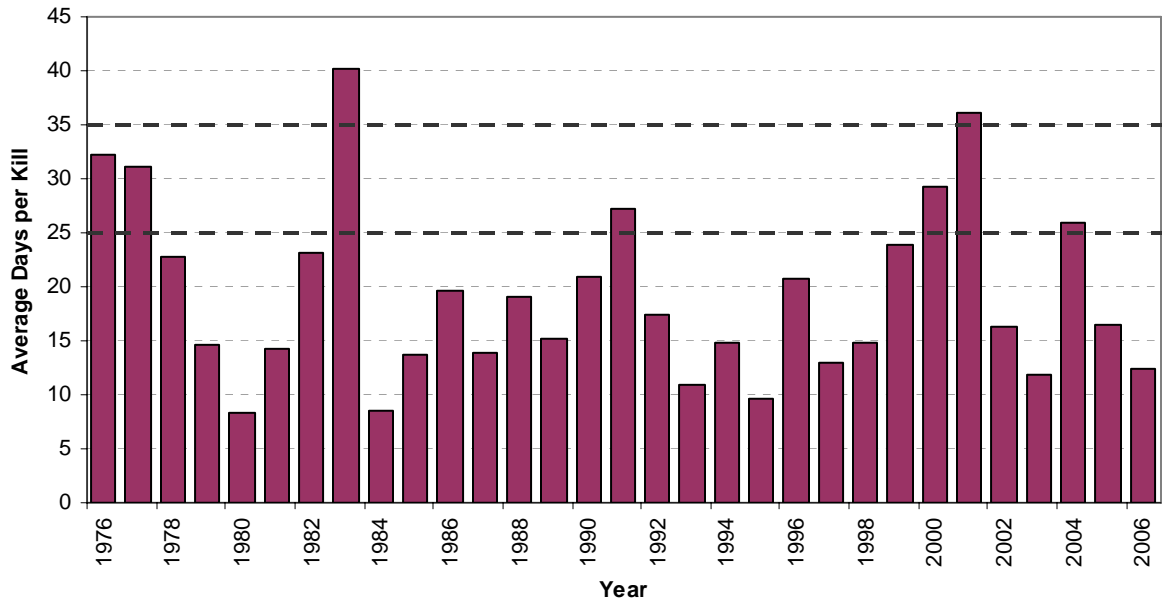


Figure 29. Average number of days per kill for subzone G from 1976 to 2006 with provincial management objectives shown.

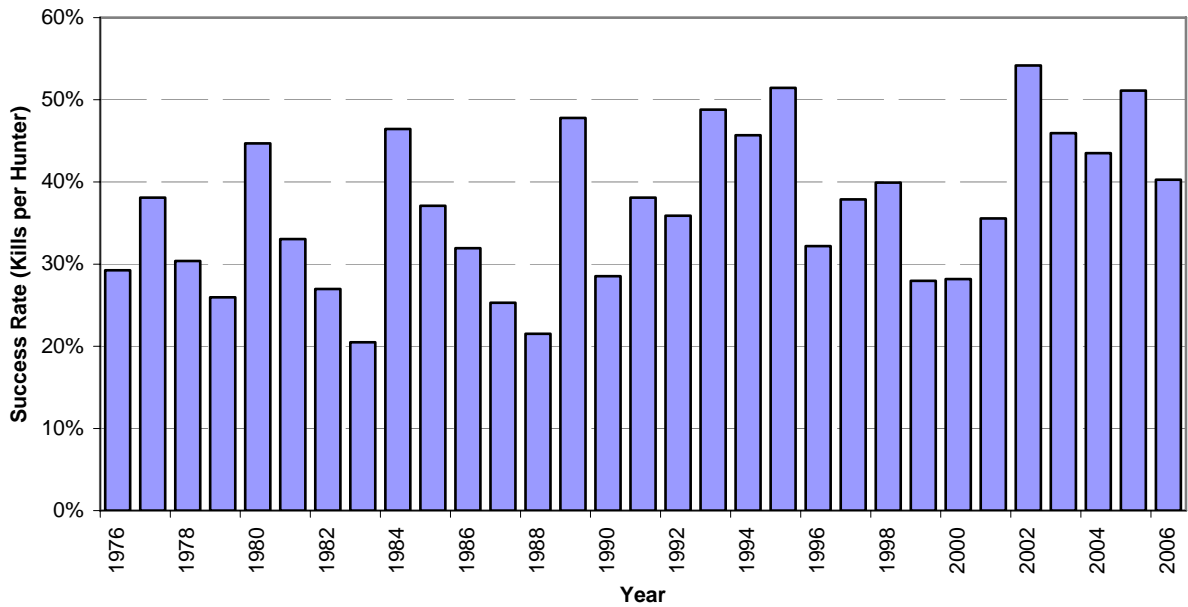
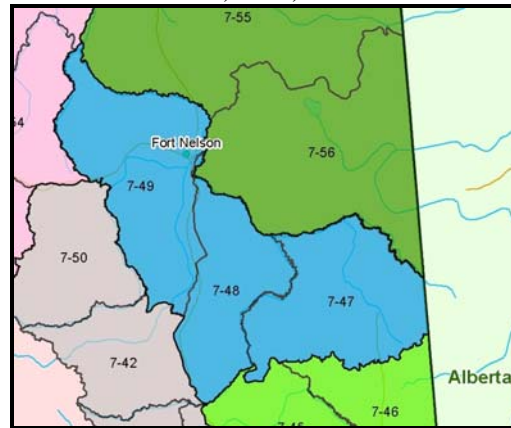


