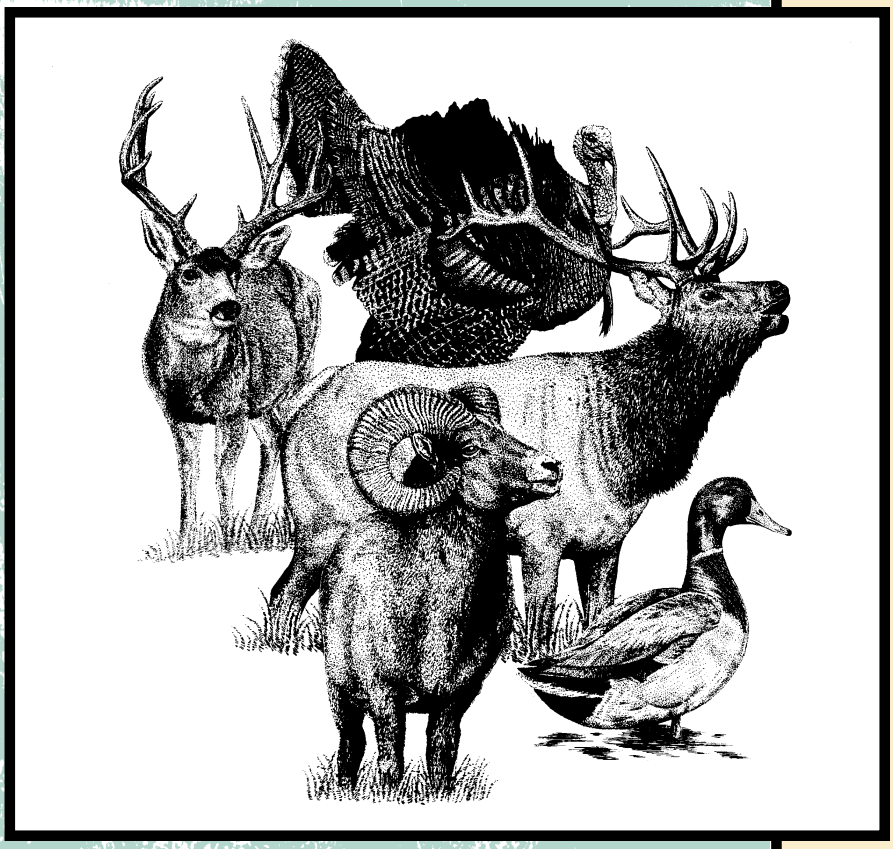
STATE OF WASHINGTON

1999 Game Status and Trend Report



Washington Department of
FISH AND WILDLIFE
Wildlife Management Program

STATE OF WASHINGTON

GARY LOCKE, GOVERNOR

DEPARTMENT OF FISH AND WILDLIFE

DR. JEFFREY P. KOENINGS, DIRECTOR

WILDLIFE MANAGEMENT PROGRAM

DAVE BRITTELL, ASSISTANT DIRECTOR

GAME MANAGEMENT DIVISION

DAVE WARE, GAME MANAGER

This Program Receives Federal Aid in Wildlife Resoration, Project W-97-R, Game Surveys.

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GAME STATUS AND TREND REPORT

July 1, 1998 - June 30, 1999

Dr. Jeffrey P. Koenings, Director

Washington Department of Fish and Wildlife
600 Capitol Way North
Olympia, WA 98501-1091

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Species

Deer **Statewide**

Prepared by: Rolf Johnson, Deer and Elk Section Manager

Population Objectives/guidelines

Our deer objectives are to maintain blacktail and whitetail deer populations and increase mule deer populations, with an objective to reduce landowner conflicts and maintain hunting opportunity. We have a buck escapement goal of at least 15 bucks per 100 does in post season surveys. In quality management areas, post season surveys should be at least 20 to 25 bucks per 100 does. Fawn production should be at least 45 fawns per 100 does.

Hunting Seasons And Harvest Trends

Hunting seasons adopted in 1997 by the Fish and Wildlife Commission have been carried forward through 1999. Eastern Washington mule deer seasons have been much more restrictive the last three years. These restrictive measures involved a three-point restriction for all mule deer in eastern Washington and a shortened deer hunting season. The general modern firearm deer seasons were reduced to nine days. Early archery seasons were reduced to the first 15 days of September. For whitetail deer the seasons remained similar, except for northeastern Washington where the whitetail season overlap with elk was deleted the last two years. Historically about 45 percent of the harvest was blacktail, 36 percent mule deer, and 20 percent whitetail. The mule deer and whitetail harvest ratios are now reversed. The 1998 harvest for whitetail was ten percent more than mule deer. Blacktail harvest was 47 percent of the statewide deer harvest. In western Washington, the general blacktail seasons have been similar with some late buck hunts north of Seattle and along the Columbia Gorge curtailed. Antlerless opportunity for muzzleloader hunters was deleted except in damage areas starting in 1997.

The 1997-98, and 1998-99 winters have been mild and deer survival has been good. Fawn/doe ratios were generally good throughout the state (Fig 1). Mule deer fawn ratios are usually reflective of winter severity. Note in figure 1 that fawn ratios are generally 40 to 80 in December surveys. In Region 2 a spring survey is conducted to determine fawn survival. Normally almost 50 percent of the fawns die during the first winter, but the last two years our spring fawn ratios in Region 2 have been excellent.

The deer season overlap with elk season in Selkirks was eliminated in 1998. A new opportunity for youth, senior, and disabled to take antlerless whitetail deer during general buck seasons was initiated in northeast Washington in 1997. Antlerless permits were reduced in anticipation of higher general season success for these hunters. Antlerless harvest by youth, senior, and disabled is now much higher than the permit hunters.

Mule deer buck success improved this year after very poor success last year as a result of three-point restriction and short

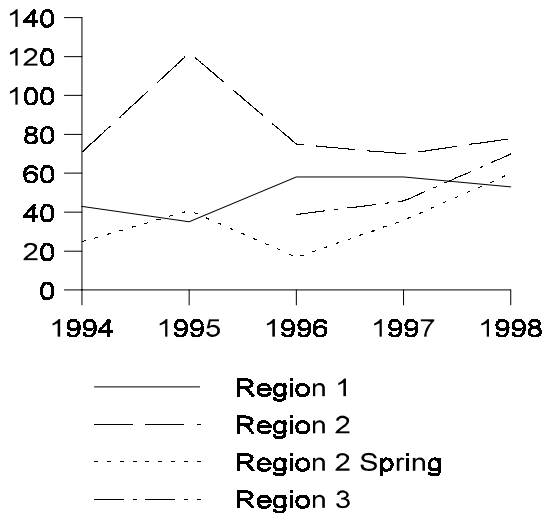

Figure 1. Mule deer fawn ratios.

seasons throughout eastern Washington. The Washington Department of Fish and Wildlife forecasted an improved deer hunting season on the eastside of the state, and hunter numbers increased over 10,000 from 1997.

We started a new reporting system to get better data on permit hunter success. The past two years, every permit hunter has been sent a hunting questionnaire and asked to report on their success. Response was quite good with about 80 percent of hunters reporting. This data is very important for accurate harvest data to model deer populations.

On the west side of the state, blacktail deer harvest has been declining for several years (Figure 2). The winter of 1996-97 resulted in high mortality for high elevation deer and urban sprawl/development are reducing hunter take in lowland areas. In addition, the hair loss syndrome may be having an impact in some areas of western Washington. This syndrome is characterized by heavy lice burdens and a muscleworm not normally present in blacktail deer. It appears that the muscleworm larvae migrate to the lungs and impair respiration. We speculate that the muscleworm larvae inhibit normal immunities and allow other parasites like lice to take over and weaken the animal. The syndrome has occurred the last four winters from December to March. Deer with this syndrome are identified by hairless patches of skin on their sides and flanks. Deer with extensive hair loss may die from hypothermia. Other deer, with less hair loss, recover and appear normal in the summer. We are conducting research, both penned studies at Washington State University and field studies on Indian Island,

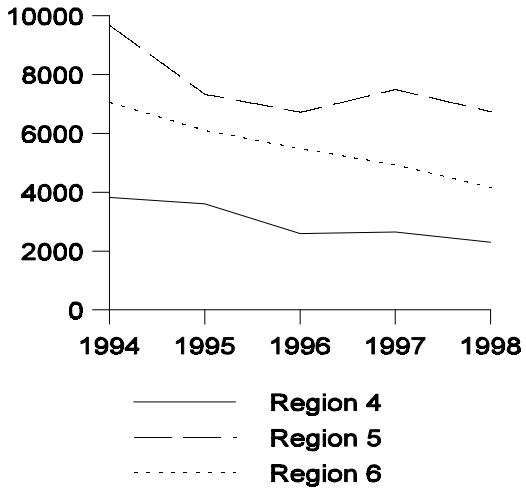

Figure 2. Black-tailed deer harvest.

Sub Base Bangor, and McNeil Island. We have not yet solved the hair loss syndrome problem.

Tribal Input

We are working cooperatively with the Colville Tribe on a mule deer study in north central Washington. The Yakima tribe has been working on mule deer management on the southern part of the Yakima Indian reservation and adjacent lands. In other areas, tribes are putting more emphasis on elk management.

Effectiveness of Regulations

The last two winters have been very mild and it is impossible to separate the impacts of regulation changes from winter severity. The three-point restriction and nine day modern firearm season for mule deer may have contributed to increasing buck escapement (Table 1). In central Washington, buck escapement (Figure 3) went from historic levels of two to four bucks per 100 does to about 24 bucks per 100 does in Region 2. This is the first time in 40 years that buck ratios have been above 15 in much of eastern Washington.

Blacktail deer harvest near the Canadian border west of the Cascade Crest took a significant decline in 1997 and did not recover in 1998. There is some speculation that cold air from the Frazier River Valley, in the 1996-97 winter, impacted blacktail survival in the northwest Cascades.

In southwest Washington, hunter numbers were up substantially but harvest was down again this year. Hunter pressure and harvest on the Olympic Peninsula declined in 1997 and again in 1998.

The 1998 statewide deer harvest of only 31,253 declined a little again this year (Table 2). Hunter numbers increased over ten percent statewide (Table 3). On the westside deer harvest declined again this year. Mule deer and whitetail harvest, however, increased by about nine percent over 1997.

Surveys

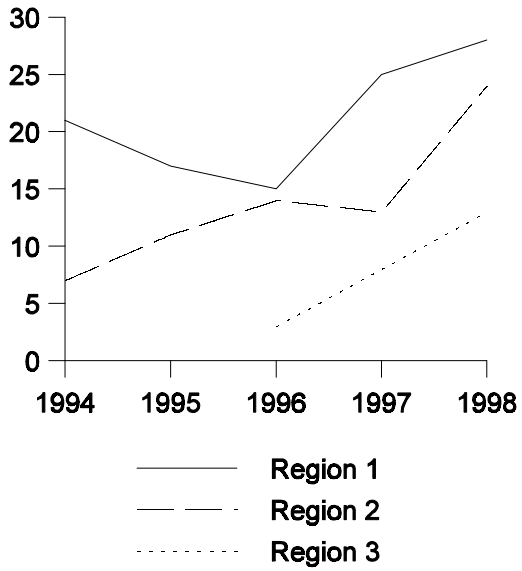

Figure 3. Mule deer buck ratios.

Pre and post season deer surveys are conducted to determine population status. Funding for surveys is limited, but we survey a few areas to determine trends and gather biological data on survival, productivity, and mortality.

Some pre-season and post season surveys are conducted from the ground and others from a helicopter. Preseason surveys are done in August and September and post season surveys are done in late November and December. In Region 2 winter survival surveys are conducted in March to determine fawn survival.

We also collect age and sex data of harvested deer. Yearling bucks and buck antler point data are monitored to track long term trends in harvest mortality rates.

In many areas of the state, surveys are conducted to gather necessary data for sex, age, kill, population, and reconstruction. The needed surveys include: (1) check stations to get age data on harvested deer; (2) annual summer productivity surveys (doe/fawn ratios); and (3) annual spring surveys for fawn survival estimates.

Spring surveys in Klickitat County indicate very good fawn survival this past year (65 fawns/100 does). Long term averages are about 41 fawns per 100 adults.

Population Status And Trend Analysis

Both mule deer and whitetail populations in southeast Washington are at high levels, except for the very southern and mountainous part of the Blue Mountains. Both mule deer and whitetail deer populations in the Spokane area have had a steady increase since 1992. Because of landowner requests and health of the deer herds in this area, antlerless hunting opportunities have increased in the Spokane area. Mule deer populations in the northeast part of the state are starting to recover from the 1996-97 winter. Fawn survival was variable this year despite

Table 1. Buck Escapement Ratios (bucks/100does, Pre-season, and Post-season 1997 and 1998).

				Mule or Black-tailed Deer					White-tailed Deer			
				1997		1998			1998	1999		
Region	GMUs	Name	Type Unit	Pre-Season	Post-Season	Pre-Season	Post-Season	Regulations	Post-Season	Pre-Season	Post-Season	Regulations
1	101-124	Northeast		-	11	25	61, 28	3 pt. min.	48	31	71	any whitetail
	127-142	Spokane		-	25	-	-	3 pt. min.	24	-	19	3 pt. min.
	145-181	Blue Mountains		-	25	58	28	3 pt. min.	22	-	27	3 pt. min.
2	209, 215, 233	Okanogan	General	-	9	-	11	3 pt. min.	-	-	-	
	218-231, 239	Methow	General	-	12	-	18	3 pt. min.	-	-	-	
	242	Alta	Quality	-	23	-	20	3 pt. min. permit only	-	-	-	
	243-251	Chelan PMU	General	-	16	-	19	3 pt. min.	-	-	-	
	248-262	Douglas	General	-	14	-	25	3 pt. min.	-	-	-	
	272	Grant PMU (outside PLWMA 201)	General	-	14	-	35	3 pt. min.	-	-	-	
	284	Kahlotus	General	-	no data		no data	3 pt. min.	-	-	-	
	290	Desert	Quality	-	no data	-	50	3 pt. min. permit only	-	-	-	
		PLWMA 201	Quality	-	35	111	37	3 pt. min. permit only	-	-	-	
3	329 & 330	Quilomene, West Bar	Quality	-	no data	-	no data	3 pt. min. permit only	-	-	-	
	342 & 371	Umtanum, Alkali	Quality	-	no data	-	no data	3 pt. min. permit only	-	-	-	
	335-346	PMU 33		-	8	-	11	3 pt. min.	-	-	-	
	352-368	PMU 35 & 36		-	no data	-	16	3 pt. min.	-	-	-	
4	460		General	-	7	-	-	any buck	-	-	-	
	485		Quality	-	37	-	-	any buck permit only	-	-	-	
5	All Region Five	Any Buck Units		49	25*	38	-	any buck	-	-	-	
		2 pt. Buck Units		53	27*	-	-	2 pt. min.	-	-	-	
6	667			24	10*	33	-	any buck	-	-	-	

last year's mild winter weather. Whitetail deer fawn survival in northeast Washington was excellent last year, but this year's fawn ratios are relatively low. It looks like whitetail in northwest Washington are once again building to population objectives. Preseason whitetail buck ratios are at 31 bucks/100 does in northeastern Washington.

Historical trends of whitetail harvest reflect winter die-offs, as well as, population control through antlerless hunting seasons. In 1991, we had a harvest of nearly 18,000 whitetails of which nearly half were antlerless. Since that time, harvest levels have declined to present levels of nearly 9,500 whitetails (Fig. 4).

Mule deer populations along the east slope of the Cascades were severely impacted by the 1996-97 winter, but the past two year's mild winters have dramatically improved survival. In the Columbia Basin, especially the area around Wilson Private Lands Management Area, mule deer populations are increasing once again.

Historical trends in mule deer harvest have declined quite markedly since 1992. The 1998 harvest improved because of population recovery (Fig. 5).

In lowland western Washington, blacktail deer populations appear to be impacted by the hair loss syndrome in many areas. The deer in mountainous areas of western Washington are affected by winter severity and tend to show the same trends as mule deer on the eastside of the state. In recent years the blacktail harvest has been declining (Fig. 6).

Disease

Epizootic Hemorrhagic Disease (EHD) is a periodic disease affecting whitetail deer in eastern Washington. We have an EHD outbreak every few years when habitat conditions are just right for no-see-ums (gnats) to spread the viral disease.

Table 2. Deer harvest 1974-1998

Year	Total	Modern	Archery	Muzzleloader
1974*	50,600	49,246	808	541
1975	58,700	57,396	778	526
1976	48,810	47,384	851	575
1977	62,570	60,930	978	662
1978	64,350	62,540	1,080	730
1979	66,000	64,136	1,112	752
1980	57,950	55,982	1,174	794
1981	49,935	47,782	1,284	869
1982	41,637	40,177	860	600
1983	40,043	38,635	950	458
1984**	40,206	37,936	1,790	480
1985	40,487	36,805	2,726	956
1986	35,928	32,246	2,715	967
1987	39,966	35,125	3,338	1,503
1988	45,706	40,500	3,867	1,339
1989	48,071	42,636	3,644	1,791
1990	45,155	39,484	3,606	2,065
1991	57,112	50,576	4,367	2,169
1992	55,297	47,701	4,856	2,740
1993	35,681	29,668	3,789	2,224
1994	47,002	39,093	4,948	2,961
1995	37,765	31,946	3,296	2,523
1996	39,442	33,634	3,472	2,336
1997	32,141	28,568	2,366	1,207
1998	30,253	26,399	2,675	1,179

*Archery and muzzleloader harvest data from 1974-1981 is based on estimated success rates and one combined archery/muzzleloader stamp. Exact numbers for archery and muzzleloader hunters is unknown, but in 1982 to 1984, nearly 85% of the archery/ muzzleloader stamp holders were archers. Therefore, we prorated the harvest by assuming 85% of the archery/muzzleloader stamp holders were archers and 15% muzzleloaders for the years 1974 to 1981. In 1982, 1983 and part of 1984, separate archery and muzzleloader stamps were sold. Success rates estimated as follows: Archery deer 6%; archery elk 3%; muzzleloader deer 23%; muzzleloader elk 11%.

**Resource Allocation initiated in 1984 and tag sales, success rate and harvest numbers obtained for all user groups.

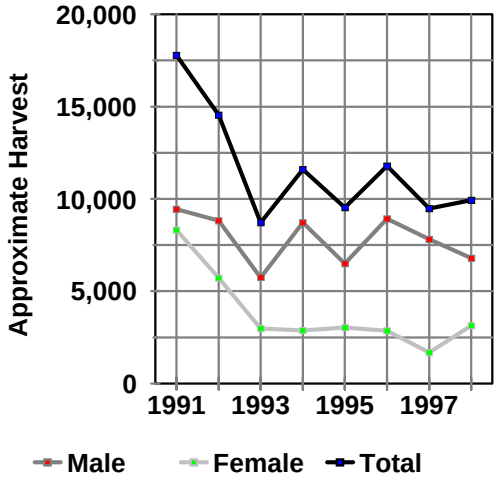

Figure 4. Recent whitetail deer harvest in Washington.

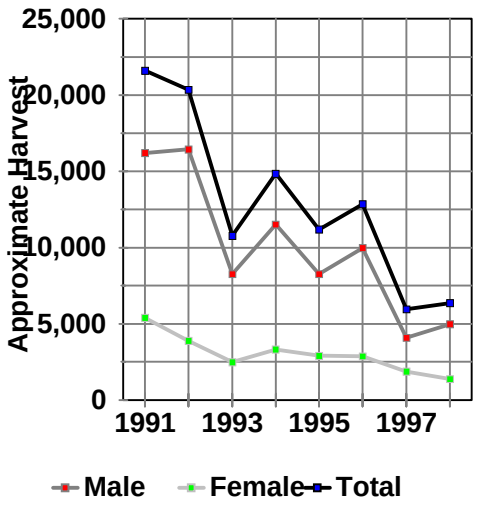

Figure 5. Recent mule deer harvest in Washington.

Generally outbreaks occur during late August or September, where deer are concentrated near alfalfa fields and where there is a pond or stream providing exposed mud for gnats. The disease occurs when deer are concentrated near water in late summer or early fall. The magnitude of mortality from EHD is quite variable and the areas affected are scattered.

We had a serious EHD outbreak in 1992 in northeastern Washington. Last year (1998) we had an outbreak of EHD in southeast Washington (GMUs 145 Mayview and 149 Prescott). The number of deer lost in this outbreak is estimated to be 500 to 1500. We also had an outbreak in 1998 and 1999 in GMUs 127-142. The area just south of Spokane is subject to EHD mortality nearly every year to some extent. In 1999 the EHD outbreak spread to a larger area of farmland in Spokane and Stevens counties. In some localized areas mortality rates were as high as 60 or 70 percent, but incidence of this mortality was isolated. There is no report of EHD on Forest Service lands. The extent of the EHD mortality is likely minor on a statewide or region wide basis, but in localized areas mortality may be substantial.

Habitat Condition And Trend

On the eastside of the state, deer populations have benefitted since the Conservation Reserve Program (CRP) was

Table 3. Deer Tag Sales, Archer/Muzzleloader Stamp and Weapon Selection Sales Under Resource Allocation

	Total	Stamp Sales			Deer Tag Sales		
Year	Deer Tag Sales	Archery/ Muzz. Stamp	Archery Stamp	Muzzleloader Stamp	Modern Firearm	Archery	Muzzleloader
1974	239,767	15,842					
1975	229,714	15,263					
1976	225,267	16,684					
1977	232,571	19,186					
1978	247,575	21,182					
1979	249,788	21,795					
1980	246,439	23,015					
1981	221,879	25,179					
1982*	207,981	9,723	14,318	2,636			
1983	206,248	discontinued	15,830	1,992			
1984**	179,991	N/A	18,376	3,846	167,096	10,683	1,470
1985	186,526	N/A	2,174	542	164,630	13,456	2,438
1986	180,819	N/A	13	2	162,549	14,987	3,148
1987	175,341	N/A	N/A	N/A	151,882	16,875	4,224
1988	183,671	N/A	N/A	N/A	158,975	18,555	4,407
1989	191,921	N/A	N/A	N/A	163,419	19,247	5,171
1990	193,342	N/A	N/A	N/A	166,337	19,983	6,175
1991	209,842	N/A	N/A	N/A	163,292	21,049	7,493
1992	199,330	N/A	N/A	N/A	179,576	23,136	8,399
1993	189,346	N/A	N/A	N/A	166,956	22,376	9,511
1994	190,346	N/A	N/A	N/A	158,527	21,456	10,222
1995	190,741	N/A	N/A	N/A	156,509	20,624	11,271
1996	183,699	N/A	N/A	N/A	149,766	20,211	11,142
1997	141,862	N/A	N/A	N/A	121,482	14,787	7,167
1998	153,927	N/A	N/A	N/A	129,987	17,136	6,804

*Archery and muzzleloader separate stamp initiated in 1982.
**Resource Allocation initiated in 1984.

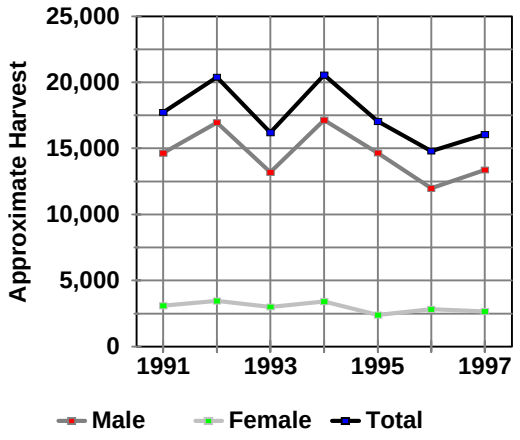

Figure 6. Recent blacktail deer harvest in Washington.

initiated. The program has provided thousands of acres of good deer habitat in traditional farmland. Weeds, namely Yellow Star Thistle is a major problem in some areas. The heavy weed growth in some areas may be limiting deer forage. Habitat conditions on some of the National Forests have declined due to excessive roads and fire suppression. Allowing natural fires to burn in wilderness areas and prescribed burns could improve deer habitat.

In many areas of eastern Washington, residential development has caused mule deer to retreat from traditional areas. Whitetails are expanding in these areas and filling a vacant niche. Several large wildfires in north central Washington during the last five years have reduced forage on winter ranges. Since mule deer depend primarily on shrubs for winter forage, range recovery will be slow. On the drier sites in eastern Washington, adequate moisture in recent years has enhanced some shrubs, especially bitterbrush growth.

On the westside, timber harvest is the key to blacktail habitat. Closure of roads to motorized vehicles has helped improve usable habitat for deer. The establishment of large blocks of Late Successional Reserve in national forests will eventually result in loss of quality habitat and deer populations. In the Gifford Pinchot National Forest, this loss is estimated at

41 percent for the Upper Lewis River Watershed. Overall, blacktail deer populations are stable at the present time.

Landowners in the Conservation Reserve Program are replanting some of their existing Conservation Reserve acreage with new wildlife seed mixtures. Other Conservation Reserve acreage may be burned to improve deer habitat. Wildfire burns, on the other hand, continue to pose a threat to critical winter ranges. In addition, residential and orchard development continue to eliminate winter ranges and migration corridors.

Wildlife Damage

The Washington Department of Fish and Wildlife is liable for damages caused by deer and elk to agricultural and horticultural crops. The Wildlife Enforcement Program handles the day to day animal damage issues. For perennial damage issues or for population control to reduce damage potential, special permit or general antlerless hunting seasons are adopted by the Fish and Wildlife Commission. Many of the antlerless permit seasons are partially or entirely related to damage control. In the Blue Mountains, the only deer damage area is in the Prescott Unit (GMU 149), where deer habitat is being replaced by vineyards and orchards. Damage complaints in the Spokane area have resulted in a number of special hunting seasons. In northeast Washington, where whitetails cause damage to alfalfa fields, we have antlerless permits and either sex whitetail seasons for youth, seniors, or persons of disability to reduce damage potential. In central Washington, deer damage to orchard crops is an ongoing issue, but alternatives to harvest are preferred. Many of the orchards are fenced to prevent damage. Other new orchards are vulnerable to damage and in severe winters, damage potential is high. Last winter was very mild and damage exposure was limited.

On the westside, damage complaints are mainly from deer eating vegetable garden crops or flower gardens. In some areas, like islands in Puget Sound, blacktail numbers are high, because of lack of public land for hunting. In these areas deer populations are uncontrolled and residents complain of deer damage to flowers and shrubs in their yard. Since WDFW is not liable for this damage, we try to resolve conflicts with helpful suggestions or general hunting seasons.

Management Conclusions

The statewide buck escapement goal of 15 bucks per 100 antlerless is now being met in most areas of eastern Washington. The Blue Mountains have had a three-point minimum restriction and short modern firearm season for several years. Starting in 1997, the three-point minimum restriction was extended to all of eastern Washington mule deer and some whitetail deer areas. In the Blue Mountains, we have been meeting the buck escapement goal of 15 bucks per 100 does for both mule deer and whitetail deer. In northeast Washington, antlerless mule deer seasons were discontinued in 1997 to help the population recover from the loss in the 1996-97 winter. Whitetail deer are responding much faster than mule deer to the last two year's mild winters and whitetail populations are rebuilding in northeast Washington.
In central Washington buck escapement is improving, and is above management objectives in most units. In 1997, a number of units were made permit only to help achieve buck escapement goals. These units (242 Alta, 290 Desert, 329 Quilomene, 330 West Bar, 342 Umtanum, and 371 Alkali) are open arid lands with minimal cover and can not reach buck escapement goals in general hunting seasons. The other units are near buck escapement goals.

Deer surveys are very limited in Washington and biologists are frequently asked to make management recommendations with limited data. We need to move forward with statewide application of sex, age, and kill modeling to manage deer in the 21st century. A number of surveys are needed to gather necessary data sets for modeling. One important question that remains to be determined is what percent of buck mortality is legal buck harvest? Our current estimate of 75 percent is being evaluated in western Washington with a couple of research projects. Other surveys, pre season, post season, and spring, as well as, improved harvest data need to be enhanced to determine population status and trends in all parts of the state.

Species	Region	PMUs	GMUs
Deer	**1**	**13**	**105-124**

Prepared by: **Steve Zender, District Wildlife Biologist**
Dana L. Base, Wildlife Biologist

Population Objectives/guidelines

Whitetail deer are the most abundant deer in northeast Washington. Mule deer are present, especially in the higher elevations and most significantly in Ferry County, but their numbers are low compared to whitetails .

The whitetail harvest management objective is to provide abundant hunting opportunity while not exceeding 75% buck mortality rates. Pre-season surveys should equal or exceed about 30 (27-33) bucks per 100 does. Antlerless harvest goals vary greatly with winter severity and deer population levels. Antlerless hunting opportunity is appropriate when fall fawn:doe ratios are >45:100 and post-winter fawn:adult ratios exceed 20:100. Antlerless hunting is an important recreational opportunity and a significant factor in maintaining herd health, and addressing problem wildlife issues.

The objective for mule deer is to provide conservative hunting opportunity, improve buck ratios and, increase productivity and population levels. We are just beginning a long-term mule deer study in Ferry County and adjacent areas so harvest management will likely remain conservative until research results are available.

Hunting Seasons And Harvest Trends

Mule deer bucks have been limited to a three point minimum for all weapons since 1997. There was no antlerless opportunity for modern firearm in GMU's 101-124, in 1998. The modern firearm season was consistent with the statewide nine day season. Harvest improved (Figure 1), greatly, for mule deer (75 report card returns for GMU 101 in 1998 vs. 27 in 1997 and 57 vs. 25 in the primary whitetail GMUs 105-124). While this is an encouraging trend, it likely has as much to do with the mild winter as the regulation changes. Buck whitetail have long seasons and harvest report card returns have increased from 139 to 225 in GMU 101, from 1997 to 1998.

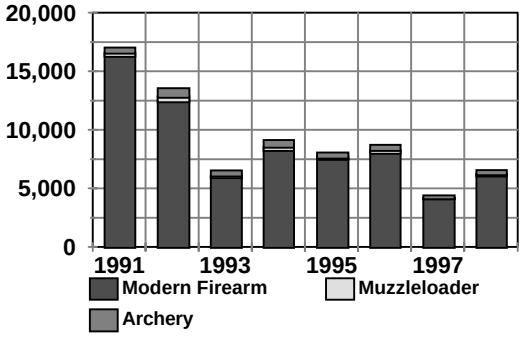

Figure 1. Total deer harvest trend, GMU's 101-124.

We have no antler restrictions on white-tailed deer bucks in units 101-124. The whitetail hunt closed on 10/30 to prevent an overlap with elk season, then the late buck hunt in GMUs 105-124 opened 10/9 and ran through 11/22 as usual.

We offered Youth, Senior, and Disabled (Y/S/D) whitetail of either sex in GMUs 101-124 during the early hunt. There were an additional 1,480 antlerless permits issued for the same period.

Hunter pressure for the general opener rebounded a bit from the low in 1997, at the Deer Park Check Station (Table 1). Hunter pressure was up 24 percent over the entire season for all weapons combined (Figure 2). Hunters responded to the increase in deer numbers following a year with good productivity and a mild winter. Success at the check station on the opening day improved in 1998. The over-all success of all hunters for all seasons in PMU 11 (GMU 101) improved from 10% to 14% from 1997 to 1998. In PMU 13 (GMU's 105-124) there was no change in success at 14%.

Table 1. Opening Sunday Deer Park check station, 1989-98.

			Percent		
Year	Hunters	Bucks	Success	Whitetails	Mule Deer
1989	705	64	10	46	18
1990	734	99	14	84	15
1991	744	76	10	62	13
1992	820	115	14	88	21
1993	750	42	6	21	21
1994	644	73	11	50	21
1995	625	37	6	29	8
1996	650	62	10	53	10
1997	503	42	9	40	2
1998	551	59	11	54	5

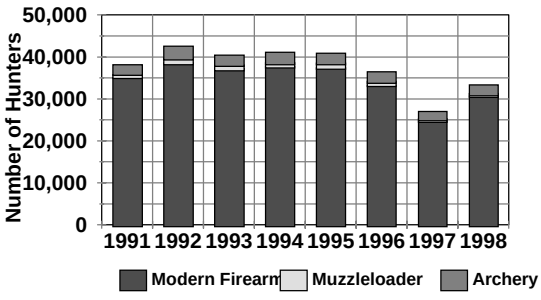

Figure 2. Trend in deer hunter pressure, GMU's 101-124.

I believe, we would have seen much better success in PMU 13, had we experienced better hunting conditions in the late part of the season. November was unusually mild with little or no snow to concentrate deer, or provide good tracking. A couple of the critical last days of the season were so wet and stormy many hunters gave up early.

Thanks to our Special Permit Hunting Questionnaire we have good data on the effort and success of our antlerless permit holders. There is always controversy regarding 'doe' hunts and many people prefer to see minimal permit levels. Unfortunately there is the perception that all permits issued result in a harvested doe. We are fortunate to have good data on success rates to develop permit levels, both from a biological standpoint and to educate the public on the actual harvest rate, per permit issued.

We issued 1,480 either-sex, white-tailed deer permits for GMUs 101-124 in 1998. Questionnaires were returned by 74% of these people. Of these, 14% did not make it out to hunt. Of those that hunted, only 46% were successful (compared to only 29% in 1997) taking 444 deer, but 67 (15%) of the deer they took with their permit were antlered bucks, so of the 1,480 permits issued we can confirm only 377 antlerless deer being harvested. Biologists have known success rates on permits were low, but I hope the results of WDFW efforts to get this information directly from the hunters will help inform people concerned with antlerless hunting of the true relationship between permit levels and actual harvests of does.

Colville Confederated Tribes (CCT) retain hunting rights in GMUs 101 and 105. While hunting regulations are set independently, regular dialog and information sharing occurs between WDFW and CCT biologists, regarding survey results, harvest results, and season recommendations. In unit 101 the CCT projected harvest of mule deer was 54 bucks and 107 does, while the state harvest of mule deer (three point minimum) was 134 bucks and 0 does (Colville Confederated Tribes, 1999). This yields a combined harvest ratio of 57 does per 100 bucks on mule deer. The CCT projected harvest of whitetails in GMU 101 was 149 bucks and 64 antlerless, while the state harvest estimate was 403 bucks and 216 antlerless, for a ratio of 51 does per 100 whitetail bucks. Tribal harvest in GMU 105 was only 10 bucks and 42 does, all whitetail. The state harvest was a total of 223 (only 12 mule deer) whitetail bucks and 85 whitetail does, the ratio was 57 whitetail does per 100 whitetail bucks (Table 2).

Table 2. White-tailed deer pre-season buck:doe and doe:fawn ratios for PMU's 11 & 13.

		August		September			
PMU	Year	Bucks	Does	Does	Fawns	B:D Ratio	D:F Ratio
11	1998	43	69	50	41	62	82
13	1998	304	936	721	547	32	76
11	1999	69	151	156	76	46	49
13	1999	181	580	509	247	31	49

Surveys

Whitetail buck:doe composition surveys are conducted in August. Deer are observed and classified from the vehicle the last 90 minutes or so before dark. The observer has free choice of any area within the district to search for deer, however, a wide distribution of areas surveyed is also an objective. Buck ratios are likely biased low as some bucks will not come out until after dark. The ratios are a good trend indicator though, and can be used as a minimum buck:doe ratio. The fawn:doe composition surveys are conducted in September. The technique remains the same as in August. The fawn:doe ratios are also likely biased low, and therefore, conservative as we see the ratio increase as September advances.

This year a greater effort was made to get a reasonable sample in both PMU 11 and 13 (Table 2). There is no late modern firearm season in Unit 101, so buck ratios would be expected to be different, and adding this sample to PMU 13 biases that buck ratio data upward.

Buck:doe ratios are similar to last year's in PMU 13, but the fawn ratios are certainly lower (49:100 vs 76:100). The large female fawn cohort from 1998 are now yearling does, but non-producers, which could be biasing the ratio downward. Fawn ratios were identical in PMU 11 and 13, and both dropped significantly from high ratios in 1997. The buck ratio in PMU 11 was lower this year, but sample size was pretty low in 1997 so it may not be significant.

We continue to develop reasonable means of surveying mule deer, but generally have found pre-season counts to be inefficient. We directed very little specific effort at mule deer pre-season, but did classify 88 total mule deer in August and September of 1999 for a B:D:F ratio of 25:100:47.

Whitetails are not generally surveyed post-season due to long hunting seasons and early antler drop. We would like to have much better mule deer post-season data, and hope to develop techniques and budgets to accomplish this with flights, but at present we are struggling to do a few ground surveys. These surveys were accomplished in GMU 101 in late fall 1998 and resulted in a buck:doe:fawn ratio of 21:100:60 (N=123).

Surveys on 'green-up' ranges, post-winter are considered valuable because they identify actual recruitment to the population since they are done in March or April after most losses would have occurred. At this point, we are not using a helicopter, which would be much more efficient. The ground surveys are time consuming but the data is very precise. Our sample in GMU 101 was 84 mule deer for a ratio of 61F:100, a considerable improvement over the 39:100 in March 1998. On Flagstaff Mountain in GMU 105 we classified 69 mule deer with a ratio of 28F:100, not much of an improvement over the 20:100 in 1998.

With the mild winter we did not specifically target spring counts on whitetails, but we did classify 113, with a ratio of 71F:100 (vs. 48:100 in 1998), confirming our expected high survival rates over winter. This also points out why we suspect the fawn ratio may appear low this summer; such a high incidence of yearlings to bias the apparent productivity of our

doe population.

We collect age, antler, and sex ratio data from harvested deer for monitoring deer populations and developing season recommendations. Yearling bucks and buck antler points are monitored to track long term trends in harvest mortality rates (Table 3). We are currently considering the early season percentage of yearlings as the estimate of the buck mortality rate. This would be the figure we would use (72% in 1998) for reference to our harvest mortality objective noted earlier (not to exceed 75%). We feel the early checks bias toward yearlings and may bias toward conservative population estimates.

Population Status And Trend Analysis

It is encouraging to see the mule deer fawn ratios improve on our limited post-season and post-winter survey routes in GMU 101. The post-winter survey in GMU 105 still produced low ratios, so the improvement in mule deer recruitment may be limited to primarily western Ferry County.

White-tailed deer populations are influenced significantly by winter severity in northeast Washington. Populations build rapidly during mild winters and experience major declines in severe winters. This past winter was equally as mild as the 1997/98 winter (Figure 3). Survival over winter was excellent, but late summer fawn ratios are relatively low for 1999. Whitetail buck ratios for 1999 appear similar to 1998 for PMU 13 at 31B:100D, but this is a pretty minimal buck ratio for our suggested management objective of 27-33. The whitetail buck harvest objectives are within management guidelines at 72% yearlings (objective is not to exceed 75%). This too, is relatively high considering the 1990-97 average is 63% yearling bucks. Based on report card returns, our percentage of five point or better bucks (13% in 1998) is lower than average

Table 3. Whitetail buck age trends from field checks and report card returns, GMU's 105-124.

	Early Checks		Late Checks		All Checks		Rprt Cards
Year	Sample	%Yrlg	Sample	%Yrlg	%Yrlg	%5pt+	%5pt+
1990	84	62	66	33	52	19	13
1991	62	61	106	29	41	24	15
1992	88	68	34	37	52	16	17
1993	21	52	44	27	31	28	16
1994	50	46	61	23	35	20	18
1995	29	83	0				16
1996	53	64	0				16
1997	40	65	63	30	39	22	12
1998	51	72	92	47	58	9	13

Recommendations for antlerless whitetail hunting opportunity are an important task each year (mule deer antlerless hunting is currently closed in northeast Washington). Arriving at a GMU antlerless harvest goal is as much art as science. Factors to consider are herd productivity, winter survival, and impact of various hunting regulations on the antlerless harvest. I use report card returns (Table 4) and the questionnaire harvest estimates (Table 5) to determine the results of the previous year's harvest. Then recommendations for adjustments in antlerless hunting opportunity are made depending on what direction the population trend appears to be going. In the spring of 1998 all data pointed toward an increasing population of whitetails, so increased antlerless hunting was recommended to keep pace with the predicted antlered harvest increase. The buck harvest increased in 1998 as expected, and the antlerless harvest strategies allowed the antlerless take to keep pace, increasing the ratio in PMU 13 from 27 does per 100 bucks ,in 1997, to 46 per 100 in 1998.

Table 4. Whitetail report card data for antlerless harvest recommendations, 1998.

PMU	Tot. Bucks	Total Does	% WT B	% WT D	WT Bucks	WT Does	WT Ratio
11	299	142	75	100	225	142	63D:100B
13	1842	823	97	99	1788	820	46D:100B

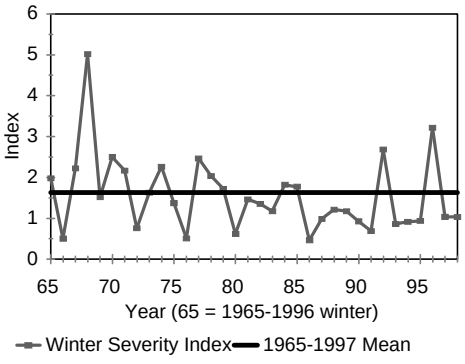

Figure 3. Chewelah winter severity index, based on mean temperature and total snowfall, 1965-1998.

Table 5. Questionnaire harvest estimates for antlered and antlerless white-tailed deer, PMU's 11 and 13, 1998. Y/S/D = Youth/Senior/Disabled Hunters.

PMU	GMU	Archery Antlerless	Permit Kill	Y/S/D Antlerless	Y/S/D per 100 Buck	Total Antlerless	Bucks	D:100B
11	101	31	15	201	45	247	448	55
13	105	3	32	53	24	88	225	39
	109	5	68	142	28	215	512	42
	113	3	5	60	24	68	254	27
	117	6	37	162	22	205	731	28
	121	33	99	387	31	519	1244	42
	124	25	121	179	15	325	1188	27
Total PMU 13		75	362	983	24	1420	4154	34

(15%).

We have adequate, although minimal, data now to use the Sex-Age-Kill (SAK) population model to estimate white-tailed deer populations in PMU 13. This model estimates (reconstructs) the fall population prior to the harvest. Since the buck harvest figures are part of the necessary data we can not estimate numbers for the coming fall population. The estimate for PMU 13 in 1998 is 8,000 bucks, 26,000 does, and 20,000 fawns, for a total of 54,000 white-tailed deer. The highest estimate in recent years was for 1991 at 87,000 and the lowest was in 1997 at 36,000. Like any model, there are a lot of assumptions that we know have biases so these figures are best viewed as representing a general idea of the population size and trend. Our population has certainly increased from 1997, but the poor hunter turnout and success in 1997 likely contributed to an underestimate of the population that year, so while the increase was significant it probably was not as dramatic as the model estimates.

Disease

There was another outbreak of Epizootic Hemorrhagic Disease (EHD) during September 1999, over a wide area of primarily low elevation farmland in north Spokane and Stevens counties. This viral disease occasionally causes localized white-tailed deer die-offs, usually in exceptionally warm, dry falls following mild winters. The last serious outbreak in this area was 1992. The virus is transmitted between deer by gnats. Generally spontaneous outbreaks occur where deer are highly concentrated (alfalfa fields) and often there is a pond or stream providing exposed mud (good habitat for gnats) and a source of water where deer frequent.

While EHD devastates the local population, possibly 50-60% of the adult deer, the die-off is restricted to very localized areas. Generally there are no losses beyond the daily movement ranges of the deer in the affected areas. Frost kills the gnats and after the 5-10 day incubation period, there are no more losses of deer.

In 1999, the deer began to die just before Labor Day weekend and continued through most of September. We do not have specific data on losses but it certainly is in the hundreds. Archers hunting in September noted a dozen or more dead deer on a hunt adjacent to alfalfa fields near Chewelah. Most calls from landowners reported several deer seen dead or sick, but there was a general estimate of many more, because they noted abandoned fawns (fewer fawns die than adults) and the general smell of dead animals throughout the area.

The important management implication is, that while it struck Chattaroy, Chewelah, Colville, Gifford, and Fruitland and devastated some local populations, it has not been detected in the hills or general forested areas where deer are less concentrated, nor did we see it in Ferry County or anything but extreme southern Pend Oreille County. There should be no long-term population implications.

Habitat Condition And Trend

The human population continues to build rapidly in northeast Washington with the associated losses of winter ranges and other critical habitat to development. White-tailed deer co-exist well with a considerable amount of the development, but the amount of land converted to buildings, roads, or impacted by dogs, snowmobiles, and ATVs takes it's toll. More significant to hunters is that much of the land becomes off limits to public hunting. Generally though, the whitetail population will do well, with the most notable population changes caused by winter weather rather than habitat.

Mule deer populations on the other hand seem to be suffering long-term declines that most likely can be attributed to changes and fragmentation of the habitat. Land managers, especially the USFS, have begun an aggressive program to restore the historic park-land forest environment that mule deer likely prefer, relative to decades of fire protection and cutting large diameter trees that leads to dense stands of fir and pine. Maintaining adequate winter and spring concentration acreage may be challenging though, as humans move farther up the slopes.

Wildlife Damage

Damage by whitetails to growing alfalfa is the primary problem of serious economic loss. Antlerless permits and either-sex hunting opportunity by youth, senior, or disabled are

part of the management strategy to stabilize populations, and control excessive deer damage. Officers issue a few Landowner Preference Permits on a case by case basis to avoid damage claims in areas with a history of deer damage. Landowners in these cases can allow a specified number of hunters to fill their deer tag outside a general deer season. Landowners in this program agree not to pursue any further deer damage claims with the department.

While a few landowners have serious chronic damage problems, the deer population has not built to the level that creates widespread intolerance, as it had in 1990 to 1992. Winter weather also affects the number and severity of problems. In severe winters, whitetails feed on haystacks in large numbers and become a serious problem, whereas they are more of a backyard viewing opportunity in mild winters like we've experienced in the last two years.

Management Conclusions

Our white-tailed deer buck management objectives are being met, but the buck:doe ratio and the mortality rate on bucks is near the limit for PMU 13. The lower than average percentage of five point or better bucks in the harvest for two years supports this observation. New season structures will be recommended for the next three year package this winter so we need to evaluate the impact on buck harvest for these proposals. At this point it would not be prudent to enhance whitetail buck harvest opportunity over a broad area of PMU 13.

We are currently looking at two methods of allocating the antlerless harvest quota. First of all, in 1998 we were well above the parameters for allowing antlerless harvest, so the decision was how many. If we have a population estimate, as we do in PMU 13 for white-tailed deer, then we can use the Mean Annual Increment (MAI) method. This is basically ½ the recruitment, giving us the number of females recruited, then times ½ (more or less depending on winter severity) to account for winter mortality. We had a mild 97/98 winter so using .25 mortality we had an estimated 3,932 females available for harvest in 1998. Another method, if the population is not known or we question the estimate and need a second opinion, is to allocate antlerless harvest based on the adult sex ratios. The PMU 13 B:D ratio was 25 in 1997. If our objective in 1998 was to stabilize population growth then we would attempt to harvest 30% + 5% (our fawn ratios were 15 above minimum guideline so a 5% increase for each 10 fawns above guideline) of the buck harvest. Our whitetail buck harvest in 1997 was 3,192 so *35% = 1,117 females available for harvest in 1998. Our actual antlerless harvest for PMU 13 was estimated at 882, so we appear to be under-harvesting our female segment if we expect to stabilize the population or if our goal is to provide as much hunting opportunity as biologically reasonable. Obviously with the considerable increase in fawn ratios in 1998 (76:100), the mild winter, and the increased buck kill 4,156, we are in line for considerable increase in antlerless harvest in 1999. We have increased permit levels and provided muzzleloaders either-sex opportunity but there is considerable opposition among the public regarding increasing doe hunting.

I think the important message here is that the antlerless portion of the harvest should be less an issue currently than the buck mortality rate. Unfortunately most hunters want longer buck seasons or more hunting in the rut, but strongly suggest we close doe hunting.

Shorter seasons or antler restrictions alone may have been an adequate adjustment to achieve mule deer buck escapement goals. Mule deer antlerless harvest may still not be advisable in Ferry County as the estimated number currently taken by Tribal members is likely sufficient. Our management objective for mule deer appears to be met, but the emphasis now needs to be on working closely with the research project and gaining better data on buck:doe:fawn ratios.

Our data needs for white-tailed deer are being met in most cases. We will continue operating check stations and do field checks to get the buck mortality estimates (% yearlings), but it would be helpful if we could initiate a tooth envelope mailing system with doe permits as we did in some past years to estimate the doe mortality rate.

We're happy with our pre-season composition surveys on whitetails. There may be some opportunity to gather post-season ratios using volunteers reporting, via internet, on the numbers and ratios of deer frequenting back yard feeders. A reasonable sample of post-winter whitetails will be gathered to monitor spring fawn:adult ratios. For mule deer we need to expand efforts or spend more money and use a helicopter to do post-season and green-up surveys.

Along with monitoring herd composition, especially fawn ratios, there needs to be greater emphasis on identifying and mapping mule deer critical habitats. We expect to gather much of this information as part of the mule deer research project.

The EHD event, this summer, will set local populations back considerably in many of the agricultural areas. However, these are the same localized areas that suffer high winter losses in severe winters, and where deer cause serious economic losses to farmers and less problems with deer will be welcomed. For the northeast Washington deer population as a whole the 1999/2000 winter will play a much more important role than the EHD outbreak. They say La Nina is coming again so deep snow and poor deer survival is a distinct possibility.

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Species	Region	PMUs	GMUs
Deer	**1**	**14-15**	**127-142**

Prepared by: G J Hickman , District Wildlife Biologist

Population Objectives/guidelines

Maintain both whitetail and mule deer populations for consumptive and non-consumptive recreational publics. Both species are responding very well to current management strategies. In 1997 and 1998, WDFW offered a short nine day modern firearm season with a three point minimum regulation for both deer species, plus a late whitetail buck hunt with a three point minimum. Archery mule deer seasons were three point minimum September 1-15 in GMU 127, and in GMUs 130-142 the season was three point minimum September 1-5, and three point minimum or antlerless from September 6-15. For whitetail, the season was extended to September 6-30, for three point minimum or antlerless. Late archery was limited to GMUs 127, 130, and 133, and hunters could take mule deer, whitetail three point buck or antlerless deer.

These PMUs provide quality recreation in a relatively open habitat. Further goals are to meet the state guidelines for buck escapement and to maintain healthy buck:doe:fawn ratios in areas which experience agricultural damage from deer.

Hunting Seasons And Harvest Trends

The last two winters have been mild in the Central District of Region One. The deer populations have been steadily increasing since the severe winter of 1992-93 (Table 1).

Table 1. Whitetail deer observed on elk surveys (GMUs 127 and 130).

Year	Number
1993	629
1994	133
1995	198
1996	290
1997	334
1998	399

Harvest of whitetail bucks increased in 1997 because of the late buck hunt in November. The harvest of antlerless animals is still below the high of 1995 (Table 2). It will be necessary to increase the harvest of the antlerless deer in the in the Central District or we face the prospect of a winter die-off in the near future. Current habitat conditions will support increased population growth until a severe winter or a significant drought. The possibility of an outbreak of EHD in whitetail is a real threat in those GMU's with a high whitetail component when drought conditions reduce standing water levels.

Hunting pressure and hunter effort increased in parts of the Central District because of the late whitetail buck hunt in 1997 and 1998, but this hunt had no adverse affect on the mule deer population (Tables 3, 4, 5,7).

Table 2. Antlerless harvest per 100 bucks.

Year	PMU	Harvest per 100 bucks
1995	15	86.3
1996	15	42.8
1997	15	20.1
1995	14	125.3
1996	14	47.4
1997	14	23.4
1998	14	25.5

Table 4. Deer harvest by species and sex, 1998.

	Mule deer		Whitetail	
GMU	Bucks	Antlerless	Bucks	Antlerless
127	3	0	125	38
130	55	47	77	21
133	149	106	92	56
136	113	53	25	6
139	67	9	150	63
142	105	46	85	32

Table 5. Percent hunter success by GMU.

GMU	1995	1996	1997	1998
127	12	15	23	17
130	15	21	21	13
133	26	27	21	17
136	23	20	20	14
139	21	20	29	18
142	33	22	39	22

Surveys

The deer populations in the Central District are surveyed by ground methods. The post-season ratios are more accurate in depicting the health of these herds (Table 6). However, whitetail bucks are often difficult to survey because of nocturnal behavior and the hunting pressure of the current late whitetail buck season. Post-season surveys for both deer species indicate a very healthy doe to fawn ratio (Table 6).