Figure 30. The average success rate (kills per hunters) for subzone G from 1976 to 2006.

3.8 Subzone H Summary

Subzone H – Prophet and Area (Blue)

7-47, 7-48, 7-49



During the early 1990's, bull and calf ratios observed within this subzone appeared to be meeting management goals. During a 1992 aerial moose habitat study near the Muskwa and Prophet Rivers, 913 moose were classified and ratios observed were 72.9 bulls/100 cows and 44.5 calves/100 cows. In 1993, transects were conducted southwest of Fort Nelson, BC and ratios observed were 52.3 bulls/100 cows and 23.3 calves/100 cows.

A stratified moose count was conducted in WMU 7-47 in 2005 and at that time a density of 0.044 moose/km² +/-24.6% was estimated. This is the lowest moose density estimated of all WMU surveyed within the Peace Region. Ratios observed were associated with wide error margins due to the small number of moose encountered, but may suggest that predation is a limiting factor for this population since a very low calf ratio was observed (9.4 calves/100 cows +/-75.1%) despite a significant bulls population (63.5 bulls/100 cows +/- 44.7%).

WMU 7-47 supported a harvest of 75 moose by resident hunters in 1991. Since that time harvest has declined and no moose were reported as harvested by residents in 2006 (despite an estimated 22 resident hunters and 137 hunter days). Harvest has also significantly declined in WMU 7-48 from 159 in 1993 to 20 in 2006. Harvest has been less variable but still generally declining in WMU 7-49 since the 1994 (180 resident kills) to 2006 (93 resident kills). Figure 28 reflects the decline in the number of hunters and harvesters in subzone H. This decline began prior to regulation changes in 1996. At the same time, hunter effort per kill (days per kill) was increasing from 1994 to 2002 (Figure 29). The number of kills per hunter is about 10% lower now than it was in the late 1980's and early 1990's. All of these factors may point to a declining population.

With low density and low calf numbers it is important to protect the bulls in this population from further exploitation. If additional transect counts supported ratios observed in 2005 it may be necessary to further reduce the bull harvest, especially in WMU's 7-47 and 7-48.

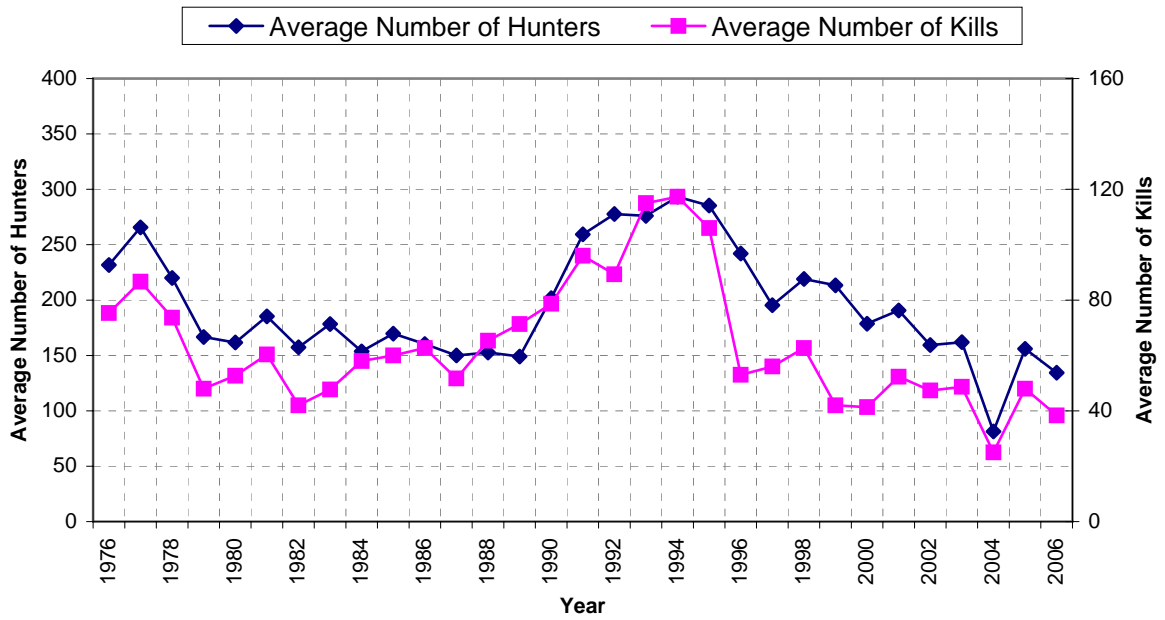


Figure 31. Average number of resident hunters and resident harvest for subzone H from 1976 to 2006.

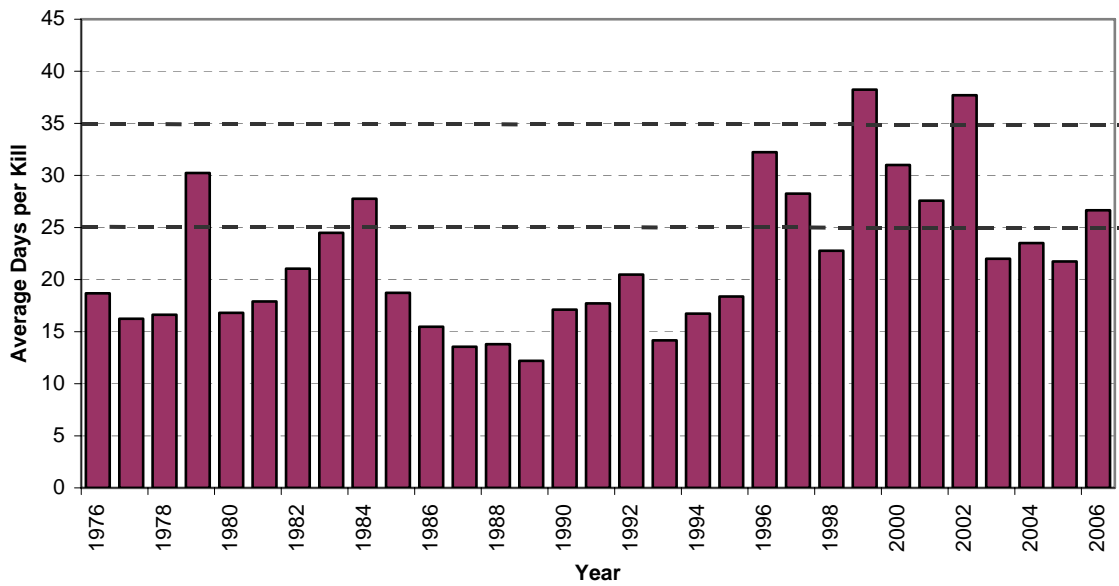


Figure 32. Average number of days per kill for subzone H from 1976 to 2006 with provincial management objectives shown.