Population Status And Trend Analysis

The buck:doe ratios in all Central District units meet or exceed all state-wide goals for post-season buck escapement levels (Table 6). Doe:fawn ratios, overall, remain high in most units and indicate range and weather conditions are good to very good. These GMUs are largely private lands, and though

Table 3. Comparison of hunters and days of effort. (General season days/kill)*

	1995		1996		1997		1998	
Unit	Hunters	Days/kill	Hunters	Days/kill	Hunters	Days/kill	Hunters	Days/kill*
127	1483	34	1696	29	2202	22	1693	31
130	1691	23	1864	15	2531	20	2727	30
133	2491	23	3614	11	3593	21	3093	19
136	1392	13	1804	16	2376	15	2412	23
139	2377	15	3470	16	3645	15	2598	20
142	1702	9	2718	12	2537	9	1860	14

Table 6. Deer survey, Central District

		Pre-season			Post-season		
Species	Year	Buck	Doe	Fawn	Buck	Doe	Fawn
Mule	1996	32	80	56	90	398	330
Deer	1997	67	199	139	96	389	467
	1998	45	104	90	55	357	325
Whitetail	1996	9	119	88	24	117	127
Deer	1997	26	113	87	64	219	231
	1998	58	175	147	30	160	219

Table 7. Total buck harvest by PMU.

PMU 14	Mule deer	Whitetail	Total
1995	278	313	591
1996	501	597	1098
1998	394	568	962
PMU 15			
1995	391	340	731
1996	574	588	1162
1998	514	534	1048

WDFW has little control of management practices on private lands, the recent weather and general fertile nature of these soils have helped produce healthy populations of both deer species.

Table 1 shows the gradual recovery of whitetail deer in GMUs 127 and 130 from 1993 through 1997. The trend data was collected while conducting aerial elk surveys and shows a steady population growth since the severe winter of 1992-93. The increased population is the reason for continuing the antlerless only deer permits in both of these GMUs. Because of landowner requests and the health of this herd WDFW will continue to offer antlerless hunts by modern firearm permit, and general whitetail antlerless opportunity for archery, muzzleloader, youth, senior, and persons of disability seasons in these two units near the urban area of Spokane for whitetail deer.

Management Conclusions

Current season structures are addressing management goals. The antlerless harvest is down again this year and the whitetail buck harvest has risen as expected with the opportunity of the late whitetail buck season. Pre-season buck:doe ratios are low, but we do not conduct credible surveys.

It seems that with three point regulations, WDFW can not only continue to emphasize whitetail deer harvest in the Central District, but may be able to increase hunter effort and recreational opportunity for harvest of these bucks by using permit only opportunity during the late season. Those units near urban centers will need to be closely watched to avoid over harvest. Thus far, we have not experienced too many urban deer problems in Spokane, though high numbers of vehicle collisions with whitetail deer are perceived as a problem in parts of GMUs 124 and 127 by the public.

Currently, crop damage is reported annually in portions of GMUs 124 through 142. Intensive recreational harvest with a wide range of seasons and opportunities have helped mitigate some damage claims. When a damage problem arises, a concerted effort is made by WDFW personnel to coordinate the hunters with the landowner. This seems to be the most successful tool to help control damage and to provide recreational opportunity.

Elk are found in most of the deer habitats in the Central District. Deer management in the Central District is often closely tied to elk management. Some units of the Central District may be restricted during the late whitetail buck season to permit only for whitetail deer. This is because of the EHD outbreak in 1998 and 1999 in the Central District, and because there is the potential for over harvest of the older buck component over the next three years if conservative steps are not employed.

Species	Region	PMUs	GMUs
Deer	**1**	**16 & 17**	**145-186**

Prepared by: Pat Fowler, District Wildlife Biologist

Population Objectives/guidelines

Deer populations are near management objectives in southeast Washington following several years of mild winters and no drought, which greatly improved fawn production and survival. Whitetail deer populations have increased in most units raising concerns for mule deer. However, a severe outbreak of EHD in September, 1998 reduced whitetail populations significantly in GMUs 145, and 149, which were the units of concern for mule deer - whitetail deer competition. Mule deer populations in the mountains are depressed.

Hunting Seasons And Harvest Trends

The three-point regulation and nine day season was implemented in the Blue Mountains for mule deer in 1990, and expanded to include whitetail deer in 1991. This regulation was implemented in order to improve buck survival and increase the post-season buck to doe ratio, which was well below management objectives. Buck survival and post-season buck ratios for both mule deer and whitetail deer have improved significantly since 1990 (Figure 1, Table 1).

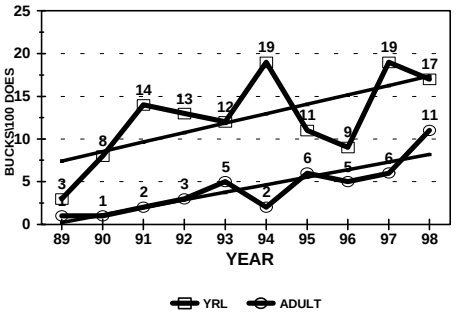

Figure 1. Mule Deer Post-season Buck Ratios, Blue Mtns.

The buck harvest declined significantly when the three point regulation was implemented, which was expected. The buck harvest increased from a low of 1317 in 1991, to a high of 2332 and 2418 bucks in 1996 and 1997, respectively. This compares favorably with an average District buck harvest of 2340 bucks between 1985-89, prior to the three point regulation. The 1998 buck harvest declined slightly to 2366, although buck deer report card returns increased 77%, from 507 in 1997 to 898 in 1998.

The composition of the buck harvest consisted of 61% mule deer (1443) and 39% whitetails (923). The average composition of the buck harvest is normally 60% mule deer and 40% whitetail deer. However, whitetail bucks are probably represented at a higher level in the harvest than they occur in the population, because approximately twice as many yearling whitetail bucks are legal under the three-point regulation as yearling mule deer bucks.

Hunters participating in the late whitetail permit controlled hunt harvested 57 bucks and 14 does for a success rate of 63% (Table 2). The quality of bucks harvested improved, with 46% having five or more antler points. Hunters averaged seeing 9.8 bucks/hunter.

The antlerless deer harvest fluctuates according to permit levels, and hunter success rates. The doe harvest has averaged 959 over the five year period from 1992 through 1996. In 1998, 1500 antlerless deer permits were issued resulting in a harvest of 591 does, a harvest rate of 25 does per 100 bucks. The success rate for general antlerless permits remained fairly high at 69%. The average success rate for hunters with whitetail antlerless permits was 49%.

Antlerless whitetail deer permits are used to control whitetail populations in mule deer areas and on agricultural land. However, hunter success on antlerless whitetail permits is usually significantly lower than for general antlerless permits. If whitetail populations continue to expand, higher levels of permits will be

Table 1. Post-season Mule Deer Surveys 1989-98, Blue Mtns., Washington

	Bucks						Per 100 Does
Year	Adult	Yearling	Total	Doe	Fawn	Total	F:100:B
1989	6	23	29	790	234	1053	30:100:4
1990	15	111	126	1358	544	2028	40:100:9
1991	17	133	150	943	455	1548	48:100:16
1992	40	153	193	1231	431	1868	35:100:17
1993	45	119	164	995	559	1718	56:100:17
1994	20	163	183	879	381	1443	43:100:21
1995	43	69	112	693	264	1069	38:100:16
1996	51	85	136	993	697	1826	70:100:14
1997	47	157	204	822	489	1515	60:100:25
1998	81	117	198	705	460	1363	65:100:28

Table 2. Late Whitetail Permit Hunt Summary, Blue Mtns., WA.

	Deer Harvest						
	No.				Htr.	Bucks	
Year	Permits	Bucks	Does	Total	Succ.	>5 point	Obs.\Htr.
1990	50	16	4	20	54%	50%	4.0
1991	120	48	22	70	68%	56%	4.7
1992	140	62	24	86	58%	42%	6.5
1993	140	66	22	88	69%	31%	6.2
1994	200	68	49	117	69%	26%	5.8
1995	200	74	18	92	56%	24%	6.5
1996	200	74	14	88	56%	38%	7.3
1997	220	79	17	96	66%	32%	10.9
1998	175	57	14	71	63%	46%	9.8

necessary.

Since fawn production and survival remained at a high level in 1998, antlerless permit levels were increased to 1675 in 1999.

Hunting pressure during the general rifle season has increased in the Blue Mountains since implementation of the three point regulation. Archery and muzzleloader hunter numbers have remained fairly stable. The increase in hunting pressure is a result of high success rates and the quality of the bucks harvested. Over 50 percent of the mule deer bucks and 70 percent of the whitetail bucks harvested during 1997 and 1998 carried four or more antler points per side (Table 3).

Mule deer populations along the Snake River breaks, west of Clarkston, and in the foothills of the Blue Mountains, west of the Tucannon River, are at good levels. Mule deer populations south of Clarkston in GMU 181 are improving. Mule deer populations in the mountains are severely depressed.

The whitetail deer population in units 145 (Mayview) and 149 (Prescott) suffered significant losses due to a severe outbreak of EHD in September 1998. Ground surveys in habitat units along the Snake River revealed as many as 20-30 dead whitetails in a single 40-60 acre plot. Whitetail deer losses were confirmed as far up-river as Lower Granite Dam on the Snake River,

Table 3. Deer Harvest Summary, Blue Mtns., WA.

	Deer Harvest				
				Mule Deer	Harvest
Year	Bucks	Antlerless	Total	≥ 4 point	Does:100:Bucks
1990	1209	771	1980	34%	64
1991	1317	1088	2405	38%	64
1992	1588	875	2463	47%	55
1993	2012	766	2778	50%	38
1994	2231	1252	3483	46%	56
1995	1451	930	2381	43%	64
1996	2332	816	3148	52%	35
1997	2418	768	3186	51%	32
1998	2366	591	2957	54%	25

Surveys

Deer surveys are conducted to determine pre and post-season herd composition.

Preseason deer surveys are conducted from the ground during August and September, and from the air with a Hiller 12-E helicopter when funds are available.

Post-season surveys are conducted during late November and December from the air with a Hiller 12-E helicopter, and from the ground in units not surveyed from the air.

Population Status And Trend Analysis

Highway 12 on the Tucannon River, Prescott on the Touchet River, and Bennington Lake on the Walla Walla River. The number of whitetail deer lost to EHD could range from a low of 500 to a high of 1500 deer.

Good forage conditions for the last two years, followed by mild winters resulted in minimal over-winter mortality and excellent fawn production and survival. In 1998, a total of 544 mule deer were classified from the ground during pre-season surveys (Tables 4 and 5). The pre-season fawn ratio increased slightly to 71 fawns\100 does, compared 63 fawns\100 does in 1997. The count on whitetail deer improved with 341 classified, resulting in a fawn ratio of 68 fawns\100 does.

Table 4. 1998 Post-season Mule Deer Surveys, Blue Mtns., WA.

	Bucks					Deer	Per 100 Does
GMU	Adult	Yearling	Total	Doe	Fawn	Total	F:100:B
145	10	12	22	77	38	137	49:100:29
149	13	20	33	118	77	228	65:100:28
154	4	5	9	35	21	65	60:100:26
162	0	3	3	19	17	40	--:100:--
163	0	12	12	65	46	123	71:100:19
172	4	5	9	43	28	80	65:100:21
178	19	39	49	147	96	292	65:100:33
181	24	29	53	181	130	364	72:100:29
186	6	1	7	20	7	34	--:100:--
Total	81	117	198	705	460	1363	65:100:28

Table 5. 1998 Pre-season Mule Deer Surveys, Blue Mtns. WA.

	Bucks						Per 100 Does
GMU	Adult	Yearling	Total	Doe	Fawn	Total	F:100:B
145	21	27	49	72	51	171	71:100:67
149	9	15	24	62	42	128	68:100:39
154	4	8	12	11	15	38	--:100:--
157	4	0	0	0	0	4	--:100:--
162	2	3	5	5	6	16	--:100:--
163	15	19	34	79	51	164	65:100:43
169	6	4	10	9	4	23	34:100:38
Total	61	76	134	238	169	544	71:100:58

Post-season deer surveys were conducted between late November and early January, using both helicopter and ground counts. A total of 1363 mule deer were classified. The mule deer fawn ratio remained comparable to 1997 at 65 fawns\100 does (Figure 2, Tables 1 and 6). The mild winter of 1998-99 resulted in excellent fawn survival.

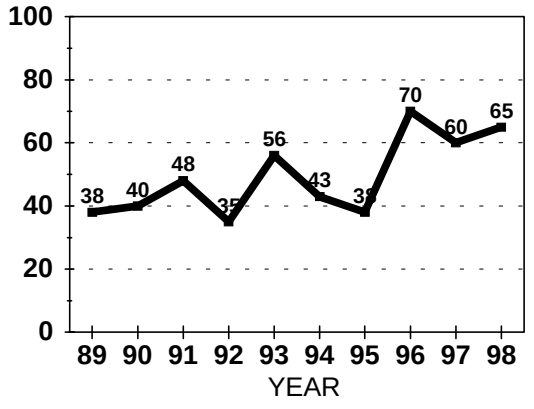

Figure 2. Mule Deer Winter Fawn Ratios (fawns:100 does) 1989-98, Blue Mtns.

The mule deer post-season buck ratio increased from 25 bucks\100 does in 1997 to 28 bucks\100 does in 1998 (Table 1). Yearling bucks comprised 59 percent of the bucks counted, compared to 76 percent in 1997. The increase in the post-season buck ratio is due to the large number of yearling (sub-legal) bucks in the population, and a significant increase in the number of adult bucks counted. The ratio of adult bucks in post-season surveys increased from 6 to 11 adult bucks\100 does (Fig. 1). However, adult bucks are probably still under represented in the post-season surveys because they have dispersed after the rut and are more difficult to locate. Adult bucks were already forming bachelor groups when helicopter surveys were conducted on December 8, indicating the rut was over.

It is difficult to obtain an adequate sample of whitetail deer in post-season surveys, lack of time and manpower. A total of 277 whitetail deer were classified producing a ratio of 27 bucks and 71 fawns per 100 does.

Habitat Condition And Trend

Deer populations in the Snake River breaks and foothills of the Blue Mountains have increased since the advent of the Conservation Reserve Program (CRP). This program provides thousands of acres of deer habitat in traditional agricultural crop lands. The four counties in southeast Washington have enrolled a large amount of acreage into the CRP program. As of October 1, 1999, Walla Walla County will have 124,234 acres enrolled (20% of cropland), Columbia County 31,800 acres (16% of

cropland), Garfield County 33,143 acres enrolled (30%+ of cropland), and Asotin County with 27,994 acres enrolled (16% of cropland). This represents an 84 percent increase in overall CRP acreage in southeast Washington, from 118,343 acres in 1998 to 217,171 acres in 1999. Some of this acreage is not yet planted, but should be completed by this time next year. These large areas of continuous habitat provide excellent forage and fawning areas, where none existed prior to the CRP program. As a result, deer populations in the farmland areas of southeast Washington should remain at good levels into the foreseeable future, if weather conditions are normal; mild winters and no drought.

Yellow-star thistle is a major problem in the foothills and along the breaks of the Snake River above Asotin. This may be one of the reasons mule deer populations in GMU 181 have not increased compared to other deer populations along the lower Snake River.

Habitat conditions on National Forest lands have declined due to roads, logging, and fire suppression. However, the Pomeroy Ranger District is in the process of re-evaluating the Travel-Access Management Plan, which will, hopefully, close more roads. A new Fire Management Plan is being implemented that will allow the use of naturally occurring and prescribed fires for improving habitat conditions, this policy will also apply to the Wenaha-Tucannon Wilderness Area.

Augmentation/habitat Enhancement

Landowners enrolled in the CRP program will be required to re-plant approximately 50 percent of their existing CRP with new wildlife mixtures, including sagebrush. The remaining 50 percent of current CRP planting will be burned to re-establish healthy stands of grasses and forbs. This will greatly enhance the value of the CRP habitat for deer and other wildlife.

Wildlife Damage

The only significant deer damage complaint in the Blue Mountains occurs in GMU 149 (Prescott), where deer habitat is being lost at an alarming rate to orchard and vineyard development. Vineyard development is increasing at an alarming rate.

Management Conclusions

Mule deer populations are healthy along the Snake River breaks down river from Clarkston, and in the foothill units west of the Tucannon River. The whitetail deer population along the lower Snake River and its tributaries suffered significant losses to EHD in September of 1998. Deer populations south of Asotin and in the mountains are depressed.

Table 3. Deer Harvest Summary, Blue Mtns., WA.

	Deer Harvest				
Year	Bucks	Antlerless	Total	Mule Deer ≥ 4 point	Harvest Does:100:Bucks
1990	1209	771	1980	34%	64
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1996	2332	816	3148	52%	35
1997	2418	768	3186	51%	32
1998	2366	591	2957	54%	25

Antlerless permits were increased in 1999, due to good fawn production\survival and increasing population levels.

The three-point regulation has accomplished the goal of producing post-season buck survival rates that meet the management objective of 15 bucks\100 does, for both whitetail and mule deer.

At the current level of hunter pressure, adult buck numbers have not declined, in fact, we have seen an increase in the number of adult bucks per 100 does post-season for both whitetail and mule deer. The quality of the bucks harvested under the three-point program has improved without a significant decline in the number of bucks harvested. In addition, public acceptance of the three point regulation is excellent due to the quality of the bucks harvested, and good hunter success rates. The three point buck regulation should be maintained in the Blue Mountains.

Aerial survey time for post-season surveys should be increased to obtain adequate samples from other GMUs in the Blue Mountains.

Species	Region	PMUs	GMUs
Deer	2	21, 22	203 -242

Prepared by: **Scott Fitkin, District Wildlife Biologist**

Population Objectives/guidelines

In general, the Okanogan District is managed for maximum productivity and sustainable harvest. The post-season sex ratio target is a minimum of 15 bucks per 100 does. Traditionally, GMUs 203 and 231 have carried a three point minimum restriction in an effort to provide greater buck escapement. GMU 242 (Alta) is managed as a quality hunt unit, with the objective of achieving escapement of 20 bucks per 100 does.

Hunting Seasons And Harvest Trends

The 1998 seasons retained the nine day general deer season and the three point minimum for mule deer implemented in 1997. No antlerless mule deer hunting occurred, for the purpose of maximizing reproduction, and helping the population rebound from recent winter mortality. The Alta unit remained permit only to insure desired buck escapement.

Hunter numbers in the Okanogan District rebounded from the 15-year low observed in 1997, but are still only half of what they were five years ago (Figure 1). A general increase in license sales and improving prospects in the district, fueled the rise in hunter numbers. Trends were similar for hunter days (Figure 2).

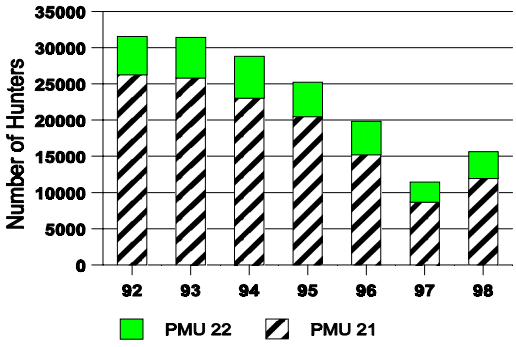

Figure 1. Number of hunters by PMU for the Okanogan District.

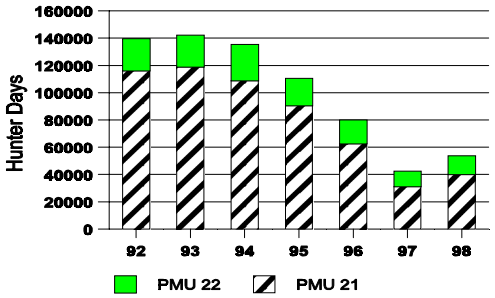

Figure 2. Hunter Days by PMU for the Okanogan District.

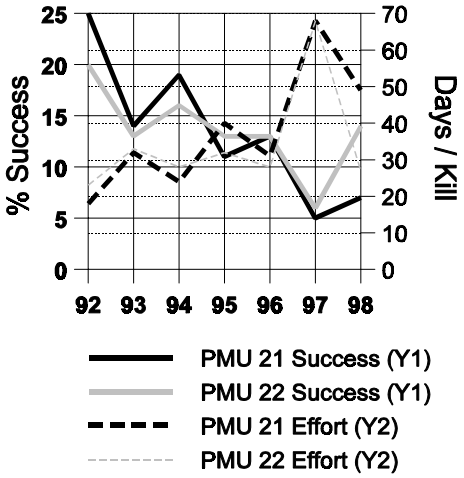

Figure 3. Success and effort by PMU for the Okanogan District .

Hunters enjoyed generally favorable weather conditions and good access, however, dry conditions made stalking difficult. The mild weather during the general season meant that deer were still well distributed at this time. Significant seasonal migration had not yet begun and hunters had to search widely to locate animals.

Even so, hunter success increased 60 percent and the number of hunter days per kill decreased 40 percent from 1997 levels in the Okanogan District (Figure 3). As a result, overall harvest nearly doubled from last year (Figure 4).

Similarly, the Chewuch check station saw significantly more activity. WDFW personnel checked 33 deer in two weekends as compared to five in 1997 (Table 1). Checked deer included three, three point yearlings, indicating that the three point harvest restriction is likely to select against animals with early antler point development, exactly the opposite of what is preferable. The check station recorded an increase in hunter numbers and hunter days of 34 percent and 41 percent respectively.

Despite increased harvest, post-season buck:doe ratios improved, exceeding escapement targets in PMU 21 in general, and the Alta Unit in particular (Table 2). The percentage of post-season bucks with $\geq$ 3 antler points remained low, at 36 percent. This is an expected result of the three point antler

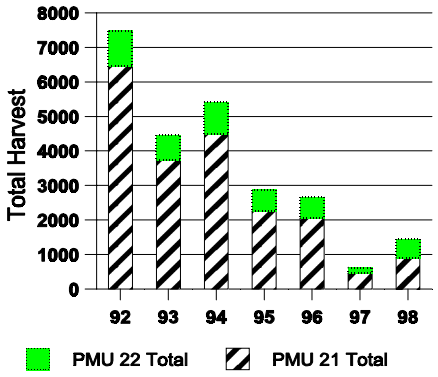

Figure 4. Harvest by PMU for the Okanogan District.

Table 1. Chewuch Check Station Results.

	Deer Age Class					
Year	Adult	Yearling	Total	% Year	Hunters	Success
1991	70	81	151	54	--	--
1992	92	105	197	54	2,256	0.09
1993	48	99	147	68	2,410	0.06
1994	--	--	160	--	1,994	0.08
1995	--	--	36	--	1,388	0.03
1996	24	51	75	68	1,247	0.06
1997	3	2	5	40	729	0.01
1998	30	3	33	9	980	0.03

restriction that concentrates harvest pressure on older age class bucks.

In GMU 242, the permit only unit, buck escapement met the management goal of 20 per 100 does, but recruitment of older bucks (31 percent of total bucks) trailed the PMU as a whole. This is not surprising, since many deer that are counted in this unit post-season have migrated from adjacent units, particularly unit 231, which has been under a three point antler restriction for many years.

Tribal Input

The Colville Confederated Tribes (CCT) deer season in PMU 22 began on July 1 and ended on November 30 for mule deer, and on December 31 for whitetail. Tribal members were not subject to the three point restriction on mule deer, and could harvest either sex during the later portion of their season. (Figure 5)

Tribal interest in deer hunting is expected to remain high as long as deer are readily available. As a result, Tribal officials share WDFW concerns about the status and trend of mule deer herds in eastern Washington, including PMU 22. As part of a recently signed agreement, WDFW and the CCT have pledged to work more closely on mule deer management and research in north central Washington. The Tribes hope to contribute up to $50,000 in support of the upcoming mule deer research project.

Following the initial Buchanon court decision, many west-side treaty tribes set seasons and began hunting deer in the Okanogan District in 1997. Harvest pressure was light and probably did not exceed 50 animals annually. A recent state supreme court ruling limited the tribes to traditional hunting areas. As a result, no hunting by west-side tribes is expected in the Okanogan District in 1999. The decision may be appealed to federal court.

Surveys

Post-season surveys are conducted to collect mule deer herd composition data and monitor progress toward population objectives. Surveys are conducted by helicopter in early December when hunting seasons have ended, most bucks have not dropped antlers, and deer are concentrated on winter ranges. Deer are counted, identified to species, and classified as ≥ 3-pt buck, < 3-pt buck, doe, or fawn.

Hiking surveys are conducted in early spring just as winter ranges begin to green-up, and before mule deer begin to migrate to summer range. As with the post-season surveys, this effort is restricted to mule deer in PMU 21, due to sample size shortcomings and limited resources.

Biologists classified a total of 2,712 mule deer during

Table 2. Post-season population composition counts from 1998, by area. F:100:B is fawns and bucks per 100 does.

		Buck Antler Class						
Area	Unit(s)	≥3 pt	< 3 pt	Subtotal	Does	Fawns	Total	F:100:B
Alta	242	18	40	58	295	251	604	85:100:20
Other Methow	218-231, 239	66	115	181	1007	891	2075	88:100:18
Methow Subtotal	218-231, 239, 242	84	155	239	1302	1142	2684	88:100:18
Okanogan	209, 215, 233	19	30	49	433	378	860	87:100:11
Total		103	185	288	1735	1520	3544	88:100:17

Table 3. Post-season mule deer population composition counts from PMU 21. F:100:B is fawns and bucks per 100 does.

	Buck Antler Class						
Year	≥3 pt	< 3 pt	Total	Does	Fawns	Total	F:100:B
1991	--	--	--	--	--	905	63:100:13
1992	--	--	72	1191	864	2127	73:100:6
1993	--	--	103	1209	984	2296	81:100:9
1994	--	--	67	1012	719	1798	71:100:7
1995	--	--	69	608	456	1133	75:100:11
1996	55	72	127	1956	1284	3367	66:100:6
1997	64	113	177	1464	1061	2712	72:100:12
1998	103	185	288	1735	1520	3544	87:100:17

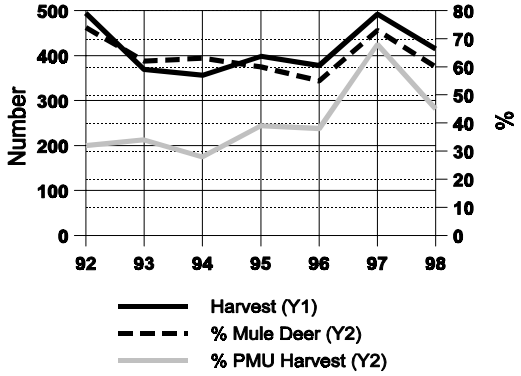

Figure 5. CCT harvest statistics.

helicopter surveys in PMU 21 in early and mid-December, 1998 (Table 3). The counts yielded overall buck:doe and fawn:doe ratios of 17:100 and 88:100 respectively, both improvements over last year. Buck escapement in the Alta unit was 20:100. These numbers indicate that escapement goals have likely been exceeded in all units, since bucks are likely under represented in survey data. By this time of year, many have begun to separate themselves from does, and tend to utilize areas of denser cover. In addition, the small antlers of some yearlings can be difficult to spot, and a few yearlings have lost their antlers altogether. We hope to minimize this bias in future surveys by flying in late November at the tail end of the breeding season, when bucks are more closely associated with does. The lower buck escapement in the Okanogan Watershed in 1998 may be largely a function of those units having been surveyed later than most of the Methow units.

In contrast to improved buck escapement, the percentage of bucks with $\geq$3 points declined to 31 percent in the Alta Unit and remained low (36 percent) in PMU 21 as a whole, as noted earlier. This trend is undesirable, since it may negatively effect breeding efficiency and timing, as well as, create more opportunity for hybridization between whitetail bucks and mule deer does.

The fawn:doe ratio is a very robust 88:100. This is a testament to the productivity of the Methow herd and more than twice the production needed to sustain herd expansion.

Table 4. Spring population composition counts from 1999, by area for PMU 21. F:100:B is fawns and bucks per 100 does.

Area	Unit(s)	Adults	Fawns	Total	F:100
Methow	218-231, 239,242	1150	708	1858	62:100
Okanogan	209, 215, 233	243	125	368	51:100
Total	215	1393	833	2226	60:100

During hiking surveys in late March and early April 1999, biologists classified 2,226 mule deer in PMU 21 (Table 4).

Table 5. Spring mule deer population composition counts from PMU 21. F:100 is fawns per 100 adults.

Year	Adults	Fawns	Total	F:100:A
1993	707	137	844	20:100
1994	507	257	764	51:100
1995	965	243	1208	25:100
1996	948	384	1332	41:100
1997	1167	198	1365	17:100
1998	1279	462	1741	36:100
1999	1393	833	2226	60:100

Data analysis produced an overall fawn:adult ratio of 60:100, indicating excellent over-winter survivorship, and recruitment. This is the highest ratio observed in several years (Table 5), and is particularly noteworthy, since increasing buck escapement will tend to reduce fawn:adult ratios relative to years past when escapement was half what it is now.

Population Status And Trend Analysis

Helicopter quadrant censuses conducted during a research project in PMU 21 in the mid 1980's produced a mule deer population estimate of approximately 25,000 animals. No recent population estimates have been calculated. Our intention is to generate estimates using population reconstruction models, and efforts are underway to obtain reliable pre-season fawn:doe ratios. Unfortunately, necessary check station data on buck mortality and age structure are unobtainable under the three point harvest restriction. Without this information, population models are ineffective. Current herd management bypasses population estimates, and is based on demographic parameters generated from spring and post-season surveys.

Throughout much of this century, the mule deer population in Okanogan County has fluctuated widely, largely in response to shifts in winter weather patterns. Even so, an overall gradual decline in mule deer numbers is evident. For roughly the last 15 years, harvest data indicated that even during periods of mild winter weather, the population is not rebounding to the historic highs of the 1950s and 60s.

Loss of winter range, due to increased human population and associated development is likely a major contributor to reduced herd size. This has been true district-wide, but is most pronounced in PMU 21. These development trends are continuing, and in fact are accelerating, especially the Methow Valley, where the largest concentration of wintering mule deer occurs. This is being mitigated somewhat by WDFW's aggressive land acquisition efforts in the Methow, that have targeted mule deer winter range and migration corridors.

Over-harvest may also have contributed to the population decline. Past harvest strategies have been based on the assumption that hunting mortality is compensatory. Current research suggests that hunting mortality may be more additive for mule deer. If so, then less harvestable surplus is available annually, and hunted populations will be slower to rebound from over-harvest or other excessive mortality. Research

beginning this year will address the effects of hunting mortality. In the interim, more conservative hunting regulations have been adopted, and guidelines for antlerless harvest have been developed using an additive mortality model. It is hoped the combination of habitat acquisition and conservative harvest will slow, and perhaps even halt, the decline over the long-term.

In recent years, qualitative observations from; land managers, biologists, and long time residents, as well as harvest figures, suggest that by 1997 the population may have fallen to half or less of what it was in the mid 1980s and early 1990s. Severe winter weather contributed most to this short-term decline.

Fortunately, the last two winters have been mild, and deer populations have rebounded nicely. Production is high, and has been aided by greater buck:doe ratios and the elimination of mule deer antlerless hunting. Barring a severe winter, continued maximum production is expected, since the population is still well below the ten-year average.

Unlike mule deer, whitetail deer have increased in the district over the long-term. Many of the same habitat alterations that have excluded mule deer, have promoted the expansion of whitetail. Whitetail now inhabit most of the major drainages and valley bottoms in the western half of the county, including many places where they were never seen historically. Relatively flat harvest figures suggest the whitetail population may be stabilizing. Whitetail have also sustained significant winter losses in recent years, but in general, have been more resilient than mule deer.

Unlike population size, herd composition is tied to harvest rather than habitat. Heavy hunting pressure on antlered mule deer caused the buck:doe ratio to hover at or below the historical minimum threshold of 10:100. Recent implementation of more restrictive seasons and a minimum management objective of 15 bucks per 100 does, have improved post-season sex ratios. This in turn should help insure higher pregnancy rates and more synchronous breeding, improving overall herd demographics.

Habitat Condition And Trend

Deer enjoyed good natural forage availability during last year's mild winter. Deer remained well distributed on traditional winter range, and were even able to utilize range farther north and west than in most winters.

Winter range continues to be lost on an annual basis throughout the Okanogan District. In PMU 21, conversion of land to agricultural and urban encroachment are responsible for most losses in the Okanogan Valley. Winter range and migration corridors in the Methow Valley are being lost to subdivision, and residential construction associated with a booming recreation industry. These development pressures are likely to continue and even accelerate, particularly in the Methow Valley.

WDFW continues to pursue the opportunity and resources to purchase land and/or easements in the most critical habitat at risk in the Methow. Over $16 million has been spent by WDFW to acquire 7,500 acres of important winter range and migration corridors since 1992, and more purchases are slated for 1998. The Methow Watershed Acquisition project scored well during the recent round IAC project funding evaluation, and has received nearly $6 million for additional land purchases and conservation easements during the 2000-01 biennium. It is hoped that this program will continue in the future; however, land prices and competition for acquisition funds are both increasing.

Seasonal ranges are poorly defined in PMU 22. Changes to the landscape are occurring much more slowly here than they are in the adjacent unit to the west. Even so, some habitat is being lost on an annual basis to human development. This is probably most evident for mule deer winter range being converted to agriculture and residences near the Okanogan River. Many deer utilize mid-elevation mature forest as winter range in the eastern portion of this unit. Much of the forest is under harvest management. Reductions in mature forest cover are likely reducing winter forage for deer. Research beginning this winter will help define seasonal ranges in PMU 22, and these results will help guide more focused deer habitat management.

Summer forage quantity and quality are important for fawn production and recruitment. In PMU 21, potential shortfalls during drought are mitigated by the availability of many acres of irrigated pasture, and by high elevation meadows that remain green even during dry years. Recent water use restrictions associated with salmonid recovery could potentially eliminate much irrigated acreage. This could significantly reduce available deer forage at lower elevations, and negatively affect deer production.

This impact could be exacerbated by the effects of grazing. Much of Okanogan County is intensively grazed. In some areas, livestock already compete with mule deer for grasses and forbs. In addition, livestock grazing accelerates the spread of noxious weeds that aggressively displace many deer food species. Throughout the district, noxious weed invasion continues to be a major concern. Both agencies and private land owners are developing more aggressive integrated weed management programs.

PMU 21 has an abundance of noxious weeds, particularly on dry land range at lower elevations, an area where forage is already limited during the critical winter-spring season. In most of PMU 22, weeds are not as significant a problem; however, most of the unit is intensively grazed, and the potential for noxious weed invasion is high. In general, the low to mid elevation range in this area is wetter during the growing season than in PMU 21. It is hoped that this will slow weed invasion to a manageable level.

Land managers are concerned that much of the bitterbrush on winter range in PMU 21 and portions of PMU 22 is very old and not very productive, due to long-term fire suppression. Some low intensity prescribed burns are being conducted in an attempt to revitalize some of these areas. Early results are encouraging; however, the long-term effectiveness of these measures will not be known for several years.

Large areas of the Sinlahekin Wildlife Area are losing productivity as winter range due to increasing tree cover, again due largely to fire suppression. Recently, the proceeds from a local estate were dedicated to the cause of enhancing mule deer habitat in Okanogan County. The first project being considered for funding is a prescribed burning program to stimulate regeneration of ceanothus and other browse species on the Sinlahekin winter range.

Road management is also receiving increased attention from public land managers. Many non-essential roads are being evaluated for seasonal or permanent closure, in an effort to provide greater wildlife security and reduce illegal harvest. This will benefit deer herds in both the short and long term.

Management Conclusions

Mule deer populations had bottomed out after a series of severe winters, but are now rebounding nicely, fueled by high productivity and recruitment, and aided by conservative hunting seasons. A gradual long-term population decline will likely continue, if reductions in habitat quantity and quality are not curbed. Buck:doe ratios have improved in response to stricter hunting regulations but the buck cohort is being shifted toward immature animals as a result of the three point restriction.

Whitetail deer numbers have also dipped during harsh winters in recent years, but will likely rebound faster than mule deer. The long-term prognosis for distribution and abundance are more favorable than for mule deer expansion. This is a function of the whitetail ability to better handle habitat changes associated with human development, and the difficulties in achieving adequate harvest on private lands where whitetail tend to concentrate.

The following recommendations are strategies for expanding the deer population and improving herd vitality while, maximizing recreational opportunities to the extent they are compatible with sound biological management.

1. *Recommendation*. Reduce the overall length of the combined deer hunting seasons with particular emphasis on an earlier ending date.

Rationale. Shortening overall season length, particularly at the end, will reduce energetic stress on deer herds, improving over-winter survivorship. An earlier ending date would minimize disturbance during the rut and improve breeding efficiency and timing. A post-Labor Day start date would reduce conflicts with non-consumptive users. This is especially true in the public lands adjacent to the Methow Valley, where hunting pressure is highest, and heavy recreational pressure continues well into autumn.

2. *Recommendation*. After the general season hunt antlered mule deer by permit only.

Rationale. This would allow for the fine tuning of the buck harvest to the available surplus, and would mitigate for unanticipated increases in harvest vulnerability due to early season snowfall.

3. *Recommendation*. Drop the three point antler restriction in all units during all seasons. Increases in adult buck numbers can be better achieved by retaining the short nine day season in mid October, and adopting the recommendations discussed above.

Rationale. A three point restriction is counterproductive for improving herd vitality. First, harvest pressure is being increased on older age class bucks, undesirably truncating age structure. This will ultimately mean fewer older bucks available for harvest, and degraded Watchable Wildlife opportunities. Second, more bucks are being killed and left in the field due to misidentification of two points as three points. Third, a selection pressure is exerted favoring individuals with lesser and/or slower antler development; these animals may represent the weaker portion of the gene pool. Finally, fewer older age class mule deer bucks increases the likelihood of Whitetail mule deer hybridization.

4. *Recommendation*. Harvest antlerless mule deer by permit only until populations have rebounded enough to support harvest during an open season. Even then, assume doe harvest is additive mortality.

Rationale. Maximum numbers of reproductive age females are needed to rebuild depressed herds. A permit only regulation allows for the tight control of the antlerless harvest. Conservative seasons are needed to insure against over-harvest until population regulation mechanisms are better understood.

5. *Recommendation*. Continue to vigorously pursue public acquisition of mule deer winter range in PMU 21.

Rationale. Mule deer carrying capacity in this unit is at least partially a function of available winter range and winter weather conditions. Winter range is rapidly being developed in the Methow and Okanogan Valleys.

6. *Recommendation*. Eliminate livestock grazing from dry land winter range on wildlife area lands unless a clear benefit for wildlife can be demonstrated, and no threat of noxious weed expansion is present. Encourage adjacent public land managers to reduce stocking rates and eliminate season-long grazing of dry land winter range.

Rationale. Noxious weed invasion is at epidemic levels throughout much of PMU 21, and the threat of continued expansion outweighs the potential benefits of improving deer forage shrub production by reducing grass cover, similar results might be achieved with low intensity burning. In addition, livestock compete for forage with deer on many low and mid elevation ranges. This competition will become more critical as less irrigated land is available during summer.

7. *Recommendation*. Retain water rights on WDFW land to provide green summer forage and combat noxious weeds to the extent that retaining such rights are compatible with salmonid recovery.

Rationale. Green summer forage is critical for mule deer production, and water restrictions, particularly in the Methow, are likely to significantly reduce the amount of irrigated pasture available to deer.

8. *Recommendation*. Lobby for the funds necessary to fence existing unprotected orchards and haystacks in deer winter range over the next five years. Phase out damage compensation over the same time period.

Rationale. Limited agency funds and staff time should be redirected towards more critical issues. Lack of a compensation program would discourage conversion of existing winter range to agricultural uses.

Species	Region	PMUs	GMUs
Deer	**2**	**23-Douglas, 24-Chelan**	**248, 254, 262, 266-269 243, 244, 245, 246, 247, 249, 250, 251**

Prepared by: John Musser, District Wildlife Biologist

Population Objectives/guidelines

Management objectives for PMU 23, Douglas, are to maintain the current deer population and post season buck ratio. Management objectives for PMU 24, Chelan, are to increase deer populations as habitat recovers from fire, and maintain the current post season buck ratio. Post season surveys and hunter harvest will be used to monitor population progress toward objectives.

Hunting Seasons And Harvest Trends

Current hunting seasons are very conservative compared to those prior to 1997, due to depressed deer populations in north central Washington. Deer season begins with early archery, which runs through the first two weeks of September. Early buck season runs from September 15-25 in GMUs 244 and 249. Early muzzleloader season is open in three units for seven days in early October. Modern firearm season is open for nine days in mid October. Our season framework is designed to allow limited permit hunting for modern firearm and muzzleloader hunters in late November. Last year's post season buck ratios were sufficient, to allow offering a few permits in most Chelan County units following general buck season in 1999. Late archery season was open in two units from November 25 through December 8.

Although there are a few whitetails in the district, the majority of our deer are mule deer. With few exceptions, all hunters, regardless of weapon, are restricted to three point or greater bucks, with little opportunity for antlerless harvest in Chelan County. We provided limited harvest of antlerless deer (by permit) in Douglas County in 1999.

Buck harvest for the Wenatchee District in 1997 was the lowest ever recorded (Figure 1). The reduction in harvest was caused by the following factors: severe winter of 1996, Tyee and Dinkelman fires (affected PMU 34), short modern firearm hunting season, and three point minimum regulation. Chelan County's buck harvest in 1998 improved slightly from 1997. Douglas County's 1998 buck harvest nearly doubled from the low point seen in 1997, and exceeded the previous five year average (figure 1).

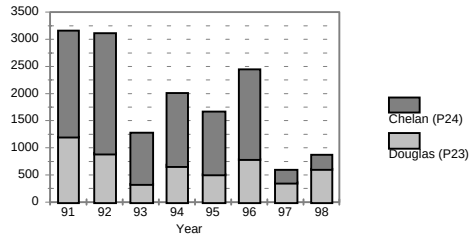

Figure 1. Wenatchee District buck harvest.

Washington deer hunter numbers increased in 1998 from the low point seen in 1997, marking the end of a steady downward six year trend. Within the Wenatchee District, deer hunters increased in Douglas County, but continued to decrease to record low levels in Chelan County. In 1998, only about one third as many deer hunters chose to hunt Chelan County compared to pre-Tyee fire years (Figure 2).

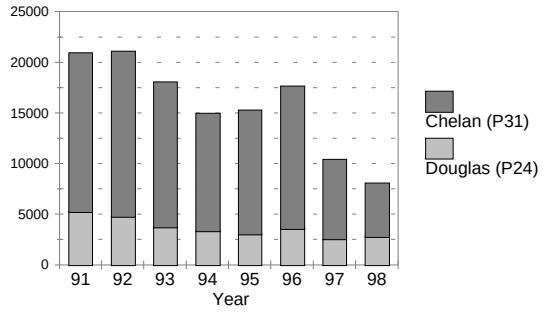

Figure 2. Wenatchee District deer hunter numbers.

Surveys

Both helicopter and ground surveys are used to monitor population composition. December surveys, which are done after deer have begun concentrating on winter range, but before antler drop are used to monitor post season buck and fawn ratios. Surveys done in February and March are most useful in assessing winter mortality and population level.

December 1998 ratios were 19 bucks and 74 fawns per 100 does in the Chelan PMU (n=1527). In Douglas PMU, December ratios were 25 bucks and 79 fawns per 100 does (n=564). Adult bucks (three years and older) made up 16 percent of Douglas County bucks and 27 percent of Chelan County bucks. Mild winter weather and low deer density resulted in excellent winter survival again this year. Limited spring surveys in March of 1999 showed 67 fawns per 100 adults. Average spring ratio in nearby Okanogan County was 45 fawns per 100 adults.

Population Status And Trend Analysis

Deer population status is quite different between the two PMUs that make up the Wenatchee District. The Chelan PMU was severely impacted by the Tyee fire, which occurred in 1994. Recovery from this fire, which removed much of the winter browse within the PMU, has been slow. In addition, the winter of 1996-97 was severe. As a result of lost habitat and winter

weather, the deer population within the Chelan PMU is at a low level. Mild winter conditions will allow this population to rebuild, but until shrub communities re-establish on winter range, this population will not reach pre-fire levels.

The Douglas PMU was also hurt by the severe winter of 1996-97, however winter conditions for these deer have been mild in both 1998 and 1999. In addition, there have been significant habitat enhancements associated with the Conservation Reserve Program that have been particularly beneficial for deer. This population has fully recovered from the 1996-97 winter.

Habitat Condition And Trend

Wildfire is a continued threat to winter habitat, which determines population level within the Wenatchee District. The Douglas County population is more dependent upon agricultural crops (especially alfalfa and wheat) during winter than the Chelan County population. As a result, fire impacts have been greater for the Chelan population and will continue to be greater in the future.

The human population is increasing by nearly two percent per year within the Wenatchee District. Residential and orchard development associated with this population growth continue to displace winter range throughout the district.

Management Conclusions

With the exception of the three point regulation, current hunting regulations are well suited to local conditions and populations. The experience of most other states with the three point regulation, is that it focuses mortality on the mature bucks that managers want to increase. We should consider dropping the regulation in areas where we can maintain minimum buck objectives without the restriction.

Research focused on both mortality of mule deer and winter ecology in areas recently burned would be helpful in managing deer in the Wenatchee District. We need to increase monitoring efforts to successfully manage these deer.

Species	Region	PMU	GMUs
Deer	**2**	**25**	**272, 278, 281, 284, 290**

Prepared by: Jim Tabor, District Wildlife Biologist

Population Objectives/Guidelines

In GMUs 272 and 284 deer herds are managed to maintain herd size at a maximum level that can be tolerated in relation to deer damage claims/complaints and to maintain a post-season buck:doe ratio of at least 15:100. Part of GMU 272 contains PLWMA 201 which has special population objectives formulated by PLWMA management in conjunction with WDFW.

In GMU 278 we strive to maintain a herd size well below carrying capacity to minimize deer damage claims/complaints from irrigated agricultural lands that make up a large percentage of this unit. Most deer in this unit occur in non-agricultural areas with a high percentage of public ownership. Herd management is intended to contain most deer use to these public lands.

In GMU 290 the management objective is to increase herd size to the long-term carrying capacity of habitat available on the Desert and Potholes Wildlife Areas without increasing damage claims/complaints from agricultural land adjacent to the wildlife areas. Additional objectives for this area are to maintain a high buck:doe ratio of at least 30:100 post-season and maintain a high percentage of adult bucks (approximately 50 %). This GMU was established for the primary purpose of providing a "quality" mule deer buck hunting opportunity through limited entry or permit only deer hunting.

Hunting Seasons And Harvest Trends

GMUs 272, 284, and 290 had a 15-day early archery season in 1998 (Sept. 1-5, three point buck minimum and Sept. 6-15, three point buck or antlerless). In addition, GMU 272 had an either sex late archery season (Nov. 25-Dec. 8). GMU 290 had a permit archery season with 13 permits (Sept. 1-15)

All units except 290 had a nine day general modern firearm buck season in 1998 (Oct. 17-25). In GMU 290, 11 permits were issued for a 16-day buck only hunt (Nov. 7-22).

In 1998, a legal buck had to have a minimum of three antler points on one side.

The only muzzleloader seasons in the Columbia Basin units reported here was in Muzzleloader Area 925 (contained in GMU 284, antlerless only, Dec. 1-31) and a permit season for one hunter in GMU 290.

No antlerless permits were issued for the 1998 season.

Special seasons and regulations were in effect in PLWMA 201 (contained in GMU 272). That part of GMU 278 within the Wahluke Slope Wildlife Area had a firearm restriction limiting deer hunters to use of archery, muzzleloader, and shotgun.

In the 1998 season, 7941 hunter-days were expended by 2675 deer hunters who hunted in the four GMUs (Table 1). This represented 13 percent of Region 2 hunters and 12 percent of Region 2 hunter-days. Hunter pressure, as measured by hunter-days, in the four GMUs combined decreased 20 percent in 1998 compared to 1997.

Table 1. Mule deer harvest in GMU's 272*, 278, 284, and 290 from 1992 - 1998.

	Harvest				Hunter		Days/
Year	Buck	Doe	Total	Success	Number	Days	Kill
1992	460	194	654	0.25	2581	8344	13
1993	373	169	542	0.23	2389	5443	10
1994	455	134	589	0.21	2774	8213	14
1995	296	114	410	0.19	2173	5816	14
1996	745	172	917	0.27	3403	8102	9
1997	629	189	818	0.24	3477	9884	12
1998	594	42	636	0.24	2675	7941	12

* Does not include PLWMA 201

Hunting conditions during the 1998 seasons were good to excellent in all units. Weather was cool and moist during the general buck season.

Overall hunter success (all weapons) in the four GMUs combined was 0.24 deer/hunter and was unchanged from that of 1997 but was 2 percent above the six year mean of 1992-1997 (Table 1). In 1998, success was higher than that of 1997 only in GMU 272. Highest success (0.58 deer/hunter) was in GMU 290.

Buck harvest in the four units combined was 594 in 1998 and decreased 5 percent from that of 1997 (629 bucks) and was 20 percent over the 1992-1997 mean of 493 bucks (Table 1). Forty-nine percent of the buck harvest in the four units was from GMU 284, 45 percent from GMU 272, four percent GMU 278, and two percent from GMU 290.

In GMU 290, 11 of 12 modern firearm permittees hunted and harvested 11 bucks. The single muzzleloader hunter did not hunt. Nine of the 11 archery permittees hunted in the area but did not harvest a buck.

Antlerless harvest in the four units has fluctuated annually. The number of antlerless deer harvested is closely related to the number of permits issued. GMU 272 had antlerless permits in all years from 1992-97 and the number varied from 50 to 200 annually. GMU 278 has had no antlerless permits in the past seven years. GMU 284 had no antlerless permits in 1994-1997 but had 150 permits in 1992 and 1993. None of the four GMUs had antlerless permits in 1998. The mean seven year harvest of antlerless deer in the four units combined was 145 (range, 42 to 194). All antlerless deer harvested (42) in 1998 were taken in muzzleloader and archery seasons.

Harvest of deer by archery and muzzleloader in the four units is small, accounting for four percent each of the total harvest in the past seven years.

The four Columbia Basin GMUs produced 24 percent of the buck harvest in Region 2 in 1998. Hunter success in the four Columbia Basin GMUs was 24 percent compared to 11 percent in the remainder of Region 2.

Surveys

Surveys to obtain data to estimate herd composition and size in the Columbia Basin GMUs have been limited in recent years to GMU 272, PLWMA 201 (contained in GMU 272), GMU 290, and GMU 284. No surveys have been conducted in GMU 278.

Post-season herd composition surveys have been done annually (except no survey in 1994) in GMU 272 including areas outside PLWMA 201. Surveys were made from a helicopter in late November or early December. In PLWMA 201 (an intensively managed cooperative of approximately 40,000 acres), pre-and post-season "total" counts are made annually. Counts are made from a helicopter in late August or early September (pre-season) and late November or early December (post-season). An attempt is made to count and classify all deer within the PLWMA during surveys. Because of excellent observation conditions due to "open" terrain and thorough coverage, it is estimated that> 90 percent of deer are counted.

Post-season herd composition surveys were made in GMU 290 from a helicopter in December 1995 through 1997. In 1995, intensive counts from the ground supplemented data obtained from the helicopter and allowed an estimate of herd size to be made. In 1997, the helicopter survey (approx. 2 hours of survey time) failed to produce an adequate sample size to estimate the composition of the herd. In 1998, the post-season survey was made from the ground by 22 volunteers and nine WDFW personnel. A herd composition survey was made in GMU 284 in November 1998 by seven volunteers and three WDFW personnel.

During December 1998, 402 deer were classified in that part of GMU 272 outside PLWMA 201 (Table 2). Post-season ratios were 35 bucks and 87 fawns/100 does. Approximately 44 percent of the bucks were judged to be adults. Buck:doe, fawn:doe, and percent adult bucks were higher than that of 1997. Surveys in 1993 and 1995 produced sample sizes to low to provide confidence in observed buck:doe and fawn:doe ratios and percent bucks. The survey in 1992 provided a sample size of 212 deer and a reliable estimate of seven bucks and 60 fawns per 100 does.