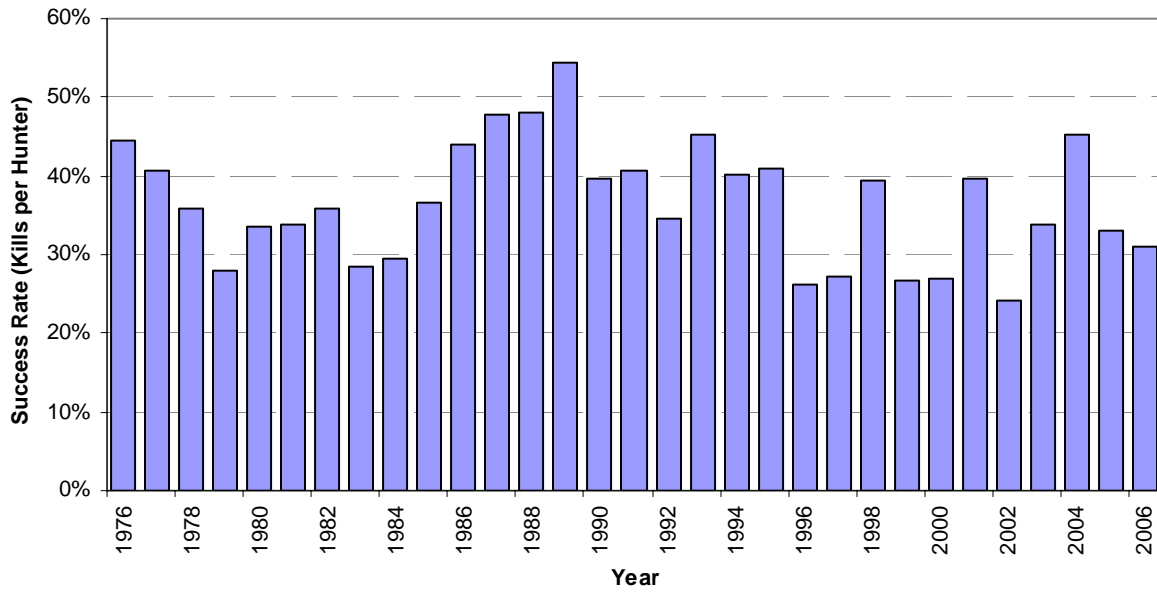


Figure 33. The average success rate (kills per hunters) for subzone H from 1976 to 2006.

4. Peace Region Hunter Harvest Statistics Summary

Over the past 10 years, the Peace Region has contributed about 22% to the total provincial moose harvest. Although still relatively high, this total harvest along with the number of moose hunters in the Peace Region has been generally declining since the early 1990's (Figure 34). From a high of over 3800 moose harvested in 1989, the harvest has declined by about 45% by the 2006 hunting season. A declining trend has been observed in all northern provincial regions for moose hunting with the exception of Region 7A, the Omineca Region (Figures 35 and 36).

Hunter effort climbed in most WMU's in the 1996 hunting season with introduction of SOFT-10 regulations, but since 2002 the number of days per kill has stabilized and returned to levels observed prior to the introduction of SOFT-10 (Figure 38). The regional hunting success (kills per hunter) did not change drastically with new regulations in 1996 and has been as high recently as has ever been observed within the Peace Region (Figure 39). A goal of 60,000 hunter days was set for the Peace in the 1990's (Hatter 1994) but the actual number of hunter days has been less than 40,000 per year over the past 3 years (Figure 40).