In PLWMA 201, the pre-season survey in early September 1998 indicated a decrease in the "resident" herd size compared to that of 1997. The "total" count on the area was 312 deer with 115 bucks and 52 fawns per 100 does (Table 3). Seventy-two percent of the bucks were adults. The post-season survey conducted in December 1998 indicated a significant increase in the "wintering" or "migrant" herd size on the PLWMA compared to 1997 (Table 4). The "total" count of 1363 deer represented a 16 percent increase from 1997. In 1998, the wintering herd included 1044 migrants composed of 95 bucks, 496 does, and 453 fawns, if one assumes that the increase in deer counted in December over the number counted in September represent migrant deer. During the December 1998 post-season herd composition survey, 337 deer were classified in GMU 290 with 50 bucks and 70 fawns per 100 does (Table 5).

Table 2. Post-season mule deer herd composition in GMU 272 from 1992-1998.

				Total	%Adult	per 100 Does	
Year	Bucks	Does	Fawns	Deer	Bucks	Bucks	Fawns
1992	9	127	76	212	44	7	60
1993	8	45	38	91	75	18	84
1994	No Data	--	--	--	--	--	--
1995	3	27	46	76	33	11	170
1996	47	223	187	457	23	21	84
1997	29	213	133	370	31	14	68
1998	64	181	157	402	44	35	72

Table 3. Pre-season mule deer surveys in PLWMA 201. 1988 and 1993-1999.

					Total	%Adult	per 100 Does	
Year	Bucks	Does	Fawns	Unid.	Deer	Bucks	Bucks	Fawns
1988	13	68	59		140	--	19	87
1993	59	79	61	14	213	--	75	77
1994	115	153	105	10	383	57	75	69
1995	116	116	101		333	72	100	87
1996	215	170	138		523	64	126	81
1997	163	205	128		496	72	80	62
1998	134	117	61		312	72	115	52
1999	207	186	114		507	80	111	61

Table 4. Post-season mule deer surveys in PLWMA 201. 1988 and 1990-1998.

					Total	%Adult	per 100 Does	
Year	Bucks	Does	Fawns	Unid.	Deer	Bucks	Bucks	Fawns
1988	45	185	141	23	394	--	24	76
1990	90	390	362		842	--	23	93
1991	134	342	264	209	949	--	39	77
1992	145	550	446		1141	48	26	81
1993	159	565	474		1198	59	28	84
1994	166	480	453		1099	52	35	94
1995	185	517	534		1236	49	36	103
1996	255	593	580		1428	50	43	98
1997	182	520	411		1177	57	35	79
1998	229	613	514	7	1363	54	37	84

Table 5. Post-season mule deer surveys in GMU 290 Desert in 1995 and 1998.

				Total	%Adult	per 100 Does	
Year	Bucks	Does	Fawns	Deer	Bucks	Bucks	Fawns
1995	35	61	74	170	57	57	121
1996	22	72	76	170	46	31	106
1997	2	55	28	85	50	3	51
1998	76	151	110	337	61	50	73

The 1995 estimate of herd size within the 250 square mile GMU 290, based on a helicopter survey and intensive ground count, was 264 (170 deer seen during the survey) deer with a composition of 54 bucks, 95 does, and 115 fawns. Based on incidental observations in the past 17 years, herd size appears to be increasing and distribution within the area is expanding. The 1998 post-season count of 337 deer indicated that the herd had increased by about 98 percent in four years.

The post-season count in GMU 284 in 1998 (188 deer classified) showed 40 bucks and 71 fawns per 100 does, with 44 percent of the bucks being adults.

Population Status And Trend Analysis

Total pre-season "population" (herd) size estimate was made only for PLWMA 201 in 1999. The pre-season (resident) herd size for PLWMA 201 was 507 mule deer. Post-season (migrant+resident) wintering herd size was 1363 mule deer in December 1998. In GMU 290, the herd size was estimated to be 264 mule deer in 1995 and at least 500 in 1998.

Little data other than estimates of harvest are available for use to evaluate long term trends of deer herd size in the Columbia Basin GMUs. Based on annual buck harvest since 1980, it appears that deer numbers in GMU 272 increased dramatically through 1996. The 1980 harvest was 112 bucks compared to the 1996 harvest of 436 bucks. In GMU 284, a trend similar to that of GMU 272 shows an even more dramatic increase in herd size. The 1980 harvest was 76 bucks compared to 322 in 1997. Buck harvest since 1980 in GMU 278 has been erratic and small but indicates herd size has increased in the last two years above that of the early 1980's. The 1980 harvest was 10 bucks compared to 23 in 1998.

In GMU 272, deer numbers appear to have increased appreciably from 1992 through 1996 based on buck harvest. The harvest dropped to 229 bucks in 1997 compared to 436 in 1996, but back up to 267 in 1998. In GMU 284, deer numbers appear to have declined significantly from 1992 to 1995, but rebounded just as strongly in 1996, 1997, and 1998 based on buck harvest. The 1998 count of deer in GMU 290 indicates that the herd has increased rapidly in the last four years. On PLWMA 201, both resident and wintering herd size increased from 1993 through 1996 but decreased in 1997. In 1998, the resident herd decreased, but the wintering herd size increased.

Post-season buck ratio in GMUs 272 in 1998 was well above the objective of 15:100. Post-season buck ratio in GMU 290 in 1998 was well above the management goal of 30 bucks per 100 does.

Deer damage claims/complaints in the winter of 1998-99 were few in number in all GMUs due to the mild winter weather.

Habitat Condition And Trend

The winter of 1998-99 was abnormally mild in all GMUs and provided a favorable condition for deer.

Winter food for most deer in GMU 272 and 284 is winter wheat and the new growth of forbs. During the winter of 1998-99, these low-growing foods were readily available to deer because of lack of snow. Wintering herds were spread widely throughout GMUs. Winter mortality was likely less than normal.

Three major changes in habitat have occurred in the Columbia Basin in recent years that appear to have affected deer significantly. Several thousand acres of primarily dryland wheat ground was put in the Conservation Reserve Program. Conversion of wheat to grass added permanent cover and some useful forage in the form of forbs, but in some areas removed a vital winter food resource (i.e., winter wheat).

Major habitat development, including irrigated and dryland food plots on PLWMA 201 provided high quality habitat for deer in GMU 272 and adjacent GMUs. Radio telemetry has shown that deer from as far as northern Douglas County and northeastern Lincoln County migrate to PLWMA 201 to winter. The number of acres of irrigated food plots on PLWMA 201 was reduced dramatically in 1998 and again in 1999, but were replaced with dryland food plots.

The spread of Russian Olive in GMU 278 and 290 has been dramatic in recent years. Distribution of deer in these units appears to be related to the occurrence of stands of this tree species.

Wildlife Damage

Deer related damage claims/complaints in the Columbia Basin GMUs includes orchard, alfalfa hay stacks, alfalfa fields, various row crops, and ornamental trees and shrubs.

Orchard tree damage and damage to alfalfa hay stacks are the most serious damages to private property, and elicit the most claims/complaints. Orchard damage and the potential for it, is most prevalent in GMUs 272 and 278. Damage can occur at all times of the year, but is most serious in winter. Deer damage to alfalfa hay stacks is confined to winter and is usually not a serious problem unless the winter is severe.

Many deer feed in alfalfa fields and various row crops during the growing season in most GMUs but claims/complaints for this damage are minimal. During the mild winter of 1998-99, few claims/complaints were made for deer damage.

Management Conclusions

Acceptable buck:doe ratios, relatively high percent adult bucks, and near maximum sustainable buck harvests were achieved in the Columbia Basin units in recent years by restricting the buck season to seven days. The three point

regulation and nine day buck season established in 1997 has reduced the buck harvest below the potential and increased post-season buck:doe ratios above 1996 and earlier levels, but unfortunately, will likely reduce the percentage of older bucks available to hunters over the long term. I feel the three point restriction should be removed and the length of the general season carefully considered for its impacts to deer and private landowners.

Population data for deer herds in the Columbia Basin GMUs are extremely minimal at present. Post-season herd composition estimates are often made from sample sizes much too small to be reliable. If the number of helicopter hours of survey time can not be increased, I suggest conducting post-season composition surveys in GMUs 272 and 284 on alternate years in an effort to obtain reliable data for each unit. Helicopter surveys should also be supplemented with counts from the ground if manpower is available.

We should continue research efforts to determine the influence of PLWMA 201 on adjacent GMUs.

Species	Region	PMUs	GMUs
Deer	3	32-36	328-372

Prepared by: Jeff Bernatowicz, Wildlife Biologist

Population Objectives/guidelines

The objective in the majority of Region 3 is to increase mule deer populations while maintaining recreational opportunity. Escapement goals are ≥15 bucks and 45 fawns per 100 does. Buck mortality should not exceed 60%.

Hunting Seasons And Harvest Trends

GMUs 329, 330, 342, and 371 are restricted to permit only. The late archery season is only open in PMUs 35 (excluding the southern portion of GMU 360), 36, and GMU 346. There is no late muzzleloader season and only GMUs 336, 352 and 360 are open during the early season.

Table 1. Deer Hunter numbers and success in Region 3.

Year	M. Firearm	Muzzle-loader	Archery	Total	Success
1986	22448 (83)	0	4607 (17)	27055	.06
1987	23164 (82)	204 (1)	4761 (17)	28130	.07
1988	23256 (81)	170 (1)	5114 (18)	28542	.10
1989	23623 (83)	254 (1)	4693 (16)	28575	.12
1990	no data				
1991	28873 (79)	1104 (3)	6736 (18)	36713	.15
1992	30159 (77)	1546 (4)	7602 (19)	39310	.12
1993	24190 (75)	1038 (3)	7070 (22)	32390	.06
1994	23022 (76)	756 (3)	6343 (21)	30122	.08
1995	19641 (78)	631 (2)	5025 (20)	25297	.08
1996	19982 (79)	673 (3)	4705 (19)	25360	.10
1997	14555 (82)	155 (1)	3086 (17)	17796	.03
1998	10586 (80)	227 (2)	2455 (18)	13268	.06
1986-96 AVG	23836 (79)	638 (2)	5666 (19)	30149	.09

The 3-pt regulation adopted in 1997 has resulted in decreased harvest and hunter numbers. Deer hunter numbers in Region 3 in 1998 were at an all time low (Table 1). Apparently, hunters have not viewed the general season 3-point restriction as a desirable "recreational opportunity". The hard winter in 1996-97 and forecast for a poor harvest undoubtably influenced hunter numbers. Modern firearm, muzzleloader, and archery hunter numbers were 56%, 64% and 56% below the ten year average.

Hunter success (Table 1) and harvest (Table 3) remained well below average. Total buck harvest was 75% below the 1991-96 average. However, modern firearm and muzzleloader permit hunters averaged 71% and 36% success in the region and accounted for 16% of the harvest. No does were harvested in 1998.

Surveys

In December 1998, a total of 1,048 deer were classified with ground surveys in the region (Table 2). The majority of the deer were surveyed on high density winter range in PMU 32 (GMUs 328-335) and 33 (GMUs 336, 340, 346). Equal time was spent in PMUs 35 and 36, but few deer could be located. No December surveys were conducted in GMU 372.

The buck:doe ratio is approaching the goal of 15 bucks:100 does (Table 2). PMU 32 has already surpassed the goal of 15, and the buck ratios in the remainder of the region has increased substantially. The fawn:doe ratio of (75) fawns/100 does was one of the highest ever recorded in the region. The high recruitment of deer, 3-point minimum restriction, and relatively low hunter numbers should result in all the units being above buck escapement goal in 1999. No surveys were conducted in PMU 35 (GMUs 352, 356, 360) or PMU 36 (GMUs 364, 368).

Table 2. Deer surveys conducted in Region 3 during December.

Year	Area	Total	Adult Antlerless	Fawn	Buck
1996	P32	704	465	231 (49)	8 (2)
1997	P32	326	202	103 (46)	21 (10)
1998	P32	325	167	131(78)	27 (16)
1996	P33	863	462	275 (58)	9 (2)
1997	P33	427	288	115 (37)	24 (8)
1998	P33	645	346	261 (75)	38 (11)
1996	P34	67	44	14 (26)	9 (17)
1996	P35	85	47	45 (40)	0
1997	P35	193	127	66 (56)	NA
1998	P35	57	32	20 (62)	5 (16)
1996	P36	659	379	210 (55)	13 (3)
1997	P36	6	4	1 (25)	1(25)
1998	P36	21	9	11	1 (11)
1997	Total	2378	1397	755(54)	39 (3)
1998	Total	780	500	220(44)	46 (8)
1999	Total	1048	554	423 (76)	70 (13)

()= Ratio per 100 does. February ratio is calculated by subtracting buck from antlerless using December buck

Population Status And Trend Analysis

No deer population models have been developed in Region 3. Harvest is not an accurate indicator of population levels, but is our only long term index. The buck kill had increased over the last 2 decades until the 3-point restriction in 1997. The buck harvest for 1991-1996 was 28% and 18% higher than the average for the 1970s and 1980s. The trend is contrary to public views. It is possible that the population has decreased but the proportion harvested has increased due to increased access and weapon efficiency. The low buck ratios indicate a high rate of harvest on bucks. The average doe harvest in all 3 decades has been below 500 animals annually for Region Three.

The current deer populations are probably well below average. Harvest peaked in 1992 after seven relatively mild winters. Fawn ratios were in the 50-70 range in all PMUs

during 1990 and 1991. A severe winter in 1992-93 caused the population to temporarily decline. The fawn ratio in the spring of 1993 averaged 42. The harvest and presumably populations increased until the winter of 1996-97. Fawn ratios in the spring of 1997 averaged 33 for the region. The lack of harvest and mild winters since 1996-97 have resulted in a rapid rebound in deer numbers.

In PMU 33, train collisions are a concern. Large portions of winter range are adjacent to tracks. Field observations in the spring of 1997 indicate high mortality due to collisions with trains. Train traffic is projected to increase from 5 to 40 trains per day.

Elk populations have increased over the last few decades and are believed to be competing with deer throughout the Region. In severe winters, the competition may result in more dramatic declines in the deer population. In PMU 34, elk populations are growing exponentially. Competition for green forage could reduce deer population, especially during droughts.

Habitat Condition And Trend

In Yakima and Kittitas counties, winter range was heavily impacted by drought, cold winters and grasshoppers during the 1980s. Conditions have improved in the last several years, and forage, especially bitter brush, is recovering. The harsh winter of 1996-97 impacted forage on the "concentrated" winter range. The reduced deer population combined with adequate moisture should help the long-term recovery of the forage base.

Deer habitat in PMU 34 and eastern PMU 32 are effected on the short term by moisture cycles. The trend in recent years is toward adequate moisture. Increases in irrigation in PMU 34 may also increase the forage base.

Management Conclusions

The restricted seasons have resulted in increased buck ratios. In December 1999, the objective of 15 bucks per 100 does will be reached. GMUs 329, 330, 342, and 371 should remain under the current permit only system. The four GMUs are open arid lands with minimal cover. Bucks in the GMUs are vulnerable to over- harvest. A strategy for the remaining GMUs will need to be developed.

Historically, the doe harvest has been minimal in Region 3. To optimize the recreational opportunity and herd production, an increased doe harvest is recommended. Population models need to be developed to estimate acceptable doe harvest.

Table 3. Deer harvest by PMU in Region 3.

	PMU 32		PMU 33		PMU 34		PMU 35		PMU 36		REGION 3	
Year	Buck	Doe	Buck	Doe	Buck	Doe	Buck	Doe	Buck	Doe	Buck	Doe
1970-79	990	183	529	152	95	0	316	67	324	86	2,254	488
1980-89	996	54	721	82	112	8	370	72	250	21	2,449	237
1991	1,545	364	1,588	294	178	29	990	130	611	164	4,912	981
1992	1,736	224	1,293	140	218	10	703	158	480	188	4,430	720
1993	509	124	678	133	98	10	82	53	43	59	1,410	379
1994	1,100	134	754	49	182	7	183	83	155	16	2,374	289
1995	746	85	781	45	95	5	200	31	154	17	1,976	183
1996	474	40	895	53	201	0	402	53	281	28	2,253	174
1997	230	0	56	0	137	0	27	0	14	0	464	0
1998	209	0	115	0	141	0	64	0	120	0	649	0
1991-96 AVG	1,018	162	998	119	162	10	427	85	287	79	2,892	455

Species	Region	PMUs	GMUs
Deer	**4**	**41-46**	**407,410,418,426,437,450**

Prepared by: Mike Davison, District Wildlife Biologist

Population Objectives/guidelines

Maintain maximum population levels compatible with available habitat base.

Hunting Seasons And Harvest Trends

Hunting season formats differ between individual Game Management Units (GMUs) based upon geographic variation. GMUs 407 and 410 are island and coastal areas with a high human population distributed throughout the habitat base. Hunting season strategies in these units generally emphasize more conservative seasons and hunting methods (permit hunts, archery, muzzleloader, or shotgun). Either-sex hunts are more common in island and coastal units because deer populations are generally higher with less public access to private lands. GMUs 418 and 437 are characterized as mainland areas of mid elevation with lower human population densities than the more urbanized island and coastal regions. Historical harvest data indicates that deer harvest success increases substantially as GMUs move south from the Canadian border. It has been speculated that lower temperatures resulting from cold air intrusion from the Frazier River basin lower carrying capacity for deer in affected units. GMUs 426 and 450 are high elevation areas situated well into the Cascade Mountain range. These units are characterized by extremely low human populations, limited road access, and severe geography. These eastern-most units differ from other areas in that; the deer populations in high elevation habitats support predominately mule deer or mule/blacktail hybrid populations, as opposed to blacktailed deer only in lower elevation units.

Harvest numbers in all mainland GMUs in north Region Four for 1998 are compared to the previous years (1997) harvest (Table 1). 1998 harvest levels in GMUs 407-450 combined, indicate only 2.5 percent increase in harvest from the 1997 season. GMUs 407 (North Sound) & 410 (Islands) can be characterized as island or coastal habitats with moderately high deer populations in combination with high human population densities and extensive road access. These two units collectively accounted for a total of 798 deer harvested in the 1998 season. This number represents 75.6 percent of the total deer harvest in north Region Four. Harvest levels in GMUs 426 (Diablo) and 450 (Cascade) collectively totaled only 24 animals for 1998. This represents an 84.6 percent increase from the previous year (1997). These two units differ from other GMUs in north Region Four in that they support Mule/Blacktail crosses.

Table 1. Comparison of deer harvest totals in Game Management Units in north Region 4.

GMU	Mean Harvest (1990-96)	Harvest (1997)	Harvest (1998)	% Change from 1997 to 1998
407*	261	280	203	-28%
410**	414	528	595	13%
418	285	78	103	32%
426	18	3	20	567%
437***	426	131	131	0%
450	29	10	4	-60%
Total	1433	1030	1056	3%

* GMU 407 (created 1997-combined GMUs 405 and 442)
** GMU 410 (created 1995-combined GMUs 406 and 436)
*** GMU 437 (created 1997-combined GMUs 433 and 440)

Harvest and recreational opportunity profiles for GMUs 407-450.

Total hunters participating in 1998 seasons for these units was 8,695. This represents 42.5 percent of the total hunters projected for all of Region Four (Total = 20,416).

Total hunter days expended by hunters participating in Region Four hunting seasons during 1998 was 82,322. An estimated 34,362 hunter days were projected for GMUs 407-450 during 1998. This represents 41.7 percent of the regional total.

A total of 1,056 deer were harvested in GMUs 407-450 during the 1998 season. This represents 45.9 percent of the total 2,302 animals harvested in all of Region Four.

Of the total, 1,056 deer killed in north Region Four, 206 (19.5%) were antlerless.

Of the total, 1,056 deer killed in north Region Four in 1998, 843 (79.8%) were taken by modern firearms, 147 (13.9%) were taken by archers, and 66 (6.3%) were taken by muzzleloaders.

A total of, 206 antlerless deer were harvested in GMUs 407-450 during the 1998 season; 117 (56.8%) were taken by modern firearms, 71 (34.5%) were taken by archery, and 18 (8.7%) were taken by muzzleloaders.

Surveys

No deer population surveys were conducted during the 1998 season in any north Region 4 Game Management Units. An effort to collect deer observation data through a cooperative/volunteer project including other state agencies (DNR, USFS) did not result in a usable data base for population modeling.

Population Status And Trend Analysis

The only evidence of population status and/or trends is the subjective observations of WDFW field employees (wildlife enforcement agents, fish and wildlife biologists) and the field observations of other natural resource agencies (DNR, State Parks, National Parks, and U.S. Forest Service) that consistently report fewer animals observed in traditional work areas over the last five to ten years.

Habitat Condition and Trend

Extensive logging in critical winter range areas has significantly impacted the ability of these areas to sustain high population levels of deer. However, no recent habitat analysis or formulated population surveys have been

conducted to quantitatively define current habitat condition or population trends. Road closures continue to increase and may buffer the influences of increased human disturbance throughout deer ranges in Whatcom and Skagit counties.

Increased use of herbicides on private timber lands has been observed over the last three to five years. This practice had declined on state and federally owned lands over the last ten years and was considered to be of minimal concern when compared to historical herbicide use levels. It will be necessary to monitor this activity in order to evaluate actual impacts on local deer habitats.

Management Conclusions

Recommendations for effective management of north Region Four deer populations include:

1. Implement a comprehensive habitat analysis of all deer range in Whatcom, Skagit, and San Juan counties.
2. Convert the San Juan Islands to a separate Game Management Unit from Island County (See 1996 PR Report-GMU 410).
3. Conduct herd composition surveys (age and sex class) in all GMUs in Whatcom, Skagit, and San Juan counties. Define population status in individual game management units, using current population modeling techniques.
4. Distribute tooth envelopes in all Game Management Units. Age and sex composition in the harvest is necessary to complete the population modeling effort. Tooth envelope distribution replaces the need for costly and logistically difficult field check and check station operations.
5. Continue monitoring local deer populations for presence /absence, distribution and severity of hair loss syndrome.

Species	Region	PMU	GMU
Deer	**4**	**46**	**448**

Prepared by: Ruth Milner, District Wildlife Biologist

Population Objectives/guidelines

Population objectives are to maintain healthy population levels to provide high quality recreational use and long term population stability within the available habitat.

Hunting Seasons And Harvest Trends

GMU 448 (Stillaguamish) was open to early archery hunters for any deer from September 1 through September 30, and to modern firearm hunters for buck only from October 17-31, 1998.

Access to private and state lands continues to diminish in Snohomish County due to gates and restrictions on motorized vehicles. In most cases, these areas can be accessed on foot, mountain bike, or horseback, but restrictions on vehicles effectively eliminates access for some hunters.

Much of the hunting in GMU 448 takes place on U.S. Forest Service lands. Many traditional access roads have been decommissioned in recent years, so motorized vehicle access continues to be reduced on federal lands, as well as on state and private ownerships.

The Swinomish, Sauk Suiattle, Stillaguamish and Tulalip tribes are the resident tribes in Snohomish County. Reporting tribes indicate one buck harvested from GMU 448.

Surveys

In 1998, deer sighting forms were submitted to WDFW staff and personnel from other agencies who work in deer habitat. Observers were asked to record the number, sex, and age of all deer sighted during the course of their normal work activities. Only three sighting sheets were returned, so data was insufficient for analysis purposes. However, we are optimistic that with time, this technique will provide good quality data that can be used to model population trends.

Population Status And Trend Analysis

At present, hunter harvest report cards continue to be the best tool for understanding trends in GMU 448. Figure 1 shows hunting trends from 1988 to 1998. Fewer people hunted in GMU 448 in 1998 compared to the early part of the decade, and fewer animals were harvested. However, the number of people hunting and animals harvested increased, between 1997 and 1998.

The increase in hunter numbers and harvested animals in GMU 448 during the 1998 season is the first increasing trend seen in several years. These data are too preliminary to suggest that conditions are improving for deer in Snohomish County. We will continue to try and refine survey techniques to enhance our understanding of black-tailed deer populations in the unit.

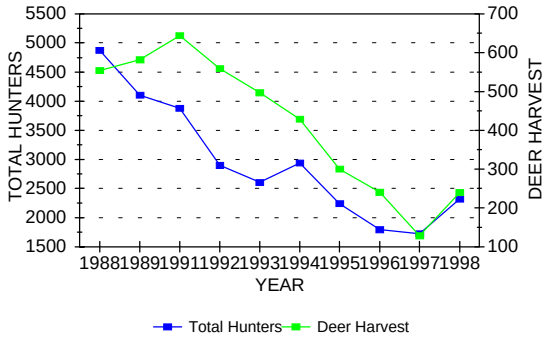

Figure 1. GMU 448 (Stillaquamish) total number of hunters and deer harvest, 1988-98.

Habitat Condition And Trend

Urbanization and suburbanization continues to increase in the western half of GMU 448. We continue to work with Snohomish County to support strong limits to growth and human encroachment into rural and forested areas, but expect to see continued loss of habitat over the next decade.

Private Industrial Timberland owners appear to be accelerating harvest in many of their holdings. This has resulted in an increased number of clear-cut areas which may enhance foraging habitat for deer in the short-term.

Management Conclusions

Continued human development in GMU 448 will further reduce the habitat available to black-tailed deer. We expect to see continued gating of many forest tracts as, well as continued road decommissioning on federal lands. As the human population within Snohomish County continues to increase, we expect to see more land posted "no trespassing" and more demand for areas which are closed to the discharge of firearms.

These trends will likely result in a reduction of land-base from which to hunt, but could also result in a higher quality hunt for those who are able to access gated areas on foot or other non-mechanized means.

Species	Region	PMUs	GMUs
Black-tailed Deer	**5**	**All**	**All**

Prepared by: **Min T. Huang, Wildlife Biologist**
Pat Miller, District Wildlife Biologist

Population Objectives/guidelines

Black-tailed deer (*Odocoileus hemionus columbianus*) populations in southwest Washington are managed under the Washington Department of Fish and Wildlife's (WDFW) mandate to maximize recreational opportunities within the framework of preserving the biological integrity of the species. Specific goals are to maintain current population levels and a minimum buck escapement of 15 bucks per 100 does.

Hunting Seasons And Harvest Trends

Information on black-tailed deer harvest and hunter effort is obtained annually from the WDFW hunter questionnaire and mandatory hunter report cards issued with each deer license. Estimates of total harvest, hunter pressure, and hunter success are based upon the sample of questionnaires and report cards returned. Biological sampling stations in Region 5 provide biological data (sex, age, condition) on deer harvested.

Black-tailed deer are hunted under WDFW's resource allocation strategy. Hunters must select a weapon type (modern firearm, muzzleloader, or archery) with which to hunt. Each weapon type has distinct seasons of varying lengths designed to provide equal opportunity. The exact season lengths and opportunity provided are determined by three year hunting packages, the latest of which is the 1997-1999 package.

Several harvest strategies are employed in Region 5. During the general modern firearm season, the majority of Game Management Units (GMUs) are managed under an any-buck strategy, where any buck with visible antlers is legal to harvest. Selected GMUs (558, 574, 578, and 588) are managed under a two point or better harvest regime. In 1998, GMU 582 was managed as a mule deer unit, with a three point minimum restriction. Muzzleloader harvest is primarily restricted to any buck, except for those seasons which fall under the branched antler GMUs above. Archery hunters are allowed any deer, except in GMUs 558, 574, 578, and 588; where there is a two point minimum on bucks. Antlerless deer, during archery deer seasons are legal in these GMUs. Apart from the archery harvest, antlerless permits are allocated based on the damage history and a percent of the minimum estimated population of selected GMUs.

In 1998 62,908 hunters spent a total of 253,517 days deer hunting in Region 5 (Table 1). This represents a 46 percent increase in hunter numbers from 1997. Hunter numbers from 1998, however, are suspect. Reporting rates in 1998 were extremely low (J. Rieck pers. comm). Low reporting rates will lead to less accuracy and precision in the estimates of total hunter pressure. Anecdotal observations in the field during the 1998 deer season indicated that hunter pressure was comparable, if not lower than in previous years.

Current regulations have resulted in relatively stable harvest trends in Region 5. We do experience annual variation in harvest and success rates in some GMUs. Black-tailed deer harvest in Region 5, however, seems to be more closely related to weather conditions than deer numbers.

Table 1. Summary statistics for deer harvest in Region 5, 1991-1998.

Year	Number of Hunters	Days afield	Harvest	% Success
1998	62,908	253,517	7,208	11.0
1997	42,925	287,203	7,963	18.6
1996	42,122	257,288	6,725	16.0
1995	43,244	293,616	7,333	17.0
1994	45,122	297,383	9,678	21.0
1993	46,616	271,232	7,154	15.0
1992	44,148	265,889	9,325	21.0
1991	39,372	233,787	7,832	20.0

Hunting conditions during the 1998 deer season were dry and warm. Dry conditions on the westside make stalking difficult. In dry years, without adjustment of hunting practices, hunter success tends to decrease in western Washington.

Overall hunter success in 1998 was 10.7 percent. Success rates were substantially lower in 1998, but much of this is an artifact, due to inflated estimates of hunter pressure. Numerically, deer harvest was similar to previous years.

Surveys

Region 5 black-tailed deer demographics are collected from three annual surveys. Surveys include; (1) annual biological sampling stations, (2) annual summer productivity surveys, and (3) annual spring counts of the Klickitat deer herd. Survey data is used as inputs into the Sex-Age-Kill (SAK) population reconstruction model.

Sampling stations designed to collect deer biological data were established in 1993. Five voluntary deer sampling stations were established throughout Region 5 during the opening weekend of the general firearm deer season, October 17-18, 1998. Biological sampling stations were located in Cougar, Randle, Toutle, Chehalis, and Longview. The Home Valley station was dropped in 1998. Stations were strategically placed near major ingress and egress routes of popular hunting areas to maximize the number of deer checked. The spatial arrangement of sampling stations allowed for coverage of the entire Region.

Deer brought to sampling stations were examined by WDFW personnel and/or qualified volunteers. Age, sex, number of antler points, and GMU of harvest were taken from each checked deer. Age was determined by tooth wear and replacement into either annual age-classes or one of three discrete categories (fawn, yearling, adult), at the discretion of

the examiner.

Data is used to determine the percentage of yearling bucks in the total adult buck harvest (≥ 1.5 years old). This percentage is equal to the overall buck mortality rate. The pertinent assumption in this determination is that yearlings are at least as vulnerable to harvest as adult bucks.

Adult sex ratios were determined by dividing the long-term estimate of annual doe mortality in Region 5, 22.2 percent (P. Miller, WDFW, unpub. data), by the annual buck mortality rates determined above. A 50:50 sex ratio at birth was assumed.

Summer deer productivity surveys were first established in 1994. Deer observations were conducted throughout the Region from August - September in 1998. Deer group sizes and composition were determined. Personnel from the Wildlife Management, Habitat Management, Fisheries Management, and Enforcement Divisions of the WDFW, along with volunteers from other State and Federal Agencies, recorded observation data for all deer encountered during field activities. All deer were classified as buck, doe, fawn, or unknown.

A fawn:doe ratio was determined from survey results. Ninety-percent confidence intervals about the mean were constructed following Czaplewski et al. (1984). Mean annual fawn:doe ratios were compared via overlapping confidence intervals to test the hypothesis of no differences in fawn:doe ratios between months ($P = 0.10$).

For spring counts, four permanent survey routes centered on the Klickitat Wildlife Area, Goldendale, WA, were censused on March 18-19, 1999. Transects were driven on the evening of the 18th and morning of the 19th. Deer group sizes and composition were determined. All deer were classified as fawn, adult, or unknown. A fawn:adult ratio was determined. Historic fawn:adult ratios were correlated to buck deer harvest using Pearson product-moment correlation.

A total of 102 deer were checked during October 17-18, 1998. The annual yearling buck percentage (AYBP) from any-buck GMUs was 0.582, compared to 0.444 in 1997. This was a non-significant difference from 1997 ($Z = 1.47$, $P > 0.05$), but a significant departure from the five year mean ($Z = 1.75$, $P < 0.05$). Assuming an age-stationary, stable population, the overall buck mortality rate in any-buck GMUs from October 1997 - October 1998 was ~58 percent. Small sample sizes in 1998 from two point units did not allow for meaningful data analysis. Overall sample size (n=102) in 1998, was comparable with previous years. Annual buck mortality rates in the range of 40-50 percent are indicative of a lightly exploited population. The long-term estimate of doe annual mortality rates in the Region is 22.2 percent. Sample size of does is inadequate to annually determine mortality rates.

Biological sampling station data continues to indicate good survivorship among the male segment of the black-tailed deer population in the Region. The increase in mortality observed in 1998 may be an anomaly, or indicative of an increase in non-hunting mortality. The AYBP also indicates that black-tailed deer are lightly exploited relative to Rocky Mountain mule deer (*Odocoileus hemionus*) in Washington (L. Bender, pers. comm.). Assuming the long-term doe mortality rate and an age-stable, stationary population, the AYBP indicates the following about deer in Region 5.

1. The 1998 buck-to-doe ratio in any-buck GMUs before the hunting season was 38 bucks per 100 does. Although a decline from the five year mean of 47, this continues to be more than adequate for stable deer demographics in the Region. We are still meeting escapement goals for black-tailed deer throughout the Region. For two point or better GMUs, the 1997 ratio was 53 bucks to 100 does (data insufficient in 1998 for estimation).
2. Although overall buck mortality seemed to increase in 1998, demographic data continue to indicate that harvest is not a limiting factor driving black-tailed deer population dynamics. Very little, however, is known about the resiliency of black-tailed deer to exploitation. Therefore, harvest in Region 5 has been conservative. The thick cover attributes of the habitat on the westside and the conservative harvest regime have resulted in a black-tail population that appears to have good to excellent survivorship and continued good recruitment.

Deer observation counts were conducted August-September 1998. As in past years, fawn:doe ratios increased as summer progressed (Table 2). The mean value of 0.645 fawns/doe was the highest since standardization of data collection in 1994. The 1998 mean is well below historical productivity data (~0.750) for the Region, and represents average to poor productivity when compared to values in the literature. We do, however, sample after the peak of neo-natal mortality, so these values are closer representatives of ultimate recruitment than fecundity.

Table 2. Region 5 observed summer fawn:doe ratios (F:D), 1998.

Month	Total	Bucks	Does	Fawns	F:D
August	205	27	111	62	0.56
September	399	50	202	140	0.69
Total/Average	604	77	313	202	0.65

A total of 481 deer were classified during the March 18-19, 1999 Klickitat deer survey (Table 3). The resulting fawn:adult ratio of 0.58±0.08 is indicative of excellent over-winter survival. The long-term mean (1985-1998) ratio for this area is 0.41.

Long-term correlations (1985-1998) between the spring fawn:adult ratio and the overall buck harvest in GMU 588 the following fall are significant (r=0.69, $P < 0.05$). These analyses indicate that spring surveys are a good predictor of eastside fall hunting success.

The biological significance of this relationship is straight forward. First, since fawns are generally more vulnerable to resource shortages and other environmental stress, low fawn:adult ratios indicate tougher over-wintering conditions and likely lower overall survival of deer. High winter mortality across all age classes will result in lower fall harvests. Secondly, biological sampling station data indicates that many yearling bucks branch and thus become vulnerable to fall harvest. Depressed fawn:adult ratios mean fewer yearling bucks

will be available in the fall; hence, a lower total buck harvest.

The long-term mean fawn:adult ratio is 0.41, and is an indicator of average conditions. Using the long-term mean ratio as a benchmark, ratios above 0.50 are indicative of better than average hunting conditions, whereas ratios below 0.40 predict poor fall hunting in Klickitat County.

Table 3. Historic fawn:adult ratios for the Klickitat deer survey, 1985-1999.

Year	Total	Classified	Fawn:adult ratio
1999	644	481	0.58
1998	328	287	0.47
1997	702	683	0.18
1996	637	496	0.42
1995	607	455	0.56
1994	460	309	0.34
1993	522	345	0.13
1992	420	272	0.42
1991	465	221	0.65
1990	590	308	0.59
1989	747	471	0.59
1988	576	454	0.42
1987	467	248	0.33
1986	364	215	0.14
1985	541	295	0.49
Long-term mean			0.41

Population Status And Trend

Region-wide deer populations are stable. Despite substantial annual variation in some units; overall harvest success rates and deer demographics continue to indicate stability.

We are likely to see some declines in deer population numbers in our mountain units due to habitat changes on public lands (see Habitat to the right). We are beginning to see some of these changes manifest in buck harvest levels, in those units primarily located on USFS lands (e.g. GMUs 516, 560), which are declining slightly.

Deer populations should continue to do well in the low elevation I-5 corridor units. Harvest levels remain stable, despite rising hunter pressure. Buck mortality rates, however, are rising in several of these units, indicating that population pressures other than direct hunting mortality are operating. The effects of the hairslip (loss) condition afflicting deer in the lower elevations of the Region continues to be evaluated. It is likely that in some areas the condition has led to elevated levels of mortality. The overall effect on deer populations relative to other forms of mortality at this time, however, seem to be slight. The marked increase in buck mortality rates in 1998, in conjunction with the widespread reports of afflicted deer are likely mere coincidence. If, however, present harvest levels are maintained and continued high buck mortality is observed, the direct mortality rate of afflicted deer may be higher than presently thought. The rate of indirect mortality of afflicted animals due to increased susceptibility to predation is unknown, but may be substantial.

Deer east of the Cascades continue to rebound after the severe winter of 1997. Over-winter survival has been high the past two years and subsequent buck harvests have been good.

Habitat Condition And Trend

At this time there are no known climatic factors directly affecting deer populations in Region 5. In localized areas, extreme winters can result in large winter kills, the winter of 1997 being an example. Weather, however, is not limiting deer in Region 5. Indirectly, however, weather factors may be exerting some pressure on deer in the Region. Severe winter conditions often result in lower yearling recruitment.

Increasing urbanization in several GMUs (504, 554, and 564) is resulting in a loss of quality deer habitat and an increase in deer/human conflicts. A cooperative project with Clark County to investigate urban deer movements was initiated to provide some insight to deer ecology in the urban environment.

Limited manpower and logistical problems have initially hindered the project. An increase in residential development along the Lewis River drainage is degrading the quality of black-tailed deer winter range. This winter range loss is being addressed in both the WDFW's Integrated Land Management (ILM) program for the Lewis River watershed, and in mitigation agreements concerning the three major hydroelectric projects (Merwin, Yale, and Swift reservoirs) on the Lewis River.

Additionally, the establishment of large blocks of Late Successional Reserve (LSR) in the Gifford-Pinchot National Forest (GPNF), particularly in the Upper Lewis River watershed, will eventually result in loss of quality deer winter habitat in the Region. Of the approximately 49,000 acres of designated deer/elk winter range on GPNF lands in the Upper Lewis watershed, 80 percent is now in LSR. This will ultimately result in a 41 percent reduction in carrying capacity in this area (R. Scharpf, GPNF, unpub. data).

Management Conclusions

Adult mortality rates and population estimates continue to indicate that black-tailed deer populations in Region 5 are lightly exploited. Buck seasons and lengths should continue to be set with the goal of maximizing hunter opportunity.

Present antlerless permit allocation should be maintained in areas west of the Cascade Crest. Population modeling and productivity surveys continue to indicate that westside deer populations are not being negatively impacted by current harvest intensity. Eastside antlerless allocation should remain conservative. Deer populations east of the Cascade Crest are just rebounding from the effects of the harsh winter of 1996/1997. Historically, eastside populations exhibit a two to three year recovery period after stochastic, additive events. Following severe winters in 1985 and 1992, eastside harvest did not approach pre-winter kill numbers for two years.

No specific habitat enhancements for black-tailed deer are planned in Region 5. Both the Klickitat (Klickitat County) and Cowlitz (Lewis County) Wildlife Areas have on-going, long-term management practices designed to benefit black-tail habitat.

For four years, deer west of the Cascade Crest have been

reported with hair loss syndrome. The proportion of the population of deer being affected by 'hairslip', impacts on survival rates of afflicted deer and the exact cause of the affliction continue to be investigated. Anecdotal evidence indicate that survivorship of afflicted deer is likely high, but this needs to be quantified. Collaring of a large sample of afflicted deer would provide excellent information on survival rates of affected deer. Figure 1 documents the distribution of reported cases in Washington in 1998/1999.

The carrying capacity of westside deer habitat is unknown. Anecdotal evidence suggests that current deer populations may be lower than in the past. Harvest data, however, suggest that deer populations in Region 5 are not being limited by hunting. Deer are either thus (1) at carrying capacity, or (2) being limited by factors other than direct hunting mortality. The relationships between current deer populations and habitat need to be clarified for westside populations.

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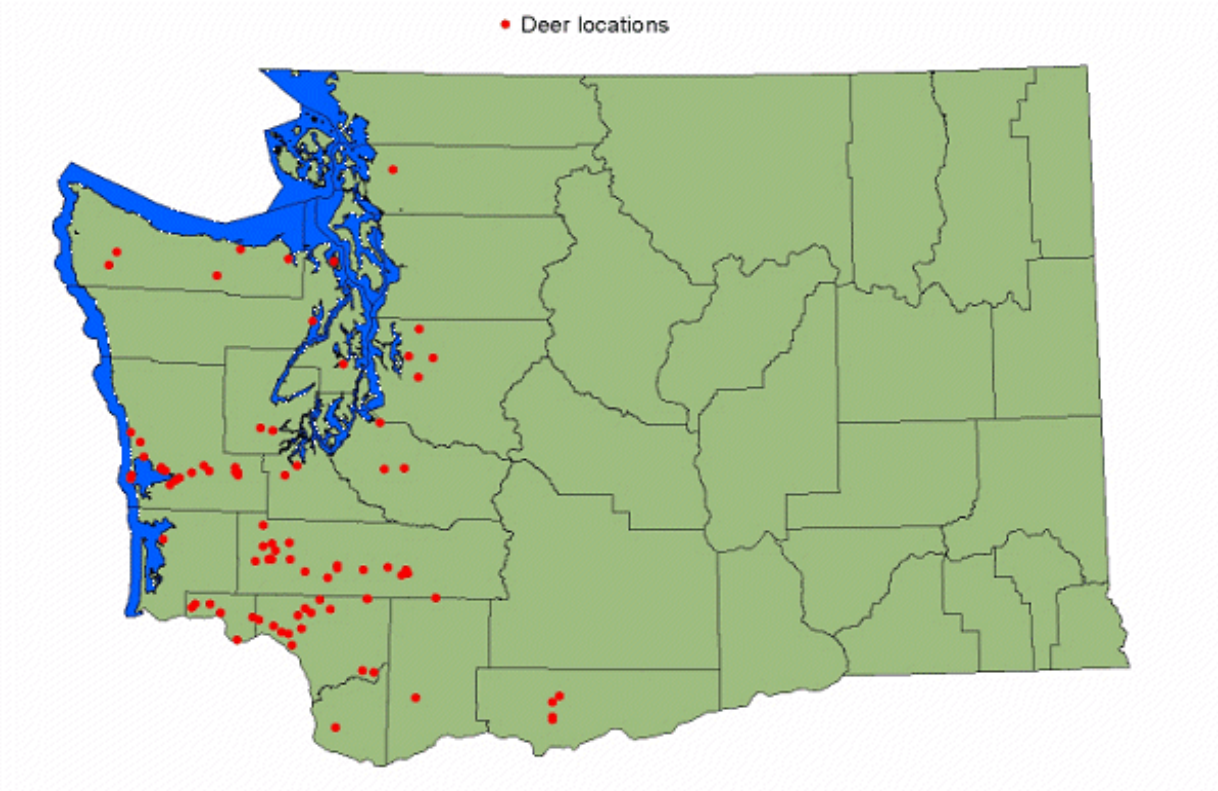

Figure 1. Location of reported cases of hairloss in Black-tailed deer.

Species	Region	PMUs	GMUs
Deer	**6**	**61-66**	**601-684**

Prepared by: Greg Schirato, District Wildlife Biologist

Population Objectives/guidelines

Objectives are to maintain deer numbers at their current relatively high numbers. Buck harvest is generally any antlered buck although Game Management Units (GMUs) 636 and 681 are managed as two point or better units.

The 1998 season was the second year in a three year season package, and antlerless permits had been reduced in some GMUs that had experienced ice storm mortality or recruitment concerns from the 1996 winter mortality.

Hunting Seasons And Harvest Trends

Based on the Game Harvest Questionnaire, hunting pressure more than doubled in 1998 over the previous year. The average number of days required per kill for all hunters increased from 27 to 37 days (Table 1). Success rate dropped from 23 to 11 percent.

Table 1. General hunter numbers and hunter days afield in Region 6.

	1996	1997	1998
Hunters	22,174	18,698	37,233
Hunter Days	121,580	113,575	154,983

Estimates of total annual mortality rates (i.e. from all sources) vary depending on the data source. Thus an analysis of harvest report card data looking at antler size (spike vs. branch antlered) adjusted for older spikes and yearling two points determined a regional buck mortality rate from .19 to .48 for Region 6 Population Management Units (PMUs). An analysis of 268 antlered deer at the Vail check station showed that 61 percent were yearlings. An aerial survey in that same unit determined that just over 70 percent of bucks were branch antlered. The best estimate of total annual buck mortality appears to fall somewhere between 40 and 50 percent. A sampling of adult (yearling and older) antlerless harvest resulted in an estimate of an average annual mortality rate of 32 percent (n=22).

In general, the hunting regulations continue to be conservative with doe harvest targeted at less than 20 percent of buck harvest.

Hunting conditions were normal with no unusual precipitation and no fire closures.

Little tribal input on deer management has been received. Tribal harvest and interest is focused more on elk. Reported tribal harvest continues to be approximately five percent of the total regional harvest.

Surveys

A pre-season helicopter survey was again conducted in GMU 667 (Skookumchuck). A total of 111 deer were classified. The ratios of fawns and bucks per 100 does were 46 and 13 respectively, declining somewhat over the previous year. A severe ice storm during the winter of 1996 may have contributed to these declines by affecting recruitment into the yearling male age class and impacting doe productivity. At the same time the buck/doe ratio observed is likely below the actual value in the population since bucks tend to be segregated from does at this time. This is further confirmed by the fact that age data taken at the Vail check station for antlered and antlerless deer suggests total mortality rates of 58 and 19 percent respectively. If this reflects the population as a whole the buck/doe ratio would be about 33 to 100.

No post season surveys were conducted during the reporting period.

The ratio of yearling to older deer was checked at the Vail check station. Of 267 antlered deer checked at the Vail Station 164 (61 percent) were yearlings. Of 24 does checked at Vail only five (32 percent) were yearlings.

Deer check stations were run at Vail on three weekends in 1998 (Table 2).

Table 2. Hunter numbers and deer checked at Vail check station in 1998.

Date	Hunters	Deer Checked
10/11/97	595	101
10/12/97	821	43
11/18/97	799	40

Population Status And Trend Analysis

A Sex-Age-Kill Ratio (SAK) model was used to generate deer population estimates by PMU. Population parameters were estimated from Vail check station data as well as aerial surveys conducted in the Skookumchuck Unit (Table 3). These estimates are magnitudes lower than 1997. This is mainly due to the higher doe mortality rate estimate. The SAK model is very sensitive to mortality rates. The sample size used is extremely small. The sample size needs to be increased to get a more reliable estimate of doe mortality rate.

Management Conclusions

The deer hair loss syndrome has been observed throughout Region 6. Even though mortalities had been observed, prior to this year, no indications of population level declines had been documented. Cougar populations have also been increasing which may be adding natural mortality. There was an 18 percent decline in buck harvest with success rates

Table 3. SAK population estimate by PMU for 1998.

PMU	Estimated Population
66	1,432
65	1,290
64	3,605
63	5,926
62	2,688
61	4,964

dropping in half. Success rate changes are often a good indicator of the population travel. The SAK model estimates a large population decline for Region 6. This will need to be examined closely with next year's sampling. It may be necessary to make large scale reductions in antlerless permits based on modeling data. A study of actual mortality rates using radioed deer has been initiated on Weyerhaeuser: Vail Tree Farm.

Species

Elk **Statewide**

Prepared by: Rolf Johnson, Deer and Elk Section Manager

Population Objectives/guidelines

The long term goal for elk populations in Washington is to maintain maximum numbers within habitat limitations and landowner tolerance. We have an objective to increase populations in the following areas: Blue Mountains - 4,500 to 5,600; Olympic Peninsula - 10,400 to 14,400 including 4,000 in ONP; Nooksack - 300 to 750; North and South Rainier - 3,300 to 4,000; and Colockum - 5,200 to 6,000. Elk populations continue to build and expand in northeastern Washington. Our goal is to increase elk abundance in Pend Oreille County and eastern Stevens County (north of Kettle Falls encourage elk east of the Columbia River; south of Kettle Falls encourage elk east of Highway 395), as well as areas of eastern King, eastern Pierce, northern Skagit, and Whatcom counties. Harvest management objectives are to achieve 12 bull per 100 cows in post season surveys in optimum harvest areas and more than 12 bulls per 100 cows in quality management areas.

Hunting Seasons And Harvest Trends

The east and west sides of the state are managed under different harvest regulations, but both are designed to achieve the same bull escapement goal. The eastern half of the state is mainly spike bull only general seasons with branch antlered bulls by permit only. The exception to this is northeastern Washington which is managed under any bull. Elk management in the western half of the state has varied over the years. For many years, we had any bull seasons in most units and a few three point minimum units. In 1997, hunting season rules similar to the eastside (spike only general seasons, branched bull by permit and modern firearm seasons reduced from twelve to nine days) were adopted in much of western Washington. Westside elk hunters voiced their preference for the three point minimum rule. At the same time, the Fish & Wildlife Commission elected to drop agency recommendations for a goal of at least five mature bulls per 100 cows in post season surveys. As a result of this situation, western Washington elk seasons, in 1998, were changed to three point minimum general seasons, except for damage areas. Escapement goals of 12 bulls per 100 cows may not be met in most westside units with a three point minimum restriction and a nine day modern firearm season. Some additional restrictions may be necessary in future hunting seasons.

Statewide elk harvest increased by 16 percent in 1998 (Table 1). On the eastside, the increase was 2,310 to 2,931 or 21 percent and on the westside, the increase was 2,609 to 2,927 or 11 percent.

As with deer, all elk permit hunters were sent a questionnaire this year requesting information on success and

Table 1. Statewide elk harvest trends.

Year	Bulls	Cows	Total
1991	5,092	3,554	8,646
1992	5,583	3,292	8,875
1993	3,804	2,563	6,367
1994	4,606	5,360	9,966
1995	3,522	2,907	6,429
1996	3,801	3,152	6,953
1997	2,992	1,929	4,921
1998	3,352	2,506	5,858

Table 2. Elk harvest 1974-1997

Year	Total	Modern	Archery	Muzzleloader
1974*	10,060	9,395	404	261
1975	12,730	12,089	389	252
1976	10,030	9,330	425	275
1977	12,820	12,014	489	317
1978	13,170	12,280	540	350
1979	12,270	11,354	556	360
1980	10,820	9,853	587	380
1981	9,559	8,502	642	415
1982	12,573	11,853	430	290
1983	8,947	8,253	475	219
1984**	9,075	8,227	622	226
1985	8,970	7,621	877	472
1986	7,698	6,413	799	486
1987	7,842	6,044	983	815
1988	8,958	6,547	1,075	707
1989	9,305	7,113	1,121	1,071
1990	8,246	5,760	895	999
1991	8,646	6,688	1,212	746
1992	8,875	6,880	1,002	993
1993	6,367	4,303	1,109	955
1994	9,967	7,146	1,560	1,261
1995	6,429	4,487	1,168	774
1996	6,953	4,933	1,156	864
1997	4,919	2,129	1,093	747
1998	5,858	3,758	1,078	1,022

*Archery and muzzleloader harvest data from 1974-1981 is based on estimated success rates and one combined archery/muzzleloader stamp. Exact numbers for archery and muzzleloader hunters is unknown, but in 1982 to 1984, nearly 85% of the archery/muzzleloader stamp holders were archers. Therefore, we prorated the harvest by assuming 85% of the archery/muzzleloader stamp holders were archers and 15% muzzleloaders for the years 1974 to 1981. In 1982, 1983 and part of 1984, separate archery and muzzleloader stamps were sold. Success rates estimated as follows: Archery deer 6%; archery elk 3%; muzzleloader deer 23%; muzzleloader elk 11%.

**Resource Allocation initiated in 1984 and tag sales, success rate and harvest numbers obtained for all user groups.

Table 3. Elk Tag Sales, Archer/Muzzleloader Stamp and Weapon Selection Sales Under Resource Allocation

	Total	Stamp Sales			Elk Tag Sales		
Year	Elk Tag Sales	Archery/ Muzz. Stamp	Archery Stamp	Muzzleloader Stamp	Modern Firearm	Archery	Muzzleloader
1974	103,593	15,842					
1975	103,615	15,263					
1976	103,488	16,684					
1977	110,049	19,186					
1978	118,636	21,182					
1979	116,464	21,795					
1980	104,452	23,015					
1981	99,451	25,179					
1982*	95,980	9,723	14,318	2,636			
1983	92,332	discontinued	15,830	1,992			
1984**	82,038	N/A	18,376	3,846	73,057	7,873	1,956
1985	84,551	N/A	2,174	542	69,620	9,998	2,514
1986	82,552	N/A	13	2	68,184	10,927	3,382
1987	79,516	N/A	N/A	N/A	62,564	11,299	4,542
1988	81,414	N/A	N/A	N/A	62,991	12,387	5,230
1989	90,494	N/A	N/A	N/A	63,249	12,560	6,507
1990	84,910	N/A	N/A	N/A	65,934	12,613	6,984
1991	87,756	N/A	N/A	N/A	66,221	13,550	7,542
1992	88,673	N/A	N/A	N/A	66,574	14,353	8,440
1993	89,134	N/A	N/A	N/A	65,386	14,590	9,872
1994	85,603	N/A	N/A	N/A	58,297	15,653	10,945
1995	88,496	N/A	N/A	N/A	62,797	14,562	11,689
1996	83,540	N/A	N/A	N/A	59,182	14,039	11,252
1997	67,036	N/A	N/A	N/A	47,510	10,700	10,282
1998	73,752	N/A	N/A	N/A	50,507	12,710	10,535

*Archery and muzzleloader separate stamp initiated in 1982.
**Resource Allocation initiated in 1984.

area hunted. Return rates are about 80 percent and this data has provided WDFW with much needed information on harvest (Tables 2 and 3).

Elk populations in the Blue Mountains continue to struggle with low calf survival. Pregnancy rates of cow elk have improved over rates in the 1980s, but calf survival is still not up to desired levels. Current elk populations are estimated at 4,500 and population objectives are 5,600. The spike bull general season was initiated in the Blue Mountains in 1989. Bull harvest has declined by 67 percent since 1985, but we are now meeting bull escapement objectives of 12 bulls per 100 cows in the post season surveys. Calf to cow ratios declined 58 percent, between the summer of 1998 and March of 1999, from 55 to 23 calves per 100 cows. Bull ratios in the Blue Mountains average 15 bulls per 100 cows and range from 7 to 18 in the various units.

Elk populations in northeast Washington continue to expand their range and increase in size. Several of the units in western Spokane, Stevens, and Ferry counties are open to any elk because of damage problems.

Elk populations in Pend Oreille, eastern Spokane and Stevens counties continue to thrive. Many habitat improvement projects sponsored by the Colville National Forrest and Rocky Mountain Elk Foundation have improved habitat for elk. These projects have involved burning, fertilization and road management. The Colville Chapter of the Rocky Mountain Elk Foundation is very eager to increase elk in this area.

Bull escapement for the Yakima elk herd has declined slightly this year, but is still close to management goals. After five years of spike only general seasons with branched bulls by permit, bull post season ratios were over 11 bulls per 100 cows. We are still short of the bull escapement goal for the Colockum herd, but bull ratios increased from five to eight this year.

Both North and South rainier elk herds continue to decline outside Mount Rainier National Park. The North Rainier Herd has declined to about 1250 and the South Rainier Herd now numbers close to 1000.

Elk hunting on the Olympic Peninsula was made three point minimum in 1997 and 1998. The WDFW and Olympic Peninsula Tribes have been meeting regularly to evaluate elk population status and develop conservative hunting seasons. The state has no antlerless elk seasons on the Olympic Peninsula to help population recovery. In the last ten years, Olympic Peninsula elk populations have declined about 40 percent.

This past year, elk harvest increased on both sides of the

state for both bulls and cows.

Surveys

Limited funding prevents us from surveying all units throughout the state, but we do sample surveys in each elk herd. On the westside we survey 10-20 percent of the elk units. In the Colockum and Yakima areas we survey about 25 percent of the elk herd areas and in the Blue Mountains we survey about 80 percent of the elk areas. In northeast Washington, elk surveys are limited to ground counts in the spring. Survey reports for each herd are reported by the area biologists.

WDFW uses the Idaho Elk Sightability Model to develop elk population status in the Blue Mountains. These surveys are conducted in March in high, medium, and low density zones. This survey indicates sightability in the Blue Mountains is approximately 79 percent. We also used a paint ball survey to cross check the sightability model. Preliminary estimates are that the sightability is very accurate. Another paint ball survey was conducted in the Spokane area. This technique provides an excellent one time population assessment.

In northeastern Washington, ground surveys from mid-March to April revealed good calf survival. Calf survival was 42 calves per 100 cows this year compared to 62 calves per 100 cows last year.

Post season surveys in the Colockum and Yakima areas revealed another year of poor calf survival. February 1999 helicopter surveys revealed only 28 calves per 100 cows in the Colockum and 33 calves per 100 cows in the Yakima areas. Bull survival increased to 8 calves per 100 cows in the Colockum area, but declined to 11 bulls per 100 cows in the Yakima herd.

Most elk surveys on the westside of the state are conducted prior to modern firearm hunting seasons. The mid-September surveys are least biased in terms of accurate bull:cow calf ratios because all elk are freely intermixed at that time. These data are used with harvest data and productivity data to develop a reconstruction model. Surveys in the southwest Washington indicate good calf survival in most areas, but poor in the Toutle mud flow. For bull ratios, the best units are the permit only units--Margaret and Toutle (Table 4). Bull survival declined in southwest Washington in 1998. Bull mortality in units previously managed under spike only increased to 70 percent. Units managed under three point minimum was 53 percent mortality. It is doubtful that bull escapement under three point restrictions will meet management goals in the future without additional restrictions. On the Olympic Peninsula, pre-season calf ratios in GMU 615 (Clearwater) were 34/100 cows and bull ratios were 19 bulls per 100 cows. In the Willapa Hills, surveys on GMU 673 (William Creek) indicate both bull and calf ratios are better with 34 bulls and 64 calves to 100 cows.

Table 4. Bull Escapement Ratios (bulls/100 cows, Pre-season, and Post-season 1997 and 1998).

			1997		1998	
Region	GMUs	Name	Pre-season	Post-season	Pre-season	Post-season
1	101-124	Northeast		12	-	-
	145-186	Southeast	14	13	14	13
3	300-334	Colockum		5		8
	334-372	Yakima		14		11
4	418-437	Nooksack		32		-
5	472	White River	30	28	31	17
	500 series	3 pt. min units**	24	7*	38	~9
	530	Ryderwood	27	13*	26	~9
	524	Margaret (permit only)	48	34*	49	~38
	556	Toutle (permit only)	35	23*	35	~23
6	602	Dickey	26	12*		
	615	Clearwater	22	5	19	-
	673	Williams Creek	25	8	34	-
	681	Bear River		19	-	-

*calculated

Population Status And Trend Analysis

Blue Mountains -

Stable at 4,500 ± 500

1,100 below management objectives

Elk populations on the westside of the Blue Mountains are stable, while elk numbers on the eastside have declined. (Obj. - 5,600)

Spokane Area -

Stable at 180 elk in GMUs 127 and 130

Northeast Area -

1,900

Elk numbers appear to be increasing, but inadequate surveys.

Colockum -

Decreasing at 5,200

Yakima -

Increasing at 16,700

Elk populations are controlled by antlerless harvest which is dictated, in part, by damage to agricultural crops.

Hanford -

Growing at 900 plus, nearly all private land with limited hunting opportunity. This population will continue to grow until some harvest or removal is achieved.

Elk harvest on the east side of the state tends to fluctuate with weather conditions during the hunting season. This is particularly true of the Yakima elk herd which is our largest eastern Washington elk herd. Last year's elk harvest increased somewhat from 1997 (Fig. 1).

Nooksack -

Currently, numbers only 250 to 300 animals. This herd once numbered over 1,000 elk. Approximately 80-100 of these elk are in a damage area with liberal hunting seasons to alleviate this damage problem.

St. Helens -

Modeling indicates declining in recent years, currently estimated at 12,000

Willapa Hills -

Modeling in the southern part indicates declines at 6,700

North Rainier -

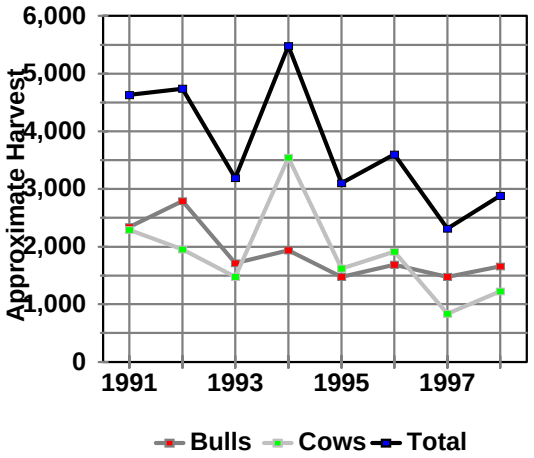

Figure 1. Recent Rocky Mountain elk harvest in eastern Washington.

Declining at 1,250

South Rainier -

Declining at 1,000

Olympic Peninsula -

Decline of approximately 40 percent over the last ten years. Population estimates of 4,000 in Olympic National Park in addition to 6,400 outside the park, therefore total 10,400.

Westside elk harvest has declined since 1994, but rebounded somewhat in 1998 in response to many liberal hunting seasons. (Fig. 2).

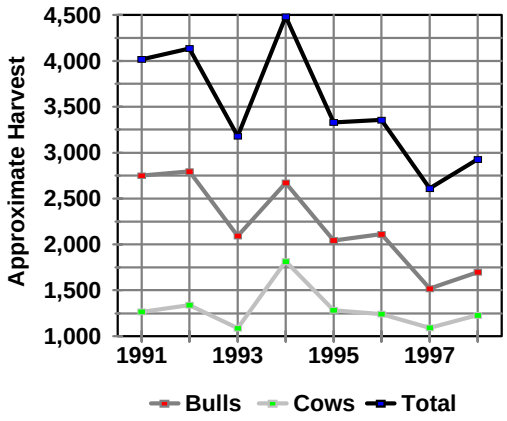

Figure 2. Recent Roosevelt elk harvest in western Washington.

Habitat Condition And Trend

Elk benefit from early successional species and therefore generally benefit from timber harvest. In most areas, road density is too high and this limits optimum habitat suitability. New road management programs are being implemented, however, habitat conditions in some areas are improving. Timber management on summer ranges is generally shifting toward smaller clear cuts or selective cuts. While this is beneficial, much of the forest service land is shifting toward late successional reserves. This change will greatly diminish the carrying capacity of winter ranges. The long term trend in elk carrying capacity is down.

Augmentation/habitat Enhancement

No elk transplants for augmentation were planned or completed in 1998. A major elk transplant from Handford to both the Blue Mountains and northeastern Washington are planned for early next year. There are some habitat improvement projects that are ongoing or planned. A controlled burn was completed on Abel's Ridge to help control the spread of yellow-star thistle. Cooperative habitat improvement projects in northeast Washington were done in cooperation with Colville National Forest and funding for the Rocky Mountain Elk Foundation. Most of the habitat improvement projects statewide depend on partial funding from RMEF. Forage enhancement projects are planned for the Nooksack elk herd and the Cowlitz Wildlife Area. Another fertilization seeding and scotch broom removal project was conducted on the Toutle mud flow below Mt. St. Helens to improve forage and stabilize the mud flow.

Wildlife Damage

The Washington Department of Fish and Wildlife is liable for damages caused by elk. In response to landowner complaints, the WDFW tries to alleviate damage problems without reducing the elk population. Over the years this has become increasingly more difficult. In the Blue Mountains, for example, elk populations are substantially below population numbers in the 1970s and 1980s, but damage complaints persist. Hunting seasons have been adopted to discourage elk from increasing in Benton and Ferry counties, and Stevens County (north of Kettle Falls discourage elk west of the Columbia River; south of Kettle Falls discourage elk west of Highway 395) and from dispersing into northern Chelan and Okanogan counties. We are also discouraging elk from increasing in Snohomish and southern Skagit counties and from dispersing east of the Columbia River in Douglas and Grant counties. In all of these areas elk are incompatible with agricultural and horticultural crop production. In many other areas we find increasing urban sprawl and development that is restricting elk range. One of the biggest challenges we face is to manage elk populations in balance with landowner tolerance.

Management Conclusions

Most elk hunting seasons in Washington are male only general seasons with antler restrictions. On the eastside of the state most units have spike bull general season with permit controlled branched bull seasons. On the westside of the state, antler restrictions were mainly spike bull only in 1997, but were changed to three point minimum in 1998. Both strategies are designed to ensure that enough bull elk survive the hunting

season to breed and perpetuate the herd. WDFW bull escapement goals are 12 bulls per 100 cows in post season surveys.

A spike bull only rule protects older bulls, which are more efficient breeders because they tend to breed cows on their first estrous cycle. For long term herd health, this strategy is optimum. The three point minium rule protects younger bulls, but over time may not be as effective and may not result in adequate bull escapement without additional restrictions.

In eastern Washington's Blue Mountains, Yakima, and Colockum elk areas, hiding cover is limited and elk vulnerability to hunter take is high. On the westside of the state, hiding cover is more abundant and mature bulls are less vulnerable to hunter harvest.

No matter what side of the state elk reside, they are under intensive hunting pressure. Washington is the smallest of the eleven western states and has the highest number of hunters per elk. Bull elk in Washington are hunted in seasons that start in September and extend until the middle of December in some areas. After many years of any bull seasons, antler restrictions, and reduced season lengths have been adopted to achieve bull escapement objectives.

In the last few years, more and more tribal hunters have been exercising their hunting rights, especially for elk hunting. Federal courts have ruled that members of federally recognized treaty tribes may hunt unrestricted by the state except for conservation closures. The state appealed the Buchanon decision in 1998 and the State Supreme Court ruled that members of federally recognized treaty tribes may hunt only within their ancestral hunting areas. The state and tribal managers are working out the specific areas open for each treaty tribe. The state and tribal managers are working on cooperative agreements to ensure conservation of the wildlife resource. For the long term, WDFW and tribes must work together to protect the wildlife resource from over harvest and habitat loss.

Species	Region	PMU	GMUs
Elk	**1**	**11**	**127 thru 142**

Prepared by: G J Hickman, District Wildlife Biologist

Population Objectives/guidelines

To maintain elk numbers at levels compatible with landowners and urban expansion. To provide as much recreational use of the resource for hunting and aesthetic appreciation as possible.

Hunting Season and Harvest Trends

In 1998, modern firearm hunting was limited by permit draw. Early archery and late muzzleloader seasons were available for either sex elk at least in part of these units. In addition, GMU 127 was open in the late archery season for either sex elk. A special hunt for Advanced Hunter Education (AHE) graduates was open, from October 20 through December 31, for elk of either sex. The weather and elk distribution during the fall resulted in a reduced harvest from 1996 and 1997 (see Table 1).

Table 1. Population composition counts from GMUs 127 and 130 (the Hangman sub herd).

Year	Bulls	Cows	Calves	C:100:B
1993	21	181	57	31:100
1994	2	106	41	36:100
1995	6	103	57	56:100
1996	17	92	48	52:100
1997	12	41	26	63:100
1998	7	100	31	31:100:7
1999	7	24	10	42:100:29

The crop damage by this elk herd has been to haystacks, hay bales, winter wheat fields and bluegrass fields. Most of the damage was in GMU 130 in agriculture fields near the Turnbull National Wildlife Refuge. The most serious damage occurs when the herd size is 50 plus, but with management efforts to disperse and minimize herd size, damage claims have been reduced. The landowners have learned that leasing hunting lands is more profitable than submitting damage claims to WDFW.

The special seasons, over the past five years, have helped to manage the elk population so that there are a limited number of claims in these units.

As in past years, when the weather and browse conditions do not force the elk out to areas where hunting is possible, the most successful harvest is in late seasons, either by muzzleloader or by AHE graduates. If these seasons are not successful, then WDFW must implement hot-spot hunts around areas of crop damage. All of these efforts were necessary from 1996 through 1998. Permission to hunt, and access to land with elk during the season is often a problem in this district. Little if any public lands are available for hunting of elk. Finding an area that allows hunter access is very difficult in this area.

Surveys

Ground and aerial surveys are used to gather population and herd composition estimates for GMUs 127 and 130. In April and early May of 1998, a mark-resight study was conducted with the elk in these two GMUs. The elk were marked with paintball dye from a helicopter and two weeks later the area was again surveyed by helicopter. The estimate from mark-resight was a minimum of 179 elk for these two units. In 1999, no funds were available to conduct aerial surveys. Ground surveys conducted in August and September revealed that elk were more widely distributed in both GMUs 127 and 130. Thus, the harvest may be more evenly distributed during the 1999 hunting season. When the groups of elk are smaller, we receive fewer reports of damage. One goal of the hunting strategies is to maintain small herds with a wide distribution, so that fewer elk are concentrated in any one area, such as the Turnbull National Wildlife Refuge in GMU 130.

Population Status And Trends

All survey efforts and harvest trend data indicate that the Hangman Creek subherd is responding to management efforts, and the lack of damage complaints thus far in 1999 indicates that we will be able to successfully manage these elk at a level that will provide recreation without damage claims.

The cow to calf ratio is down from the high of 1995 but is similar to 1994. The 1999 survey sample size was down because of reduced funding for aerial surveys. (Refer to Tables 2 and 3 for population trends in this herd.)

Table 2. Harvest and hunter effort for Spokane County Hangman subherd.

Year	Bulls	Cows	Total	Hunters	Hunter
1997	18	36	54	452	2159
1996	29	93	122	1207	4968
1995	23	28	51	1067	3685
1994	40	67	107	913	3647
1993	6	19	25	677	2493
1998	8	31	39	N/A	N/A

Modeling of this population is based largely on best estimates of several herd parameters. In the future, to accurately model this subherd WDFW will need, at the very least, the herd age structure (based on harvested animals), and composition surveys to demonstrate productivity. The Selkirk herd plan identifies $7,000 for surveys, another $4,000 will be necessary to collect the extra data to begin modeling this population.

Management Conclusions

As in past years, most of the elk in this district were on the Turnbull National Wildlife Refuge in GMU 130. In the past, damage claims resulted in the concentration of the animals in

this area south of Cheney. As an additional means of managing the antlerless elk in southern Spokane County, the WDFW continues to encourage Turnbull National Wildlife Refuge to allow a limited entry permit only hunt for antlerless elk on the refuge. The harvest results indicate that an increasing number of elk are utilizing the refuge during the hunting season and at other times of the year (Table 3).

Table 3. Elk surveyed in Turnbull National Wildlife Refuge (a portion of the Hangman sub herd).

Year	Number of elk.
1994	25
1995	84
1996	73
1997	94
1998	138

Species	Region	Elk Management Areas	GMUs
Elk	**1**	**Northeast Washington PMU 11**	**101-124**

Prepared by: Steve Zender, District Wildlife Biologist

Population Objectives/guidelines

The harvest management objective in Northeast Washington is to maintain the overall bull mortality rate at <50% which would mean September bull:cow ratios of 25-30:100. Antlerless hunting opportunity is by permit only, except that archers may hunt either sex. Elk population growth and distribution is encouraged in this area.

The objective in Ferry and Stevens counties is to reduce expansion of elk north of Kettle Falls and west of Highway 395 to control elk distribution in agricultural areas.

Hunting Seasons And Harvest Trends

Elk in northeast Washington are widely scattered throughout the heavily forested habitat and are exceptionally difficult to harvest. While we have very limited population data, there is currently no indication bull:cow ratios are a problem. Therefore, there are no special bull antler point restrictions and any bull is legal.

Archers may hunt elk of either sex, have the entire area for the early general hunt, and five units open late that overlap late whitetail hunts. Muzzleloaders have a general bull hunt in GMU 109. The modern firearm general bull hunt was limited to a nine day October 31-November 8 season in 1998. Antlerless permits were issued for the entire Northeast Hunt area (GMU's 109, 113, 117, and 124 E of 395) rather than a few permits by individual units.

In 1998 the Northeast Elk Tag area was separated from the Blue Mountain Tag area. The only noticeable impact appears to be an increase in modern firearm hunters (Figure 1).

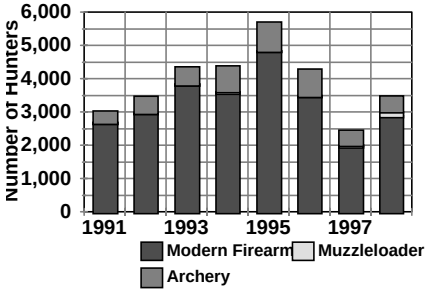

Figure 1. Elk hunters by weapon choice, GMUs 101-124.

The harvest for the northern GMUs increased significantly from 1997 to 83 animals, which is the approximate 1991-97 average (Figure 2). Our hunter report card returns were similarly up, with the major increases in GMUs 117 and 124 (Table 1). Report card returns for the Selkirk Unit (GMU 113) continue to be well below levels experienced in the early 1990s.

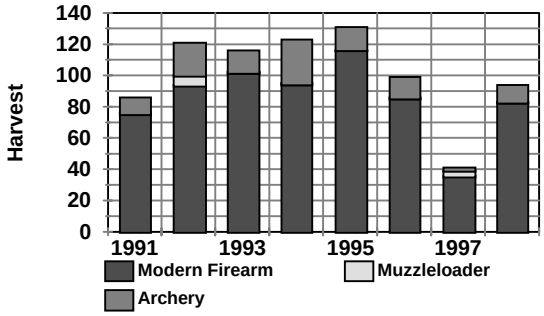

Figure 2. Elk harvest by weapon, GMU's 101-124.

Table 1. Elk report cards by GMU, 1993-98

Year	101	105	109	113	117	121	124	Total
1993	1	3	6	24	7	0	12	53
1994	3	2	7	17	13	3	12	57
1995	0	2	2	8	10	3	14	39
1996	2	5	5	15	6	4	6	43
1997	0	4	4	8	3	3	6	28
1998	1	3	4	7	10	3	12	40

A special survey of all permit holders (Rieck, 1999) revealed that success by "any elk" permit holders was 21 percent. The 80 permits issued resulted in a take of only one bull and 12 cows.

Elk continue to expand and apparently increase in the "elk control" units (GMUs 101, 105, 121, and western 124). While hunter report card returns are still low, anecdotal information indicates increasing harvest as well. Harvest levels are likely still too low to reduce or possibly even slow population expansion.

The north half tribal elk hunt includes GMUs 101 and 105 where tribal members took two elk (Murphy, 1999).

Surveys

Harvest rates have generally been relatively low for the northern Selkirk Herd so obtaining bull:cow ratios has not been a high enough priority to survey. For management decisions we currently rely on trends in the bull mortality rates based on age estimates (antler point data) from hunter reports and field checks (Table 2). Hunter reporting rates appear to be low, which is very discouraging when trying to glean information with small sample size.

Recognizing the biases with small sample size, the percentage of yearlings is greater than our objective of <50 (44% yearling in 1998). We do not have adequate data at this time to develop population estimates through modeling efforts.

Table 2. Report card and field check antler point data, GMU's 101-124.

Year	1-2 points	3-5 points	6+ points	Total
1994	9 (35%)	6 (23%)	11 (42%)	26
1995	18 (46%)	12 (31%)	9 (23%)	39
1996	21 (46%	12 (27%)	12 (27%)	45
1997	11 (52%	4 (19%)	6 (29%)	21
1998	7 (44%)	5 (31%)	4 (25%)	16

Our best opportunity to observe elk is from mid-March to mid-April. Flight money was not available this year, so we began a program of involving volunteers to classify elk groups. Basically the observations during early mornings or late evenings are made of elk that concentrate on "green-up" fields or openings.

The cow:calf ratio is the only reliable data gathered on post-winter surveys. This year's efforts yielded a ratio of 42 calves per 100 cows (N=136 cows & calves); which means good calf survival. We were pleased with the results from the volunteers, especially the Pend Oreille County Sportsmen. We do need to involve more people and get a broader distribution of area surveyed.

Population Status And Trend Analysis

While hard data is very limited, general observations and anecdotal information indicate elk populations are stable or a bit lower (northern Pend Oreille County) in the traditional elk management units. Elk continue to increase in distribution and numbers south and west into the Kalispell drainage, the Huckleberry Mountains, the Wedge, and Kettle Crest.

Habitat Condition And Trend

Habitat conditions for elk look relatively favorable for the foreseeable future. Road closure policy by federal and private land managers has been much more aggressive in recent years. Logging is increasing again on USFS lands and continues intensively on private lands. The forage from the high rate of logging in the 1980s should be reaching a stage where elk can thrive on it. Size of mature timber cover areas are getting smaller though and thus the quality of cover may be more of a problem than we are aware of at this time.

Wildlife Damage

Only one formal elk complaint was filed in the elk management units; this in northern Pend Oreille County. There were no formal elk complaints filed in the Upper Columbia/Kettle Falls area where we have the either-sex hunt (Roberts, 1999). No special landowner preference permits were issued for elk damage. It is a credit to our Wildlife Officers' positive interactions with landowners and the landowners' tolerance of elk that we experience few formal complaints.

Habitat Enhancement

Cooperative efforts to enhance habitat, primarily through seeding grass forage, browse burns, and road closures, is an ongoing effort. Most projects have involved Rocky Mountain Elk Foundation, state and federal agencies, and private timberland corporations. During the spring of 1999 WDFW and the Rocky Mountain Elk Foundation initiated a project to burn and fertilize 80 acres and seed 40 acres on the LeClerc Creek Wildlife Area. The purpose was to enhance the very limited spring grass forage for elk in Pend Oreille County. A large RMEF, WDFW, and USFS project involving burning of 1,200 acres and seeding 300 acres of roads over a three year period in the Cliff Ridge - Addy Mountain area began this year. There are several other RMEF projects being carried out with the USFS throughout the elk management units that include winter shrub burns, road closures, and seeding.

Management Conclusions

Survey data are difficult to obtain but our experiences continue to indicate the March/April counts on green-up should continue. These surveys give us good information on recruitment in the herd. We would like to expand our involvement with volunteers for these surveys. If funds become available we will certainly try helicopter flights during late September for bull:cow:calf ratios as recommended in the statewide elk survey protocol.

We will increase our efforts to improve the sample size of the age or antler data collected from harvested animals. Poor response is particularly frustrating as hunters seem reluctant or very complacent about returning harvest reports. As a result it required considerable time on our part to make contacts in the field or at sports club meetings.

While composition surveys will always be necessary for hunting season recommendations, this herd needs more detailed information on elk distribution, numbers, and habitats. Many management decisions depend on knowledge of elk distribution and preferred habitats, e.g., enhancement projects, current or potential crop damage, and interaction with tribes. There is always emphasis on coordinating habitat enhancement dollars but it seems to be assumed that the key habitats are known. The fact is our knowledge of key areas is relatively limited. Finding out more about what specific areas elk use during each season of the year should be part of the ongoing efforts to enhance habitats.

Literature Cited

Murphy, M. 1999. 1998 North Half Colville Tribal Harvest. Fish and Wildlife Dept., Colville Confederated Tribes.

Rieck, J. 1999. 1998 Game Harvest Report. WDFW.

Roberts, W. 1999. Personal Communication.

Species	Region	PMUs	GMUs
Elk	1	13 & 14	145-186

Prepared by: Pat Fowler, District Wildlife Biologist

Population Objectives/guidelines

Elk populations in the Blue Mountains have declined by approximately 1500-2000 animals since 1987. The current post-season elk population is estimated at 4,500 (± 500) head. The population management objective will be to increase the Blue Mountains elk herd to approximately 5600 post-season. The goal is to increase elk populations that are below management objectives in units containing primarily public land. Sub-populations in GMU 169 (Wenaha), GMU 175 (Lick Creek), the eastern portion of GMU 166 (Tucannon), and GMU 172 (Mt. View) are below population management objectives by approximately 1100 elk.

Hunting Seasons And Harvest Trends

The spike-only management program for bull elk was implemented in 1989 after research determined pregnancy rates for cow elk were lower than normal (65%), and post-season bull to cow ratios were running from 2-5 bulls\100 cows. The program was designed to increase both the post-season bull to cow ratio and the number of adult bulls in the population in order to improve breeding effectiveness and pregnancy rates.

The bull harvest has declined approximately 67 percent since 1985. Hunters harvested 831 bull elk in 1985, compared to a five year average bull harvest of 252 since 1994 (Table 1). This reduction in the bull harvest is due to a marked decline in elk populations in GMUs 166, 169, 172, and 175, and poor calf survival for the entire Blue Mountains elk herd.

Table 1. Blue Mountains Elk Harvest (PMUs 13 &14), 1992-98

	Bulls					Antlerless Harvest
Year	Spikes	Adult	Total	Antlerless	Total	Cows:100 Bulls
1992	278	78	356	281	637	79
1993	190	82	272	243	515	89
1994	241	64	305	167	472	55
1995	177	64	241	15	256	6
1996	138	69	207	109	316	53
1997	309	71	380	57	437	15
1998	107	41	148	61	209	41

The 1998 yearling bull harvest declined sharply compared to 1997, from 309 to 104, respectively, a decrease of 65 percent. Yearling bull report cards declined only 25 percent, from 63 to 47. Post-season calf ratios were similar between 1997 and 1998, at 24 and 22 calves per 100 cows. The number of yearling bulls counted in post-season surveys increased by only 25 bulls. The reason for the dramatic decline in the yearling bull harvest is unknown, considering post-season calf survival, population levels, and survival rates were similar between years.

Controlled hunt permits for "any bull" were implemented in 1991 after post-season bull ratios reached the management objective. Hunters that draw a bull permit can still look forward to a very high quality hunt (Table 2). Permit holders in 1998 averaged 55 percent success; rifle-68 percent, muzzleloader-75 percent, and archery-27 percent. The quality of bulls harvested is exceptional with 73 percent being six point or larger.

Table 2. Permit Controlled Bull Elk Harvest - All Weapons, 1992-98, Blue Mtns. WA. (excludes GMU-157 Watershed)

	Bull		Hunter	Percent	Bulls Obs.
Year	Permits	Harvest	Success	6 Point+	Per Hunter
1992	131	53	44%	64%	4.7
1993	132	53	41%	66%	3.1
1994	122	42	37%	66%	3.4
1995	122	45	41%	72%	4.9
1996	139	49	42%	68%	5.5
1997	110	54	51%	79%	6.7
1998	62	31	55%	73%	6.8

Hunters in the Mill Creek Watershed experienced fair hunting conditions, and the area remained accessible throughout the hunting season. The permit level for the 1998 season was reduced from 75 to 50. Hunters harvested 14 elk (12 bulls, and 2 cows) for a success rate of 40 percent. The quality of bulls remained fair, with 42 percent being six point or larger.

The cow elk harvest varies from year to year based on damage complaints and the level of hotspot hunting. The total cow elk harvest (hunting season and damage control) increased from 62 in 1997, to 118 in 1998. General season cow permits have been eliminated in all units, except Peola, and the only hunting season permits issued are in damage units for muzzleloader hunting; which are low impact. The hunting season harvest of cow elk remains fairly consistent, with 57 and 61 cows harvested in 1997 and 1998, respectively. Permits issued for damage control (hotspot\landowner) in 1998 resulted in a harvest of 57 cow elk in the west Blue Mountains, and none in the east Blue Mountains. A total of 97 cow elk were harvested in the West BM, compared to 21 (Peola, Couse ML) in the East BM.

The implementation of various restrictions (Zone tags, Resource Allocation, stratified season, spike-only) has reduced elk hunter participation in the Blue Mountains significantly since the early 1980s. Elk hunter numbers peaked in 1980 at 18,298, but declined to between 10,000-12,000 after the spike-

only program was initiated in 1989. Since 1989, Blue Mountains elk tag sales have ranged from a high of 10,000+ , to a low of 3,886 in 1998, a decline of over 61 percent in ten years. In 1998, GMUs 101-142 were removed from the Blue Mountain tag area. Elk hunter numbers in the Blue Mountains have declined 79 percent since 1980.

Surveys

Pre-season surveys are conducted to determine calf production when elk re-group after calving (Tables 3 and 4).

Table 3. 1998 pre-season elk surveys, Blue Mtns. Wa.

	Bulls					Elk	Per 100 Cows	
GMU	Adult	Yearling	Total	Cows	Calves	Total	Bu.	Ca.
154	2	13	15	103	57	175	15	55
157	2	3	5	2		7	--	--
162	1	4	5	37	23	65	14	66
166	1	3	4	21	7	32	--	--
169	3	1	4	21	7	32	--	--
172	17	23	40	332	193	570	14	58
178	2		2	21	13	36	---	---
181				9	7	16	--	--
186		1	1	33	9	43	--	--
Total	28	53	101	579	316	976	14	55

Table 4. Pre-season elk survey summary, Blue Mtns. Wa.

	Bulls						Per 100 Cows	
Year	Adult	Yearling	Total	Cow	Calves	Total	Bu.	Ca
1990	29	41	70	466	232	768	15	50
1991	68	131	199	1014	454	1667	20	45
1992	77	53	130	530	253	913	25	48
1993	86	69	155	875	445	1475	18	51
1994	25	72	97	538	270	905	18	50
1995	28	48	76	684	276	1036	11	40
1996	65	68	133	1037	500	1670	13	48
1997*	67	30	97	716	376	1189	14	53
1998	28	53	81	579	316	976	14	55

* aerial survey conducted in late June

Post-season surveys are conducted to determine population trend and herd composition in late winter. The annual post-season survey was conducted during mid March, 1999. The survey followed the protocol for the Idaho Elk Sightability Model using the Hiller 12-E helicopter. Fewer zones were surveyed in 1999 due to heavy snowfall at high elevation that concentrated elk at lower elevations, and limitations of the survey budget.

Population Status and Trend Analysis

Post-season surveys in March, 1999 produced a count of 3,615 elk, compared to 3,118 elk in 1998. Based on estimated sightability, the Blue Mountains elk herd contains approximately 4,500 elk (± 500), which is 1,100 elk below management objectives, but above last year's estimate. Elk populations vary in status from GMU to GMU. Game management units in the Blue Mountains are designed to encompass the range of major wintering elk populations, which also conforms to the major watersheds.

Elk populations on the west side of the Blue Mountains have increased slightly, elk populations on the east side have stabilized over the last two years, while the Wenaha continues to decline. Elk populations in the Wenaha-Tucannon Wilderness (GMU 169), and Units 166, 172, and 175 have declined tremendously over the last ten years. The largest decline has occurred in GMU 169 (Wenaha), where the population plunged from 2,500 elk in 1985 to approximately 600 in 1999. The line of demarcation between stable and declining elk populations appears to be the Tucannon River (Figure 1).

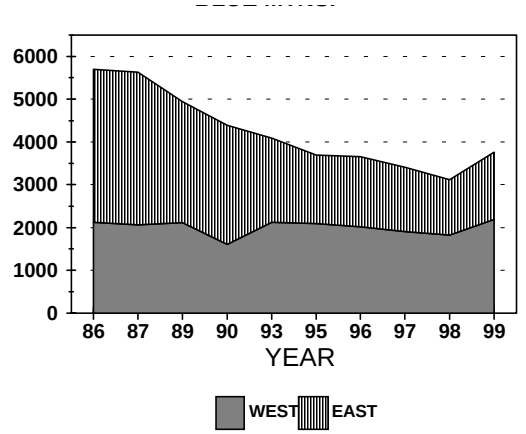

Figure 1. Elk Survey Trend, Blue Mtns. WA. Surveys conducted in March.

Calf survival is poor in all units (Table 5). The level of cow elk mortality appears to be the one major factor that is different between the east and west sides of the Blue Mountains, with the eastern Blues suffering a higher level of mortality. However, the installation of one-way gates in the elk fence will reduce the level of cow elk mortality due to damage in GMU 178, which should reduce cow mortality in this area.

The level of cow mortality in the Wenaha will be difficult to monitor and control, because most of the mortality probably occurs during the Oregon antlerless elk season in the Mt. Emily, Walla Walla, and Troy units where antlerless permits are still issued. The number of permits issued has declined over the last few years, and this may help reduce cow mortality in the Wenaha sub-herd.

Elk populations will remain low until calf survival increases to a level high enough to more than compensate for the loss of cow elk to damage control hunts, Oregon cow permits, and other mortality factors.

Calf survival continues to be a major problem. Post-season calf ratios have declined over the last ten years (Figure 3). Summer calf ratios have improved due to higher pregnancy rates in cow elk (Table 6). However, high calf mortality during summer and winter continues to be a problem. Calf to cow

Table 5. 1998 Post-season elk surveys, Blue Mtns. Wa.

	Bulls							Per 100 Cows	
GMU	Adult	Raghorn	Yearling	Total	Cows	Calves	Total	Bu.	Ca.
154	19	3	18	40	408	106	554	10	26
157	10	9	14	33	230	40	303	14	17
162	62	14	34	110	675	128	913	16	24
166	19	4	13	36	311	76	423	12	24
169	16	17	10	43	250	28	321	16	11
172	35	8	15	58	320	86	464	18	27
175	5	11	16	32	469	119	620	7	25
181	0	0	0	0	0	0	0	---	----
186	0	0	1	1	61	16	78	--	--

Table 6. Post-season Population Trend - Herd Composition Surveys, Blue Mtns., Washington.

	Bulls						Elk	Per 100 Cows
Year	Adult	Raghorn	Yearling	Total	Cows	Calves	Total	C:100:B
1989	86	---	140	226	2777	703	3706	25:100:8
1990	108	87	137	332	2922	818	4072	28:100:11
1991	276	---	155	431	2660	469	3560	18:100:16
1992	185	76	139	400	3103	589	4092	19:100:13
1993	169	71	91	331	2395	435	3167	18:100:14
1994	253	101	111	465	2690	534	3689	20:100:17
1995	202	105	82	389	2836	431	3656	15:100:14
1996	165	69	86	320	2487	598	3405	24:100:13
1997	123	54	89	266	2325	547	3118	23:100:11
1998	166	66	121	353	2663	599	3615	23:100:13

ratios declined 58 percent between the summer of 1998 and March 1999, from 55 ca.\100 cows to 23 ca.\100 cows.

Post-season bull ratios remain at management objectives, with 15 bulls\100 cows in spike only units, and an average of 13 bulls\100 cows for all units. Bull ratios ranged from a low of 7 bulls\100 cows in GMU 175 (Lick Creek), to a high of 18 bulls\100 cows in GMU 172 (Mt. View). Bull permit levels should be conservative, because recruitment of yearling bulls into the adult bull population will remain low due to poor calf survival.

It will be extremely difficult to increase elk populations in GMUs 166, 169, 172, and 175 unless the major problems impacting these sub-populations are addressed; habitat effectiveness, calf survival, agricultural damage control, and the level of cow elk mortality.

Habitat Condition and Trend

Habitat conditions on National Forest land should be starting to improve due to increased levels of controlled burning and an increase in the number of roads closed to motor vehicles. The Pomeroy District is in the process of re-evaluating the Access-Travel Management Plan, which will, hopefully, result in a few more road and area closures. The road closure plan on the Walla Walla Ranger District is completed.

The Columbia Basin Ecosystem Project recommends a 50 percent increase in logging to improve forest health. Increased logging would greatly impair efforts to maintain and improve habitat effectiveness for elk on the Umatilla National

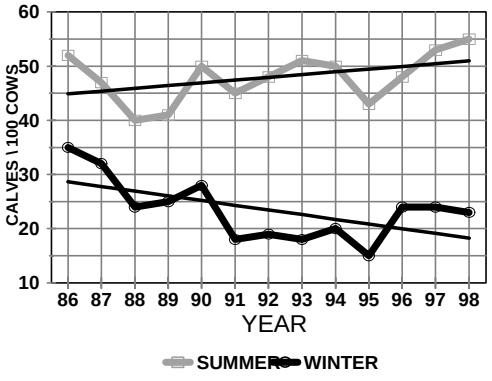

Figure 3. Calf Ratio Trend, Blue Mtns., WA.

Forest, and could result in a continuing decline in elk populations in the Blue Mountains.

Augmentation\Habitat Enhancement

Habitat preservation and enhancement projects continue on the Wooten and Asotin Wildlife Areas, mostly in the form of weed control; yellow-star thistle and knapweed. It is becoming more difficult each year to find money for matching Elk Initiative and Rocky Mountain Elk Foundation projects. As a result, fewer projects are being developed and proposed for funding.

Elk Damage

Elk damage complaints continue to be a major management problem in historical areas: GMUs 154, 162, 178, 172, and 181. A permit controlled, antlerless only muzzleloader season was implemented in GMU 181 (Couse) in December, 1997 and continued in 1998. This was an attempt to use a low impact season to move 100-150 elk back into traditional wintering areas in GMU 172, and has resulted in only 26 cow being harvested in two years. Surveys conducted in March, 1998 produced a count of 26 elk in the Couse unit, while the survey in 1999 resulted in no elk observed. The number of elk counted in GMU 172 (Mt. View) increased by 119 elk (345 to 464), indicating the muzzleloader season was successful in moving this group of elk back into the Mt. View unit.

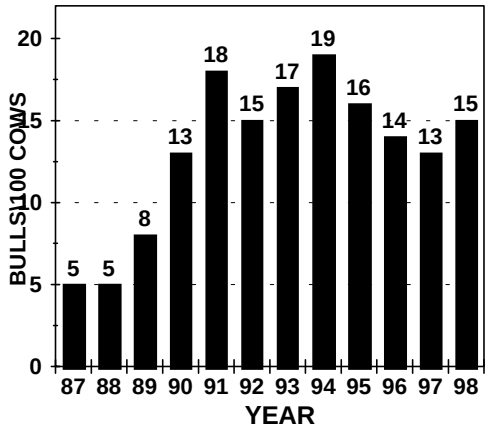

Figure. 2 Bull Ratio Trend, Spike Only GMU's, Blue Mtns., WA.

Hotspot and Landowner antlerless permits are excellent tools for targeting damage areas. However, the number of permits issued, and the conditions and procedures under which these permits are issued must be carefully coordinated in order to maintain management objectives, and accomplish damage goals without jeopardizing these damage control tools.

One-way gates have been installed in the elk fence between the Wooten Wildlife Area and Charley Creek. The gates are installed to allow elk on agricultural land outside the fence to move back onto National Forest and WDFW land. During surveys in March, 1999, only four bulls were observed outside the fence where we traditionally counted 50-100 elk. Hunters and Department personnel have confirmed elk are moving back through the one-way gates onto public land. This should allow the WDFW to reduce the damage kill in GMU 178 (Peola).

Management Conclusions

The spike-only management program has improved the age class structure of the adult bull population resulting in a significant improvement in breeding efficiency. Another positive effect is the dramatic increase in the quality of adult bulls available for harvest (Figure 2, Table 2).

The Blue Mountains elk herd continues to suffer from low calf survival, which has a negative impact on the elk population, and reduces the number of yearling bulls available for harvest under the spike-only program. Elk populations on the west side of the Blue Mountains are relatively stable and near management objectives, with the exception of GMU 166 (Tucannon) east of the Tucannon River. Elk populations on the east side of the Blues, and in Unit (169) Wenaha are below management objectives by approximately 1,100 elk. Elk populations on the eastside of the Blue Mountains can only improve if calf survival increases dramatically, and we are able to significantly reduce cow elk mortality.

The Blue Mountains elk population will not increase significantly until several factors that are negatively impacting this elk herd are brought under control. First, calf elk survival must improve dramatically. Second, habitat values that have declined due to roads, logging, noxious weeds, and fire suppression must be reversed in order for elk to fully utilize the available habitat on public land. Third, the Blue Mountains Elk Control Plan has been very effective by improving landowner\WDFW relations, but new and innovative techniques and options must be developed and financed in order to increase landowner tolerance of elk on private land. And fourth, continue to work toward the development of a cooperative management program with treaty tribes. The Blue Mountains elk population will not increase in the near future unless we reverse and\or control these four factors impacting the Blue Mountains elk herd.

Species	Region	PMUs	GMUs
Elk	**3**	**32-36**	**328-372**

Prepared by: **Jeff Bernatowicz, Wildlife Biologist**
Leray Stream, District Wildlife Biologist

Population Objectives/guidelines

The population objectives for Yakima and Colockum elk herds are 13,000 and 6,500 elk with post season bull ratio's near 12 bulls per 100 cows.

Hunting Seasons And Harvest Trends

Hunting seasons were changed to a consistent opening date in 1997 and 1998 for all eastside elk populations. Historically, the Colockum units opened earlier than Yakima units. We are also in the fifth year of spike only bull hunting during the general seasons with branched antler bulls by permit. Archers and muzzleloaders may take antlerless animals in some areas.

We avoid hunting during the peak of the rut (mid-late September). Damage seasons in Region 3 begin as early as August 15 in the Cle Elum area. Early archery seasons begin on September 1. Archery season runs for 14 days. Damage seasons vary in length depending upon local damage situations. General muzzleloading seasons begin in early October and run for seven days in selected units. Modern firearm seasons begin in late October and run nine days. Late muzzleloader and bow seasons run from late November through early December. Modern firearm permits, in damage areas may run through December. The late muzzleloading and modern firearm seasons are designed to reduce elk damage.

In 1998, the number of elk hunters in Region 3 increased 11 percent, but was 10 percent below the ten year average (Table 1). Muzzleloader hunters were the only user group above the ten year average. Hunter success was up from 1998 and near the ten year average.

Harvest in both the Yakima and Colockum units increased from record lows in 1997, but was below the ten year average (Table 1). Bull harvest increased approximately 30 percent, but was 12-20 percent below the ten year average. Antlerless harvest, which is dictated mostly by permits, declined six percent in the Colockum and increased 108 percent in the Yakima units. The antlerless harvests were 60 percent and 18 percent below the ten year average.

Surveys

Post season aerial surveys were conducted in February (Colockum) and early March (Yakima) 1999. Survey units were stratified and randomly selected. We covered 30 percent (n=9) and 36 percent (n=14) of the Colockum and Yakima survey units. In addition we ground surveyed feedlots in the Yakima area.

Calf:cow ratios remained at the lowest levels since aerial surveys began in 1990 (Tables 2 and 3). Recorded bull ratios increased in the Colockum and decreased in Yakima. Both remained below the goal of 12 bulls:100 cows. However, we believe the 1999 trend in bull ratios is inaccurate. Bulls tend to be in a clumped distribution in February. We only surveyed roughly 33 percent of the units in 1999 and probably didn't get an accurate representation of bulls.

Population Status And Trend Analysis

The current population estimates for the Colockum and

Table 1. Elk harvest and hunter numbers and success in Region 3.

	Colockum Harvest		Yakima Harvest		Regional Hunter Numbers				Regional Hunter Success			
Year	Bull	Antlerless	Bull	Antlerless	Modern	Muzz.	Archery	Total	Modern	Muzz.	Archery	Avg.
1986	715	437	754	516	24265	1346	3440	29051	9%	13%	5%	8%
1987	564	579	824	482	21505	2163	4173	27841	8%	22%	6%	9%
1988	797	735	1492	1152	23054	2530	4473	30057	15%	17%	9%	14%
1989	977	537	1294	901	25785	3323	3992	33100	11%	14%	9%	11%
1990	621	761	1595	1016	NO	DATA			NO	DATA		
1991	611	652	1348	1246	26928	4086	5865	36879	11%	10%	7%	10%
1992	801	613	1513	1020	26513	4618	5989	37120	11%	12%	6%	11%
1993	550	433	782	770	26328	5503	6114	37945	6%	9%	7%	7%
1994	542	731	970	2418	21341	5517	5622	32480	17%	11%	9%	15%
1995	469	660	631	892	20288	6190	4819	31297	9%	6%	8%	8%
1996	449	593	911	1069	21237	5490	5558	32285	10%	7%	8%	9%
1997	335	255	717	426	18253	3918	3701	25872	6%	9%	9%	7%
1998	492	239	975	889	20128	4705	4362	29195	8%	11%	9%	9%
10 Year Average	615	597	1125	1091	22985	4588	5049	32622	11%	11%	8%	10%

Yakima herds are 5285±2048 and 16786±4334 respectively. The actual populations are believed to be at the upper end of the range. In 1998, we counted 3809 elk in the Colockum while surveying 40 percent of the units. During deep snow we've been able to account for 13,000-15,000 elk in the Yakima herd (excluding PMU 34). In GMUs 371 and 372, the population is estimated at 1000 elk.

Table 2. Colockum elk - winter Population composition counts for 1990-99. C:100:B is calves and bulls per 100 cows.

	Bull Antler Class						
Year	Prime	Raghorn	Yearling	Total	Cows	Calves	C:100:B
1990	21			21	918	336	37:100:2
1991	23			23	559	213	38:100:4
1992							
1993	4	2	22	28	1439	607	42:100:2
1994							
1995	17	19	14	50	1197	409	34:100:4
1996	48	18	88	154	1597	486	30:100:10
1997	56	19	16	91	1581	467	30:100:6
1998	41	19	88	148	2807	854	30:100:5
1999	38	38	25	101	1181	327	28:100:8

Table 3. Yakima elk - winter population composition counts for 1990-99. C:100:B is calves and bulls per 100 cows.

	Bull Antler Class						
Year	Prime	Raghorn	Yearling	Total	Cows	Calves	C:100:B
1990	28	0	0	28	929	371	40:100:3
1991	28	0	0	28	432	195	45:100:7
1992							
1993	9	4	51	64	943	457	48:100:7
1994							
1995	23	12	5	40	748	396	53:100:5
1996	18	15	126	159	1719	604	35:100:9
1997	10	28	44	82	610	254	42:100:13
1998	94	187	274	510	4085	1333	33:100:14
1999	46	363	230	639	5933	1960	33:100:11

The Colockum elk herd appears to be decreasing. Assuming an average post-season population of 5285 and 34 calves:100 cows, there would be 1302 calves in March. If mortality were ten percent from March to hunting season, recruitment to the yearling age class would be 586 bulls and 586 cows. Harvest has averaged 615 bulls and 597 antlerless over the last ten years (Table 1).

The Yakima herd (excluding PMU 34) is likely increasing. Assuming an average population of 15,000 and 40 calves per 100 cows, there would be 4127 calves in March. Recruitment to hunting season with a 10 percent mortality would be 1887 yearling bulls and 1887 cows. Harvest has averaged 1047 bulls and 1048 cows.

Population models for the southern portion of PMU 34 (GMU 372) indicate a growth of ~20 percent annually. Elk have only recently been seen significant numbers in the northern portion (GMU 371).

There is currently a wide variance on the population estimates, herd composition and mortality. Population models need to be refined. However, the available data does raise concern over the Colockum herd.

Habitat Condition And Trend

During the past three seasons weather patterns have been favorable, resulting in improved forage production on all ranges. However, the summer of 1998 was a very dry period with no green up until December. The Yakima winter ranges are generally in good condition notwithstanding the dry summer.

The Colockum winter range forage quality is likely decreasing. All the winter wheat have been converted to CRP**.** The older CRP is in crested wheat grass which is unpalatable to elk.

Most of the summer range for both herds is managed by; U.S. Forest Service, Washington Department of Natural Resources, Boise Cascade Corporation, Plum Creek Timber Company and Longview Fiber Corporation. Habitat suitability for elk varies across these ownerships depending on management emphasis. Timber management on summer range is generally shifting away from large clear-cuts in favor of smaller clear-cuts or selective cuts. Management of the Forest Service land is shifting toward a late serial emphasis. These changes in forest management are resulting in reduced forage production on summer range. The reduction in forage production along with an increased awareness of watershed impacts is beginning to generate concern about accumulative ungulate grazing that is occurring on summer range used by elk in Region 3.

Wildlife Damage

Elk damage to agricultural crops is a concern throughout Region 3. Most of the serious problem areas within the Yakima elk area have been fenced. However, in some areas the fence is deteriorating and needs to be rebuilt. Most of the Colockum herd is not fenced. Damage is being managed by an early and late muzzleloader hunt. The boundaries of the hunt are drawn depending on where damage is occurring. The program has been fairly successful.

PMU 34 (Alkali and Kiona) does not have fences to prevent damage. The rapidly growing PMU 34 herd has reached the point of tolerance for many surrounding landowners. A plan being adopted to capture and transplant 500 elk from the herd.