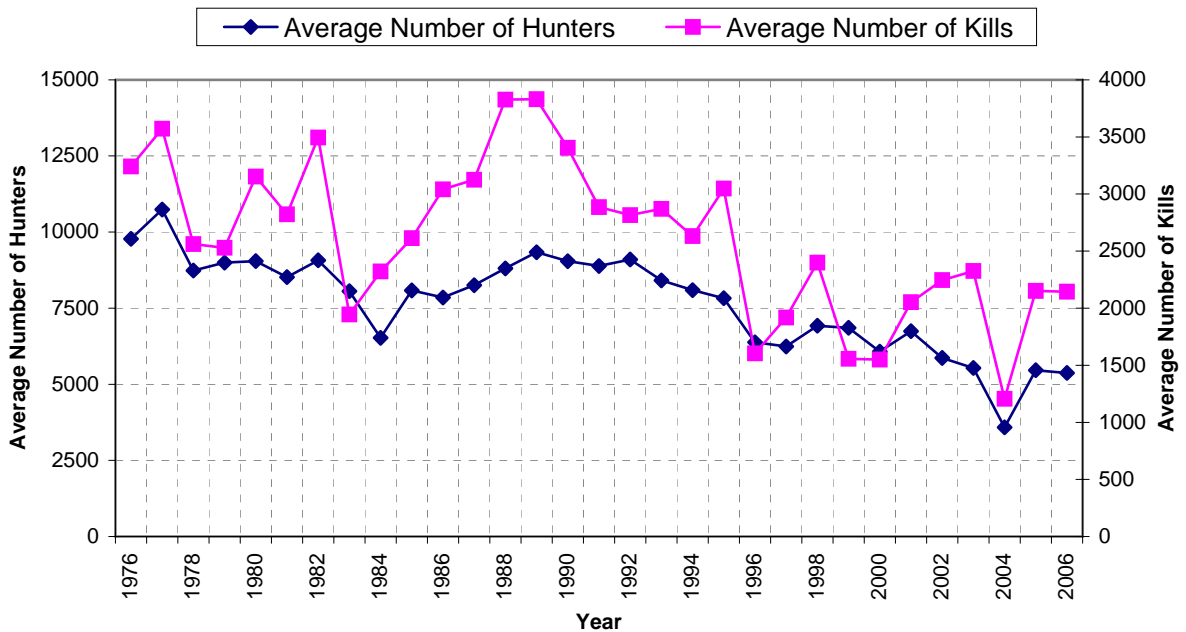


Figure 34, Average number of resident hunters and resident harvest of moose for the Peace Region from 1976 to 2006.

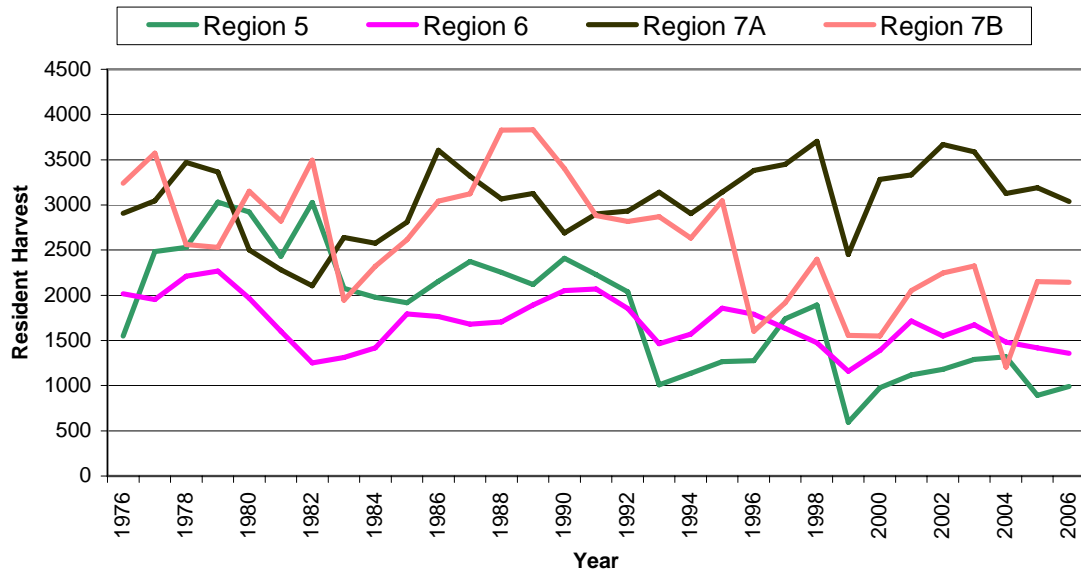


Figure 35. The total resident moose harvest for each of regions 5-Caribou, 6-Skeena, 7A-Omineca, and 7B-Peace from 1976 to 2006.