Management Conclusions

The available data indicates harvest may be exceeding recruitment in the Colockum Herd. Recruitment and range quality are also decreasing. Reducing bull harvest while maintaining antlerless harvest is recommended until more

accurate population models are developed. The limited flight budget in the region should focus on the Colockum Herd in the near term.

The Yakima Herd has exceeded the goal of 13,000 elk and the bull component in near the goal of 12 Bulls:100 cows. A large portion of the herd in PMU 34 is scheduled to be removed through trapping-relocation. The remainder of the herd should be decreased through increasing antlerless harvest over the next three to five years.

Species	Region	PMU	GMUs
Elk	**Four**	**45**	**418 & 437**

Prepared by: Mike Davison, District Wildlife Biologist

Population Objectives/guidelines

The long-term management objectives for the Nooksack elk herd are:

1. Stabilize and/or reverse the downward population trend in the Nooksack herd.
2. Reverse the pattern of outward migration of elk from the central portion of the range to peripheral (agricultural damage) areas.
3. Maintain the number of elk occupying lowland agricultural habitats at or below current levels.
4. Increase population numbers to a minimum of 750 animals on primary elk range.

More specific objectives and strategies for management of the Nooksack elk herd include:

1. Increasing the scientific database by expanding the level of herd composition surveys (pre and post season) necessary to complete population reconstruction and/or modeling techniques;
2. Increase precision and accuracy of tribal and recreational harvest reports;
3. Monitor elk numbers and distribution in agricultural damage areas;
4. Increase elk population numbers in GMU 418 to a minimum of 750 animals by maintaining a conservation closure, enhancing road management, and habitat enhancement projects;
5. Promote expansion of the Nooksack elk herd into newly designated elk range south of the Skagit River (GMU 437 Sauk) by maintaining a conservation closure in GMU 437, maintaining hunting pressure on elk utilizing agricultural lands in order to encourage depredating animals to migrate into GMU 437, and potentially by re-introduction (transplants) of elk into newly designated range;
6. Manage the Nooksack elk herd for a minimum five percent annual growth rate by maintaining post season bull ratios of 12 or more branched antlered bulls per 100 cows and an average of 30-45 calves per 100 cows;
7. Reduce damage caused by elk through the use of special hunting formats (hot-spot hunts, landowner damage hunts and landowner preference permits),
8. Increasing forage enhancement projects on public and private lands adjacent to damage areas.
9. Encouraging development of motorcycle, ATV, horse and hiking trail systems in elk range areas peripheral to damage areas.

Hunting Season and Harvest Trends

Conservation closures were established in both GMUs 418 and 437 in 1997 as outlined in the management strategies for the Nooksack elk herd (Draft Nooksack Elk Herd Plan, 1997). Tribal hunting pressure is less significant on an individual tribe basis than from a cumulative impacts perspective. Of the 11 tribal signatories associated with the Point Elliott Treaty (ratified March 8, 1859), 7 have been documented hunting the Nooksack elk herd. To date, it has been assumed that all seven active tribes have voluntarily complied with the Conservation Closures. Tribal compliance with the existing Conservation Closure has been generally good but a number of violations have been documented and or reported during the 1998 season. Tribal harvest report summaries for 1998 indicate only one bull elk was harvested in GMU 418. Harvest report card returns for non-tribal hunters indicated a total of 36 elk taken in damage oriented hunts during the 1998 season.

Surveys

Herd composition surveys were completed on Sept. 28-30, 1998. Only 45 total elk were classified for the three flights combined. This number represents a significant decline from previous years and is considered an inadequate sample size for establishing meaningful population estimates via population modeling. Previous year surveys have been conducted earlier in the season (late July and early August), at a time when visibility of animals was better. Survey efforts for the future may be moved earlier to increase sample size.

Population Status And Trends

The Nooksack Elk Herd Plan (Draft 1997) identifies the development of a statistically valid population model as the highest research priority for this herd. Funding provided by the Upper Skagit Tribe has significantly increased available flight time for herd composition surveys but may have arrived too late due to current low elk population numbers and distribution. Current population estimates for the Nooksack Herd based upon field observations, place current numbers of elk between 250 and 300 animals. Elk numbers and distribution within the central range does not appear to have changed from previous low levels. However, the numbers and distribution of elk in the peripheral lowland habitats, generally associated with elk crop depredation problems, appears to have significantly declined resulting in fewer damage complaints during 1998.

Habitat Condition And Trends

Habitat analysis has not been updated from earlier Landsat/GIS work completed in 1991. Upgrade of this earlier habitat work is considered a high research priority and will require relatively little effort beyond purchase of current (Year 2000) Landsat flight data. Problems limiting the current effectiveness of the Nooksack elk range continue to include, high road densities on both summer and winter range areas, cumulative disturbance impacts from multiple recreational and management uses on the land, and increased development of trails (hiking, horse, and ORV). Housing development and conversion of forest lands to agricultural and/or industrial use is accelerating and poses the greatest threat to elk habitat in the future.

Wildlife Damage

The Wildlife Enforcement Division reports a substantial

decrease in the number and distribution of elk related damage complaints received during the 1998 season. Estimates of elk numbers occupying agricultural damage areas have decreased from 150-200 animals in 1997, to 75-100 by the end of 1998. A total of three damage related kill permits were issued to local landowners during 1998 with only one elk actually harvested. Damage oriented hunting seasons in Whatcom and Skagit counties resulted in the harvest of only five animals during 1998.

Augmentation/habitat Enhancement

Grant proposals submitted to the Rocky Mountain Elk Foundation for habitat enhancement, research, and elk relocation (augmentation) projects were not approved in 1998 or early 1999. Therefore, no augmentation or habitat enhancement programs were implemented within the primary range of the Nooksack Elk Herd during the 1998 season.

Management Conclusions

Management recommendations for the Nooksack Elk Herd and associated habitat include the following:

1. Continue efforts to establish a statistically valid population estimate via population modeling. Shift of the survey time period for aerial herd composition surveys to late July and early August, in an effort to increase elk classification sample size.
2. Continue road closure agreement with DNR and Crown Pacific, Inc. in primary winter range areas.
3. Evaluate the potential for a paint-ball marking research project in the Nooksack.
4. Maintain and/or upgrade existing habitat enhancement projects.
5. Establish new habitat (forage enhancement and road closure) projects in key summer range areas.
6. Maintain elk population numbers in agricultural damage areas at or below current estimated levels (75-100 animals).
7. Evaluate the potential for a transplant project in GMU 418 (Nooksack) and 437 (Sauk).

Species	Region	PMU	GMU
Elk	4	48	485

Prepared by: Rocky Spencer, District Wildlife Biologist

Population Objectives/guidelines

The Green River Elk Herd is a relatively small and compact population that continues to decline. Elk historically occurred in the Green River, but numbers were limited. In the early 1960s with increased timber harvest, elk populations expanded. There are no historical population estimates, but late winter-early spring numbers likely peaked at between 800-1,000 elk between 1988 and 1991. The 1997 late spring\early winter population estimate is 227 elk (range 177 to 277). The current elk population estimate is about 110-140 animals and continues to decline.

Because the majority of this herd resides within the boundaries of a municipal watershed, public access has been restricted and hunting has always been limited. Historically however, hunters would ignore this restriction and risk a potential trespass fine for the opportunity to kill a trophy bull. This unregulated access created potential water quality problems and in 1984 the City of Tacoma and the Washington Department of Fish and Wildlife (then Department of Game) cooperated to create a unique game management unit (GMU 485) for a limited entry elk permit hunt. Unauthorized trespass and hunting closed season violations are effective deterrents, virtually eliminating unrestricted access. In addition this created the cooperative management opportunity for mature quality bulls and highly successful antlerless hunting.

Our management objective for this herd since 1984 has been to maintain and enhance the opportunity for both trophy bull hunting and maintain high success rates for antlerless elk hunting. Despite its small size this herd has a reputation for meeting management objectives, providing a high hunter success rate, including trophy bulls and has been one of the most popular permit hunts in Washington State.

Hunting Seasons and Harvest Trends

Hunters may enter and exit this GMU at one of two specified gates, providing the opportunity to check every harvested elk. Beginning in 1984, 50 either-sex elk permits were allocated each year for the five-day all citizen season. Hunters focused on the branched bulls and subsequent composition surveys revealed a decline in this herd component. Subsequently permit allocation was changed beginning in 1986 to reduce bull harvest and increase antlerless harvest. In 1996, 35 antlerless, and 15 branched bull permits were issued.

Beginning in 1992 the Muckleshoot Tribe began exercising treaty hunting rights in the Green River. Subsequently, permit allocation has changed to include the Tribe: 1992 and 1993 - 15 elk (6 spike, 9 antlerless); 1994 - 31 elk (6 spike, 19 antlerless, 6 br. bull); 1995 and 1996 - 43 elk (6 spike, 35 antlerless, 2 br. bulls). Permit numbers totaled 93 for both hunts combined. No permits were issued in 1997 and in 1998.

Total elk harvest remained fairly consistent for the years 1984-1991, averaging 46 elk. Between 1992 and 1994 average harvest increased to 57 elk, dropping notably to 44 and 25 elk respectively in 1995 and 1996 despite the same permit level allocation (Figure 1). These are seemingly minor increases and changes in harvest and yet are an important consideration for this particular herd.

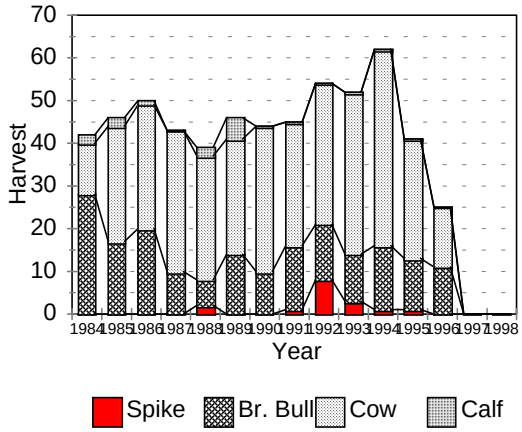

Figure 1. Harvest of Elk in GMU 485.

Prior to 1992 these regulations met our management objectives. The increase in harvest from 1992-1996 may have adversely affected the population. There were no permits in 1997 or 1998.

The hunter success rate was initially high, averaging 91 % (range 78-100 %) between 1984 and 1991. Between 1992 and 1995 the success rate declined, averaging 67 % (range 44- 83 %). The 1996 success rate of 27% was a notable exception to the past and the lowest recorded since 1984 (Figure 2).

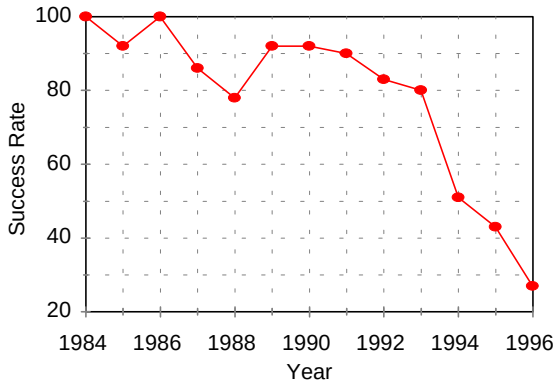

Figure 2. Hunter success for elk in GMU 485.

The Muckleshoot Tribe collects age and reproductive data during their established hunt. The tribe also contributes by providing flight dollars for composition flights. Permit levels and allocation result from yearly meetings between the Tribe, State, and Tacoma Public Utilities.

Surveys

Prior to 1986 elk composition was primarily from the ground by foot or vehicle; standardized helicopter surveys are now the primary method, supplemented with ground surveys.

Pre-season (September) Bull:Cow:Calf ratios from 1984 - 1998 are presented in Table 1. One notable point for discussion are the extremely low calf survival rates. The preseason composition shows a general decline in calf:cow ratios since 1984. These rates are below the average for other western Washington herds. Beginning in 1996, flights in June, July, and August was conducted to better assess calf production at parturition and to document and compare recruitment with traditional September composition surveys. Calf:cow ratios averaged 40:100 for June-August and declined to 26:100 by September. Inadequate funding caused this survey to be in scaled back in 1997. In 1998 no preseason flights were conducted because of population declines.

Table 1. GMU 485 Pre-season Elk Herd Composition 1984-1997 (all ratios per 100 cows) no flights in 1998.

Year	Spikes	Br. Bulls	Total Bulls	Calf
1984	7	21	28	41
1985	8	12	20	36
1986	8	19	27	30
1987	13	14.5	27.5	22
1988	7.5	36	43.5	35
1989	5.3	28	33.3	28
1990	5.4	31	36.4	26
1991	7.5	26	34	15
1992	5	30	35	33
1993	3	26	29	20
1994	8	30	38	22
1995	11	29	40	26
1996	7	29.5	36.6	25
1997*	8.3	27.7	36	30

* includes data from July 97 flight- elk not mixing at this time. No surveys were conducted in 1998 because

Our preseason branched bull ratios have generally increased since 1984 and stabilized at about 29:100 cows. Pre-season for branched bulls have remained stable for the 1994-1997 period. No data was collected in 1998.

Post season (March)composition counts since 1985 have shown a general decline in calf recruitment (Table 2). Branched bull composition increased until 1991, stabilized from 1992-1994 at about 21: 100 cows and dropped in 1995, 1996, rose slightly in 1997 and declined again in 1998. The low spike recruitment in 1993 though 1996 could account for the subsequent decline in branched bull ratios. This data should be viewed with caution because post-season branched bull counts may under represent bulls.

Table 2. GMU 485 Post-season Elk Herd Composition 1984-1998 (all ratios per 100 cows)

Year	Spike	Br. Bull	Total Bull	Calves
1984	5.5	3	9	21
1985	6	4	10	30
1986	4	9	13	23
1987	5	5	10	15
1988	8	11	19	22
1989	6	12	18	21
1990	7.5	19.5	27	15
1991	7.4	23	30	14
1992	9.3	11	20	21
1993	3.4	18.5	22	12
1994	3.7	16	20	13
1995	4.3	9.2	13.5	10
1996	2.3	6	8.4	11.5
1997*	3.4	23.5	27	7
1998	1.8	12.7	14.5	6.4

* flight and data provided by D. Vales, Muckleshoot

Population Status and Trend Analysis

In 1994, 156 elk were marked with paintballs fired from CO2 rifle using a Bell 206B helicopter. Three resurvey (recapture) flights were flown with 1,206 total and 202 marked elk seen. An average of 56% of the total marked elk were seen for the three flights combined (range 55.7-79.5%). The estimate was 612 elk (range at 95% CI is 544 to 680) including 460 cows, 50 calves, 85 br. bulls, and 16 spikes. This type of mark-recapture estimate has been successful in Washington for estimating elk populations.

There are no historic population estimates for comparison, but our long history and experience with this elk herd from field observations and sub-herd location suggests this herd has declined from about 1992 to the present. Also, the total number of elk counted post season helicopter composition flights in March has shown a decline from 1992 thru 1998. This suggests a decline in the population and generally supports our field observations (Figure 3).

Our 1994 population estimate indicated only 50 elk calves were recruited to the population. This coupled with the decline and low recruitment indicated from post season composition counts since 1985 suggested a declining population. Increased harvest in declining populations can compound the problem by increasing the rate of decline. Other factors that may be affecting this herd are 1) a density dependent decline associated with changes in several forest stages which reduces winter range carrying capacity and elk numbers exceeding carrying capacity. This can have a negative effect on recruitment and there is some data to support this hypothesis; 2) predation may be affecting recruitment; predation mortality may be additive and not compensatory. This GMU is closed to harvest of bear and mountain lion and these predators are likely at maximum

densities relative to prey availability. Analysis of mountain lion elk kills (n=28) found highly significant statistical selection for elk < 1 year old. Certainly a combination of these variables should be considered.

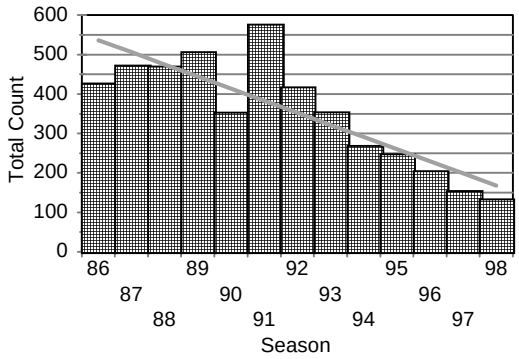

Figure 3. Total counts of elk during helicopter census in GMU 485.

In March\April 1997 we conducted another paintball mark\recapture estimate. This was the first opportunity to assess population changes since 1994. We suspected the 1997 population estimate would show a decline from the 1994 estimate of 612 elk. The 1997 estimate was 227 elk (range 177-277). Please see GMU 485 Mark-Recapture Population Estimate-Final Report 1997 for results and discussion. The winter total trend count in 1998 was 133 elk, again suggesting a decline in the population (Figure 3).

In addition, mortality data from radio equipped adult cows is currently about 27% per year (D.Vales per. Comm. 1999). This far exceeds recruitment rates and forecasts a continued population decline.

Calf Mortality Study

The WDFW initiated calf mortality study in May of 1997 and again in June 1998 to determine the sources of elk calf mortality. This was a cooperative study that included the Muckleshoot Indian Tribe, City of Tacoma, Public Utilities, Weyerhaeuser and Plum Creek Timber Companies, and the Army Corp of Engineers. Preliminary results suggest that predation, predominantly mountain lion is the primary source of death to radio equipped calves. However, based on preliminary data, the nutritional status of radio equipped adult cows, many of which are associated with these calves is poor, and this also may be affecting calf survival and their vulnerability to predation. These results are preliminary and no definitive conclusions will be available from the study will be available until June 2000.

Habitat Condition And Trend

The area has intermingled ownership of private, state, and federal timber lands. Most of the timber lands are intensively managed and create a mosaic of seral stages. Average rotation between successive harvests is about 60 years on private and state lands. These managed lands are interspersed with remnant old growth forest, primarily in federal ownership, at higher elevations (> 2500 feet).

There is preliminary information to indicate that overall elk winter range carrying capacity in GMU 485 has declined from about 1955 to 1995. This was determined from a forage based model called HABSIM (Raedake 1995) that essentially tracks forest seral stages and quantifies the change in the amount determined as forage and elk numbers for each seral stage over time. This could be affecting elk recruitment as discussed earlier.

We are currently preparing a Geographic Information Systems (GIS) habitat evaluation of elk winter range to further evaluate the potential influence of habitat changes on this elk population.

Augmentation/habitat Enhancement

Considering augmentation of approximately 125 elk in late winter-early spring of 2000. The WDFW is now considering augmenting this elk herd with the addition of approximately 120 elk, primarily cows and calves. If predation is the limiting factor affecting recruitment, the objective would be to "swamp" the effects of predation through augmentation. If nutrition is the primary factor influencing recruitment then we should expect continued decline in this herd and augmentation would not be an effective alternative.

Wildlife Damage To Private Property\ Nuisance Problems

Elk in this GMU are not a problem to private property and we have no nuisance problems.

Habitat Enhancement Activities

We are currently working cooperatively with the U.S. Army Corp of Engineers, Tacoma Public Utilities, and the Muckleshoot Tribe to create open meadow grass habitat plots for elk. These are mitigation measures enacted to compensate for the anticipated loss of habitat from raising the Howard Hansen Dam and subsequent loss of habitat due to additional water storage.

Management Conclusions

Low elk calf recruitment rates are a concern for this elk herd. Continued low recruitment and the antlerless harvest rate up to 1996 were incompatible. Our 1997 paintball mark-recapture population estimate documented a 42% decline in this population.

The low post season spike ratios from 1993 through 1998 (1.8:100 cows) are a concern and now affects bull recruitment rates. Our management goal is to increase the population to a minimum 550 elk and maintain high bull to cow ratios and ensure a majority of bulls reach the prime age class (5-10 years).

This permit hunt is one of Washington's most popular because of the opportunity to harvest and view quality bulls and the high success rates. We did not issue elk permits for the 1997 and 1998 season because of the continued population decline. No permits will be issued in 1999.

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Species	Region	PMUs	GMUs
Elk	**4**	**48**	**472**

Prepared by: Rocky Spencer, District Wildlife Biologist

Population Objectives/guidelines

The White River Elk Herd is moderately sized; current winter population estimate is 829 elk (range 693 to 966) (winter estimate 1995), which is lower than historic estimates. Between 1978 and 1987 wintering elk likely ranged between 1100 to 1500. We are currently working to increase the population to a level near 1150-1250. This will involve coordination with native American Tribes to establish harvest levels.

This elk herd has received intensive management attention during the last nine years. Focused management was needed because of the combined elk harvest during established all citizen seasons and hunting by several Native American Tribes, primarily during the winter. Additionally, habitat analysis trends indicate the carrying capacity has gradually declined during the last 10 years.

This is a classical migrating elk herd. Beginning in early spring elk begin moving up from winter range into Mt. Rainier National Park. Park habitats consist of a mosaic of densely forested valleys of old growth timber to a patch work of forest and subalpine lush meadows at higher elevations. Elk remain within the Park through the September and early October breeding period and begin to move to the lower elevation winter range with the first snowfalls. Approximately 85% of this elk herd is migratory. Elk winter on lands owned by private timber companies, and federal and state timber lands.

Hunting Seasons And Harvest Trends

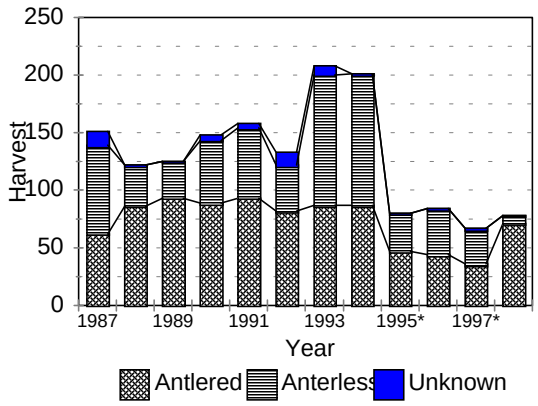
Management strategies for this elk herd changed over the years. These changes were implemented to address the unique elk harvest circumstances and to increase the mature bull component. From the early nineteen seventies-any bull was legal; about 50 antlerless permits were issued annually until they were discontinued in 1978. Any bull hunting continued until 1987, when a 3 point or better restriction was implemented to increase post hunting season bull ratios. In 1992 management direction changed to spike only hunting and branched bull by permit. Essentially a quality management approach that recognized increased mortality and antlerless harvest by Native American Tribes.

This management approach was reviewed and analyzed during 1996. The 1997 hunting season was made permit only for all hunters. This allows more accurate determination of hunting mortality by state authorized hunters. Public opposition to this permit hunt led to a change back to 3-point or better bull hunting in 1998.

The states elk hunting seasons are 14 days for archery during the first two weeks of September and a modern firearm 9 day season from early to mid November, dates change with calendar date adjustments.

Individual tribes establish their own off reservation hunting seasons, which in general run from September though December or January, but can extend to early February. We have asked tribes that hunt this GMU to close seasons at the end of December because of the potential concern for overharvest.

Known harvest in GMU 472 (White River) in 1997 was 67 elk (36 antlered, 31 antlerless), including tribal harvest. This is similar to the 1996 season, but is lower than the average reported for 1987-1992. In 1998, overall harvest increased slightly, but changed notably; with 71 bulls and only 7 antlerless elk reported in the harvest. This the lowest antlerless harvest recorded in the past 12 years (Fig. 1). Actual harvest may be higher, not all tribes have reported their harvest for the 1998-99 season.



*does not include unknown harvest by native american ti

Figure 1. Harvest of Elk in GMU 472.

Hunter pressure continues to be low compared to historic levels but did increase from 1997. The number of state authorized hunters for years 1984 to 1998 is presented in figure 2. The number of hunters increased in 1998 with the change from permit only to 3-point or better bull hunting. Hunter

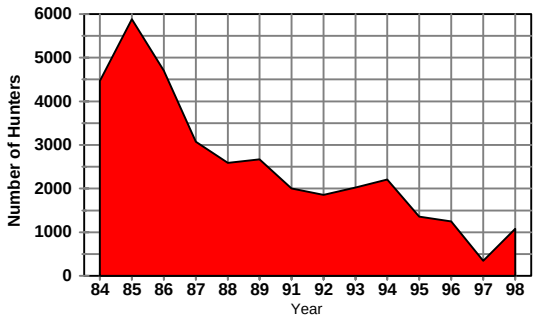


Figure 2. Number of hunters 1984-1997

success rates have ranged from 2% to 4% during this period. Tribal hunting increased during the mid to late 1980's and continues today, but we have no information on the number of tribal hunters or success rates.

The spike-only branched bull by permit regulation was effective in increasing the percentage of branched bulls in the population based on data collected from pre-season composition counts during the years this regulation was in effect.

Record snowfall limited hunter access to traditional hunting areas during all citizen and tribal seasons in 1996, but returned to a more traditional level in 1997 and 1998.

Surveys

Initial fall population surveys consisted of aerial surveys using a fixed wing aircraft following a standardized survey route established in 1978 and continued to the mid 1980s. These surveys were supplemented with on ground surveys to collect elk herd composition data. Beginning in 1988 we replaced the fixed wing flights with a Bell 206B helicopter, following the same survey route. This increased efficiency and accuracy counting total elk numbers and permitted simultaneous collection of composition data. All flights are conducted during September and October evening hours (1700 to 1945 hrs. military hours) to maximize the potential to view elk groups.

The park is divided into "range units" and elk groups are counted in these units. Following three replicate flights an average number of elk sighted is determined for each range unit; this is used to calculate the E4 value. Based on elk work done elsewhere and experience in this park we assign a correction factor (1:1) and calculate the population index.

The real value gained from these flights is the ability to have a long term and repeatable index to evaluate changes in the population, collect composition data, and develop appropriate management strategies. Generally, these population index methods can result in a slight underestimate of the total population.

We fly a Bell 206B helicopter on standardized survey routes over known elk winter\spring range. Flights are conducted between mid-March and mid-April following spring vegetation "green up" to optimize viewing efficiency. Surveys are timed just prior to elk movement to higher elevations and Mt. Rainier National Park.

A paintball mark\recapture technique was used estimate population numbers. Elk were marked with red paint fired from a paintball gun using a Bell 206B Helicopter with a pilot, shooter, and recorder. Elk groups were counted and composition determined then are approached by the helicopter and painted (marked). Because of behavioral differences and habitat segregation, males and females were marked disproportionately. We intentionally attempted to mark all branch antlered and yearling bulls, approximately 10% of females and 30% of calves.

Marking is done in mid to late March; resurveys are conducted in late March through April and are spaced at least 4 days apart to ensure adequate "mixing" of elk. Timing is crucial: to 1) ensure optimal marking and resighting of elk and 2) allow adequate time to complete resurveys prior to shedding of elk winter pelage and paint marks. This timing also ensures limited public opportunity to see marked elk while recreating.

Three resurvey flights were conducted and the number of marked to unmarked elk was recorded. This method shows great promise, and we have achieved excellent results. The paintball marking technique saves considerable cost and time compared to traditional mark\recapture efforts.

We currently are examining the potential to provide confidence intervals for fall and winter\spring composition and fall population index counts.

We contracted with the University of Washington Center For Quantitative Sciences to test for homogeneity across the classes (cow, spike ,branch bull, calf) using contingency tables and chi-square test. This determined if classes and surveys could be pooled to reduce variance in abundance estimates. Variance, standard error and coefficient of variation were also calculated. The analysis was designed by Dr. John Skalski and Nancy Gove.

Pre-season ratios are presented in Table 1. The data indicate a fairly stable yearling bull (spike) component during the survey period with the exception of 1992 when spike ratios rose to 13.3:100 cows. We have no explanation for this increase; but it may reflect the higher calf productivity rate observed in 1991 coupled with an above average spring\winter calf survival rate.

Table 1. GMU 472 Pre Season Composition 1988-1998.

Year	Spikes	Branched Bull	Total Bulls	Calf
1988	7.7	14	21.7	39
1989	9.2	12	21.2	40
1990	8	16.5	24.5	35
1991	5.6	16	21.5	45
1992	13	21	34	42
1993	6.5	24	30.5	27
1994	5.5	27	32.5	50
1995	8.2	18	20.2	35.5
1996	5.5	25.6	31	37
1997	7	23	30	38
1998	4.7	26	30.8	33.5

Calf:cow ratios in 1994 were the highest recorded in several years and may likely reflect 1) a relatively dry early spring and summer in 1994 increasing calf survival and 2) a relatively mild winter in 1993 which may have increased the overwinter nutritional condition of pregnant cows.

Post-season ratios are presented in table 2. In conjunction with paintball surveys, we collected 1994 post season composition data during the mark\recapture efforts in March and April of 1995. A total of 822 elk were classified by age and sex, this resulted in 1.7:17.6:100:34.4 spike:bull:cow:calf ratio.

Table 2. GMU 472 Post Season Composition 1988-1998.

Year	Spikes	Branched Bull	Total Bulls	Calf
1988	7.5	3.8	11.3	28
1989	6.8	4	11	38.5
1990	12.5	1.3	13.8	35
1991	6.8	1.8	7.6	33
1992	10.6	7.3	18	41.5
1993	9.6	3	12.6	36
1994	1.7	17.6	19.4	34.4
1995	5	9	14	42
1996	5.6	9.3	15	27
1997	9.6	18.8	28.4	26.7
1998*	7.1	9.7	17	20

*flight by Muckleshoot Indian Tribe, data from D. Vales 1999.

The low spike:cow ratio (6 spikes) is a notable concern and insufficient to maintain adequate recruitment to the bull herd component. The 1995 (flown March 1996) post season survey revealed spike ratios increased from 1.7 to 5 per 100 cows. The 1996 post season spike ratio was 5.6 to 100 cows and rose to 9.6 in 1997 (Table 2). This is the highest in four years and is likely a result of the permit-only regulation and limited snowfall during the all citizen season thereby reducing harvest.

It is interesting to note that in 1990, 1992, 1993 and 1995 post season calf:cow ratios equaled or were greater than pre season ratios. This may suggest unusually good recruitment or more likely, antlerless harvest, primarily adult cows, is artificially inflating post season calf counts. In 1997 and 1998, the calf:cow ratio dropped to 27 and 20:100 respectively, which may reflect difficult winter conditions, declining winter range carrying capacity, and poor adult cow survival. The 1998 postseason calf cow ratio is the lowest ever recorded for this GMU.

Population Status And Trend Analysis

Helicopter composition surveys have been flown over basically the same routes since 1988 (adjusted for habitat changes) during similar periods. Total elk counted from 1987-1992 averaged about 297 elk compared to 196 elk for the 1993-1996 period. Also, the 1995-96 count was the lowest recorded to date (Figure 3). The 1997 count was 255 and the 186 elk counted in 1998 represents a 27 percent decline.

Figure 4 shows FPI results and trend data for the period 1985-1998. These data indicate a general decline in the elk population from historic levels. This decline is most apparent from 1985-1989 followed by a slight increase and stabilization from 1990 to 1993. In 1994 we saw the population index decline to its lowest level; similar to the 1988 and 1989 index.

The 1995 FPI increased about 16% from 1994, but then declined again by about 20 percent in 1996 to 782 elk and then declined again in 1997 to 574 elk and rose slighlty in 1998 to

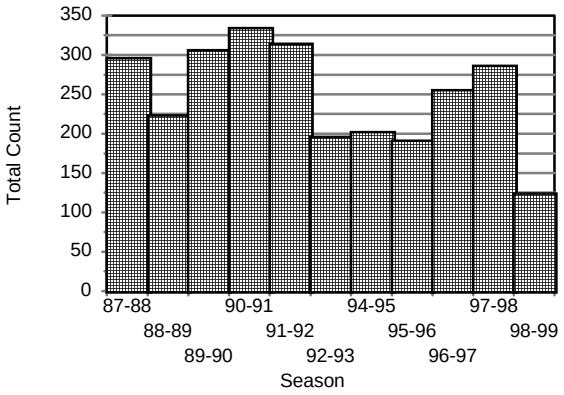


Figure 3. Total helicopter counts for GMU 472.

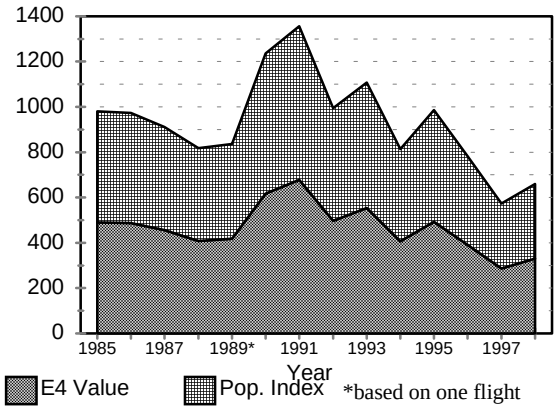


Figure 4. E4 and population index values for GMU 472.

660 elk. This is below historic levels. Two scenarios have been proposed to account for the declines and fluctuations in this population: 1) Density dependent mortality related to a decline in long term winter range carrying capacity and 2) antlerless elk harvest, primary associated with late season hunting is responsible for the decline and 3) Recently, yearly mortality rates from radio equipped adult cows is about 29% (D. Vales. Per comm 1999), this is far higher than current recruitment rates. Likely both all these factors play a contributing role in the population dynamics of this elk herd. However, we believe antlerless harvest, has historically, but not currently, been the most important factor affecting this population.

The 1994-95 mark-recapture population estimate was 829 elk, range 693 to 966; composed of 524 cows, 204 calves, 95 branched bulls, and only 6 spike (yearling) bulls. The spike (yearling) component is a notable concern. These ratios have increased in 1996 and 1997 and declined slightly in 1998 despite the 3 point antler restriction. The 1997 ratio is the highest in four years (Table 2).

The 1998 FPI is 660 elk, only a slight increase from 1997. However, the winter trend data for 1996 and 1997 indicates a slight increase in the population supporting this trend.

We suspect the population will continue to fluctuate and likely decline . This is due primarily to unregulated antlerless harvest coupled with the current adult female mortality rate based on data collected from collared adult cows. The adult female mortality is 29% (D. Vales, 1999), which exceeds current recruitment (table 2) for this population.

Habitat Condition And Trend

In general long term winter range habitat for this herd is declining. Based on similar forest management practices the forage based HABSIM model (Raedeke and Lemkuhl 1984) indicates a decline of about 15% from 1980 though 2030.

It is difficult to determine the degree to which this projected decline will effect the overall elk population. Particularly when we consider that changes in timber management practices could result in changes to this projection.

We are exploring a Landsat Geographic Information System project to more accurately model habitat conditions and determine trends.

The primary winter range received record snowfall in 1996\97 with "normal" snowfall in 1997\98.

Some development of permanent and summer residences have occurred within the winter range. There has been no assessment of the overall impact to the elk population. However, personal observations have indicated elk use the grass openings surrounding these homes during the winter\spring period.

Habitat that supports this elk herd is intermingled with public and private land. Currently numerous land exchange proposals are under consideration. No landowner assessment of habitat conditions and trends have been made since the 1984 Raedeke and Lemkuhl Report.

Wildlife Damage and Nuisance Problems

There are no nuisance or damage problems in this GMU.

There are summer homes and permanent residences within the winter range for this elk herd; however few complaints are received.

Management Conclusions

This elk herd is intensively managed. Our objectives are to provide quality bulls during general hunting seasons and to attempt to ensure ceremonial and subsistence use by Native American Tribes.

Currently, the most significant concern is to accurately determine harvest by state and tribal hunters and to monitor the population trend. Particular attention needs to be directed at the high adult female mortality rate. This is vital to proper herd management and population evaluation.

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Species	Region	PMUs	GMUs
Elk	5	Region 5	Region 5

Prepared by: Min T. Huang, Wildlife Biologist
Pat Miller, District Wildlife Biologist

Population Objectives/guidelines

The Washington Department of Fish and Wildlife's (WDFW) long-term population goal for elk (*Cervus elaphus*), in all Game Management Units (GMUs) of Region 5, is to maintain current population and harvest levels. General hunting GMUs are managed to achieve post season bull elk escapement goals of 12 bulls per 100 cows, while limited entry GMUs are managed for 15-25 bulls per 100 cows. Herd productivity is managed to be greater than or equal to the previous five year's mean, unless productivity was below maintenance levels during that period.

Hunting Seasons And Harvest Trends

Data on elk harvest, hunter success, and hunter effort is obtained annually through the WDFW hunter questionnaire and mandatory hunter report cards issued with each elk tag.

Elk are hunted under WDFW's resource allocation strategy. Hunters must choose a weapon type (modern firearm, muzzleloader, or archery), each of which has distinct seasons of varying length, designed to minimize the chance of over-exploitation and to provide equal opportunity. The exact length and timing of each season are determined by three year hunting packages, the latest of which was the 1997-1999 package.

In 1998, elk were managed under three principal harvest strategies in Region 5. During the modern firearm season these were; any-elk GMUs (564, 568, 574, 578, 582, and 588), three point GMUs (501, 504, 505, 506, 510, 513, 520, 530, 550, 558, 560, and 572), and permit only GMUs (524 and 556). Apart from the any-elk GMUs and GMU 501, antlerless harvest was allowed during archery seasons, and by permit during general firearm and muzzleloader seasons.

The experiment with spike-only, branched bull by permit, regulations in certain Region 5 GMUs was abandoned after only one year in 1998. All Region 5 GMUs, with the exception of the elk-elimination units, were managed under three point minimum antler regulations. Spike-only regulations were put in place in 1997 in an effort to increase adult bull survivorship. This change in management was met with strong public opposition. Reduction of the general season to nine days was also initiated in 1997 to reduce bull mortality. A nine day general season was retained in 1998.

Since 1991, hunter pressure in Region 5 has been stable *(r* = 0.45, P = 0.28), with a mean ±SE of 25,743 ± 1337. Days spent afield has also remained stable over this period (*r* = 0.46, P = 0.28), with a mean ±SE of 150,261 ± 5247.

Modeling and survey efforts indicate that many of the three point GMUs are not meeting WDFW escapement goals of 12 bulls per 100 cows. Modeled post-season bull:cow ratios range from 9-17:100 throughout the region. The 1997 change in regulations from any bull to "spike-only" GMUs, in conjunction with a reduction in the length of the general season, were designed to determine whether bull escapement could be improved. The change back to three point minimum in 1998 did not allow enough time for assessment of the effects of regulation change on population demographics.

Warm, dry conditions prevailed through much of the early 1998 elk season. Extremely hot, dry weather persisted until mid October in much of the Region. Early archery hunters were most influenced by the dry conditions, as most private timber companies closed their lands due to fire hazard.

A total of 33,983 elk hunters spent 154,069 days afield in 1998. Region 5 harvest was 2201 elk. Overall hunter success during the general season was six percent. General season reporting rates in 1998 were extremely low. Smaller sample sizes result in less accurate and precise estimates of hunter pressure. The 1998 totals are likely positively biased. Hunter pressure, based on field observations, was comparable to the previous year. Permit hunt reporting rates were good. Permit hunt success continued to be high, with reported success rates of 58 percent for the 33 permit hunts that were offered in the Region.

Several GMUs (560, 574, 578) saw elevated elk harvests in 1998. In Lewis River (GMU 560), much of this can be attributed to the spike-only regulations of 1997, which spared many bulls. Good over-winter survival led to large numbers of harvestable bulls in this unit. An increase in hunter pressure may be responsible for the large harvests in 574 and 578. Both of these units are managed to discourage elk.

Since 1991, total elk harvest in the Region has been stable *(r* = -0.18, P = 0.68). The days required to harvest an elk, however, indicate a marginally non-significant upward trend (*r* = 0.69, P = 0.08). Increasing effort to harvest elk may be indicative of an overall decline in the population. The 1998 hunter pressure data, however, indicates the lack of precision in the data. Thus total reliance and management inference based solely upon harvest/effort trends is unwise.

Since the Buchanan court decision of 1996, several areas within Region 5 have experienced elevated tribal hunting pressure and harvest. Tribal harvest intensity has been concentrated in the Packwood and Mt. St. Helens area. The complete extent of tribal harvest levels has been extremely hard to ascertain. Enforcement officer mortality forms, field checks, and locker checks indicate that tribal removals in the, Region 5, permit-only units has been fairly substantial. Our modeling and surveys corroborate this trend. In 1997-98, bull mortality rates in GMU 556 increased from 39 percent to 52 percent. This increase can be largely attributed to tribal bull elk hunting, as

permit removals were at the same levels as in previous years. Winter loss during that time period was normal. Increased mortality rates were also observed in GMU 524 during the same time period. With respect to the high prime bull ratios found in these two units, modeling indicated that the levels of removal that occurred, in these two units, during 1997-98 were unsustainable. Thus, in an effort to maintain the older bull component in these two units, permit levels in 1998 were reduced. Our field checks and locker checks indicated that tribal removals were also fewer in 1998-99 than in the previous year. Without total reporting from the tribes, however, these are just estimates of the actual level of removal. Pre-season surveys will provide a more complete assessment of the effects of tribal removal on elk demographics.

Increased cow take in the Packwood area, by tribal hunters, has also been a concern. The South Rainier elk herd has been declining for several years, although the resident elk herds in the Cowlitz River Valley have been increasing over the same time period. The timing of tribal harvest in this area results in harvest of both migratory and resident elk. In the absence of intensive survey effort in this area, it is difficult to determine the impact of tribal harvest on the migratory herds.

Surveys

Historically, spring and fall elk composition counts have been used to determine the sex and age structure of the Region 5 elk population. In 1998-99, only fall composition counts were conducted. Data from these counts are used to evaluate; (1) whether elk herds are meeting productivity and escapement goals, (2) the effect of alternative harvest strategies on bull elk population structure, and (3) as input into the elk reconstruction model (Bender 1996).

Fall composition counts are used to generate cow:calf, bull:cow, and bull age structure ratios. Fall cow:calf ratios are an index of population productivity. Since bulls, cows, and calves freely intermix during and immediately after the rut, fall composition counts provide the most un-biased bull:cow ratios. Bull:cow ratios are used to assess bull escapement, which provides information on the number of bulls available for breeding and harvest. Bull age structure is used to estimate annual bull elk mortality rates.

Severe budget cuts in 1998 significantly curtailed survey effort in Region 5. We concentrated, therefore, on the permit-only units (524 and 556), several of the 1997 spike-only units (520 and 550), and a three point unit (530).

Counts were conducted from a helicopter and on the ground throughout the Region. Since harvest is the primary factor driving bull elk dynamics, all survey results were analyzed relative to harvest strategy. The sizes and composition of all elk social groups encountered were recorded. All sample units (SUs) were sampled only once, and SUs were widely spaced (>5 miles between SUs). Since sampling was accomplished within a short time period, the possibility of double count bias was minimized. In 1998, surveys were conducted from 17 September to 25 September.

Observed elk were classified as calf, cow, or bull. Bull elk were further classified by number of antler points, to determine the percentage of prime (five or more antler points per side, i.e. 5x5) bulls present in the herds.

Data was used to generate calf:cow and bull:cow ratios, expressed as the number of bulls and calves per 100 cows. Ninety percent confidence intervals were constructed about the ratios following Czaplewski et al. (1983).

A total of 998 elk were classified during the fall 1998 composition flights (Table 1). Weather conditions were good throughout the sampling period, and sample size in each unit was excellent. Due to the lack of overall coverage of the Region's GMUs, analysis is limited to GMU specific trends, rather than harvest regime or PMU analysis.

Table 1. Results of Region 5 fall elk composition flights, September 1998.

GMU	Spike	Immature	Prime	Bulls	Cow	Calf	Total
524	38	37	20	95	193	70	358
556	29	20	7	56	158	52	266
520	35	6	9	50	133	39	222
530	8	6	2	16	62	29	107
550	5	3	1	8	23	13	45

Sample sizes and overall GMU coverage in Margaret and Toutle were good. A total of 624 elk was counted in these two units. Current and historic demographic parameters are presented in Table 2. Both units showed higher bull mortality in 1998 than in 1997, and higher overall bull mortality than the long-term trend.

Table 2. Demographic parameters for 524 and 556.

Year	GMU	B:C ratio	C:C ratio	Bull Mortality	Sample size (n)
1998	524	49±6	36±5	40%	358
	556	35±7	33±7	52%	266
1997					
	524	48±5	48±5	35%	410
	556	35±7	49±10	39%	237
1996					
	524	54±6	45±5	38%	332
	556	44±9	49±9	37%	230

In 1998, elevated bull mortality rates due to increased harvest intensity in these two permit-only units was expected. The observed changes were particularly evident in GMU 556 (Toutle). The observed bull mortality rates of 52 percent (42 percent attributed to hunting mortality) are a significant departure from both 1997 and the long-term mean ($P < 0.05$). The 1998 observed bull mortality rates in Toutle were identical to the long-term rates in our traditional three point units.

Bull mortality rates were also higher in Margaret, although the 1998 departures from the long-term mean were not as dramatic as was seen in Toutle. Bull mortality rates were 40 percent in 1998. The higher bull mortality rates observed in 1998, in both the permit-only units, were solely due to increased hunting mortality (see Population Status and Trend below).

Both Margaret and Toutle also exhibited lower productivity (Table 2) in 1998. The decrease was a significant one in Margaret, and marginally non-significant in Toutle. The productivity results of 1998 in these two units continues a three year downward trend in overall productivity.

Unit coverage and overall sample sizes were excellent in GMUs 520 and 550 (Table 3). Although only one year of data is available, the spike-only regulation did result in more observed mature bulls in these two units. The percentage of raghorn bulls observed was comparable to previous years, indicating that spike escapement was adequate. The bull:cow ratios in these two units were also higher, and overall bull mortality rates were reduced (Table 4).

Table 3. Survey data from 520 and 550.

GMU	Spike	Immature	Prime	Bulls	Cow	Calf	Total
1998	40	9	10	59	156	52	267
1997	34	9	3	46	176	74	296
1996	16	5	2	23	90	38	151
1995	32	5	2	39	165	89	293

The only three point unit surveyed in 1998 was Ryderwood (GMU 530). Sample size was relatively low and coverage was less than desired. Bull:cow ratios and productivity were comparable with previous years (Table 5). Overall bull mortality rates of 50 percent were lower than in 1997.

Table 5. Demographic parameters from GMU 530.

Year	B:C ratio	C:C ratio	Bull Mortality	Sample size (n)
1998	26±10	47±16	50%	107
1997	31±11	39±13	64%	122
1996	21±8	39±12	56%	135
1995	39±12	47±14	50%	134

Similar to past years, spring ground surveys were conducted on the St. Helens Wildlife Area. The Wildlife Area typically winters 500-700 animals. These animals are primarily migrants from summer ranges in GMU 556 and 524, although a resident population of 100-200 elk resides on the Mount St. Helens Wildlife Area and the surrounding area. It is typical for biologists to document five to ten winter mortalities on the mudflow in any given year. The spring of 1999, however, resulted in the documentation of 79 mortalities (Table 6). The actual number of mortalities was certainly higher. Although high calf mortality is to be expected during a winter kill, the poor quality of the winter habitat was evident in the large proportion of prime animals that succumbed during this particular event.

Table 6. Documented winter mortality on the St. Helens Wildlife Area, 1999.

Date	Calf	Prime cow	Old cow	Spike	Prime bull	Unk	Total
2/12	1	4	0	0	0	0	5
2/23	3	2	1	1	0	0	7
3/11	15	3	1	0	0	0	19
3/26	9	10	6	0	4	2	31
4/7	1	8	3	3	1	1	17

Although thought to be remote, concern over the possibility of a widespread winter mortality event precipitated a spring aerial survey in May of 1999. A flight targeting some of the known wintering areas in several of the GMUs surrounding the Loo-wit Unit was conducted on May 27. Due to the difficulty in locating carcasses, particularly at the time of year the survey was conducted, the calf:adult ratio was chosen as the measure of winter severity and over-winter survival of elk. Results indicated that the winter die-off on the Toutle mudflow was an isolated event. From a sample size of 240, a calf:adult ratio of 28±7:100 was observed. Extrapolating preseason 1998 survey data, preseason calf:adult ratios in the spring survey area were 28±6:100. Taking into account sampling error and observational bias, the spring survey results indicate excellent over-winter survival in the areas that were surveyed.

Population Status and Trend

Population modeling in Region 5 indicates most populations are declining. Since 1994 the South Rainier Elk Herd has declined approximately 30 percent. Over the same time span the St. Helens Elk Herd has declined nearly 20 percent. The southern portion of the Willapa Hills Elk Herd has declined about 16 percent.

Habitat Condition And Trend

Climate tends to have a negligible effect on Regional elk populations west of the Cascade Crest. Localized effects, however, can be drastic. Although snowfall at higher elevations may be heavy, subsequent freezing conditions seldom occur. Elk at higher elevations tend to be migratory in response to snow; whereas elk at lower elevations exhibit year-round fidelity to those areas. The primary effect of climate on elk west of the Cascade Crest is the influence it exerts on hunting pressure. The severe winter kill of 1998-99 in the Toutle River Valley was due more to the poor quality of wintering ground, than a catastrophic winter event.

East of the Cascade Crest climate will periodically result in significant winter kill of elk. The last significant winter kill occurred during the winter of 1991-1992. The winter of 1998-99 was relatively mild at the lower elevations, with very little

snowfall. High elevation sites did, however, receive near record snowfall. A small fraction of Region 5 elk reside east of the crest. On a Regional basis, only during extreme winters will climate significantly influence elk population numbers.

Region 5 faces significant loss of elk habitat through a number of different avenues: (1) loss of both summering and wintering habitat on US Forest Service (USFS) lands due to the establishment of extensive Late Successional Reserve (LSR) areas; and (2) loss of additional winter range along the Lewis River watershed, due to increased residential development along the three hydroelectric reservoirs (Merwin, Swift, and Yale Reservoirs), the creation of which has already resulted in loss of significant amounts of historic winter range.

Loss of elk habitat due to LSR establishment is expected to approach 41 percent in certain areas (R. Scharpf, GPNF, unpub. data). Efforts to minimize this impact, including manipulation of Managed Late Successional Areas (MLSA's) to provide elk forage, are currently being evaluated by the USFS and WDFW.

Mitigation for the loss of winter range along the Lewis River watershed has been addressed in the Merwin Wildlife Management Plan. The Plan is a cooperative management agreement for Merwin Reservoir between Pacificorp (Portland OR), the utility company which manages Merwin, Swift, and Yale Reservoirs, and the WDFW. Similar negotiations are ongoing over Yale Reservoir; negotiations over Swift Reservoir will begin prior to the expiration of Pacificorp's license in 2000. Concurrently, efforts to modify residential development to minimize impacts to winter range are being addressed as part of WDFW's Integrated Land Management program for the Lewis River watershed.

Degradation of significant wintering habitat is also occurring along the North Fork of the Toutle River, specifically along the mudflow within the Mount St. Helens Wildlife Area. The dire condition of the habitat was evident this past winter. Declines in habitat quality are a result of (1) shifts in plant composition away from nutritious forages, (2) invasion of exotics such as Scotch Broom, and (3) continued erosion of stream side vegetation. The quality of the surrounding slopes is also declining, as the canopy closes.

Augmentation/habitat Enhancement

Steps continue to be taken to enhance forage quality on the Toutle mud flow through plantings and fertilization. Twenty acres were seeded in 1998. Unfortunately, as this past winter illustrated, much more is needed. A cooperative project with Weyerhaueser in the spring of 1999 resulted in the fertilization of 200 acres. Stabilization of the mud flow itself through tree planting is also being investigated.

Ongoing enhancement projects on the Cowlitz Wildlife Area are continuing (M. Cope pers. comm.). The cooperative project between the RMEF and International Paper Company in the Boistfort Valley has ceased, due to the acquisition of the area by Hampton Forest Products and conflicts with agricultural interests nearby. Due to controversy over lack of access the initial project in the Boistfort Valley was less successful than initially hoped. New seeding projects in Lewis County are being pursued.

Management Conclusions

Bull escapement is still below the WDFW guideline of 12 bulls per 100 cows in many of our open entry GMUs. Permit-only GMUs continue, however, to meet escapement goals. Since 1993, bull elk mortality rates in the previously "spike-only" and historic three point GMUs have averaged 0.70 and 0.53 respectively. This resulted in neither harvesting strategy meeting WDFW bull elk survivorship goals. Long-term mean prime bull (>4.5 years old) percentages in our open entry GMUs (previously spike-only and historic three point units) are poor (~10%), compared with permit-only GMUs. The long-term bull escapement means in Margaret and Toutle are 21 percent and 22 percent respectively.