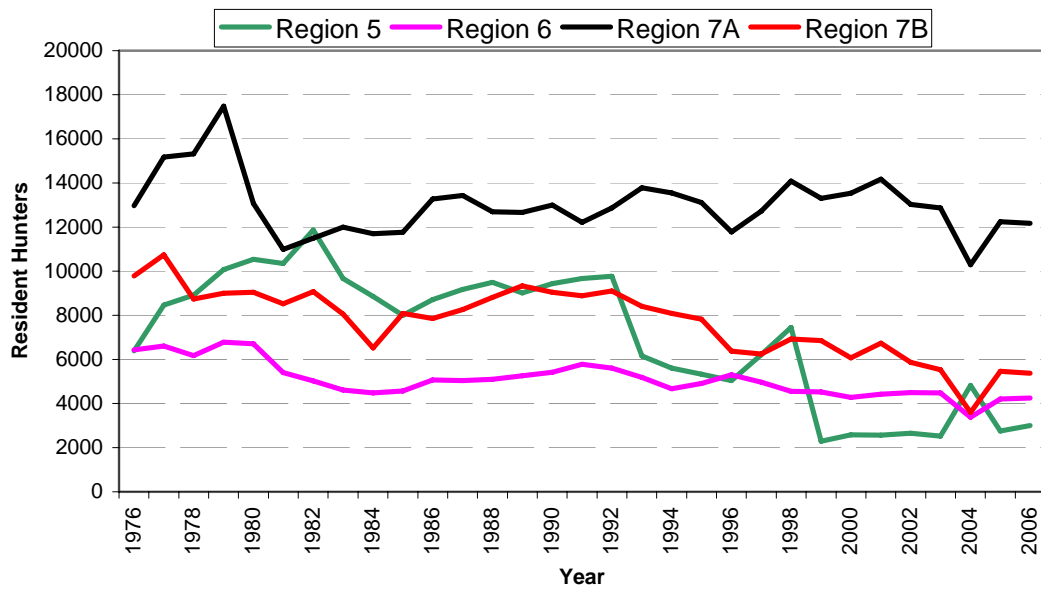


Figure 36. The total number of resident moose hunters for each of regions 5-Caribou, 6-Skeena, 7A-Omineca, and 7B-Peace from 1976 to 2006.