Regulation changes designed to test the three-year effects of harvest strategy on population parameters were shelved in 1998. All westside GMUs that were 'spike-only' in 1997 became three point in 1998. Initial data indicates that the spike-only regulation resulted in a substantial increase in the number of prime bulls. The percentage of raghorn bulls remained constant, while overall bull mortality rates declined. It is doubtful that the reduction from 12 days to 9 days, during the general modern firearm season, will result in the desired bull escapement.

Previously, antlerless permit levels have been allocated solely based on subjective perceptions of elk damage to agriculture and tree farms. Use of the elk population reconstruction model will provide quantitative data, which will allow for more objective permit allocation. Antlerless permit allocation can now be based upon both population size, observed productivity, and damage levels.

The current level of population surveying in Region 5 is inadequate to determine the impacts of both winter severity and various harvest regimes on elk populations. The utility of spring surveys to determine overwinter calf survival was illustrated in the early 1999 survey. Although biased for adult sex ratios, spring surveys do provide relatively good indications of calf survival and ultimate recruitment rates to the population.

The intensity and coverage of Region 5 fall surveys presently result in confidence intervals about vital population parameters that are too imprecise to detect differences between harvest strategies and different GMUs within harvest strategies. Present survey coverage also does not provide representative sampling of all of the Region. In order to better understand elk population responses to various harvesting strategies and environmental stochasticity, the ability to detect small, but biologically significant differences in population parameters must be available. Pre-season survey intensity needs to be increased, in order to increase sample sizes and thus shorten confidence intervals around the ratios.

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Species	Region	PMUs	GMUs
Elk	**6**	**61-66**	**601-684**

Prepared by: H. M. Zahn, District Wildlife Biologist

Population Objectives/guidelines

Harvest strategies that greatly limit the take of antlerless elk are inherently conservative. A total of 100 antlerless permits were shared by various user groups in selected areas of Region 6, south and east of the Chehalis River. Management objectives on the Olympic Peninsula are to stop and reverse significant population declines documented in recent years, as well as developing cooperatively long-term management strategies with Olympic Peninsula Treaty Tribes.

Hunting Seasons and Harvest Trends

The 1998 hunting season was the second season of the 1997-99 three-year hunting season package. It was also the second year that the three point minimum requirement for antlered elk harvest applied region wide. The previous year's (1997) spike only regulation in Population Management Units (PMUs) P61 (GMUs 658, 660, 663, 672, 673, 681, 684) and P62 (GMU 667) was not well received by the public. The moratorium on antlerless permits or hunting by any user group continued in 1998 for PMUs on the Olympic Peninsula. Based on the state-wide hunter questionnaire, elk harvest in 1998 was 32 percent above that of the 1997 elk season. Numbers of elk hunters increased by 80 percent and the number of hunter-days by 62 percent over the corresponding 1997 figures (Table 1). Hunting conditions were typical for the area and season with no unusual dry or inclement weather recorded during the actual seasons.

Table 1. Antlered elk harvest estimates by Population Management Unit (PMU).

PMU	Antlered Harvest	Percent Change from 1997
61	109	+2
62	14	-22
63	68	+296
64	5	no harvest
65	85	+18
66	37	+336

All of these harvest estimates are for state hunting seasons only and do not include harvest by treaty tribes.

During the 1998-99 reporting period meetings between regional personnel and representatives of Olympic Peninsula Tribes continued for the purpose of managing the elk resource of the Olympic Peninsula cooperatively. Periodic technical and policy meetings have taken place with representatives of the Point No Point Treaty Council, including the Quinault, Hoh, Quileute and Makah Tribes.

Surveys

During the period of September 17 through September 25, 1998, one and three pre-season helicopter elk surveys were conducted in Game Management Units (GMUs) 673 (Williams Creek) and 615 (Clearwater) respectively. Due to lack of moisture, elk did not show well in the more open Clearwater unit (Table 2).

Table 2. Results of pre-season surveys in 1998.

	Bull Antler Class				Per 100 Cows		
Unit	Branch	Spike	Cows	Calves	Branch	Spike	Calves
615	6	11	89	30	7	12	34
673	19	7	77	49	25	9	64

Post-season (late March - early April) surveys were not conducted during the spring of 1999.

Post-season surveys are not a good indicator of bull escapement since adult males do not freely mix with other elk during this time. This observation pertains particularly to the forested areas of coastal Washington. However, using the pre-season composition surveys the total antlered mortality rate appears to be about 60 percent. It appears that the stated goal of at least 12 bulls per 100 cows in post-season surveys is probably not being met in the Clearwater unit.

Population Status And Trend Analysis

There is no change since last year in the elk population status. However, the overall increase in antlered harvest region-wide (up 38 percent) is likely an artifact of the very low bull harvest the previous year. It is likely that changes in population size will not be apparent until at least the end of the current 3-year season package (1997-99). Even then it may not be possible to document population increases through a corresponding harvest increase. Population estimates based on sampling procedures such as paint-ball marking or population reconstruction modeling based on valid population parameters will be necessary to track population changes through time. To generate better estimates of population parameters more surveys need to be conducted.

The decline in elk numbers in prime elk habitat on the Olympic Peninsula has been the focus of much of the technical discussions of the cooperative elk management group (WDFW and Olympic Tribes). As a result of these discussions, WDFW has continued the moratorium on antlerless harvest on the Olympic Peninsula for the 1998 season. Recommendations as a guide to tribal harvest planners are shown in Table 3.

Table 3. Maximum cow harvest levels recommended to tribal policy planners in 1998.

GMU	Maximum Cow Harvest
601	6
602	22
603	2
607	15
612	7
615	26
618	11
621	12
638	15
642	2
648	12
651	6

Habitat Condition And Trend

Habitat conditions on managed forest lands continue to be generally favorable for elk, although high road densities are detrimental. Units that sustained heavy large scale timber harvest during the 1970s (portions of Pacific County) now have large stands of second growth, but we have not documented nutritional stress (due to lack of forage) in those populations. Current forest management practices which favor smaller clear-cuts will benefit elk.

Management Conclusions

The 1998 seasons marked the second year of elk hunting season strategies designed to reverse the population decline particularly on the Olympic Peninsula. The 1998 elk seasons in Region 6 retained some of the conservative elements of the previous season, such as no antlerless elk harvest during state seasons on the Olympic Peninsula, while at the same time expanding the three point minimum requirement for antlered harvest to all of Region 6.

Species

Mountain Goat **Statewide**

Prepared by: **Steve Pozzanghera, Carnivore, Furbearer and Permit Species Section Manager**
Clifford G. Rice, Game Surveys Coordinator

Population Objectives/guidelines

Statewide mountain goat population objectives include: 1) restoring these animals to historic abundance levels, 2) continuing to monitor individual goat herds so that hunting opportunities can be maintained or created, and 3) providing or enhancing mountain goat viewing opportunities for appreciative use of these unique animals. While statewide mountain goat productivity goals (25 kids:100 adults) and harvest thresholds (no more than a 4% harvest of total estimated population) exist, no current numeric population objectives exist for mountain goats, at either the statewide or individual goat management unit level, in Washington.

Hunting Seasons And Harvest Trends

Mountain goat hunting opportunity in Washington is limited by permit. Permit availability and therefore hunter opportunity has decreased dramatically over the last 10 years (Figure 1.) Fifty-seven permits were available in 15 different goat management units for 1998 and a total of 2,503 applicants entered the drawing. The 1998 mountain goat season provided 49 days of mountain goat hunting (September 13 to October 31). All goat units open to hunting allowed the use of any legal weapon, this provides eligibility to all hunters for all units and maintains hunter choice of weapon.

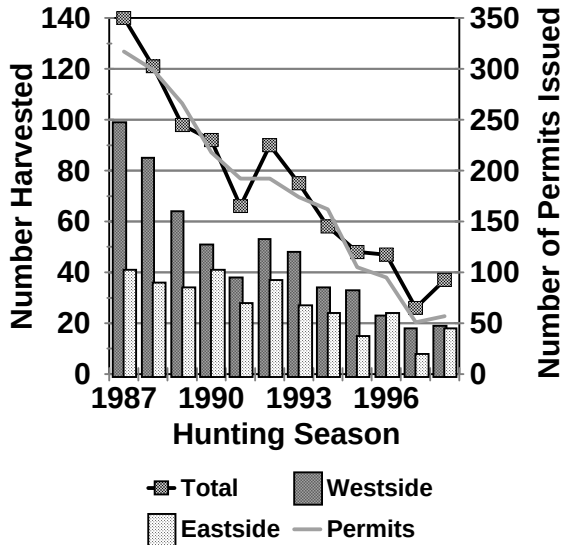

Figure 1. Statewide mountain goat harvest.

Of the 57 permits available in 1998, 53 individuals actually reported that they hunted goats. A total of 37 goats were killed for a hunter success rate of 70%.This was a higher success rate than the previous 2 years and a reversal in the trend of declining permits and harvest.

Surveys

Due to funding constraints, only 6 of 15 mountain goat units open to hunting in 1998 were surveyed. Both ground counts and aerial surveys were used to survey and classify goats as either adults or kids. Surveys were conducted at differing times throughout the year, with a general observation by most regions that goats may be most visible in mixed groups (i.e., both nannies with kids and billies) during the early fall. Some regions also indicated a desire to conduct aerial goat surveys at the same time of year that pre-season, elk composition surveys are being done.

Population Status And Trend Analysis

Mountain goat populations have been on the decline in Washington for many years. Historically, there population in Washington may have been as high as 10,000 animals. Today they likely number fewer than 4,000. Hunting opportunity has decreased accordingly, and current permit levels are extremely conservative. Despite continued reductions in hunting opportunity many local goat populations continue to decline. Such long-term gradual decline in the population would seem to suggest that habitat changes are negatively influencing goat numbers.

The Olympic Peninsula mountain goat situation remains unresolved. Olympic National Park would like to remove goats from the Park but has asked an independent science team to review the findings published in the 1994 National Park Service scientific monograph. WDFW would like to maintain mountain goat populations on the Olympic Peninsula. Based on a National Park Service goat survey conducted in late spring 1998, the population of goats within the Park remains at approximately 250 animals. Due to goat population concerns, all WDFW goat management units on the Peninsula were closed to hunting in 1998.

There are some bright spots for mountain goats in Washington, and the status of several populations is actually very good. Goat productivity has been excellent in the Smith Creek goat unit of Region 5 and this herd appears to be expanding its range. Despite limited survey data, there is also evidence that goat population in Region 2's Chelan county appear to be increasing, particularly in the vicinity of Lake Chelan.

Habitat Condition And Trend

Fire suppression policies and natural forest succession continues to degrade critical mountain goat foraging habitat. Fire suppression allows conifers to invade these natural openings and decreases their foraging value for goats. The degradation and loss of alpine meadows, coupled with

increasing recreational human use and disturbance of alpine habitat are likely the two greatest negative impacts to mountain goats. If mountain goat populations are to increase, the WDFW must enter into cooperative agreements that address the prescribed use of fire for the maintenance of alpine meadows and recreational use plans which minimize road construction and human disturbance to alpine habitat.

Management Conclusions

Mountain goat survey protocols need to be refined, standardized, and prioritized so that all units open to goat hunting are surveyed annually. Better mountain goat population estimation may be possible using a mark-resight system that utilizes paint marking of goats, and this technique should be experimented with. A statewide quantitative assessment of total alpine meadows goat habitat is needed so that we can begin to identify goat units that have experienced the most substantial loss of meadow due to conifer intrusion. This will allow us to prioritize areas in which we seek cooperative agreements with the US Forest Service for the prescribed use of fire.

Species	Region	Goat Units	Population
Mountain Goat	**1**	**NA**	**Linton Mountain Goat Herd**

Prepared by: **Dana L. Base, Wildlife Biologist**
Steve Zender, District Wildlife Biologist

Population Objectives/Guidelines

The current population objective for the Linton Mountain Goat Herd is to maintain a viable population for public viewing. The Linton Mountain area received national recognition when the U.S. Forest Service recognized the Sullivan Lake District of the Colville National Forest with an award for developing a public mountain goat viewing area. The area was developed in partnership with the Washington Department of Fish & Wildlife, local industry, and the Inland Northwest Wildlife Council.

Hunting Seasons And Harvest Trends

Mountain goats at Linton Mountain were hunted from 1972 through 1976. The number of permits authorized annually ranged from 5 to 15 and animals harvested ranged from 4 to 11. A total of 34 mountain goats were taken by hunters over the 5 year period. As reported by Guenther (1972), mostly nannies were killed. Hunting has not resumed at Linton Mountain since 1976 as the herd population has not consistently met Department guidelines for maintaining a season.

Surveys

Surveys of the Linton Mountain Goat Herd are generally accomplished by ground-based counts. Excellent views of nearly the entire goat range are afforded by vantage points along Boundary Road near the town of Metaline Falls. Additional vantage points are on a primitive road that services a high voltage power line with a wide right-of-way clearing parallel to the goat cliffs. Surveys seem to be most productive when conducted either early or late in the day. In recent years the counts have been so low that multiple visits have become necessary to improve the likelihood of seeing any goats whatsoever.

Three surveys were conducted between June and October of 1998 with the highest count of 5 adult mountain goats observed on June 3rd. So far in 1999 only one mountain goat, an adult, has been seen.

Population Status And Trend Analysis

In this century, Linton Mountain was not occupied by mountain goats until 7 animals were released there by the Washington Department of Game in 1965. Table 1 presents a discontinuous record of population surveys for mountain goats on Linton Mountain since 1965. The original herd came from Nason Ridge in Chelan County and consisted of 2 billies, 4 nannies, and 1 female kid. In 1981, 11 mountain goats from the Olympia Mountains were translocated to Hooknose Mountain which is roughly 5 miles north of Linton Mountain. At least 3 of these 11 new goats, 2 billies and 1 nanny, were subsequently found at Linton Mountain.

Table 1. Population composition counts of Mountain Goats in the Linton Mountain Area. K:100 is kids per 100 adults.

Year	Kids	Adults	Population Estimate	K:100
1965 a	1	6	7	17
1966	b	b	7	b
1967	b	b	9	b
1968	b	b	11	b
1969	b	b	14	b
1970	b	b	18	b
1971	8	b	23	b
1972 c	8	b	32	b
1973 c	b	b	32	b
1974 c	b	b	35	b
1975 c	b	b	33	b
1976 c	4	b	34	b
1977	b	b	b	b
1978	b	b	b	b
1979	b	b	b	b
1980	b	b	b	b
1981	b	b	b	b
1982 d	5	8	20	62
1983	3	12	25	25
1884	1	10	25	10
1985	6	12	25	50
1986	7	25	35	28
1987	6	21	35	29
1988	7	24	40	29
1989	6	20	40	30
1990	1	9	40	11
1991	1	13	25	8
1992	7	26	33+	27
1993	4	16	20+	25
1994	3	13	16+	23
1995	0	18	18+	0
1996	0	9	10 - 20	0
1997	1	9	10	11
1998	0	5	5	0

a = Year that 7 Mountain Goats were translocated from Chelan County to Linton Mountain.
b = No survey data available.
c = Years that herd was hunted by special permit.
d = Year that 3 marked Mountain Goats were identified at Linton Mountain that came from failed release of 11 animals at Hooknose Mountain in 1981.

Only one kid has been identified on any survey done since 1994. Adult goats surveyed from 1994 to the present may have included yearlings. The two age classes are often lumped due to difficulty distinguishing them at long viewing distances.
The mountain goat population at Linton Mountain is perilously low and unproductive (Table 1). Reasons may include poor habitat conditions, the recent severe winters of 1992-93 and 1996-97, and predator take, especially of kids.

Habitat Condition And Trend

No recent comprehensive surveys of mountain goat habitat have been made at Linton Mountain. Both quantity and quality of forage along with predator escape terrain may be limiting factors to herd population growth. The WDFW has made recommendations at various times to the USFS (who owns most of the goat range) to conduct controlled burns for habitat enhancement. The Sullivan Lake Ranger District has developed such a controlled burn plan but has not implemented it thus far.

Augmentation

There are no plans for population augmentation. As the pool of breeding animals is dying out since the population peak ten years ago, a new introduction would be necessary to keep the herd viable.

Management Recommendations

The Linton Mountain Goat Herd is a nationally recognized wildlife resource. The following recommendations are given to help restore a viable mountain goat population there:

- Increase survey effort to document as precisely as practical how many animals are left, especially kids (if any). Since surveys are labor intensive, qualified survey volunteers who possess necessary optical equipment should be solicited.
- Encourage the U.S. Forest Service to proceed with a controlled burn at Linton Mountain as soon as possible for the purposes of improving mountain goats' ability to escape predators and to improve production of forage plants.
- Initiate discussions with appropriate agency administrators to consider a new introduction of mountain goats to supplement the Linton Mtn. Herd.
- Funding alternatives for accomplishing the previous recommendation should be explored and sought after.

Literature Cited

Guenther, S.E. 1972. Linton Mountain Goat Study. Unpublished report for the Washington Dept. of Game. Olympia. 8 p.

Species	Region	Goat Unit(s)	Population
Mountain Goat	**2**		**Chelan County**

Prepared by: John Musser, District Wildlife Biologist

Population Objectives/guidelines

Management objectives for Chelan County mountain goats are to; increase all populations, and restore conservative levels of hunting (hunting mortality no more than 4% of minimum known population) as objective levels are reached. Overall, Chelan County's mountain goat population is 44 percent below objective. Individual units range from 10-80% below objective (Table 2).

Table 2. Chelan County mountain goat population objectives by management unit.

	Survey Year			Survey	% From
	1996	1997	1998	Objective	Objective
N. Chelan	42	80	64	100	-36
S. Chelan	13	44	41	50	-18
Stehekin	4		5	25	-80
Chiwawa	14	15		30	-50
N. Wenatchee	42	6	27	30	-10
East Stevens	33	14	13	30	-57
Total	123	163	150	265	-44

Surveys

Three survey methods are used to monitor mountain goat populations in Chelan County. As part of a hydro power relicense agreement, Chelan PUD completes 12 winter wildlife surveys using a boat on Lake Chelan , Chelan county's largest contiguous mountain goat habitat. Washington Department of Fish and Wildlife personnel accompany PUD personnel on 1 survey per year. For Lake Chelan, the total number of known goats is the result of comparing all surveys completed during each winter. In recent years, a small helicopter has been used to survey selected mountain goat units. Incidental surveys are done in conjunction with other work. These incidental data are used to supplement other survey efforts. Because of difficult terrain and low populations densities, mountain goats are expensive to monitor. Budget constraints preclude regular monitoring of most unhunted populations.

We have set survey objective levels for each geographic mountain goat area within the Wenatchee District. Conservative hunting may be recommended in units where surveys document objective levels.

Population Status And Trend Analysis

Although Chelan county mountain goat populations are all below documented historic levels, most populations are not monitored close enough to describe recent population trends. The Lake Chelan populations have been closely monitored for the past 15 years. The current trend for Lake Chelan is static (Table 1).

Table 1. Population composition counts from Lake Chelan. K:100 = kids per 100 adults.

Year	Kids	Adults	Population Estimate	K:100
1989	29	112	141	26:100
1990	18	98	116	18:100
1991	27	155	185	17:100
1992	16	88	104	18:100
1993	13	92	105	14:100
1994	25	98	123	26:100
1995	12	109	121	11:100
1996	7	47	70	15:100
1997	18	105	124	17:100
1998	17	88	105	19:100

The Cascades received more snow last winter than any year since 1956. Some areas set all time records for snow pack. These heavy snows probably increased mortality of goat populations.

Habitat Condition And Trend

Fire suppression during the last 50 years has decreased forage for mountain goats. Most mountain goat habitat is within wilderness and is managed by Wenatchee National Forest. Although fire suppression policies are changing, habitat changes will be slow in coming. Wilderness designation precludes most traditional "habitat improvement" projects.

Management Conclusions

Mountain goat populations in Chelan County are below historic and objective levels. All populations are expected to gradually increase to objective level. As populations reach objective, we will recommend conservative hunting. We will use Master Hunters and mountain goat identification guides to reduce harvest of dominant female mountain goats when hunting is resumed.

Species	Region	Goat Unit(s)	Population
Mountain Goat	**2**	**2-1, 2-2**	**Methow and Mount Chopaka Units**

Prepared by: Scott Fitkin, Okanogan District Wildlife Biologist

Population Objectives/guidelines

Currently, the Methow unit is being managed for conservative, sustainable yield, with the goal of increasing herd size and distribution where possible. Productivity in this unit remains high, indicating forage resources are available to support expansion. Incidental observations suggest goats are beginning to recolonize historical range along the "goat wall" west of Mazama. Animals in this portion of the unit are often viewed at a salt lick along the Hart's Pass Road, providing a favorite watchable wildlife opportunity.

The Chopaka goat herd is limited in size, but provides excellent viewing opportunities for the general public, and is managed primarily as a watchable wildife resource. Harvest in the hunted portion of the herds range has been conservative to promote expansion of this small population.

Hunting Seasons And Harvest Trends

Hunters enjoyed excellent conditions; the high country remained accessible throughout the season. Five permits were issued for the Methow Unit, and one permit was issued for the Mt. Chopaka Unit.

Hunters filled 3 of 5 permits issued for the Methow Unit, and hunted for an average of 9 days. On average hunters saw more than 20 goats apiece, including numerous kids. (Table 1)

Table 1. Summary of harvest information for mountain goats in the Methow Unit.

Year	Permits	Hunters	Harvest	Success	Goats Seen/Hunter
1991	5	5	4	80%	--
1992	5	5	5	100%	21
1993	8	8	7	88%	31
1994	8	7	6	86%	26
1995	8	8	8	100%	31
1996	8	8	5	63%	8
1997	5	5	4	80%	20
1998	5	5	3	60%	22

The lone hunter in the Mt. Chopaka Unit harvested a goat during four days of hunting, and saw only 6 adult animals. Productivity in this herd remains low; no permits will be offered in 1999.

Surveys

Limited resources have precluded aerial surveys in the Okanogan District the past two years. Ground surveys of a small portion of the Methow Unit yielded mixed results. In 1998, observers saw no goats. A compilation of hunter reports and incidental reports from agency personnel were used to estimate productivity, expressed as kids per 100 adults (Table 3). In 1999, ground surveyors counted 25 adults and 6 kids in late July in the Mt. Gardner area; hunter observations are forthcoming. No other goat surveys were conducted.

Table 2. Summary of harvest information for mountain goats in the Mt. Chopaka Unit.

Year	Permits	Hunters	Harvest	Success	Goats Seen/Hunter
1991	2	2	2	100%	--
1992	2	2	2	100%	6
1993	2	2	1	50%	9
1994	1	1	1	100%	15
1995	1	1	0	0%	0
1996	1	1	1	100%	2
1997	1	1	1	100%	17
1998	1	1	1	60%	6

Population Status And Trend Analysis

Several years of survey data from the Chopaka Mountain area indicate low productivity, and a herd likely in decline (Table 4). Goats appeared to flourish in the area after the last major fire in 1919; however, no major fires have occurred since. A reduction in habitat quality may be responsible for the downward trend. A paint ball marking effort in 1997 produced a population estimate of only 24 animals.

Table 3. Population composition counts from the Methow Unit. K:100 is kids per 100 adults.

Year	Kids	Adults	Population Estimate	K:100
1994	6	25	--	24:100
1995	--	--	--	--
1996	16	41	--	39:100
1997	20	49	--	41:100
1998	--	--	--	44:100
1999	--	--	--	--

Funding shortfalls have resulted in inconsistent data collection in the Methow Unit, and inferences about population levels and trends in the Methow Unit are rather speculative. Even so, existing data indicates productivity is healthy, and the population is likely slowly expanding (Table 3). This is particularly true of the animals in the Gardner Mountain portion of the unit, where recent fires have had favorable effects on goat habitat.

A small number of mountain goats are widely scattered throughout suitable goat habitat in the western portion of the Okanogan District outside of the established goat units. Little

Table 4. Population composition counts from the Mt. Chopaka Unit. K:100 is kids per 100 adults.

Year	Kids	Adults	Population Estimate	K:100
1991	26	6	--	23:100
1992	4	28	--	14:100
1993	2	18	--	11:100
1994	3	9	--	33:100
1995	--	--	--	--
1996	4	16	--	25:100
1997	2	11	24	18:100
1998	--	--	--	--
1999	--	--	--	--

survey work has been done in these areas due to lack of resources. Population size or trend is unknown for these animals, although anecdotal information from outfitters suggests a growing population in the Amphitheater Mountain area of the Pasayten Wilderness .

Habitat Condition And Trend

Most higher elevations within Okanogan goat range received higher than average snow fall last winter. The effects on population parameters are unknown.

Goat habitat is almost entirely within secured areas and the amount available remains stable. Habitat quality varies noticeably throughout goat range in the Okanogan District. For instance, goats in the Gardner Peak area continue to benefit from favorable foraging conditions created by recent fires. On the other hand, range quality in the Chopaka Mountain area has probably suffered from fire suppression and could benefit from some pro-active fire management.

Much of the district's goat habitat is in wilderness areas. Thus, changes in habitat quality will occur primarily through natural stochastic events such as wildfires and avalanches, rather than human intervention.

Management Conclusions

Through the years, both survey effort and results have been highly variable in this district, yet the management objective of harvesting no more than four percent of a herd hinges on reliable survey data. As a result, emphasis should be placed on providing the resources necessary for a consistent survey effort, and developing a more comprehensive, standardized, and reliable survey technique.

Paint ball marking of mountain goats appears promising as a population estimation technique. The effort on Chopaka Mountain should be repeated and intensified, and should include at least two re-sight flights. This methodology should be expanded to the Hancock Ridge and Gardner Mountain herds in the Methow Unit as financial resources allow.

Goat populations in the Methow Unit are the most robust in the district, and observed productivity suggests there may be room for herd expansion. Suitable goat habitat adjacent to this unit is sparsely populated at best, and could support many more animals than exist currently. In light of this, the current conservative harvest strategy in the Methow Unit should continue. If in practice, the Methow herd grows but exhibits little dispersal, animals should be actively relocated to other suitable areas in the district.

In contrast to the Methow unit, productivity in the Mt. Chopaka Unit appears low, and the population may be in decline. As a result, harvest should remain suspended until reliable survey data over successive years indicates compliance with state-wide population and productivity thresholds. This herd is an important wildlife resource for both consumptive and non-consumptive recreation. Land managers should explore the feasibility of using prescribed burns to enhance existing goat habitat, and improve herd productivity.

Species	Region	Goat Unit(s)	Population
Mountain Goat	**3**	**3-3 thru 3-11**	**Naches Pass, Bumping River, Tieton River, Blazed Ridge, Kachess Ridge**

Prepared by: **Leray Stream, District Wildlife Biologist**
Jeff Bernatowicz, Wildlife Biologist

Population Objectives/guidelines

Objectives are to maintain stable goat populations throughout our goat units for public viewing and hunting opportunities.

Hunting Seasons And Harvest Trends

Mountain Goat season is open only to hunters drawing a special permit. In 1998, there were 15 permits spread over the 5 units (Tables 1-5). All 15 permit holders were successful in 1998.

Table 1. Summary of harvest information for goat Unit 3-9 Tieton.

Year	Permits	Hunters	Harvest	Success	Goats Seen/Hunter
1990	5	5	4	80%	27
1991	5	5	4	80%	12.8
1992	5	5	3	60%	22
1993	5	2	2	50%	24
1994	5	5	4	80%	49
1995	3	3	3	100%	53
1996	5	5	4	80%	28
1997	1	1	1	100%	46
1998	3	3	3	100%	53

Table 2. Summary of harvest information for goat Unit 3-7 Bumping River.

Year	Permits	Hunters	Harvest	Success	Goats Seen/Hunter
1990	15	14	11	79%	14.1
1991	10	9	7	78%	17.4
1992	10	10	9	90%	19.4
1993	6	6	5	83%	17.2
1994	6	5	4	80%	16.2
1995	2	2	2	100%	49
1996	6	5	5	100%	28
1997	1	1	1	100%	15
1998	2	2	2	100%	15

Surveys

Surveys were not conducted in 1998 due to budget constraints. Goat units are remote and require either a helicopter survey or lots of days effort from the ground.

Table 3. Summary of harvest information for goat Unit 3-6 Naches Pass.

Year	Permits	Hunters	Harvest	Success	Goats Seen/Hunter
1990	8	7	7	100%	65
1991	8	5	4	80%	25.2
1992	8	8	8	100%	34
1993	10	9	9	100%	26
1994	10	8	7	88%	31
1995	1	1	1	100%	40
1996	10	9	7	78%	36
1997	1	1	1	100%	15
1998	3	3	3	100%	34

Table 4. Summary of harvest information for goat Unit 3-10 Blazed Ridge.

Year	Permits	Hunters	Harvest	Success	Goats Seen/Hunter
1990	Closed				
1991	Closed				
1992	Closed				
1993	Closed				
1994	Closed				
1995	Closed				
1996	3	2	1	50%	31
1997	1	1	1	100%	83
1998	6	6	6	100%	20

Table 5. Summary of harvest information for goat Unit 3-11 Kachess Ridge.

Year	Permits	Hunters	Harvest	Success	Goats Seen/Hunter
1990	closed				
1991	closed				
1992	closed				
1993	closed				
1994	closed				
1995	closed				
1996	1	1	1	100%	40
1997	1	1	1	100%	20
1998	1	1	1	100%	40

However, 1997 surveys are included which provides our most recent data. Surveys are usually conducted in June for productivity surveys and again in September when elk preseason composition counts are conducted. Our estimation is that the September surveys tend to yield the best results in total goat numbers and composition. I feel that we may be missing a larger contingent of goats in June due to nannies hiding in the forest and the possibility of kids not yet being born. Most of our low count years were June surveys. September surveys have the disadvantage of potential bad weather but still affords the best time for surveys.

Tables 6-10 show past survey results for Goat units that are presently open for hunting.

Table 6. Population composition counts from unit 3-9 Tieton River.

Year	Kids	Adults	Population Estimate	K:100
1989				
1990				
1991	7	21		33:100
1992				
1993	11	39		28:100
1994	11	21		52:100
1995	9	72		13:100
1996	30	60		50:100
1997	17	73		23:100

Table 7. Population composition counts from unit 3-7 Bumping River.

Year	Kids	Adults	Population Estimate	K:100
1989				
1990				
1991	5	12		42:100
1992	12	66		18:100
1993	7	43		16:100
1994	5	35		14:100
1995	5	30		17:100
1996	20	39		51:100
1997	12	49		25:100

Table 8. Population composition counts from unit 3-6 Naches Pass.

Year	Kids	Adults	Population Estimate	K:100
1989	24	94		26:100
1990				
1991	10	42		24:100
1992	11	86		13:100
1993	5	18		28:100
1994	13	27		48:100
1995	9	78		12:100
1996	23	58		40:100
1997	10	55		18:100

Table 9. Population composition counts from unit 3-10 Blazed Ridge.

Year	Kids	Adults	Population Estimate	K:100
1989				
1990				
1991	9	22		41:100
1992				
1993				
1994				
1995				
1996	27	57		47:100
1997	40	99		40:100

Table 10. Population composition counts from unit 3-11 Kachess Ridge.

Year	Kids	Adults	Population Estimate	K:100
1989				
1990				
1991	21	39		54:100
1992	7	18		39:100
1993	14	44		32:100
1994				
1995				
1996	11	25		44:100
1997	1	5		20:100

Population Status And Trend Analysis

Mountain Goat populations in Yakima and Kittitas Counties appear to be stable. Surveys indicate varying Kid to adult ratios from year to year and between goat units. Without intensive survey effort small sample sizes have the tendency to increase the variance between years and units. Thus population status is generally determined on the best information available, which at times comes from our viewing public, especially when we do not have the funds

available to complete surveys. All the Goat unit south of Interstate - 90 appear to be doing well while our units north of I-90 are questionable. More information is needed on goat populations north of I-90 before population assessments can be made.

Habitat Condition And Trend

The winter of 1998-99 was a normal snowfall year with milder temperatures at lower elevations. Even though heavy snowfall occurred at high elevation, indications are that it did not impact the goat population. Cool and dry conditions in summer 1999 may have affected forage production.

Management Conclusions

Habitat conditions are improving s in Region 3 mountain goat range as a result of moist weather patterns. We are trying to survey as many of the goat units as possible and hope to be able to adequately survey all goat units each year. However, we do not have adequate funds to survey in 1998.

Our goal for permits levels are for no more than four percent of a healthy and stable population. This past year permits were decreased due to the harsh winter and no ability to assess the status of the population before the commission set permit levels. Future permit levels will depend on the outcome of this years winter and the ability to do surveys.

Species **Mountain Goat** **E. Ross Lk. , Jack Mt., Foss and Pratt River, Corral pass**

Mountain Goat **Goat Management Units 4-08, 09, 32, 34, 38**

Prepared by: Rocky Spencer, District Wildlife Biologist

Population Objectives/Guidelines

Mountain goat (*Oreamnos americanus*) are important in Washington for recreational viewing and hunting opportunities. Conservative harvest management strategies have been implemented to accomplish both objectives. Despite these efforts many local and regional populations have declined. Harvest management objectives are established at the 4 percent level, following the guidelines of Herbert and Turnball (1977). Similarly, Younds (1980 in Johnson 1983) suggests that a 5 percent harvest level can be sustained only if productivity rates are moderate and mortality rates are nominal. Further, conclusions from this study and data from Alberta indicate that detailed population dynamics information is needed if harvest levels are to exceed 3 to 5 percent (Johnson 1983). This data is currently not available.

While there are sound biological criteria to establish these harvest levels, we currently lack the baseline population information by which to implement this harvest strategy. This, coupled with limited survey dollars, habitat loss, road construction, and hunting that may have exceeded population harvest quota objectives have all likely contributed to local and regional population declines.

Hunting Seasons and Harvest Trends

Hunting is by permit only, generally beginning September 1 and 15 for archery and modern firearm hunters respectively, and ending on October 31. Ten permits each were issued in mountain goat hunts 6432 and 6434, Foss and Pratt Rivers respectively for years 1990-1996, and scaled back to 5 permits beginning in 1997 because of population concerns. Corral Pass was an archery only hunt with four permits allocated from 1991-1998, except it changed to any legal weapon in 1997. Hunter success and effort are presented in Table 1. Because the circumstances surrounding mountain goat hunting can vary notably from year to year because of snowfall, cloud cover, visibility, hunter skills and effort, yearly totals may not provide good insight to the dynamics of the population and hunting. Table 2 provides long term averages for specified categories for years 1991-1998. It should be noted that permit levels in the Pratt and Foss River were reduced from 10 to five each in 1997 and 1998; which primarily affects goat kill averages for 1995-98.

Table 1. Harvest and hunter effort summaries for specified areas in 1998.

Area	Number of Permits	Number of Goats Killed	Success Rate	Goats Seen	% Kids	Days\ Kill
Pratt River	5	0	0	0	0	0
Foss River	5	3	75	6	16.7	7.7
Corral Pass	4	4	100	40	20	4.3
East Ross Lake	5	0	0	21	19	0
Jack Mountain	2	0	0	2	0	0

Table 2. Averages for specified categories and years for Mt. Goat Hunts in Pratt River, Foss River, East Ross Lk., Jack Mtn., and Corral Pass.

Area	Year	Success Rate	Goats Killed	Goats Seen Per Hunter	% Kids	Days Per Kill
Pratt	91-94	51	4.5	59	18	6
River	94-95	38	1.75	21	19	13
Foss	91-94	25	1.8	23	24	7
River	95-98	26	1.5	18	7	38
Corral	91-94	63	1.8	105	24	10
Pass	95-98	75	2.3	53	23	12
E. Ross	91-94	40	3.3	32	20	24
Lake	95-98	24	2.5	29	22	8
Jack	91-94	63	1.3	24	12	5
Mtn.	95-98	38	.5	12	7	4

Pratt River shows declines in all categories (except % kids) between the years specified (Table 2), including an increase in days per kill. This trend continued in 1998, suggesting this population has declined since 1990.

Foss River averages show less dramatic and little change in success rate and goats seen, but a notable decline and increase in the percent kids, and days per kill respectively (Table 2). From the 1998 data, the major concern is the decline in the number of goats seen, which supports the average declines indicated for years specified in table 2.

Corral Pass also showed a decline the average number of goats seen in table 2 and again in 1998, table 1. This could indicate a decline in this population and should be watched closely.

Similarly, East Ross Lake and Jack Mtn. both show a 40% decline in hunter success rates for the 91-94 vs. 95-98 averages. Goats seen per hunter have also declined in both units, most notably is the 51% decline for Jack Mtn.; coupled with a 47% decline in the percent kids seen, this raises concern about this population (Table 2).

It is important to remember that the 1998 season was unusually warm and dry, which could have influenced all categories for specified areas in table 1 and to a lesser degree table 2.

There is currently no evaluation of the effect predation (primarily cougars) may have on these populations.

Population Trend and Analysis

Currently there are no statistically valid population estimates for mountain goat populations in the Pratt and Foss River, Jack Mtn., East Ross Lake and Corral pass areas. The comparative data for the 1991-94 and 1995-98 averages suggests a decline in these populations based on number of goats seen and and to a lesser degree the percent kids, days per kill may not be a good measure of population parameters for East Ross Lake and Jack Mtn. Both these areas show a decline in days per kill, yet all other parameters, except percent kids for East Ross Lake, suggest a decline in these populations (Table 2). Because of the need to manage goat populations conservatively permit levels will be reduced or eliminated in the Pratt and Foss Rivers and likely reduce in Corral Pass in 1999. Similar consideration should be given to East Ross Lake and Jack Mtn.

Habitat Condition and Trend

We have no direct data on habitat conditions and trends. However, empirical evaluation of available information has shown road access and logging of winter range has increased notably in the Foss and Pratt River Units, and cover adjacent to escape terrain has declined. Several authors have suggested these activities and conditions can be detrimental to goat populations (Wright 1977, Chadwick 1973, in Johnson 1983).

Management Conclusions

Management conclusions and recommendations are as follows:

1. It appears that mountain goat populations have declined from historic levels in at least the Foss and Pratt river Units**.** These units should be closed. Monitor Corral Pass, Jack Mtn., and East Ross Lake closely for continued indications of a population decline and the need to reduce permit levels.
2. Design and conduct a pilot project using paintball mark-recapture technique on selected populations. Refine and evaluate this technique to estimate goat populations with statistical validity. Determine if this application could be applied to other populations.
3. Consider a long term sightability study using brightly colored neck collars with radio transmitters, in conjunction with paintball mark-resight study to establish baseline population estimates.
4. Use the data collected from 2 and 3 above to establish, seek funding, and implement systematic survey routes to continue to provide baseline population estimates with CI's for all goat units. Once established, repeat routes biannually.

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Species	Region	Goat Units	Populations
Mountain Goat	**5**	**5-2, 5-3, 5-4**	**Goat Rocks, Smith Creek, Tatoosh**

Prepared by: Min T. Huang, Wildlife Biologist

Population Objectives/guidelines

Mountain goats (Oreamnos americanus) are prized in Washington as both a game animal and for viewing purposes. Region 5 of the Washington Department of Fish and Wildlife (WDFW) has three mountain goat population management units; Tatoosh (Goat Unit 5-2), Smith Creek (Goat Unit 5-3), and Goat Rocks (Goat Unit 5-4). Hunting in all three units is allowed by permit only. Current population goals for these three areas are to maintain or expand current population levels. A productivity goal of 20-25 kids per 100 adults is applied to these populations. Legal harvest levels are designed to remove 4% or less of the population.

Hunting Seasons And Harvest Trends

In 1998, as was the case in 1997, all three Units in Region 5 were open to any legal weapon. Prior to 1997, Smith Creek Unit was an archery-only Unit. Harvest quotas were conservative in 1998: Smith Creek, 3; Tatoosh, 5; and Goat Rocks, 7.

Hunting seasons in all three Units have traditionally been the last two weeks of September and the entire month of October. In 1998 the season opened on 1 September for archery-only hunting. Firearm hunting was allowed from 13 September - 31 October. The bag limit was one goat of either sex, with horns longer than 4 inches per permit. Hunting pressure in each Unit is limited by the conservative nature of the permit allocations.

Harvest trends, hunter success rates, hunter survey returns, and WDFW/USFS surveys indicate that mountain goat populations are not being negatively impacted by present hunting intensity. Concern over possible low recruitment or increasing adult mortality in the Goat Rocks Unit led to a reduction in permits from 10 to 7 in 1998. Current year survey effort indicated stable demographic ratios (See Surveys below)

Weather conditions in 1998 were variable for goat hunting. Warm, dry weather during the early weeks of September made hunting difficult, particularly in the Tatoosh Unit. The majority of animals in Tatoosh available for harvest migrate out of Rainier National Park with the onset of snow at the higher elevations. Warm weather tends to delay this movement. As a result, all harvest in Tatoosh occurred in the latter stages of the season. Early season harvest in Smith Creek was a result of archery-only hunting and the presence of resident animals. Harvest in Goat Rocks was concentrated in the month of October.

Overall, hunter success in 1998 was up from the previous two years (Table 1). Historically, success rates in the Goat Rocks Unit approached 100%. This was the case in 1998. This Unit contains extensive, high quality habitat, has the highest

Table 1. Summary statistics for Region 5 mountain goat harvests, 1993-1998.

Unit	Year	Permits issued	Harvest*	Success (%)	Avg goats seen	Kid:Adult seen	Avg days to harvest goat
Smith Creek	1998	3	2	67	21	36±24	7.7
	1997	3	1(2)	50	25	67	9.5
	1996	5	2	40	30	26±15	12.5
	1995	5	2(4)	50	36	14±14	22.5
	1994	3	2	67	17	28±24	6.0
	1993	3	2	67	43	59±30	11.0
Goat Rocks	1998	7	7	100	32	43±19	3.2
	1997	10	9(9)	100	21	30±20	2.8
	1996	10	6(9)	67	50	36±17	5.8
	1995	10	10	100	38	42±23	2.2
	1994	10	10	100	45	39±19	2.3
	1993	10	10	100	39	39±21	1.9
Tatoosh	1998	5	2(4)	50	15	54±28	7.5
	1997	5	1	20	11	16±16	8.0
	1996	5	1(3)	33	9	37±32	35.0
	1995	5	3(4)	75	9	28±22	6.0
	1994	5	2	40	3	33±33	15.0
	1993	5	2	40	3	15±15	12.5

*Numbers in ( )'s indicate surveys returned, if less than permits issued.
**Data missing

goat numbers, and is comprised of resident animals. Success rates in Goat Rocks since 1985 are stable (r=0.46, P=0.11). The number of goats seen by hunters is increasing (r=0.705, P=0.005). Harvest in 1998 comprised 6 billies and 1 nanny.

Since 1985 success rates in Tatoosh are declining (r=-0.644, P=0.01). The trend, however, is stable in the 1990's (r=-0.243, P=0.35). Goat sightings per hunter are up (r=0.673, P=0.009), though many sightings are from the Carlton Creek area or further north in the Park. Harvest in 1998 consisted of 2 nannies.

Goat hunting was initiated in the Smith Creek Unit in 1993, following augmentation and recovery of the population. The endemic goat population was nearly extirpated due to over-exploitation facilitated by easy hunter access and the patchy distribution and lower quality of goat habitat in the Unit. In 1993 hunting was archery-only. Permit allocation was conservative (n=3) for the first couple of years of hunting. Overall harvest was acceptably low and population response was favorable. Subsequently, permits were increased to 5 in 1995. The change in 1997 to any weapon resulted in a return to 3 permits. Hunter success has been stable (r=-0.278, P=0.62), as has the number of goats seen per hunter (r=-0.51, P=0.33). Harvest in 1998 was 2 nannies, with the additional crippling loss of an unknown sex animal.

Surveys

From 1993-97 survey intensity was concentrated in the Smith Creek Unit. A cooperative project between the Gifford Pinchot National Forest-Cowlitz River District and WDFW facilitated the use of helicopter surveys in Smith Creek. The results of those surveys indicated that the conservative permit allocations in the Unit were sustainable. Despite the continued presence of factors that make this population susceptible to over-exploitation (easy access, limited quality habitat) goat populations in Smith Creek continue to exhibit high overall productivity and relatively high numbers.

As a result of limited funding in 1998, survey effort in Region 5 was conducted solely from the ground. A total of three survey days were expended. Surveys concentrated on Smith Creek and Goat Rocks. In addition to WDFW surveys, USFS wilderness rangers were requested to note locations and composition of goats during the summer. All goats were classified as kid, billy, nanny, unknown adult, or unknown. A kid-to-adult ratio was calculated from survey results. Ninety-percent confidence intervals around the ratios were determined following Czaplewski et al. (1983).

A total of 31 goats were observed in Goat Rocks and 8 in Smith Creek (Table 2). The kid-to-adult ratio of 29:100±20 in the Goat Rocks is within acceptable limits. The lower 90% confidence interval, however, is below desired productivity levels. Sample size in Smith Creek is too small for meaningful interpretation, however, hunter report cards indicated kid-to-adult ratios of 36:100±24. In Goat Rocks, hunters saw 43:100±19.

Table 2. Mountain goat survey results, Smith Creek and Goat Rocks Units, 1998.

Goat Unit	Billies	Nannies	Kids	Unk Adult	Kid:Adult
Smith Creek	2	4	2	0	N/A
Goat Rocks	2	8	7	14	29±20:100

Population Status And Trend Analysis

Goat populations in Region 5 are stable. There are no significant trends in any of the Units. Current levels of removal are sustainable. Permit allocation is conservative enough that removal of nannies in Smith Creek and Tatoosh does not have a detrimental effect on productivity. The majority of harvest in Goat Rocks has historically been of billies. Reliance solely upon hunter success rates, however, is impractical, due to small sample sizes. Changes or inferred stable trends can be biased merely by sampling error (Caughley 1977).

Five years of relatively intensive survey effort and hunter report cards also indicate that goat populations are doing well in the Region. Although plagued by significant annual variation (see Management Conclusions below), hunter reported kid:adult ratios indicate good productivity in the Region.

Results of the cooperative Cispus AMA study with the USFS indicate that goat populations are expanding in several areas of the Region. Sightings of goats are becoming common around the Mt. St. Helens area and the north-south ridge systems south of the Cispus river contain good numbers of goats (see Management Conclusions below). A sighting of one of the original ear-tagged Smith Creek transplants in the Mt. Adams Wilderness indicate that goats are likely expanding their range. Long-term changes in habitat (see Habitat Condition below), particularly in the Smith Creek Unit, may limit certain goat populations in the future.

Habitat Condition And Trend

High elevation openings characteristic of goat habitat are being lost in the Smith Creek Unit due to conifer encroachment. Alpine meadows are critical mountain goat foraging areas, and their decline, given the limited extent of suitable goat habitat in the Smith Creek Unit, represents a serious threat to the sustained viability of this goat population. Results of the cooperative Cispus AMA project indicate that in the four study areas (Stonewall ridge, South Point ridge, Smith ridge, and Castle Butte), a total of 404 acres of alpine meadow have been lost in the period 1959- 1990 (Table 3).

Table 3. Analysis of alpine meadow in the Smith Creek Goat Unit. (From T. Kogut, USFS)

Ridge system	Extent of Meadows (acres) Historic (1959)	Recent (1990)	Difference
Stonewall	348	259	-89
South Point	749	529	-220
Smith	248	195	-53
Castle Butte	599	557	-42
Total	1944	1540	-404

The documented loss of alpine meadow constitutes an overall decrease of 20.8% in the study area. Of the 1,540 acres of alpine meadow identified to presently exist in the study area, only 311 acres (20.2%) were classified as having low conifer intrusion. The remaining alpine meadows were classified as having moderate (53.8%) and high (26.0%) levels of conifer intrusion. Meadows with high to moderate conifer intrusion can be expected to become un-suitable for goats within 35 years. Avalanche chutes comprise an additional 1047 acres of marginal goat habitat.

High alpine meadows are thought to be primarily created through disturbance such as avalanche, disease, windthrow, and fire (Hemstrom 1979). Periodic fire is considered to be one of the most important factors in the creation and maintenance of alpine meadow (Olmsted 1979). United States Forest Service policy currently dictates the suppression of both man-made and naturally occurring fires. This policy has probably resulted in the losses of alpine meadow documented in the above study.

Habitat Enhancement

Continued budget cuts and other constraints in both the USFS and WDFW make the possibility of a prescribed burn program in the foreseeable future unlikely. Habitat at present is not limiting goats, however, enhancement will have to be pursued in the next decade as more and more habitat in the Smith Creek Unit is lost to conifer encroachment.

Management Conclusions

All three mountain goat Units in Region 5 are valued for both viewing and hunting opportunities. Consequently, harvest quotas are kept conservative to maximize both the consumptive and non-consumptive recreational attributes of these populations. Present permit levels in these Units are adequate and should remain.

Based upon the results of the cooperative Cispus AMA study, alpine meadow restoration in the Smith Creek Unit is recommended. This is contingent upon USFS funding and environmental approvals.

The initiation of aerial survey is also recommended. Due to inherent low productivity and high mortality rates among 1 and 2 year olds, mountain goats are highly susceptible to over-harvest. Presently, our information about goat population dynamics is limited. Although hunter report cards provide information on demographic parameters, this data is highly variable. Between year variation in hunter observed ratios within each goat Unit is very significant (B_c = -845.2, $P < 0.001$). This is further evidenced by the large confidence intervals around the estimates (Table 1). This is likely due to hunters observing and counting the same groups of goats repeatedly, some mis-classification, and lack of sampling independence. Aerial surveys would provide the least biased data and the most efficient method of census, particularly considering the large expanse of area involved. Budgetary constraints and other species priorities make annual aerial surveys impractical, however, surveys on a three year interval would still provide excellent data.

Research is needed to develop population estimates and models for the goat populations in Region 5. Marking of goats with highly visible, numbered ear tags, and colored collars, in conjunction with the use of an open population model such as the Jolly-Seber, or Pollack's robust design, could provide a useful population estimator and model. Both the Jolly- Seber and Pollack's robust design provide estimates of survival, productivity, and total population size at each sampling interval. Re-marking could be achieved through ground surveys and hunter surveys. Due to relatively small population sizes, the initial marked sample sizes needed for acceptable precision and low variance of the estimate would not be excessive. Due to the openness of the habitat goats favor, a mark-resight study of goats may not experience the observational bias and lack of capture heterogeneity that often plague such studies (McCullough and Hirth 1988). Should acceptable variance and model outputs be obtained, accuracy and reliance upon current trend data could be evaluated.

Additionally, identification of important habitat linkages between Smith Creek and Goat Rocks with isolated habitats such as Mt. Adams and Mt. St. Helens National Volcanic Monument should be initiated. Geographic Information Systems (GIS) coverages could be employed to identify suitable goat habitat within un-suitable matrix. Potential corridors between such areas could then be managed for goats.

Augmentation/translocation Recommendations

None are needed nor recommended.

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Species **Region**

Bighorn Sheep **Statewide**

Prepared by: **Steve Pozzanghera, Carnivore, Furbearer, and Permit Species Section Manager**
Cliff Rice, Game Surveys Coordinator

Population Objectives/guidelines

The goal of the bighorn sheep management program is to increase Rocky Mountain and California bighorn sheep populations to self sustaining levels that occupy all available habitat within their historic range in Washington.

Specific bighorn sheep management objectives and strategies that relate to habitat, populations, recreation, information and education, enforcement, and research are detailed in the statewide 1995 Bighorn Sheep Management Plan. Specific herd management objectives and strategies are identified within 14 individual Bighorn Sheep Herd Plans.

Hunting Seasons And Harvest Trends

Bighorn sheep hunting opportunity in Washington is strictly limited by permit. Permit availability and therefore hunter opportunity has decreased slightly over the last 10 years (Figure 1.) Eleven general season permits were available in 8 different sheep management units for 1998 and a total of 2,360 applicants entered the drawing. One of the 8 areas available for hunting in 1998 was open for the first time (Quilomene). Two additional permits were available for bighorn sheep in 1998 (1 raffle ,and 1 auction). The 1998 bighorn sheep general season provided 26 days of hunting (September 15 to October 10). In 1998 all sheep units open to hunting allowed the use of any legal weapon, this provides eligibility to all hunters for all units and maintains hunter choice of weapon. Hunters with a permit may take any bighorn ram (i.e., no curl restrictions).