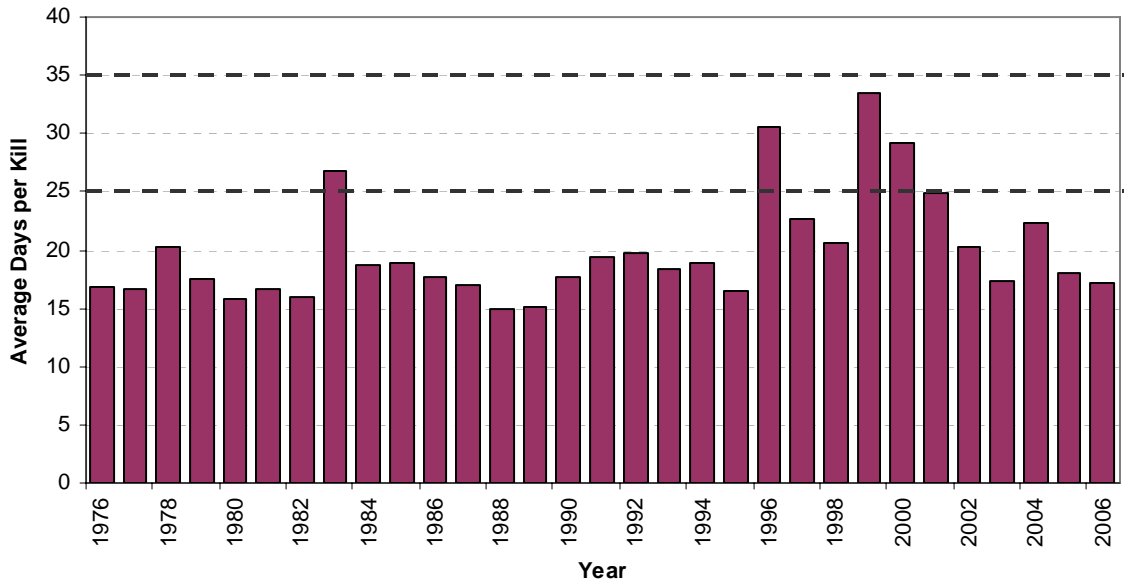


Figure 37. Average number of days per kill for the Peace Region from 1976 to 2006 with provincial management objectives shown.

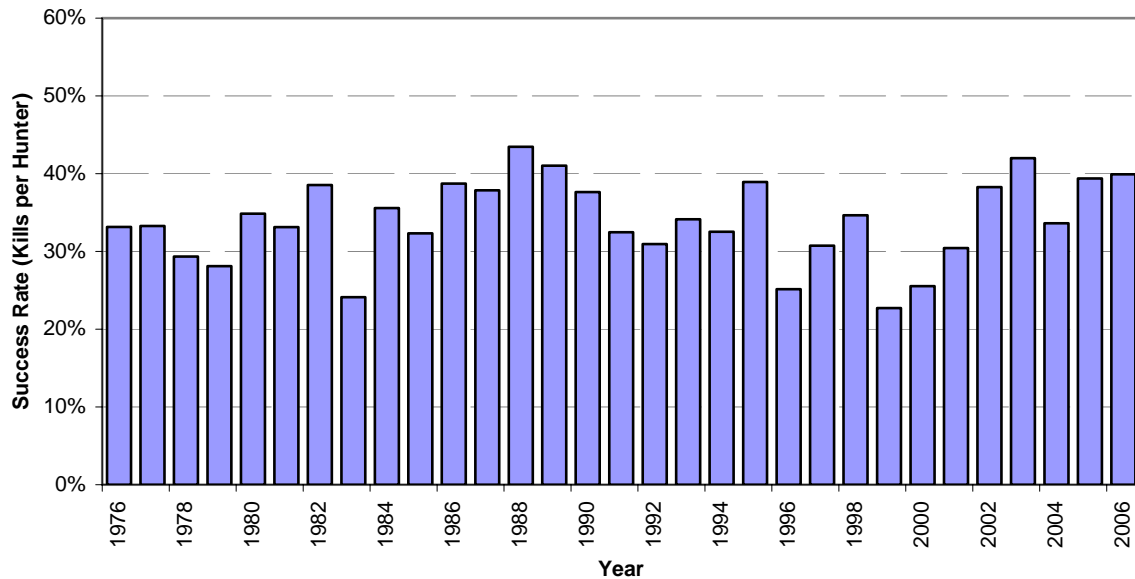


Figure 38. The average success rate (kills per hunters) for the Peace Region from 1976 to 2006.