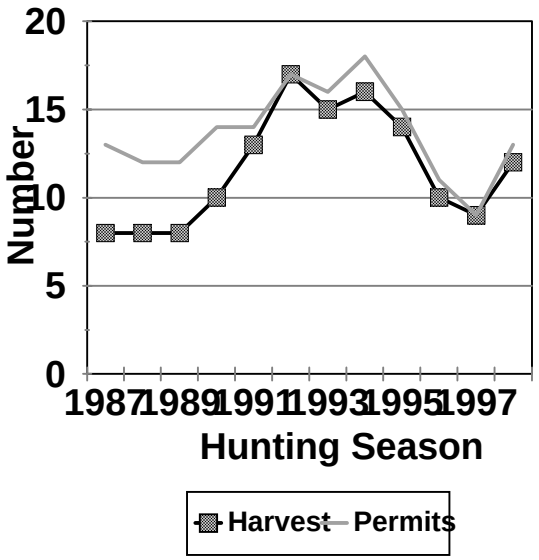

Figure 1. Number of sheep harvested and permits issued in Washington State.

Bighorn sheep hunting seasons in Washington occur relatively early in the year and weather is rarely a factor in hunter success. Of the total 13 permits available in 1998, all 13 individuals actually reported that they hunted bighorn sheep. A total of 12 sheep were killed for a hunter success rate of 92%. This harvest is equal to the 11-year averabe of 12 sheep /year (1987 to 1997) (Figure 1.).

Surveys

All seven of 8 bighorn sheep units open to hunting in 1997 were surveyed. Additional herd surveys of non-hunted populations occurred in 8 other units, including within 4 herds of the Blue Mountains. Survey efforts in this area continue to be a priority as we attempt to document population recovery from the 1995 pasteurella outbreak. Both ground counts and aerial surveys were used to survey and classify sheep as either lambs, ewes, or rams. Rams were further classified as yearling, less than 3/4 curl, or greater than 3/4 curl. adults or kids. Surveys were conducted at differing times throughout the year, with a general pattern for most regions to survey lamb production in early summer and total herd composition in the winter. Some regions also indicated a desire to conduct aerial sheep surveys in conjunction with their winter elk composition surveys.

Population Status And Trend Analysis

Rocky Mountain bighorns in the Blue Mountains continue to struggle as they recover from the 1995 pasteurella outbreak which decimated their populations. Lamb mortality has remained high through 1998. Despite this, the total sheep population estimate for 1998 within the Blue Mountains has increased slightly (Table 1). and it is hoped that 1999 lamb survival will improve. California bighorn populations increased in most herds, as these animals rebounded from the severe winter of 1996-97. The population of California bighorns now numbers more than 700 (Table 2). Population growth has allowed us to establish a new herd within the Tieton River drainage using 12 bighorn sheep that were captured and relocated from within the Umtanum and the Quilomene units.

The Washington Department of Fish and Wildlife has continued its cooperative work with the Foundation for North American Wild Sheep, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, U.S. Forest Service, and the Bureau of Land Management on restoration of bighorn sheep within Hells Canyon. Sightability surveys which should enhance our ability to estimate total populations within Hells Canyon were completed for the first time in 1997. These cooperative flights will continue for 1998.

Lastly, the Washington state chapter of the Foundation for North American Wild Sheep continues to be active in bighorn

Table 1. Rocky Mountain bighorn sheep population trend.

Sheep Herd	Population 1994	1995	1996	1997	1998	1999	Comments
Hall Mountain	35	35	35	30	30	--	Recent low lamb survival improved. High predator populations are likely a contributing factor.
Asotin Creek	15	12	13	13	30	35	A supplemental release of 10 bighorns from BC occurred in January 1998. This herd escaped the pasteurella die-off.
Black Butte (Joseph Creek)	215	50	45	54	64	70	Lamb mortality remains high. Yellow-star thistle continues spreading despite aggressive herbicide programs.
Wenaha	110	90	50	69	65	70	Lamb mortality continues to be high. Yellow-star thistle is serious range threat.
Cottonwood Creek (Mt. View)	60	45	18	23	23	32	Survival of lambs in 1999 greatly improved.
Total	435	232	161	189	212	237	

sheep management and it is hoped that we may work cooperatively with this group on sheep reintroductions, habitat improvement projects and habitat acquisition.

Habitat Condition And Trend

General bighorn sheep range conditions in 1997 were good to excellent based on above average winter and spring precipitation. Range conditions have also been positively influenced in several areas by wildfires which burned in the late 1980's and early 1990's. These areas have had their shrub and tree component removed and it has been replaced by grass; a positive shift for bighorn sheep. Noxious weed invasion, primarily yellow-star thistle continues to be a concern on most bighorn sheep range as does the grazing of domestic sheep.

Management Conclusions

Bighorn sheep management in Washington centers around several issues. Noxious weed control is important for maintaining quality forage habitat for sheep and aggressive programs aimed at eliminating invading species and restoring native grasses are essential. Noxious weed control can be accomplished only in conjunction with better overall range grazing practices. Where the potential exists for conflicts between bighorn sheep and domestic sheep, particularly on federal lands, we should seek cooperative agreements that place a priority on the restoration of native species (i.e., bighorn sheep).

Restoration and reintroduction of bighorn sheep should remain a priority, and several herds may need augmentation if they are to rebound from apparent stagnation. Releases of sheep into the Tieton should continue for several more years and additional sheep should be released onto the north shore of Lake Chelan.

The monitoring of the Blue Mountains herd also remains a priority as that area recovers from the 1995 pasteurella die-off. Lastly, coordination and cooperation with the tribes will become of greater importance as tribal interest in sheep hunting increases.

Table 2. California bighorn sheep population trend.

Sheep Herd	Population 1994	1995	1996	1997	1998	1999	Comments
Tucannon	50	45	50	50	42	30	Continued poor lamb survival. Predation may be a limiting factor. As an California population in the Blue Mtns., should be replaced with Rocky Mountain sheep.
Vulcan	115	100	70	70	35	--	No lambs in most recent surveys and low number of adult ewes in the population.
Mt. Hull	--	55	60	65	--	70	Population stable lthough anticipated growth may have been moderated by harsh winters in 92-93 and 96-97. Colville tribe will likely convert their sheep permit to either sex.
Sinlahekin	--	--	45	40	40	40	Population continues to struggle. Range forage condition is poor due to noxious weed and livestock competition.
Swakane	30	38	25	30	36	--	Population is static yet contains a high number of adult rams.
Quilomene	50	70	90	135	143	164	Continues as the fastest growing herd in Washington since introduction in 1993. Exposure to domestic sheep a threat.
Umtanum	200	150	150	150	154	174	Population has maintained itself despite removal of 43 sheep for transplants to new areas.
Cleman	55	60	65	100	117	135	Third consecutive good lamb production year.
Lincoln Cliffs	35	45	65	90	102	--	Excellent production continues as herd continues to grow.

Species	Region	Sheep Unit(s)	Population
Bighorn Sheep	**1**	**NA**	**Asotin Creek Herd**

Prepared by: Pat Fowler, District Wildlife Biologist

Population Objectives/guidelines

The population management objective for the Asotin Creek herd is to increase bighorn sheep numbers to a self sustaining, healthy population capable of supporting both consumptive and non-consumptive recreation. It is estimated that the current herd range can support a healthy population of approximately 75-100 bighorn sheep.

Surveys

Surveys conducted in March were done using the protocol for the sightability model developed in Idaho. The Idaho protocol does not differ significantly from the system we have used for many years. In March, 1999 observers counted all seven collared sheep, with a total of 27 bighorn sheep counted (Figure 1).

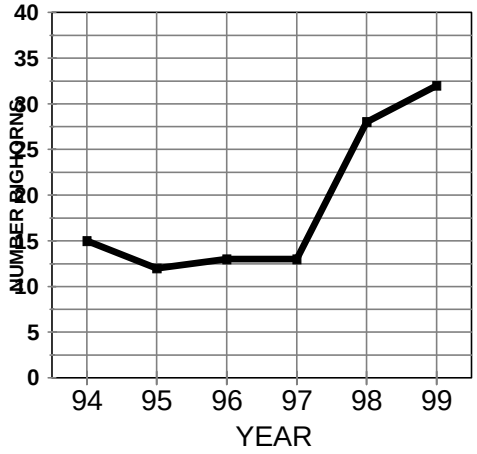

Figure 1. Bighorn sheep survey trend, Asotin Creek. (Includes migratory rams)

Population Status And Trend Analysis

Bighorn sheep were re-introduced into the Asotin Creek drainage in 1991 with the release of six bighorn sheep from the Hall Mountain herd in northeast Washington. Another supplemental release occurred in 1994 with the release of nine bighorn sheep from Hall Mountain. The population fluctuated between 10 and 15 bighorn sheep, but failed to show significant growth, probably due to low lamb survival (Table 1).

A supplemental release of 10 bighorn sheep from British Columbia occurred in January of 1998: 2 yearling rams, 7 ewes, and 1 female lamb.

Surveys conducted in June of 1998 produced a count of 27 bighorn sheep: 7 rams, 13 ewes, and 7 lambs. If lamb survival improves, this bighorn population should start to show an increasing trend over the next few years. Surveys conducted in 1999 also produced a count of 27 bighorns.

All of the bighorn sheep from the 1998 release were radio-collared, except the lamb, in order to monitor movements. The ewes have confined their movements to the upper Asotin Creek drainage (normal herd range). One ewe died in early 1999. The rams continue to move back and forth between the Mt. View herd range on Lake Rigde and Asotin Creek. This type of movement will expose the Asotin Creek herd to scabies and other diseases associated with the Mt. View herd.

Lamb mortality was minimal in 1998, with 8 lambs counted in June 1998, and 7 lambs surviving to the spring of 1999. Lamb survival at this level will allow the herd to increase in numbers, as long as adult mortality remains low.

Surveys in June of 1999 resulted in a count of 16 ewes with 8 lambs. Minimal lamb mortality occurred during the summer, by August, 8 lambs were still alive in the Asotin Creek herd.

Habitat Condition and Trend

Habitat conditions within the range of the Asotin Creek herd are generally good. However, yellow-star thistle is invading the area and could cause significant habitat degradation if it is not controlled.

Table 1. Population Trend and Herd Composition, Asotin Creek Herd, Blue Mtns. Washington
( ) indicates number of Class-4 rams in > 3/4 segment. * Count in June 1999. Yl = yearling, <3/4 = less than 3/4 curl rams, >3/4 = greater than 3/4 curl rams, and L:100:R is lambs (L) and rams (R) per 100 ewes (100).

			Rams				Count	Population	Per 100 Ewes
Year	Lambs	Ewes	Y1	<3/4	>3/4	Total	Total	Estimate	R:100:L
1994	3	6	3	2	1	6	15	15	100:100:50
1995	1	4	1	3	1	5	10	12	125:100:25
1996	1	5	0	1	4 (1)	5	11	13	100:100:11
1997	2	14	1	1	3 (1)	5	21	13	36:100:33
1998	7	13	3	2	2 (1)	7	27	30	54:100:54
1999*	8	16	1	2	5 (2)	8	32	35	50:100:50

* Rams are moving onto Lake Ridge, within the range of the Mt. View herd, eight observed on Lake Rg. in June 1999.

Augmentation/habitat Enhancement

Weed control projects are being implemented within the herd range. Controlled burns are also in progress on an experimental basis to halt the expansion of yellow-star thistle

Aerial application of herbicides is also being used to control the spread of noxious weeds.

Disease and Parasites

The Asotin Creek herd was not impacted by the Pasteurella die-off that occurred in 1995-96. This herd has remained scabies free since re-introduction, but rams moving between the Asotin and Mt. View herds will, undoubtedly, infect this population with scabies in the near future.

Management Conclusions

The management objective for the Asotin Creek herd is to increase the population to approximately 75-100 bighorn sheep.

At that point, the population and habitat will be assessed to determine if the population can expand safely, or herd growth should be controlled. If herd growth needs to be controlled, options for controlling the population will be evaluated: trap and transplant, ewe seasons, etc.

Permit controlled hunting for rams will be implemented when the population meets specific criteria established in the Bighorn Sheep Management Plan.

Species	Region	Sheep Unit(s)	Population
Bighorn Sheep	**1**	**9**	**Black Butte Herd**

Prepared by: Pat Fowler, District Wildlife Biologist

Population Objectives/guidelines

The Black Butte herd suffered a major Pasteurella die-off during the winter of 1995-96, reducing the population from approximately 220 bighorn sheep to 52. The long-term management objective will be to restore this bighorn sheep population to 150-200 animals.

Hunting Seasons and Harvest Trends

Permit controlled hunting was terminated in both Washington and Oregon after the die-off. Permit controlled hunting will be recommended when this population meets criteria for establishing permits, as listed in the Bighorn Sheep Management Plan. Since the Black Butte herd is an inter-state herd, hunting seasons and permit levels will be developed in conjunction with the Oregon Department of Fish & Wildlife and Idaho Department of Fish and Game.

Surveys

Surveys conducted in March, 1999, were done using the protocol for the sightability model developed in Idaho. The Idaho protocol does not differ significantly from the system we have used for many years, so the data should be comparable under normal survey conditions. The level of sightability is determined by the number of collared ewes counted, compared to the total number of collared ewes in the population. In 1998, 10 of 11 collared ewes were observed; 91%. In 1999, all 11 collared ewes were observed; 100% . Developing a sightability model for the type of terrain inhabited by bighorn sheep in the Blue Mountains is very important, because it may differ substantially from models developed in different habitat types in other areas. Applying models developed in other areas may introduce a significant amount of error into population estimates derived from surveys.

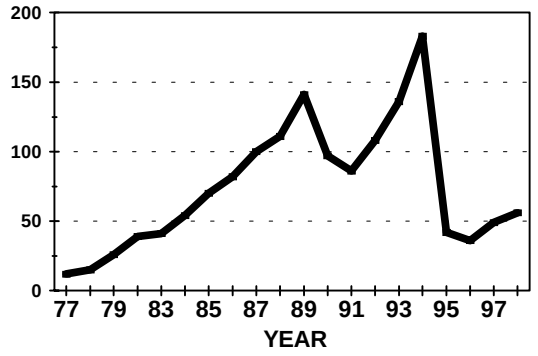

Figure 1. Bighorn Sheep Survey Trend, Black Butte Herd

Population Status And Trend Analysis

Aerial surveys are conducted in conjunction with post-season elk surveys in March, in order to determine population trend and herd composition at the low point of the annual population cycle. The Black Butte bighorn sheep population has increased slightly since the die-off of 1995-96. Population trend surveys conducted in 1996, 1997, and 1998 produced counts of 36, 49, and 56 bighorn sheep, respectively (Table 1, Figure 1).

Table 1. Black Butte Herd Composition Data 1989-99, Blue Mtns. Washington. ( ) indicates number of Class-4 rams in > 3/4. YI = yearling, <3/4 = less than 3/4 curl rams, >3/4 = greater than 3/4 curl rams, and L:100:R is lambs (L) and rams (R) per 100 ewes (100).

			Rams				Count	Population	Per 100 Ewes
Year	Lambs	Ewes	Y1	< 3/4	> 3/4	Total	Total	Estimate	R:100:L
1989	33	64	—	28	16 (8)	44	141	150	69:100:52
1990	16	46	—	14	21 (9)	35	97	120	76:100:35
1991	23	45	—	13	5 (2)	18	86	110	40:100:51
1992	31	55	—	10	12 (7)	22	108	130	40:100:56
1993	39	75	—	7	15 (7)	22	136	150	29:100:52
1994	51	93	—	13	26 (8)	39	183	215	42:100:55
1995	2	34	3	1	2 (1)	6	42	50	19:100:6
1996	2	29	2	1	2	5	36	45	17:100:7
1997	7	30	4	4	4 (2)	12	49	54	40:100:23
1998	11	31	4	5	5 (2)	14	56	64	45:100:35
*1999	15	31	5	6	4 (2)	15	61	70	48:100:48

* 1999 surveys conducted in June-July, ram numbers estimated from previous surveys.

Lamb production and survival has been monitored closely since the Pasteurella induced die-off. Lamb mortality due to pneumonia took a heavy toll of lambs shortly after birth in 1996 and 1997. Surveys of the Black Butte herd were conducted in early July, 1998 and produced a count of 27 ewes with 19 lambs (70 la./100 ewes). In March, 1999, 27 ewes were counted with 11 lambs, which indicated lamb mortality over the ten month period was close to 42%.

During June, 1999, surveys produced a count of 26 ewes with 19 lambs (73 la./100 ewes), excellent productivity. By September, several lamb mortalities were documented, both to accidents and pneumonia. In September, 27 ewes were counted with 9 lambs (33 la./100 ewes), indicating lamb mortality of 55% over a two month period. Lamb mortality in 1999 may exceed the level of lamb mortality experienced in 1998-1999.

Habitat Condition And Trend

Yellow-star thistle continues to spread into the Black Butte-Grande Ronde drainage. Efforts to control the spread of yellow-star by using aerial application of herbicides have been fairly aggressive, but is failing to slow the advance of this invader.

Augmentation/habitat Enhancement

Yellow-star thistle is the biggest threat to habitat in the range of the Black Butte herd. Efforts will continue to control and reverse the spread of this noxious weed. Combinations of herbicide, biological controls, and re-seeding may be tried in the future.

Disease and Parasites

The pneumonia induced die-off appears to be running the usual course over time. Lamb survival was poor in 1996 and 1997, but improved slightly in 1998. Lamb production in 1999 was excellent, however, by September over half of the lambs had died.

To date, we have not been able to isolate the specific pathogen responsible for lamb mortality. Work continues in an effort to isolate and identify the various strains of bacteria that may be involved in this process.

In September, 1999, two rams and several ewes were observed with runny noses, and a number of them were coughing. At this writing, we do not know how severe the current infection may be, or what direction it will take.

Scabies continues to be a problem, but Rocky Mountain bighorns appear to deal with this nuisance fairly well. However, in some years, severe infestations can cause problems for lambs and reduce survival rates.

Lungworm loads appear to be holding at a low level based on analysis of fecal samples from radio-collared ewes and necropsied individuals, and is not a problem at this time.

Contact with domestic sheep is still considered the major threat to this bighorn sheep population. A ranch adjacent to the Chief Joseph W.A. has approximately 150 domestic sheep that occasionally trespass onto WDFW ground, and could come in contact with bighorn sheep. A barrier fence was constructed in the spring of 1999 in an effort to limit contact between domestic sheep and bighorns. However, the fence may not stop bighorn rams from investigating the domestic sheep at certain times of the year.

Management Conclusions

The Black Butte herd is struggling due to the Pasteurella die-off that occurred in 1995-96. This population will not increase significantly until annual lamb survival is maintained at 30-40 lambs/100 ewes for several years.

The bighorn sheep population has increased from a low of approximately 45 sheep in 1996, to 70 in 1999.

Contact with domestic sheep is still considered the most significant threat to the Black Butte herd. This problem will continue until the public understands the threat domestic sheep pose to bighorn sheep.

The long term management objective for the Black Butte herd is to increase the population to approximately 150-200 sheep. At that time, habitat and herd health will be assessed to determine if the population should be allowed to increase, or management options implemented to stabilize population growth: trap, transplant, or ewe seasons.

Species	Region	Sheep Unit(s)	Population/Herd
Bighorn Sheep	**1**	**NA**	**Hall Mountain**

Prepared by: Dana L. Base, Wildlife Biologist
Steve Zender, District Wildlife Biologist

Population Objectives/guidelines

Rocky Mountain bighorn sheep were introduced to Hall Mountain from Alberta, Canada in 1972 (Johnson 1983). The Hall Mountain Bighorn Sheep Herd Plan calls for maintaining a population of 40 - 70 Rocky Mountain bighorn sheep within the Hall Mountain herd. Herd composition objectives stipulate a lamb to ewe ratio of at least 50:100. A ram to ewe ratio of 50:100 is also desired. The Hall Mountain herd is not currently hunted; however, this population has been used as a primary source for transplants of Rocky Mountain bighorn sheep to other parts of the state. In addition, the Hall Mountain herd has played a substantial role for a "Watchable Wildlife Area" where the general public could easily see bighorn sheep.

Surveys

As traditionally carried out since the early 1970's, ground surveys at the winter feeding station were used in late 1998 and early 1999 to estimate the total number of sheep, sex ratio, and lamb production. (Table 1). Similar efforts counting and classifying bighorn sheep in British Columbia which occasionally mix with the Hall Mountain herd were also carried out over the 1998-99 winter. Count totals at a feeding station along Canada Highway 3 included 5 lambs, 14 ewes, and 9 rams

Table 1. Population composition counts from the Hall Mountain Bighorn Sheep Area since herd establishment in 1972. Note that subsequent to the original release of 18 sheep in 1972, there has been only one release of two adult ewes in 1981. There have been 85 sheep translocated out of the population over nine separate years.

						Number Translocated			
Year	Lambs	Ewes	Rams	Count Total	Population Estimate	Lambs	Ewes	Rams	Ratio Lambs : 100 Ewes : Rams
1972	ND	13	5	18	= first release				? : 100 : 38
1973	ND	ND	ND	ND	ND				ND
1974	7	ND	ND	19	25				ND
1975	5	ND	ND	22	30				ND
1976	2	7	5	14	36	2	5	2	29 : 100 : 71
1977	ND	ND	ND	ND	25				ND
1978	5	10	6	21	30				50 : 100 : 60
1979	8	ND	ND	27	35				ND
1980	9	15	4	28	45				60 : 100 : 27
1981	14	24	10	48	60				58 : 100 : 42
1982	15	34	21	70	70	4	8	3	44: 100 : 62
1983	13	22	13	48	55	7	3	1	59 : 100 : 59
1984	17	27	17	61	65				63 : 100 : 63
1985	12	29	21	62	65	8	15	3	41 : 100 : 72
1986	9	11	13	33	35			1	82 : 100 : 118
1987	6	10	12	28	30	2		1	60 : 100 : 120
1988	5	12	10	27	30				42 : 100 : 83
1989	9	15	13	37	40				60 : 100 : 87
1990	11	20	19	50	50	3			55 : 100 : 95
1991	6	12	12	30	40	1	3	2	50 : 100 : 100
1992	5	14	12	31	40				36 : 100 : 86
1993	9	18	13	40	45	3	4	4	50 : 100 : 72
1994	6	14	13	33	35				43 : 100 : 93
1995	5	15	10	30	35				33 : 100 : 67
1996	5	17	10	32	35				29 : 100 : 59
1997	3	14	10	27	30				21 : 100 : 71
1998	6	11	8	25	30				55 : 100 : 73

ND = Insufficient data available.

for a lamb/ewe/ram ratio of 36 L : 100 E : 64 R (G. Woods, pers. comm.). The U.S. Forest Service (Sullivan Lake Ranger District, Colville National Forest) has been monitoring survival and movements on a number of bighorn sheep from the Hall Mountain herd by radio telemetry since 1995 (Aluzas 1997, Bertram 1996). On January 12, 1999 we corral-trapped thirteen bighorn sheep including 4 lambs, 3 rams, and 6 ewes at the Noisy Creek Winter Feeding Station in cooperation with the Washington State University School of Veterinary Sciences and the Colville National Forest. Five of the captured sheep were fitted with new radio collars. Table 2 presents information on all sheep fitted with radio transmitters and their current status. As of June 1999, there were 5 rams and 6 ewes alive and actively transmitting.

average (6) for number of lambs at the feed site.

Several radio telemetered sheep mortalities were confirmed in 1997, the same year we had very low lamb numbers at the feeder (Table 2). We are encouraged that survival of marked adults as well as the higher number of lambs returning to the feeder in the past year has improved considerably.

The low lamb ratios in 1996 and 1997 raised concern for pregnancy rates in the ewes. An added advantage of an annual trapping effort with WSU is the ability to monitor this. Test results from blood samples taken from the ewes captured in January 1999 indicated that all six were pregnant (W. J. Foreyt, pers. comm.).

Habitat Condition And Trend

This part of the state is heavily forested and bighorn sheep depend upon the steep terrain and open grasslands on Hall Mountain and other scattered sub-alpine openings for forage and predator avoidance. Between Hall Mountain, Crowell Ridge, and Gypsy Ridge, escape terrain appears significantly limited and fragmented. Sheep, and especially lambs, migrating between these and other peaks and ridges have to go through forest and may be highly vulnerable to predators. At this time there are no firm plans to enhance existing bighorn sheep habitat.

Table 2. Radio telemetered Bighorn Sheep from Hall Mountain and their status as of June 1999.

Transmitter Frequency	Mo/Yr Radio-Tagged	Sex	Capture Age	Ear Tag #	Status
149.878	12/95	M	10+	Orange 12	Mortality in July 1997
149.196	12/95	F	2.5	Yellow 28	Unknown - latest signal at Hall Mtn., 7/29/98
149.218	12/95	F	2.5	Yellow 30	Mortality in July 1998
149.238	02/96	M	4+	Red 11	Alive - latest signal at Hall Mountain
149.070	02/96	F	4+	Red 14	Alive - latest signal at Hall Mountain
149.339	12/96	F	4+	Red 39	Mortality in August 1997
149.238 & # 149.442	12/96	M	4+	None	Unknown-last detected at Gypsy Ridge,8/13/97
149.320	12/96	M	8.5	Yellow 29	Mortality in August 1997
149.301	12/96	F	2.5	None	Alive - latest signal at Gypsy Mountain
149.180	12/96	F	4+	None	Mortality in September 1997
149.077	12/96	M	6+	None	Alive - latest signal at Hall Mountain
# 149.162	12/96	M	2.5	Red 16	Unknown - last detected at Hall Mtn.,10/10/97
149.360	12/96	M	4+	None	Alive - latest signal at Hall Mountain
* 149.320	12/96	F	2.5	Green 8	Alive - latest signal at Hall Mountain
149.842	01/99	F	4+	Lavender 51	Alive - latest signal at Hall Mountain
149.850	01/99	F	4+	Lavender 52	Alive - latest signal at Sand Mountain
149.862	01/99	F	6.5	Lavender 54	Alive - latest signal at Gypsy Mountain
@149.878	01/99	M	4+	Lavender 58	Alive - latest signal at Hall Mountain
149.944	01/99	M	4.5	Green 18	Alive - latest signal at Hall Mountain

= Experimental radio transmitter attached to ear tag on two bighorn sheep. All other sheep received radio-collars.
* = Original radio frequency on 149.320 ewe was 149.010.
@ = Radio frequency re-used on a new bighorn sheep subsequent to mortality of the first animal.

Population Status And Trend Analysis

The Hall Mountain bighorn sheep herd has apparently not recovered to the 1993 population level, the last year that animals were transplanted out of the herd (Table 1). From 1994 through 1997 lamb recruitment had declined to less than the management objective ratio of 50 lambs per 100 ewes. In 1998 this ratio improved to 55 lambs per 100 ewes. The combined British Columbia - Washington herd has 25 ewes and 11 lambs for a lamb:ewe ratio of 44. Our number of ewes at the Hall Mountain feeder has dropped to a relatively low level at 11 but the improved lamb survival this year brings us up to the 10 year

Wildlife Damage

There have been no reported incidents of wildlife damage caused by the Hall Mountain bighorn sheep. As this population

has traditionally been fed during the winter months at the Noisy Creek Feeding Station, the sheep tend to concentrate there and thus "stay out of trouble." Potentially, without supplemental winter feeding, sheep could easily stray to human settlements for food.

Watchable Wildlife Area

The 1998-1999 winter (like the preceding winter) was mild compared to most winters in northeastern Washington. Hence the Hall Mountain bighorn sheep availed themselves of less food at the Noisy Creek Feeding Station than over more typical winters. A substantial portion of the stockpiled hay bales and alfalfa pellets went unused. As ususal, public visitation to the site peaked around the Christmas and New Years holidays. Sheep largely quit using the feeders by late February of 1999 and winter feeding was discontinued at that time.

The Washington Department of Fish and Wildlife has recently renewed its "Special Use Permit" from the U.S. Forest Service for trap and feed storage structures at the Noisy Creek bighorn sheep feeding and viewing station. In addition an enhanced public viewing platform and fenced area is scheduled for construction before next winter. Continuing the feeding program will hopefully contribute to recovering herd productivity so that Hall Mountain bighorn sheep may continue to be used as transplant stock for other areas in Washington.

Augmentation/Translocation

No efforts were made to either supplement or translocate Hall Mountain bighorn sheep in 1998.

Management Recommendations

The Hall Mountain Bighorn Sheep has not recovered to population and lamb recruitment levels experienced in the early 1990's. There are some encouraging signs, however, as lamb recruitment was up in 1998 and each of the six ewes captured at the feeder was pregnant. Close monitoring of ewes and lambs especially needs to continue. This should be facilitated by the radio-collaring of five new sheep in January 1999. The following additional recommendations are given to help enhance herd productivity in the future:

* Continue to take blood samples of ewes for pregnancy testing at the annual winter sheep capture.
* Radio track all telemetered sheep as closely and regularly as practicable.
* Encourage the Colville National Forest to carry out controlled burning to enhance forage and predator escape terrain on Hall Mountain and other areas that are key to the herds range.
* Finish construction of a fenced viewing area for the public which should reduce the potential of disturbance to feeding sheep as well as enhance wildlife viewing quality at the Noisy Creek winter bighorn sheep feeding station.

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Species	Region	Sheep Unit(s)	Population/Herd
Bighorn Sheep	**1**	**12**	**Lincoln Cliffs**

Prepared by: G J Hickman, District Wildlife Biologist

Population Objectives/guidelines

An initial introduction of eleven bighorns to the Lincoln Cliffs area of Lincoln County occurred in December of 1990. Three additional sheep were released in March 1991, and five in 1996. The re-introductions were a cooperative venture between the Washington Department of Fish and Wildlife and the Bureau of Land Management with a total population objective of 60 or more sheep. Funds to capture the three bighorns from Vulcan Mountain were provided by the Safari Club International, Inland Empire Spokane Chapter. Funds for a 1995 release of 4 female and one young ram were provided by the North American Foundation for Wild Sheep as were the funds for the capture and transplant made in March of 1999.

Table 1. Bighorn sheep survey results, Lincoln Cliffs herd.

Year	Animals in Herd	Comments
1993	26	
1994	35	
1995	45	
1996	65	5 bighorns added to herd
1997	90	excellent lamb production
1998	102	early surveys -good lamb crop

Table 2. Bighorn sheep herd production trends, Lincoln Cliffs herd.

Year	Ram:ewe:lamb Ratios
1993	45:100:54
1994	46:100:57
1995	52:100:52
1996	46:100:48
1997	56:100:60
1998	32:100:76
1999	56:100:41

Hunting Seasons And Harvest

The first permit for this herd was issued for the 1997 hunting season. The permit holder harvested a healthy adult ram which green scored 154 points on the SCI system. We should be able to allow one permit for an adult ram each year, but there is no indication that biological or social reasons will allow the harvest of more than one ram per year. In 1998 the second permit was issued and a 157 6/8 green score ram was taken.

Two rams that we know of died in the fall of 1998, one was a 2 ½ year old which was necropsied at Washington State University Veterinary School with no definite cause of death, the second was a 4 ½ year old found dead of unknown causes.

Herd health is monitored closely during the spring and rut season surveys. The local residents keep an eye on the animals and report to WDFW if they observe any health hazards or sick animals.

There has been alfalfa crop damage by this population. In severe winter conditions the bighorns have been known to feed on stored hay near residences in the Lincoln area. In an effort to mitigate for future crop damage, and to assist with the start of a new population of California bighorns within Washington State, in March of 1999, ten pregnant ewes(100 % pregnancy confirmed by Dr. Foreyt's blood tests) and one male lamb were captured and transplanted to Lake Chelan's Coyote Creek area.

Habitat Condition and Trend

The steppe habitat is in excellent condition and there is no competition from domestic livestock currently. Habitat is lost annually to recreational housing developments but these are at lower elevations in the Lincoln townsite area. WDFW and the Bureau of Land Management should help stabilize the habitat base for this herd by acquiring more acres into public ownership in the Lincoln townsite area. The bighorns in this herd have been observed in a much larger area than the Lincoln Cliffs itself. The ear tagged animals and other members of the herd have been seen from as far east as Porcupine Bay on the Spokane Arm to the east side of Banks Lake in Grant County. Population Status and Trend Analysis In 1998 a minimum of 22 lambs were produced. The lamb crop in 1999 would have been at least 24 with the 10 lambs produced by the ewes transplanted to Lake Chelan. The reason that the population dropped by fall of 1998 was disease mortality as indicated by the statements in Hunting Season section and the normal mortality experienced every winter (Tables 1 and 2).

Management Conclusions

Population objectives of 60 plus bighorns have been met and lamb production continues at a satisfactory rate. The herd meets the requirements set forth in the agency sheep management plan (WDFW 1995) to allow permit harvest. For the second year in a row, the lamb production set a record. To safeguard the health of this herd, we monitor reports of domestic sheep in proximity to bighorns. The recommendations for this herd are to acquire more public land in the area and use the yearly increases for transplant and permit hunting.

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Species	Region	Sheep Unit(s)	Population
Bighorn Sheep	**1**	**8**	**Mt. View Herd**

Prepared by: Pat Fowler, District Wildlife Biologist

Population Objectives/guidelines

The Mt. View herd suffered a major Pasteurella die-off during 1996, resulting in a population reduction of approximately 70%, from 60+ bighorn sheep to 18. The management objective will be to restore this bighorn sheep population to 60+ animals.

Hunting Seasons And Harvest Trends

Permit controlled hunting was terminated in this population after the die-off. Hunting will not be implemented until the population meets criteria established in the Bighorn Sheep Management Plan.

Surveys

Surveys conducted in March were done using protocol for the sightability model developed for bighorn sheep in Idaho. The survey protocol developed in Idaho is not much different than the technique we have been using for many years, and the data should be comparable.

Population Status And Trend Analysis

Aerial surveys are conducted in March in conjunction with annual post-season elk surveys in order to determine population trend, and herd composition at the low point of the annual population cycle. The Mt. View herd has increased slightly since the die-off of 1996. Surveys for 1996, 1997, 1998, and 1999 produced a population trend count of 16, 21, 21, and 29 bighorn sheep, respectively (Table 1, Figure 1).

Lamb survival has been relatively poor, following the normal mortality pattern after a Pasteurella die-off. Surveys conducted in the summer of 1998 produced a count of 13 ewes with 9 lambs (69 lambs/100 ewes). In March, 12 ewes were counted with 5 lambs (42 lambs/100 ewes), indicating 44% mortality had occurred in six months.

Surveys conducted in 1999 produced a count of 29 bighorns in early July; 5 rams, 14 ewes, 10 lambs. In August, 13 ewes were counted with 10 lambs, indicating survival had improved dramatically over 1998, for the same time period. If lamb survival is maintained at 30-40 lambs/100 ewes, the population should continue to increase.

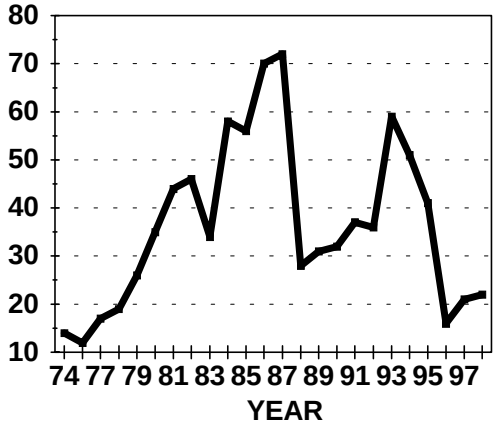

Figure 1. Bighorn Sheep Survey Trend, Mt. View Herd.

Table 1. Population Trend and Herd Composition, Mt. View Herd-Unit 8, Blue Mtns. ( ) indicates number of Class-4 rams in > 3/4 segment. Yl = yearling, <3/4 = less than 3/4 curl rams, >3/4 = greater than 3/4 curl rams, and L:100:R is lambs (L) and rams (R) per 100 ewes (100).

			Rams				Count	Population	Per 100 Ewes
Year	Lambs	Ewes	Y1	< 3/4	> 3/4	Total	Total	Estimate	R:100:L
1989	6	16	—	5	4 (2)	9	31	31	56:100:38
1990	7	18	—	5	2 (1)	7	32	32	39:100:39
1991	8	15	—	8	6 (4)	14	37	37	93:100:53
1992	5	16	—	6	8 (4)	14	35	35	88:100:31
1993	18	23	—	10	8 (4)	18	59	65	78:100:78
1994	10	24	—	10	7 (4)	17	51	60	71:100:42
1995	6	28	1	1	5 (2)	7	41	45	25:100:21
1996	1	14	1	0	0	1	16	18	7:100:7
1997	3	14	1	1	2 (1)	3	21	23	29:100:21
1998	5	12	3	2	2 (1)	7	21	23	58:100:42
*1999	10	14	3	1	1	5	29	32	36:100:71

*1999 surveys conducted in June-July, ram numbers estimated from previous surveys.

Habitat Condition And Trend

Over grazing by domestic livestock is still the major habitat problem within the range of the Mt. View herd. Yellow-star thistle is advancing up the Grande Ronde River and could inundate this range within the next few years. The future for habitat in this area is very uncertain. Land use practices will be difficult to change.

Disease and Parasites

The pneumonia induced die-off appears to be running the usual course over time. This herd suffered high lamb mortality in 1996 and 1997, but lamb survival improved slightly in 1998 and 1999.

Scabies is a continuous problem, and appears to have a greater impact on this herd than others, with the exception of the Wenaha. Two heavily scabied yearlings (ram and ewe) were observed in February, 1999, and the ewe appeared to be very weak. A die-off that occurred in 1988 may have been induced by scabies, which resulted in high mortality due to pneumonia.

Management Conclusions

The Mt. View herd is struggling due to the Pasteurella die-off that occurred in 1996. This population will not increase significantly until annual lamb survival reaches 30-40 lambs/100 ewes over a several year period.

The Mt. View bighorn sheep population has increased from 18 animals in 1996, after the die-off, to approximately 32 bighorn sheep in 1999. The population has increased slowly due to high lamb mortality.

Management direction will be to increase the Mt. View bighorn sheep population to 60+ animals. At that time, habitat and herd health will be assessed to determine if the population should be allowed to increase, or management options implemented to stabilize population growth: trap, transplant, or ewe seasons.

Species	Region	Sheep Unit(s)	Population
Bighorn Sheep	**1**	**3**	**Tucannon Herd**

Prepared by: Pat Fowler, District Wildlife Biologist

Population Objectives/guidelines

The Tucannon herd is one of five bighorn sheep herds residing in the Blue Mountains. This herd was not exposed to the Pasteurella die-off that occurred in 1995-96. The population objective for this herd will be to increase this bighorn sheep population to 50-70 animals.

Hunting Seasons And Harvest Trends

One ram permit was issued in 1998. The hunter harvested a Class-4 ram with horn length measurements of 37 x 39, with 14 4/8 inch bases. One permit was recommended for 1999. No permit will be recommended for 2000, unless future surveys produce more rams than currently counted in the population.

Surveys

Surveys conducted in March were done using the Idaho bighorn sheep sightability model. The protocol for this model does not differ significantly from the system we have used for many years. We used a Hiller 12-E helicopter for surveys, which gives maximum visibility.

Population Status And Trend Analysis

Aerial surveys are conducted in March in conjunction with post-season elk surveys in order to determine population trend, and herd composition for the year; low point of the annual population cycle (Figure 1). The survey this year produced a count of 12 bighorn sheep; 10 ewes, and 1 lamb.

Lamb survival has declined significantly since 1997. In 1998, only four lambs were counted and only 2 lambs in 1999. (Table 1).

Surveys conducted in June and September of 1999 produced only 17 ewes with 3 lambs, and 17 ewes with 2 lambs, respectively. Only seven rams have been counted in 1999.

The ram population has declined from 18 to 7 since 1994, probably due to a combination of low lamb survival and predation. The current population decline may be due to scabies, combined with a high level of predation.

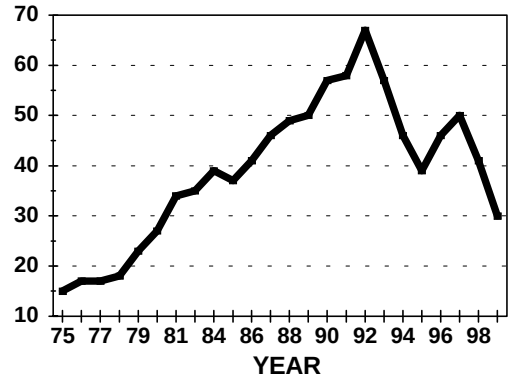

Figure 1. Bighorn Sheep Survey Trend, Tucannon Herd.

Habitat Condition And Trend

Habitat conditions on the Wooten Wildlife Area are excellent, but yellow-star thistle is moving into the area, and it is a constant battle to keep it from spreading.

Augmentation/habitat Enhancement

Weed control is the major habitat improvement project at the present time.

Table 1. Population Trend and Herd Composition, Tucannon Bighorn Sheep, Blue Mtns. Washington. ( ) indicates number of Class-4 rams in > 3/4 segment. Yl = yearling, <3/4 = less than 3/4 curl rams, >3/4 = greater than 3/4 curl rams, and L:100:R is lambs (L) and rams (R) per 100 ewes (100).

			Rams				Count	Population	Per 100 Ewes
Year	Lambs	Ewes	Yl	<3/4	>3/4	Total	Total	Estimate	R:100:L
1989	9	23	---	10	8	18	50	55	78:100:39
1990	11	22	---	11	13 (5)	24	57	65	104:100:50
1991	12	23	---	10	13 (5)	23	58	65	100:100:52
1992	15	28	---	12	12 (4)	24	67	70	86:100:54
1993	12	24	---	13	8 (2)	21	57	60	89:100:50
1994	4	24	---	4	14 (2)	18	46	50	75:100:17
1995	2	24	1	4	7 (1)	12	39	45	50:100:8
1996	10	24	1	4	7 (2)	12	46	50	50:100:42
1997	10	27	1	3	6 (3)	10	47	50	37:100:37
1998	4	22	4	2	6 (2)	12	38	42	50:100:18
1999	2	17	0	2	5 (1)	7	26	30	41:100:12

Disease and Parasites

The Tucannon herd has not been exposed to the Pasteurella die-off that occurred in other bighorn sheep populations in southeast Washington. Domestic goats have been observed running loose on WDFW land four miles north of the Tucannon herd range. This could be a significant danger to this bighorn population.

Scabies has been documented in the Tucannon herd. Sheep observed during the aerial survey in March appeared to be infected. Again, in June, sheep were observed that appeared to have scabies. On September 15, a ewe was reported that was disoriented and having trouble maintaining her balance. This ewe was located on September 16, she had been killed by a cougar, and the carcass was taken to W.S.U. for necropsy. Both ear canals were blocked due to scabies. Impaction of the ear canals by scabies can result in inflamation and infection of the inner ear, resulting in disorientation and inability to stand or walk. Scabies may impact California bighorns much more severely than Rocky Mountain bighorns. In 1987, the Mt. View population (Cal. bighorns) was infected with scabies and mortality was very high. Adjacent herds of Rocky Mtn. bighorn sheep did not show the same response, even though they were also infected with scabies. The appearance of scabies in the Tucannon herd, combined with low lamb survival and fewer adults observed in the population may be the result of the scabies infection, combined with a high level of cougar predation.

Management Conclusions

The Tucannon herd appears to have declined significantly in numbers over that last year. Population size has been difficult to determine because of limited time.

This herd has fluctuated in numbers over the last 25 years, mostly due to periods of low lamb survival. Lamb survival in this area appears to be impacted mostly by predation rates, but scabies may be a factor in the current population crisis.

The current crisis could result in this population declining below 20 animals. If the population decline is that severe, it will be difficult to recover this population to management objective in the near future.

Species	Region	Sheep Unit(s)	Population/Herd
Bighorn Sheep	1	2	Vulcan Mountain

Prepared by: Steve Zender, District Wildlife Biologist

Population Objectives/guidelines

The population objective for the Vulcan Mountain herd is to maintain a population of 80-110 sheep. These sheep use private rangeland a considerable amount of time and that has been a contentious issue with ranchers when population levels were high. The population has declined in recent years and is below the lower population objective for the herd. The immediate objective is to monitor herd characteristics, investigate herd health, reduce parasite loads, and improve herd productivity. Hunting is one of the primary objectives of this herd and is co-managed with the Colville Confederated Tribes (CCT).

Hunting Seasons And Harvest Trends

Since both state and tribal hunters hunt Vulcan Mountain, biologists confer prior to developing their respective permit recommendations. The allowable harvest for 1998 was considered to be two rams so each manager recommended one permit be issued.

The state (WDFW) received 737 applications for the one permit offered for any ram from the Vulcan Herd in 1998. One ram was taken (Table 1). The Tribe received 342 hunter applications for the either-sex permit. One tag was issued but no sheep was taken. (Murphy, 1999).

Table 1. Summary of harvest information for bighorn sheep in the Vulcan Mountain Unit.

Year	Permits	Harvest	Avg Age	Horn Length
1992	3	3	6.3	32,33,29
1993	4	4	5.8	36,27,35,33
1994	4	4	6.3	32,33,33,31
1995	2	2	5.5	36,31
CCT	2	1R	1.5	
1996	2	2	6.6	33,33
CCT	2	1R1E	1.5R	
1997	1	1	6.0	30
CCT	1	0		
1998	1	1	5	27
CCT	1	0		

Most sheep hunters are interested in taking relatively mature rams with quality horns. When we develop recommendations for permit levels we consider the number of mature rams available. While the horn length was poor again this year the age of the ram taken was consistent with the maturity of the average rams taken over the years. The poor horn quality is attributed to general poor health of the herd, which will be discussed later in the report.

Three ewes were struck and killed by the same vehicle in late October along the Kettle River county road, making it a total of at least 5 sheep killed by vehicle collision along this stretch in the last year or so. Dana L. Base, WDFW wildlife biologist, coordinated funding for sheep "Crossing" signs, through Foundation for North American Wild Sheep (FNAWS) and installation by Ferry County Public Works.

Surveys

The official composition and trend survey is conducted in late fall. The technique is a standardized vehicle route along the highway and into the Cummings Creek Meadows. Observations are accomplished by binoculars and spotting scope from observation points along the route. The timing is such that rams are in the rut and distributed in relatively observable areas with the ewes and lambs. The entire area known to be used by sheep is surveyed but this is a very broken and timbered habitat so every sheep is not expected to be seen. It is the most effective method we have found. The route is run more than once as fog or snow are often factors affecting the results. After eliminating duplication for the two day effort our best combined count was 16 Rams, 8 Ewes, and 0 Lambs (Table 2). Our sheep hunters are also requested to keep records of the sex and age of sheep observed while hunting. Our hunter this year saw 12 sheep but he too saw no lambs.

Population Status And Trend Analysis

The Vulcan herd has declined dramatically over the last several years (Figure 1). The adult ram numbers have held up enough to allow the minimal permits for 1999 (1 each for WDFW and CCT) but recruitment is at or near zero this year and we continue to lose adults due to road-kills and parasites or

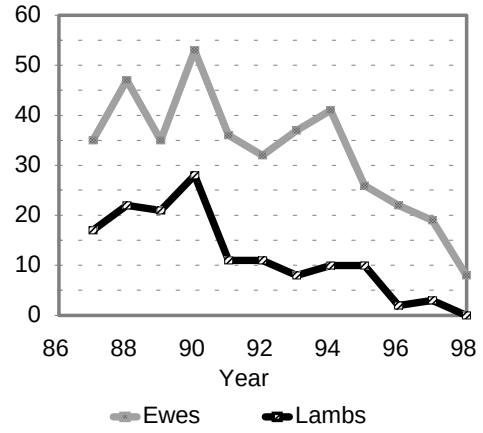

Figure 1. Vulcan ewe and lamb fall counts, 1987-98.

Table 2. Fall population composition counts from Vulcan Mountain. Yl = yearling, <3/4 = less than 3/4 curl rams, >3/4 = greater than 3/4 curl rams, and L:100:R is lambs (L) and rams (R) per 100 ewes (100).

			Rams				Count	Population	
Year	Lambs	Ewes	Yl	<3/4	>3/4	Total	Total	Estimate	L:100:R
1990	28	53				26	107		53:100:49
1991	11	36				24	71		30:100:67
1992	11	32				13	56		34:100:41
1993	8	37			3	9	54		22:100:24
1994	10	41			9	18	69		44:100:24
1995	10	26	3	13	9	25	61		38:100:104
1996	2	22	1	11	7	19	43		09:100:86
1997	3	19	2	21	7	30	52		16:100:158
1998	0	8	0	9	7	16	24		0:100:200

disease. Our fall count in 1994 produced a total of 51 ewes and lambs vs 22 for 1997 and 11 for 1998 (Table 2).

Local landowners, woods workers, and hunters have found remains of a few sheep that appear to have died during winter. The past couple of winters have been mild so other factors are suspected. We have observed many sheep on several occasions to be in very poor health (thin, poor coat, signs of chronic scours). We also picked up horns from the carcass of a dead 5 year old ram that had only 23 inch long horns, which points to chronic poor health as a normal mature ram would be about 34 inches or more. Our hunter harvested ram was 5 years and it only had 27 inch horns, again unusually slow growth over it's lifetime.

Since our lamb ratios did not improve in last fall's survey we did make a short survey early this spring to determine if lambs were present early but later disappearing, something often associated with high predation. On May 27, 1999 I observed at close range a group of 11 adult ewes, 1 ram but no lambs. Sheep should have lambs by this time. Of the several landowners I contacted only one had seen 1 lamb and that in a group of about 5 ewes. Many of the ewes and the ram I saw were thin and showed signs of scours.

Disease and Parasites

With the obvious poor condition of the animals and the observed losses we have focused our available time on checking for parasites or disease. Dr. Briggs Hall, WDFW veterinarian advised the first step was to obtain fecal samples and determine if there were unusual parasite loads. The Spokane Chapter of Safari International provided funding for analysis of fecal samples we collected. Samples were submitted to Dr. William J. Foreyt at WSU for analysis. Dr. Foreyt reported the results indicated unusually high levels of Parelaphostrongylus larvae, which is significant assuming we are certain these samples were from sheep. There are also about 15 domestic goats that range out from their barnyard and occasionally come in contact with the bighorns. We have introduced Dr. Foreyt to the owners of the goats and as the owners are very cooperative and interested in the bighorns they have allowed tests on their animals. Dr. Foreyt's work with these goats is ongoing at this time. Any knowledge gained in relation to the Parelaphostrongylus larvae or the work with the domestic goats will be significant not only for Vulcan Mountain but for bighorns everywhere.

Habitat Enhancement

About 20 acres of remote meadow on Mr. Carl (Dick) Strandberg's property was fertilized to enhance ewe and lamb spring/summer range. This was accomplished through the generous donation of funds, labor, and ATV's provided by Spokane Chapter of Safari Club International.

The USFS, Republic District, planned and coordinated a weed spray project on critical sheep habitat in Cummings Creek. Contributors on this project were USFS, WDFW, and Ferry County Weed Board.

Management Conclusions

We'll certainly need to survey and look closely at our population level this fall to determine if it is appropriate to continue hunting next year. General observations we have already made this spring indicate extremely poor lamb production again this year.

Efforts to coordinate forage improvement projects such as fertilizing Moran Meadow and working with the Ferry County Weed Board for knapweed control will continue.

We are making arrangements to attempt to treat the sheep by placing medicated salt blocks out or feeding medicated pellets. Our multi-pronged approach is to improve the range conditions through fertilizing where we can, treating rangeland for weed control and thus increasing forage, treating for parasite loads, and continuing to support research on the implications of domestic goats on bighorn range.

In my experience, and in my observations of many other areas of the northwest, bighorn sheep are unfortunately a very fragile, expensive, labor intensive species to manage. We are fortunate that there is also a high degree of interest and financial support from organized groups, land management agencies, local government, and local landowners. Sheep are really lucky that so many people care so much.

Literature Cited

Foreyt, William J. PhD, Personal communication.

Murphy, M. 1998. 1997 North Half Colville Tribal Harvest. Fish and Wildlife Dept., Colville Confederated Tribes.

Species	Region	Sheep Unit(s)	Population
Bighorn Sheep	**1**	**11**	**Wenaha Herd**

Prepared by: Pat Fowler, District Wildlife Biologist

Population Objectives/guidelines

The Wenaha herd suffered a major Pasteurella die-off during the spring and summer of 1996, reducing the population from approximately 90 bighorn sheep to 49. The management objective will be to restore this bighorn sheep population to 90+ animals.

Hunting Seasons And Harvest Trends

Permit controlled hunting was terminated in both Washington and Oregon after the die-off. Hunting will be initiated when this population meets the criteria for establishing permits as listed in the Bighorn Sheep Management Plan. Since the Wenaha herd is an inter-state herd, hunting season recommendations will be developed in conjunction with the Oregon Department of Fish & Wildlife.