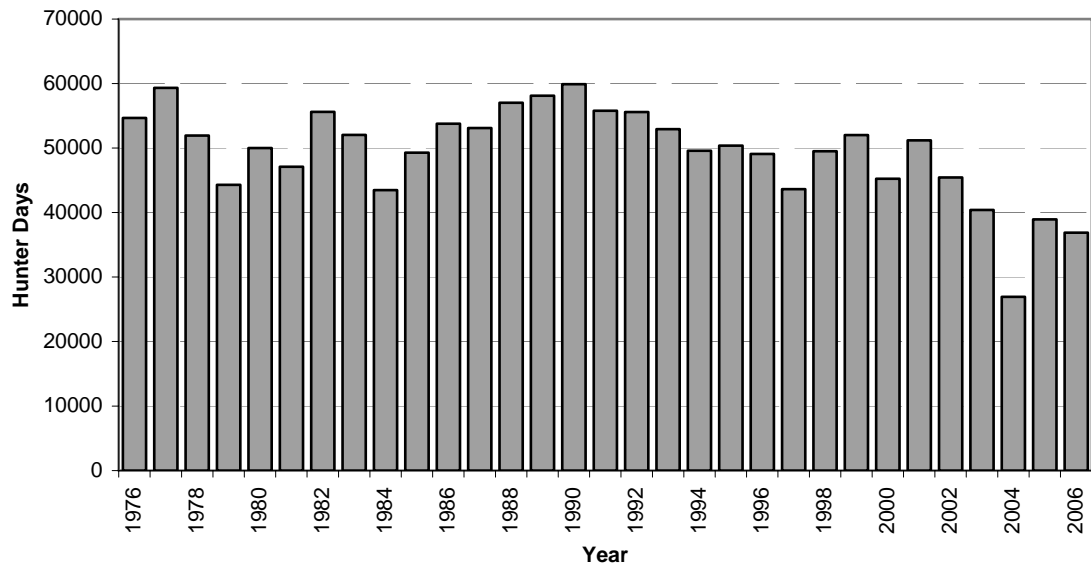


Figure 39. The total number of hunter days for the Peace Region from 1976 to 2006.

5. Moose Inventory and Research Priorities

5.1 Inventory Priorities

There are quite a few areas of the Peace Region that would benefit from additional inventory of moose populations. Since inventory funds are limited, priorities for research should must be set. A list of suggested priorities is found below.

Subzone A

Stratified counts are needed within this subzone in order to produce baseline density measures for moose. Mountain pine beetle infestations have started to emerge as a regional issue and management for forestry values, moose, and caribou must be coordinated to ensure conservation needs are met.

Subzone B

A fair amount of moose inventory has been conducted within this subzone since 1998. Repeating these survey efforts in 5 to 7 years time may help managers understand the response of moose to pine beetle infestation and forestry management.

Subzone C

With stratified counts of WMU's 7-46 and 7-45 in 2005 and 2007 respectively, the short-term inventory needs for this subzone are related to ensuring bull and calf ratios are adequate. Transects should be conducted within WMU 7-46 to determine if bull ratios are adequate for this low-density population.

Subzone D

In the next few years transect data could be used to ensure bull harvest is not limiting. These transects could also direct SRB counts if considered necessary. If counts are conducted for deer or elk within this subzone, moose can be counted along with the main target species.

Subzone E

Subzone E is in high need of additional moose inventory work since the largest scale moose declines where thought to have occurred here in the 1990's and not much inventory has been directed here since the institution of the *SOFT-10* regulation.

Subzone F

It may be possible to analyze some moose data that was collected from stone's sheep inventory to gain some insight onto moose populations in this subzone. Additional research will be needed here, ideally SRB counts, but if funds are lacking transect counts could also help verify bull and calf numbers.

Subzone G

Management goals were being met during the 2004 inventory. A similar inventory could be completed in 5 to 7 years (or conduct transects could be conducted periodically) to determine ratios of bulls and calves.

Subzone H

Transect work, especially in WMU 7-47, will help ensure that the bull ratio does not drop below 50 bulls/100 cows due to hunting pressure.

5.2 Research needs

At the time of this report (February 2008) the *SOFT-10* strategy had been in place in the Peace Region for 12 hunting seasons. Despite an apparent success in limiting the bull harvest and improving bull to cow numbers in many subzones, additional research may be needed to determine if the *SOFT-10* strategy has influenced the number of tripalm bulls expressed in the Peace Region. For some counts prior to the implementation of the *SOFT-10* strategy brow palm points were counted on bulls and this type of count could be repeated to provide information on current number of brow tines expressed.

Industrial development in many parts of the Peace Region is increasing steadily and will likely play an important role in landscape and habitat changes associated with the management of moose. Climate change and mountain pine beetle will likely also contribute to the factors influencing moose management. Appropriate management strategies should balance these potential landscape-changing factors with clearly defined management objectives for moose.

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