Surveys

Surveys conducted in March were done using protocol for the bighorn sheep sightability model developed in Idaho. The survey protocol is very similar to the technique we have been using for many years, and the data should be comparable under normal conditions. During surveys in 1998, observers counted 90% of the collared ewes (9 out of 10 collared ewes), and 100% of the collared ewes in 1999 (10 of 10 collared ewes).

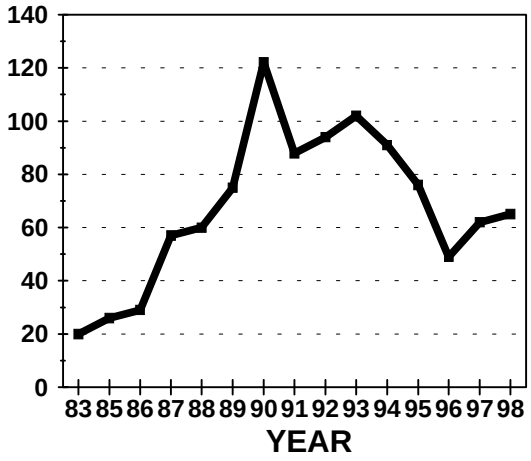

Figure 1. Bighorn Sheep Survey Trend, Wenaha Herd.

Table 1. Wenaha Herd Population Trend and Composition Counts, Blue Mtns. Washington. ( ) indicates number of Class-4 rams in > 3/4 segment. Yl = yearling, <3/4 = less than 3/4 curl rams, >3/4 = greater than 3/4 curl rams, and L:100:R is lambs (L) and rams (R) per 100 ewes (100).

			Rams				Count	Population	Per 100 Ewes
Year	Lambs	Ewes	Y1	<3/4	>3/4	Total	Total	Estimate	R:100:L
1989	12	36	—	15	12	27	75	100	75:100:33
1990	33	59	—	14	16 (7)	30	122	135	51:100:56
1991	19	45	—	11	13	24	88	100	53:100:42
1992	19	51	—	4	20	24	94	115	47:100:37
1993	25	48	—	14	15	29	102	120	60:100:52
1994	21	55	—	6	9	15	91	110	27:100:38
1995	9	48	4	2	13 (4)	19	76	90	40:100:19
1996	2	43	4	0	0	4	49	50	9:100:5
1997	4	50	1	7	0	8	62	69	16:100:8
1998	8	41	3	5	8 (1)	16	65	65	39:100:20
*1999	12	27	2	4	0	6	45	70	22:100:44

* Ground surveys conducted June-August.

Population Status And Trend Analysis

Aerial surveys are conducted annually in conjunction with post-season elk surveys in order to determine population trend, and herd composition at the low point of the annual population cycle. The Wenaha bighorn sheep population has increased slightly since the die-off of 1996. Surveys conducted in the spring of 1997, 1998, and 1999 produced counts of 49, 62, and 65 bighorn sheep, respectively (Table 1, Figure 1).

Lamb production and survival has been monitored closely since the die-off. Lamb mortality due to pneumonia continues to take a high toll of lambs in June and July, shortly after birth. Surveys conducted in mid June, 1998 produced a count of 27 ewes with 14 lambs (52 lambs/100 ewes). Counts conducted in the spring of 1999 produced a count of 27 ewes with 4 lambs

(15 lambs/100 ewes), indicating annual mortality of approximately 70%.

Lamb production and survival did not improve significantly in 1999. Surveys in the summer produced a count of 27 ewes with 15 lambs (56 lambs/100 ewes), but, by late August, the number of lambs counted had dropped to 5 lambs with 25 ewes (20 lambs/100 ewes), indicating mortality of approximately 67% over two months.

Habitat Condition And Trend

Habitat conditions on ODFW and National Forest lands are good, but private lands have been impacted by overgrazing. Yellow-star thistle could become a major problem within five years if the rate of spread is not controlled on the lower Grande Ronde river.

Augmentation/habitat Enhancement

The U.S. Forest Service is proposing a series of controlled burns within the boundaries of the Wenaha-Tucannon Wilderness. This will improve habitat conditions for bighorn sheep.

Disease and Parasites

The pneumonia induced die-off appears to be running the usual course over time. Lamb survival during the last four years has been very poor.

To date, we have not been able to isolate the specific pathogen responsible for lamb mortality.

Scabies continues to be a problem, but Rocky Mountain bighorns appear to deal with this nuisance fairly well. However, in some years, severe infestations may cause problems for lambs and reduce survival rates.

Lungworm loads appear to be holding at a low level based on analysis of fecal samples from radio-collared ewes and necropsied individuals, and is not a problem at this time.

Management Conclusions

The Wenaha herd is struggling due to the Pasteurella die-off that occurred in 1996. This population will not increase significantly until lamb survival reaches 30-40 lambs/100 ewes over a several year period.

The bighorn population remains at a low level, with approximately 65 sheep in the present population, compared to 90 sheep prior to the die-off.

Management direction will be to increase the Wenaha bighorn sheep population to 90+ animals. At that time, habitat and herd health will be assessed to determine if the population should be allowed to increase, or management options implemented to stabilize population growth: trap, transplant, or ewe seasons.

Species	Region	Sheep Unit(s)	Population
Bighorn Sheep	**2**	**10 & NA**	**Mt. Hull and Sinlahekin Herds**

Prepared by: Scott Fitkin, Okanogan District Wildlife Biologist

Population Objectives/guidelines

Both the Mt. Hull and Sinlahekin herds are being managed for steady population growth for as long as available resources will support increased numbers. A conservative, any ram permit harvest is also allowed to the extent it is compatible with population growth objectives.

Hunting Seasons And Harvest Trends

WDFW issued one ram permit for the Mt. Hull Unit and the Colville Confederated Tribes issued one ewe permit. No permits were issued in the Sinlahekin area. Warm, dry conditions prevailed during the hunting season.

The WDFW permit holder harvested a 3/4+ curl ram, and the tribal tag was filled with a seven year old ewe (Table 1). In 1999, the tribal permit will be converted to either sex. This will likely result in a total unit harvest of two rams annually.

Table 1. Summary of harvest information for bighorn sheep in the Mt. Hull Unit.

Year	Permits	Harvest	CCT* Permits	CCT Harvest
1989	0	0	0	--
1990	0	0	0	--
1991	0	0	0	--
1992	2 ram	2 rams	0	--
1993	1 ram	1 ram	0	--
1994	1 ram	1 ram	0	--
1995	1 ram	0	1 ewe	0
1996	1 ram	1 ram	1 ewe	0
1997	1 ram	1 ram	1 ewe	0
1998	1 ram	1 ram	1 ewe	1 ewe

Surveys

Helicopter surveys of the two sheep units produced mixed results. Observers counted 42 sheep in the Mt Hull unit, but located no sheep in the Sinlahekin unit (Table 2). Incidental observations of sheep in the Sinlahekin unit by WDFW personnel confirmed sheep presence, and illustrated the hit and miss nature of aerial surveys.

Supplemental ground surveys by Foundation for North American Wild Sheep (FNAWS) members in the Mt Hull unit validated and augmented the aerial effort. The ground survey documented a population of at least 66 animals (Table 3). In addition, seven ewes were observed from the ground on Chopaka mountain during the winter months. These sheep probably moved to the area from the Sinlahekin.

Population Status And Trend Analysis

Observational data suggests that the Mt. Hull herd grew fairly steadily following reintroduction in 1970. Numbers were highest in the late 1980s and early 90s during a spell of mild winter weather, peaking in 1991 at 80-90 animals. The population declined slightly in the early 90's, particularly following the severe winter of 1992-93. Herd numbers have slowly rebounded in recent years and are expected to climb back to historic highs. Much expansion beyond that level is unlikely, given the existing resource base.

The Sinlahekin herd is more problematic. Initially, the herd grew rapidly following reintroduction in 1957. High productivity and continued expansion allowed for translocation of sheep to other ranges in Washington. During the last ten years, the population has declined, incurring particularly heavy losses during the winter of 1992-93. Herd demographics have not improved since, and the population is likely still in decline. Rams appear especially vulnerable to winter starvation, and appear to be in rather poor health overall. Five mature rams succumbed to severe winter weather in 92-93, and individuals may not reach a 3/4 curl until they are seven or eight years old. Also, productivity in this herd appears to be low. This herd could be in danger of local extirpation in the foreseeable future. The Sinlahekin herd probably numbers between 25-40 animals.

Habitat Condition And Trend

Over-winter survivorship for all sheep in the Okanogan District was likely high during the mild winter of 1998-99. Despite the mild winter, at least seven sheep dispersed from traditional range in the Sinlahekin to Mount Chopaka, as they have during recent severe winters.

Winter range may be a limiting factor for the Sinlahekin herd. It may also be that range quality on a year-round basis is significantly degraded. The amount of available sheep habitat in this area has remained relatively stable, yet the carrying capacity of the range seems to have declined significantly compared to years past. Intensive competition with livestock and corresponding invasion by noxious weeds, particularly diffuse knapweed, are probably major contributors to this trend.

Much of the sheep forage habitat for the Sinlahekin herd is not under WDFW control. Bighorn are poor competitors and can escape livestock competition only in the steepest areas where soils are thin and forage limited. The DNR has increased the AMUs on its permits in sheep range in recent years, and most of the adjacent private land is moderately to intensively grazed. These activities are likely to continue, maintaining competition and accelerating weed expansion.

In addition, a domestic sheep herd exists immediately adjacent to bighorn range at the northeast corner of Aeneas Mountain, and wild sheep are often in close proximity to the domestic animals. Past research indicates a high endemic level

Table 2. Population composition counts from the Sinlahekin area. Yl = yearling, <3/4 = less than 3/4 curl rams, >3/4 = greater than 3/4 curl rams, and L:100:R is lambs (L) and rams (R) per 100 ewes (100).

			Rams			Count	Population	
Year	Lambs	Ewes	<3/4	>3/4	Total	Total	Estimate	L:100:R
1990	--	--	--	--	--	--	--	--
1991	--	--	--	--	--	--	--	--
1992	6	30	--	--	15	41	--	20:100:50
1993	2	17	--	--	4	23	--	12:100:24
1994	1	21	--	--	1	23	--	5:100:5
1995	9	24	5	6	11	44	--	46:100:46
1996	2	20	7	0	7	29	30-45	35:100:35
1997	--	--	--	--	--	--	25-40	--
1998	--	--	--	--	--	--	25-40	--
1999	0	0	0	0	0	0	25-40	--

Table 3. Population composition counts from the Mt Hull area. Yl = yearling, <3/4 = less than 3/4 curl rams, >3/4 = greater than 3/4 curl rams, and L:100:R is lambs (L) and rams (R) per 100 ewes (100).

			Rams			Count	Population	
Year	Lambs	Ewes	<3/4	>3/4	Total	Total	Estimate	L:100:R
1990	--	--	--	--	--	--	80	--
1991	--	--	--	--	--	--	80-90	--
1992	0	26	1	7	8	34	80	0:100:31
1993	0	17	2	7	9	26	--	0:100:53
1994	5	28	2	8	10	53	--	18:100:36
1995	11	16	6	11	17	44	55	69:100:106
1996	0	5	10	6	16	21	40-60	0:100:320
1997	8	25	--	--	8	41	55-65	32:100:32
1998	--	--	--	--	--	--	--	--
1999	19	24	15	8	23	66	70	80:100:96

of parasitism and disease in this herd. Existing nutritional stress on the bighorns enhances vulnerability to pathogens, and the potential for disease transmission is high. A stochastic event such as the contraction of a highly virulent disease strain could eliminate the Sinlahekin population.

By contrast, the Mt. Hull range generally appears to be in good shape and the amount of available habitat is stable. Livestock competition and noxious weed invasion are less of a problem in this area. Even so, some potential habitat threats have been identified, including a proposed DNR land swap on the fringes of the herd's range.

The forest service is concerned that fire suppression is slowly allowing the sheep range on Mt. Hull to become too overgrown. Prescribed burning is being conducted for the purpose of reducing tree and shrub cover and encouraging grass and forb growth. The Forest Servie is also aggressively controlling noxious weeds with funding provided by the FNAWS. WDFW fully supports these efforts.

Management Conclusions

Mt. Hull Herd: The Mt. Hull herd appears helthy. Good productivity and improving demographics should easily support the anticipated harvest of two rams annually. The population should climb to the historic high, perhaps beyond, depending on the success of Forest Service habitat enhancement projects.

Sinlahekin Herd: Both bighorn sheep numbers and range quality on Aeneas Mountain area are likely in decline, and these trends are likely to continue. Management should focus on reducing competition with livestock, reclaiming land colonized by noxious weeds, and finding ways to encourage the growth of forage species. Also, the incidence of disease in the herd should be closely monitored due to proximity of a domestic sheep herd.

If range condition and herd vitality do not improve soon, the future of the Sinlahekin band looks bleak. In addition, the lack of genetic diversity is also a concern. Even so, any augmentation of the herd is currently inadvisable, since the available range appears to be poorly supporting the animals already present, and the proximity of domestic sheep would put introduced animals at grave risk. Areas immediately adjacent to Aeneas Mountain offer very limited opportunities for range expansion, with the exception of Chopaka Mountain, where competition with mountain goats would be a concern.

An alternative to expanding the Sinlahekin herd, is to

establish another herd on suitable range in the northeast portion of the Pasayten Wilderness. This area represents a large area of unoccupied historic range of relatively high quality. In addition this area is connected to occupied bighorn range in Canada. The potential for serious noxious weed invasion is low; however, a livestock conflict does exist. Currently, much of the area is part of an active domestic sheep allotment. The threat of disease transmission associated with the domestic herd is a barrier to bighorn sheep occupation at this time.

Creative solutions for these types of conflicts are available, as indicated by the recent FNAWS buyout of domestic sheep leases on the Chelan-Sawtooth Crest. Similar efforts are being explored for leases in the Okanogan District. If the removal of domestic sheep can be negotiated, then an aggressive reintroduction effort is recommended. A concurrent radio-telemetry study of habitat use, population dynamics, and dispersal of bighorns in this high elevation habitat is also recommended. The establishment of bighorn sheep in the Pasayten would greatly enhance watchable wildlife opportunities, as well as provide for a superior quality, high elevation, wilderness hunt unique in Washington. It would also improve the long-term prognosis for California bighorn sheep in the Okanogan District and the state as a whole.

Species	Region	Population
Bighorn Sheep	**2**	**Wenatchee District**

Prepared by: John Musser, District Wildlife Biologist

Population Objectives/guidelines

Within the Wenatchee District bighorn have been reintroduced to Swakane Canyon and North Lake Chelan. There are also a few bighorn from the Quilomene herd that use the south part of the district in the Colockum Creek and Squilchuck Creek watersheds.

Management objectives for Wenatchee District bighorn are to: increase size and range of existing populations; ensure genetic strength by augmenting existing populations with bighorn from other areas; minimize risk of disease to bighorn by eliminating overlapping domestic sheep allotments on public land and providing information about the importance of keeping these species apart to the public; and reintroduce bighorn to historic but unoccupied habitat within the district.

There are about 36 bighorn in the Swakane. Our population objective for Swakane is 50 adult sheep.

Colockum - Quilomene bighorn, which number approximately 125, range into Chelan County. About 6 Colockum sheep are currently between Colockum Creek and Wenatchee Heights.

Bighorn were reintroduced to the north shore of Lake Chelan in March of 1999. Ten ewes and a yearling ram were obtained from Lincoln Cliffs and 2 3-year-old rams were obtained from Quilomene for the Chelan reintroduction. Our population objective for North Lake Chelan is 200 adult sheep.

Surveys

Swakane has more tree and shrub cover than other California bighorn areas of eastern Washington. Cover allows sheep to hide from helicopters making aerial surveys ineffective. For the Swakane, we rely on incidental reports from Department personnel and the public as well as ground surveys utilizing volunteers (Table 1). From July 1998 through July 1999, 35 reports of Swakane bighorn were received. The most useful information from these reports include:

- A full curl ram at mouth of Roundy Creek Canyon (13.5 miles up Entiat River Road).
- A "huge" ram at Chiwawa River Pines.
- A total of 24 ewes and lambs at Rattlesnake Road.
- 10 rams along 97A near WDFW office. At least 5 of these are 3/4+ rams.
- 4 lambs born in May 1998 reported in February 1999.

Thirteen bighorn were reintroduced to the north shore of Lake Chelan in March, 1999. We have received 10 reports of these sheep since release. Ten ewes, 1 adult ram and 2 lambs were found on a helicopter survey in June, 1999. Based on reports within a week of our survey, we believe the other adult ram is also alive.

Population Status And Trend Analysis

The Swakane bighorn population is static and numbers about 36.

The Chelan bighorn population totals 14 and can not be considered established yet.

There are about 6 bighorn that use the Colockum and Squilchuck watersheds within the Wenatchee District. These sheep are part of the recently reestablished Quilomene herd.

Habitat Condition And Trend

Habitat conditions for both Swakane and Chelan bighorn are excellent. The Dinkelman fire, which occurred 10 years ago reduced tree and shrub cover and increased grass cover. This successional set-back has been beneficial to bighorn. The Wenatchee National Forest plans to burn in several places within the expected range of Chelan bighorn. These burns will benefit

Table 1. Population composition counts from Swakane. Yl = yearling, <3/4 = less than 3/4 curl rams, >3/4 = greater than 3/4 curl rams, and L:100:R is lambs (L) and rams (R) per 100 ewes (100).

			Rams				Count	Population	
Year	Lambs	Ewes	Yl	<3/4	>3/4	Total	Total	Estimate	L:100:R
1989	2	3	1	3		4	9	18	66:100:300
1990	1	4	1	2	4	7	12	20	25:100:175
1991	4						4	20	:100:
1992	2	9			1	6	17	25	22:100:188
1993	6	8		1	7	8	31	30	75:100:100
1994	6	6		3		12	27	30	100:100:200
1995	3	19	2	8	6	16	38	38	16:100:84
1996	2	4			2	2	8	25	50:100:50
1997	3	9		7	4	11	23	30	33:100:122
1998	4	20		5	7	12	36	36	20:100:60

bighorn.

Wildlife Damage

We have not received damage complaints related to these bighorn. However, rams are frequently seen during winter and spring in the vicinity of Ohme Garden. There is potential for damage if this use increases.

Augmentation/habitat Enhancement

Population augmentation seems appropriate for both the Swakane and Chelan bighorn populations. We hope to obtain additional bighorn from British Columbia as early as fall of 1999. These animals will be used to augment our Chelan population. Although Swakane needs additional animals, we believe the risk of *Pasteurella* pneumonia resulting from domestic sheep contact in Swakane precludes additional bighorn at this time.

Outside of existing bighorn range in the Wenatchee District, there are no areas that would be considered high priority for bighorn reintroduction. Douglas County has extensive, suitable habitat, but it is almost exclusively privately owned. Without a long-term agreement ensuring compatible land management, bighorn reintroduction to Douglas County is not recommended.

Management Conclusions

The threat of disease from domestic sheep is significant for the Swakane bighorn. Domestic sheep were documented 3 times within the core habitat of Swakane bighorn in the last year. Bighorn rams were documented in domestic sheep allotments twice during the last year. Wenatchee National Forest is currently evaluating sheep allotments in the area. WDFW and Wenatchee National Forest are currently developing a MOU concerning bighorn management. These efforts are expected to reduce overlap and conflicts between domestic sheep and bighorn.

The Swakane bighorn would probably benefit from population augmentation. However, we need to solve the domestic sheep range overlap problem before we augment this population.

Although the Swakane bighorn population is relatively static, it contains at least 12 adult rams. We will issue 1 sheep hunting permit for Swakane in 1999.

The nucleus for Lake Chelan bighorn has been established. We need to aggressively seek additional bighorn to ensure success of this herd.

Species	Region	Sheep Unit(s)	Populations/Herds
Bighorn Sheep	**3**	**4, 5, 7, & 13**	**Clemon Mountain, Tieton, Umtanum, Selah Butte, Quilomene**

Prepared by: **Jeff Bernatowicz, Wildlife Biologist**
Leray Stream, District Wildlife Biologist

Population Objectives/guidelines

The objective is to restore bighorn sheep to native ranges and allow for increases in their population size compatible with the carrying capacity of the habitat.

Hunting Seasons And Harvest Trends

Region 3 supports five populations of California Bighorn: Tieton, Cleman Mountain, Umtanum, Selah Butte, and Quilomene. Hunting is permit, ram only and occurs in all units but Tieton. In 1998, 2 general permits were issued in for Clemans Mountain, Umtanum, and Selah Butte (Tables 1-3). In addition, both the auction and raffle permit holders hunted Clemans Mountain. One permit was issued for Quilomene. All permit holders filled their tags.

Table 1. Summary of harvest information for bighorn sheep in the Clemon Mt. Unit.

Year	Permits	Harvest	Success	Sheep Seen/Hunter
1996	1	1	100%	65
1997	2	2	100%	50
1998	4	4	100%	40

Table 2. Summary of harvest information for bighorn sheep in the Umtanum Unit.

Year	Permits	Harvest	Success	Sheep Seen/ Hunter
1990	5	3	60%	130
1991	3	3	100%	32
1992	3	3	100%	118
1993	3	3	100%	86
1994	3	3	100%	48
1995	3	3	100%	54
1996	3	3	100%	37
1997	2	2	100%	19
1998	2	2	100%	53

Table 3. Summary of harvest information for bighorn sheep in the Selah Butte Unit.

Year	Permits	Harvest	Success	Sheep Seen/Hunter
1997	1	1	100%	12
1998	2	2	100%	40

Surveys

Historically, surveys have been conducted using ground surveys. Hiking routes were laid out following ridge lines from the top to the bottom in the units surveyed. Since 1993, most surveys are flown via helicopter. Helicopter surveys are flown at contour line levels for each drainage within the herd unit. Surveys are generally conducted in June. Survey results are given in tables 4, 5, 6 and 7.

Population Status And Trend Analysis

Bighorn sheep were native to areas within Region 3, but had been eliminated by over hunting and disease transmitted from domestic animals by the early 1900s. Bighorn sheep re-introductions began in Region 3 during the 1960s on the Colockum Wildlife Area and Cleman Mt.

The Colockum reintroduction was the first and most successful with the population quickly building to well over 100 animals by the late 1960's. The population crashed in the early 1970's. The cause of the decline was not totally documented, but was either a result of *Pasteurella H.* pneumonia or winter mortality. Colockum bighorns were at very low numbers in the 1980s and reportly died out by 1990. Reintroduction was initiated just south of the Colockum on the Quilomene Wildlife Area in 1993. By 1996, 41 bighorns had been released in the area. The Quilomene population is now estimated at over 160 sheep and growing rapidly (Table 7).

The Cleman Mountain population was established in 1967 with eight animals. The herd grew rapidly to over 100 animals (Ellis Bowhay, Pers. Comm. 1998) and then crashed and stagnated in the late 1980s. The decline and stagnation was probably a result of disease. A portion of the population was captured, tested, and treated with antibiotics in 1990. Augmentation has included: 4 in September 1989, 4 in January 1990, and 19 in 1996. Since 1996, production and herd growth have increased and the population has grown to 135 animals (Table 4).

The Umtanum herd was established in 1970 with the release of eight animals. Within 15 years the population grew to more than 200 animals. Population estimates have varied between 150 and 200 animals since 1989 (Table 5). Dispersal, winter mortality, and the removal of 43 sheep for augmenting other populations are suspected for causing the fluctuation. Fires in the major lambing areas in 1996 have probably also biased surveys. Only 27 ewes were seen in June 1998, down from 102 in in 1994 (Table 5). However, 74 ewes and lambs were documented in March 1998. The ewes are likely lambing in an area which is not surveyed. The current population is estimated at 174 animals (Table 8).

Table 4. Population composition counts (June) from Clemon Mt. Yl = yearling, <3/4 = less than 3/4 curl rams, >3/4 = greater than 3/4 curl rams, and L:100:R is lambs (L) and rams (R) per 100 ewes (100).

			Rams				Count	Population	
Year	Lambs	Ewes	Yl	<3/4	>3/4	Total	Total	Estimate	L:100:R
1989						12	31	35	:100:
1990	7					16		40	:100:
1991	7	13	1	6	2	23	47	47	54:100:177
1992	8	19	3	8	1	20	47	47	42:100:105
1993	8	20		23		23	51	51	40:100:115
1994	4	18				27	49	55	22:100:150
1995	6	17	3	13	4	20	43	60	35:100:118
1996	9	30				19	58	65	30:100:63
1997	17	40	9	9	2	24	81	100	43:100:60
1998	20	42				36	98	117	48:100:86
1999	32	66				37	135	135	48:100:56

Table 5. Population composition counts (June) from Umtanum. Yl = yearling, <3/4 = less than 3/4 curl rams, >3/4 = greater than 3/4 curl rams, and L:100:R is lambs (L) and rams (R) per 100 ewes (100).

			Rams				Count	Population	
Year	Lambs	Ewes	Yl	<3/4	>3/4	Total	Total	Estimate	L:100:R
1989								170	47:100:88
1990								180	:100:
1991								190	:100:
1992								190	:100:
1993	32	66				31	129	200	48:100:47
1994	20	102				29	151	200	20:100:28
1995	35	69				41	115	150	51:100:59
1996	26	47	4			42	115	150	55:100:89
1997	5	30	3	5	9	17	52	150	17:100:57
1998	23	27				18	68	154	85:100:67
1999	25	44				22	91	174	57:100:50

Table 6. Population composition counts (June) from Selah Butte. Yl = yearling, <3/4 = less than 3/4 curl rams, >3/4 = greater than 3/4 curl rams, and L:100:R is lambs (L) and rams (R) per 100 ewes (100).

			Rams				Count	Population	
Year	Lambs	Ewes	Yl	<3/4	>3/4	Total	Total	Estimate	L:100:R
1994							17	17	:100:
1995	6	14				12	32	32	43:100:86
1996	8	25				10	43	43	32:100:40
1997	8	31	2	15	2	19	58	58	26:100:61
1998	7	14	3	12	4	19	40	43	50:100:136
1999	1	24				22	47	47	4:100:92

Table 7. Population composition counts (June) from Quilomene. Yl = yearling, <3/4 = less than 3/4 curl rams, >3/4 = greater than 3/4 curl rams, and L:100:R is lambs (L) and rams (R) per 100 ewes (100).

			Rams				Count	Population	
Year	Lambs	Ewes	Yl	<3/4	>3/4	Total	Total	Estimate	L:100:R
1995	12	26				7	45		46:100:27
1996	14	43				13	70		33:100:30
1997	19	44				23	86		43:100:52
1998	21	46	1		4	19	86	143	46:100:41
1999	30	57				41	128	164	53:100:72

Sheep from the Umtanum herd crossed the Yakima River during the winter of 1992-93 and formed the Selah Butte sub-herd. The Selah Butte population has varied between 43 and 58 since 1996. Variations are likely due to movement between Umtanum. For example, 24 sheep were captured and translocated from 43 in 1996. In 1997, the Selah Butte herd expanded to 58. The 1999 population was estimated at 47. The production of 1 lamb from 24 ewes (Table 6) in 1999 is a concern.

The Tieton River was established with the release of 12 bighorn sheep (3 rams, 9 ewes) in spring of both 1998 and 1999 (24 total). Two rams were translocated from the Quilomene in fall 1998. Three ewes and 2 rams emigrated, 1 ram was poached, and one ewe was predated (probable bear) of the 26 sheep released. A total of 7 lambs have been produced in 2 years. One of the 7 lambs was probably associated with the predated ewe. The June 1999 population was estimated at 25 sheep in the Tieton.

Habitat Condition And Trend

Forage resources are good as a result good winter moisture and spring rains during 1997 and 1998, providing excellent growing conditions. Noxious weeds are present on all sheep ranges especially along roadways and on some riparian areas in the Quilomene unit. It is important to continue management of these areas to prevent further invasion of noxious weeds. Small fires in the Yakima Canyon have reduced shade and escape cover in the primary lambing area, but the regenerated grasses are providing abundant food.

Augmentation/habitat Enhancement

In the past 2 years, reintroduction/augmentation efforts have focused on the Tieton. Twenty-six animals have been released in the area. The source of the sheep has been Quilomene, Umtanum, and Selah Butte. Mineral blocks have been put out within the range of all 5 herds. Sheep at Clemans Mt. are feed during the winter.

Management Conclusions

The bighorn sheep population in Region 3 is healthy and growing. However, the history of Big horn sheep in Region 3 has been one of boom and bust. Historical declines have likely been associated with disease, particularly *Pasteurella H*. which is transmitted by domestic sheep. The probability of another disease outbreak is high. Domestic sheep have been documented within a few miles of wild sheep in the Quilomene twice in the last few years. A radio collared ram from Clemans wandered 10 miles west and likely crossed paths with domestic sheep. Two rams, reportedly from the Umtanum/Selah Butte population were seen within a few miles of a major sheep grazing operation and within the domestic sheep transition range. Bighorns released in the Tieton in 1999 explored an area 4 miles to the south which had domestic sheep the previous year. Private rangelands within/bordering areas frequented by bighorn sheep in the Quilomene, Umtanum/Selah Butte, and Tieton which are idle or grazed by cattle could be converted to domestic sheep.

The best long term insurance is to re-establishment bighorn sheep to as many separate ranges as possible. If one population declines, other separate populations should be available as a source of "clean" stock for augmentation. The bighorn sheep population level vs risk of disease must be assessed. History has shown that bighorns can not stockpiled. As the wild sheep population grows, the probability of contacting domestic increases. Potential bighorn/domestic contact has been documented in the past few years in the 2 populations growing the fastest (Clemans and Quilomene). In 1998, estimated production of all Region 3 sheep was 105. Removal was 3 (24 transplant, 6 harvest). Production and removal in 1999 are estimated at 128 and 27 (14 transplant, 13 harvest). No removal for transplant is scheduled for 2000. Increasing the recreational harvest, including ewes, is recommended.

Species	Region	Moose Hunts	GMUs
Moose	**1**	**1-6**	**GMUs 109, 113, 117, 124, 127, 130**

Prepared by: Steve Zender, District Wildlife Biologist

Population Objectives/guidelines

Moose population management objectives in Washington are to maintain a healthy population and provide quality hunting opportunity through limited entry permits. Increased emphasis on harvest may be needed to address moose damage and nuisance activity near the Spokane metropolitan area.

Hunting Seasons And Harvest Trends

Moose hunting opportunity in Washington is limited by permit. Permit availability and therefore hunter opportunity has increased over the last 10 years (Figure 1.) Forty-three permits were available in 5 different moose management units for 1998 and a total of 8,314 applicants entered the general permit drawing. One additional moose permit was available by raffle and 1,646 individuals purchased a raffle ticket. General permit season dates remained October 1 - November 30. All moose units were open for the use of any legal weapon in order to provide eligibility to all hunters for all units and maintain hunter weapon choice. Moose hunters were allowed to take one moose of either sex, except the special youth hunt in GMU 124 which was antlerless only. If drawn, it is a once in a lifetime opportunity (waived for youth hunt permits). There is a mandatory hunter report to be returned to WDFW.

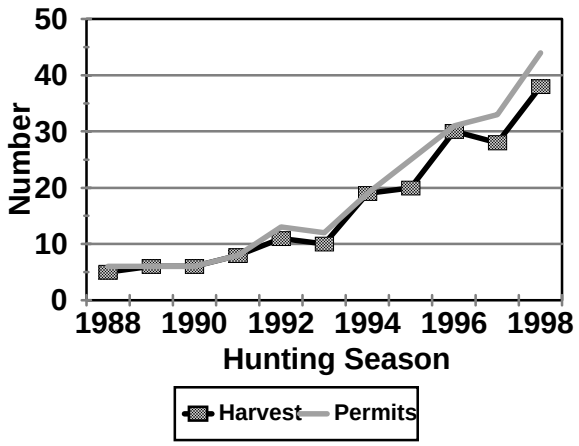

Figure 1. Statewide moose permits and harvest.

Of the 44 permits available in 1998 (including the raffle permit), all of the individuals reported that they hunted moose. A total of 38 moose were killed (32 bulls, 6 cows) for a hunter success rate of 86%. The mean number of days hunted per hunter was 6, compared with an average of 7.7 in past years. Hunters also average about 7 days per moose harvested and hunters in 1998 had a little better success at 6 days (Table 1). The youth hunt in GMU 124, Mount Spokane, was very successful. All the youngsters (15 years or younger) hunted and all saw multiple moose (24 total). Three of the four harvested a cow moose.

Table 1. Statewide moose harvest and hunter effort.

Year	Permits	% Success	Bull	Cow	Total	Days per Hunt	Days per kill
1998	44	86%	32	6	38	6	6
1997	21	86%	17	1	18	9	9
1996	23	96%	19	3	22	5	6
1995	20	85%	10	5	15	7	3
1994	15	100%	14	1	15	8	7
1993	9	78%	6	1	7	11	9
1992	9	78%	7	0	7	6	7

Surveys

The primary moose survey effort is an annual helicopter survey in late December. The initiation of a moose raffle hunt has greatly enhanced our aerial survey abilities by providing dedicated moose management funds. However, it is becoming increasingly difficult to schedule suitable helicopter flight service during the busy early winter survey season because only a couple of pilots and aircraft are available to the agencies and tribes in eastern Washington and northern Idaho.

This year we chose to survey some of the best areas in the Selkirk and 49 Degrees North units as efficiently as possible to get a general idea how numerous moose continue to be and to monitor bull escapement and calf:cow ratios. In the Selkirk unit we saw 19 bulls of which only 26% were yearling and most (13) were mature bulls. The Bull:Cow ratio was 76:100. In the 49 Degrees North unit we saw 33 bulls of which only 27% were yearling and 22 were mature bulls. The calf ratios continue to be relatively low at 28:100 in Selkirk and 23:100 in 49 Degrees North (Table 2).

We also wanted to take an opportunity to survey the east slope of the Huckleberry Mountain range in GMU's 121 and 124. Sightings and occasional poaching have increased in the areas from about Waitts Lake south to Springdale and Grote Road. We did not have fresh snow for tracking and the selective type logging in this area left plenty of cover to hide moose. While we saw a few places with moose tracks we did not see any moose. There are certainly resident moose here but the habitat is much dryer than where we find numerous moose in other units.

Moose hunters provide their observations with the mandatory report. Hunters reported calf:cow ratios a bit higher than our observed ratios from the helicopter flights but ratios are

Table 2. Population composition counts by area surveyed in 1998.

Area	GMU	Date	Bull	Cow	Calf	Total	B:100C:Ca	Hours	Moose per hour
Selkirk	113	12/20	19	25	7	51	76:100:28	6.0	8.5
49 Degrees North	117	12/21	14	22	5	41	64:100:23	2.5	16.4
Huckleberry	121	12/21	0	0	0	0	NA	2.0	0
Total			33	47	12	92	70:100:26	10.5	8.8

still relatively low (Table 3). Hunters are consistently having more difficulty in recent years finding, and especially killing a moose, in the Selkirk unit than other units (Table 3). We observed a good sample of moose on our survey flight so there is no indication of a shortage of moose with the present data. There has been significant moose hunting areas added to the road closure areas for grizzly bear habitat protection and this has put much more of the preferred moose hunting area out of reach for many hunters.

Table 3. Moose hunter observations and days per kill, 1998 season.

Unit	Moose/ Day	Days/ Kill	Cow	Calf	Total Moose
Selkirk	0.3	15.7	13	4	43
Mt Spokane	2.0	3.9	42	13	103
49 Degrees	1.7	4.8	35	16	107
Threeforks	0.4	2.7	1	0	4
Hangman	0.4	No Kill	2	1	3

Population Status And Trend Analysis

Early winter composition survey flights have been accomplished each year for 5 years (Figure 2). Bull ratios remain high so it does not appear harvest has had an appreciable effect on the population composition (we primarily harvest bulls). Calf ratios are down a slightly and continue to be very low. We know we are classifying animals correctly but we are not sure if we are seeing a random sample of the population.

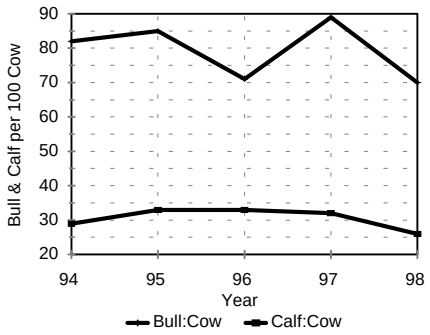

Figure 2. Moose composition flight results. Areas surveyed varies each year.

Research is needed to determine if cows with calves are randomly distributed with the other adults we see in the open brushfields in late December. The hunter observations indicate ratios might be a bit higher but still show relatively low ratios (Table 3). Until we have data that indicates recruitment is higher than what we and the hunters are observing our permit levels will likely remain conservative. Consider that we observed and classified 92 moose on our flights and only 12 were calves, then 6 are likely bulls; it appears we need nearly 100 moose to sustain a harvest of 6 bulls at this recruitment rate. We didn't fly the Mount Spokane unit, but hunters saw 103 moose of which only 13 were calves, so again this indicates we need about 100 moose to add 6 bulls to the population.

We monitor age and antler spread of harvested bulls to detect trends in the age structure of the bull population (Figure 3), which in turn indicates the mortality rate on the bull population. The mean antler spread and the mean age of bulls increased this year so our increased hunting has not reduced the quality of the bulls available. We had no yearling bulls taken this year. Since 1992 we've averaged taking 30% prime bulls (bulls >5 years old), in 1998 we took 24% prime bulls (Table 4).

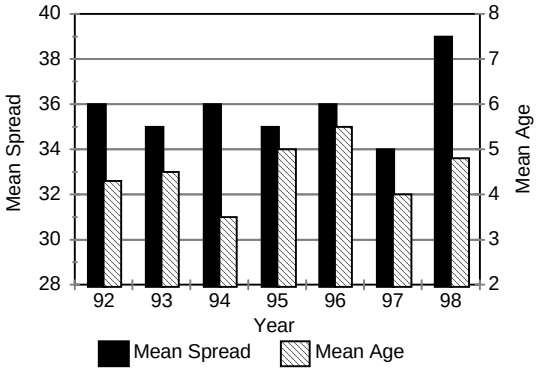

Figure 3. Age and antler spread of harvested moose, all units.

Condition And Trend

This past winter was not especially cold but it was very wet. For ungulates wintering at lower elevations this meant an easy time with less snow than normal but for moose in the clearcuts above 3500 feet it meant near record snow depths. We are not sure what impacts this may have had on survival, especially of calves, but we did notice moose had to find mature

Table 4. Tooth age and antler spread for harvested moose in Washington, 1992-98.

Year	Sample	Mean Age	Mean Spread	% Yearling	% 2-5 yrs.old	% > 5 yrs.old
1992	8	4.3	36	13	62	25
1993	8	4.5	35	13	62	25
1994	9	3.5	36	0	89	11
1995	13	5	35	8	54	38
1996	21	5.5	36	10	33	57
1997	26	4	34	12	58	30

timber areas or move considerably lower to avoid deep, heavy snow late in the winter. It was probably not an easy winter for moose and there may have been some calf losses.

Moose prefer 15-25 year old clear-cuts or thinnings on mesic sites. Logging was intense in northeast Washington in the 1980s on public and private lands. More recently the rate of logging on public lands has decreased but private lands have been heavily logged. Generally, it appears conditions for moose production will be optimal for the next few decades. Our observations this winter with the deep snow leads me to believe mature forest stands for snow intercept cover adjacent to forage units may be the critical habitat component of the next decade in the heavily logged areas.

Human Safety and Nuisance Problems

Individual moose frequently cause human safety or nuisance concerns in the metropolitan area of Spokane. Moose are great wanderers in search of new habitat and each year, primarily in late spring, moose walk through yards, across busy city streets, and eventually end up finding seclusion in a nursery or someone's back yard. In the metropolitan area this generally prompts numerous complaint calls (damaged fences, cars, shrubs, and certainly concern for the animals safety) that WDFW Officers must spend considerable time resolving. In 1998 there were 34 formal nuisance complaints handled by our officers in Spokane County. To date in 1999 (October) there have been 26. While Pend Oreille and Stevens counties have far more moose we receive only a couple of formal complaints a year in these counties. It's likely that a certain percentage of moose are always going to strike out to explore new range each year, those that happen to head west into Spokane are going to be a nuisance at best and a safety issue at worst.

Management Conclusions

There is tremendous interest in moose hunting in Washington. Populations appear to be expanding their range. This is a species that we may have an opportunity to increase hunting opportunity on but we need more knowledge of the populations and the level of harvest they can sustain.

Early winter helicopter surveys have proven effective in identifying moose distribution and sex/age composition. It is not necessary to fly all units each year but it is valuable to fly one or two traditional areas and an area new to us each year. It is especially critical that we monitor the calf:cow ratio and the winter snow conditions to get some data on recruitment. While many people suggest increasing harvest, we need the data that says we have the recruitment to sustain that harvest.

Moose population management (primarily hunting opportunity) in the GMU's surrounding Spokane will likely need to continue to address the nuisance concerns in the metropolitan area.

Species

Black Bear **Statewide**

Prepared by: **Steve Pozzanghera, Carnivore, Furbearer, and Permit Species Section Manager**
Clifford G. Rice, Game Surveys Coordinator

Population Objectives/guidelines

Black bear management objectives in Washington include providing a maximum sustainable recreational harvest opportunity, while minimizing black bear nuisance and damage activity. Harvest age guidelines, which act as indicators of the overall health of the bear population are used to monitor the influence of harvest on bears (Table 1). Monitoring parameters include the percent of the harvest that is female, and the median age of bears taken during hunting seasons (sexes separated and combined).

Table 1. Guidelines for black bear harvest management.

Criteria	Over Harvest	Acceptable Harvest	Desirable Harvest
%Females in harvest	≥40%	≤36%-39%	≤35%
Median harvest age	≤3 Years	≥4 Years	≥5 Years
Median age of males in harvest	≤2 Years	>2 Years	≥4 Years
Median age of females in harvest	≤4 Years	≥5 Years	≥6 Years

Hunting Seasons And Harvest Trends

Black bear seasons have changed significantly over the last 3 years. Initiative 655 which banned the use of bait and hounds for hunting black bear, and the use of hounds for hunting cougar and bobcat was passed by Washington voters in the November 1996 general election. Therefore, the use of bait and hounds for the hunting of black bear became illegal for the 1997 season. In an effort to mitigate the anticipated decrease in bear harvest (i.e., post I-655), 1997 bear seasons were lengthened, and bear bag limits were increased in some areas. Legislation was also passed that provided the authority to the Fish and Wildlife Commission to establish reduced costs for black bear and cougar transport tags. As a result of these efforts, the 1998 black bear harvest increased above previous levels (Table 2) Hunter success remained low and the number of days that it took a hunter to harvest a bear rose to a was also high (Figure 1 and Table 2.) The increased harvest is a consequence of double the number of hunters being active (Table 2).

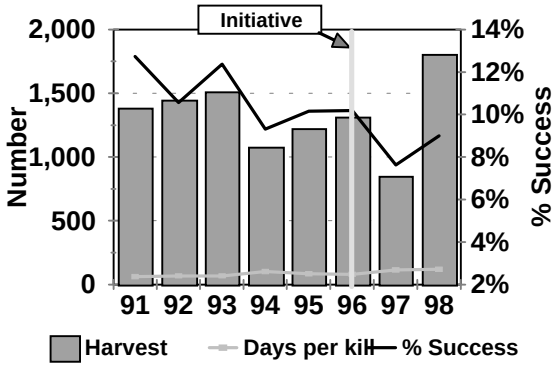

Figure 1. Harvest, days per kill, and percent success for black bears harvested in Washington State.

Population Status And Trend Analysis

Based on a model using population reconstruction methods and harvest age data, the statewide black bear population in Washington now exceeds 30,000 animals. The population model also suggests that the population is increasing. The statewide harvest median age data also supports the fact that the

Table 2. Statewide black bear harvest, hunter effort and median age information, 1990 - 1997.

								Median Age		
Year	Male	Female	Total # of hunters	% Success	Hunter Days	Days per kill	Males	Females	% females
1990	NA	NA	NA	NA	NA	NA	NA	2.5	4.5	NA
1991	876	503	1,379	10,839	13%	84,771	61	3.5	4.5	36%
1992	921	521	1,442	13,642	11%	98,434	68	4.5	4.5	36%
1993	986	521	1,507	12,179	12%	102,558	68	3.5	5.5	35%
1994	654	419	1,073	11,530	9%	110,872	103	3.5	4.5	39%
1995	850	368	1,218	11,985	10%	102,859	84	3.5	4.5	30%
1996	951	359	1,310	12,868	10%	104,431	80	4.5	5.5	27%
1997	546	298	844	11,060	8%	97,426	115	4.5	5.5	35%
1998	1,157	645	1,802	20,891	9%	216,456	120	4.5	5.5	36%

bear population as a whole is not being negatively impacted by our harvest (Figure 2.).

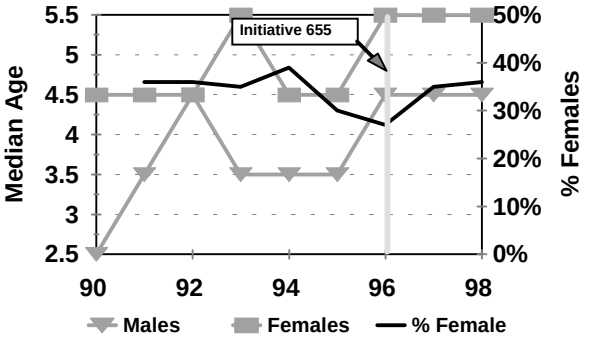

Figure 2. Median age and percent females in black bear harvest in Washington State.

Hair snags and DNA analysis may be a viable option for population monitoring in the future, and WDFW's black bear research project which is set to conclude at the end of 1999 may provide some valuable recommendations on black bear population monitoring methods.

Nuisance and Damage Activity

A long-term, standardized report on black bear nuisance and damage activity is not available for Washington. However, a statewide problem wildlife field report was instituted in March of 1995. The use of this report form has allowed WDFW to begin to collect baseline information related to the levels of black bear nuisance and damage activity in the state (Table 3.) The 1998 field reports indicate that the total number of black bear/human complaints reported by the public increased markedly between 1997 and 1998 from 541 to 786, respectively. Black bear nuisance and damage activity may not be a good indicator of the status of the population, but more likely it reflects environmental conditions. For example, in 1996 we had a late spring with poor forage conditions for black bear, followed by a poor fall huckleberry crop.

Table 3. Statewide black bear/human complaint summary, 1995-1997.

			# Killed		
Year	Total Complaints	# Relocated	By WDFW	Other	Human Attacks
1995*	208	36	6	4	1
1996	556	70	16	4	0
1997	541	37	16	26	0
1998	786	70	15	20	1

Management Conclusions

Washington has a unique and challenging situation when it comes to management of our black bear population. Washington is the smallest of the eleven western states, yet we have the second highest human population; a population which continues to grow at record levels. We also have one of the largest black bear populations in all of the lower 48 states. Given that approximately 75% of our black bear habitat is in Federal or private industrial ownership a large portion of core black bear habitat is relatively secure. This means that the long term outlook for black bear is generally good.

As local bear populations respond to current reduced levels of harvest a greater emphasis on monitoring populations within individual bear management units will be necessary. Continued changes to bear seasons, and tag fees are likely, as we seek to minimize levels of human/black bear conflicts by using general season hunting, public education, and depredation control.

Species	Bear Unit Number	Black Bear Management Unit
Black Bear	**1**	**Coastal**

Prepared by: Warren Michaelis, Wildlife Biologist

Population Objectives/guidelines

In view of the implementation of Initiative 655 as well as the increasing number of bear complaints in residential areas the primary objective at this time is the control of a population likely to increase.

Hunting Seasons And Harvest Trends

The estimated total black bear harvest for the coastal region in 1998 was 221 (Table 1). This represented an increase of approximately 40 percent over the 1997 harvest. About fifty-nine percent of this total were males and forty-one percent females. In spite of the increased harvest, hunter success declined while the estimated number of days per kill increased. The 1998 general black bear season extended from August 1 through November 15 and through use of a damage bear tag hunters could take up to two bears. Damage bear tags were valid in the coastal unit.

Table 1. Region 6 bear harvest summary 1994-98

Year	Male	Female	Total	Days/ Kill	Hunter Success%
1998	131	90	221	178	5
1997	102	56	158	92	9
1996	222	44	266	103	10
1995	212	93	305	82	12
1994	168	110	278	94	10

Population Status And Trend Analysis

The age distribution of bears harvested in the last five years is listed in Table 2. The median age for black bear harvested in 1998 was determined from black bear tooth samples submitted by successful hunters. Forty-six teeth from male bears and 27 from females were aged. The median ages for males and females were 4.5 and 6.5 years respectively.

Nuisance and Damage Activity

Early bear damage season in Region 6 during 1998 resulted in a total harvest of 61 bears.

Management Conclusions

The overall increase in bear harvest over the 1997 harvest suggests increased participation in bear hunting by big game hunters that, in the past, may not have purchased a bear tag. The expectations were clearly for more available bears following Initiative 655. It remains to be seen whether this level of participation will be maintained in years to come.

Table 2. Age distribution of male and female black bear harvested in the Coastal BBMU from 1994-98 (N=number of tooth samples).

	Male				Female			
Year	N	Min.	Max	Med. Age	N	Min.	Max	Med. Age
1998	46	0.5	24.5	6.5	27	0.5	24.5	6.5
1997	39	1.5	21.5	4.5	19	2.5	20.5	8.5
1996	63	1.5	20.5	3.5	32	1.5	19.5	5.5
1995	48	0.5	20.5	4.5	27	1.5	16.5	4.5
1994	34	1.5	28.5	3.5	18	1.5	15.5	5.5

Species	Bear Unit Number	Black Bear Management Unit Name
Black Bear	**3**	**North Cascades Black Bear Management Unit**

Prepared by: Ruth Milner, District Wildlife Biologist

Population Objectives/guidelines

Population objectives for black bear in the North Cascades Bear Management Unit (BMU # 3) are to maintain healthy populations that can sustain a recreational hunt, while minimizing nuisance and damage complaints from timberland owners and people living in urban areas.

Hunting Seasons And Harvest Trends

Bear Management Unit # 3 encompasses Game Management Units 418, 426, 437, 448, 450 and 460. Hunting seasons in BMU #3 are the same as the statewide seasons for western Washington.

Statewide criteria for assessing acceptable harvest levels for black bear are discussed elsewhere. In general, the percentage of females harvested over the last 4 years (1995-1998) considered with the median ages of males and females harvested indicates that a healthy population is being maintained at current harvest levels (Figure 1).

Total Number of bear hunters increased in 1998, with 2948 hunters reporting that they hunted the North Cascade Unit. This is a 38% increase from 1997; and also shows increased hunter activity compared to 1995 and 1996 (Figure 2) .

Total harvest increased between 1998 and 1997 as well (283 bears, 1998 vs 116 bears, 1997) (Figure 1), perhaps indicting an increase in proficiency for hunters who are no longer allowed to use bait or hounds to hunt bear.

An additional 11 bears were taken with animal damage permits in 1998. Requests from the public for agency staff to respond to nuisance complaints continues to increase.

Population Status And Trend Analysis

Black bear population surveys were not conducted in BMU #3 in 1998. Harvest data indicate the black bear population remains healthy.

Habitat Condition And Trend

Habitat condition, in general, appears stable in BMU#3. .

Management Conclusions

Increased numbers of people hunting and the resultant in crease in bears harvested indicate that opportunities for quality bear hunting exist in this management unit.

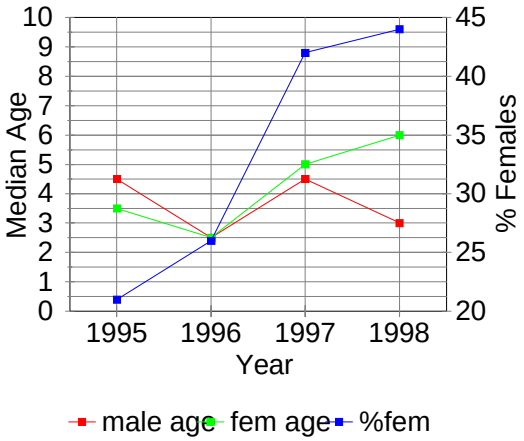

Figure 1. Median ages and percent female bears harvested from 1995 through 1998, BMU 3.

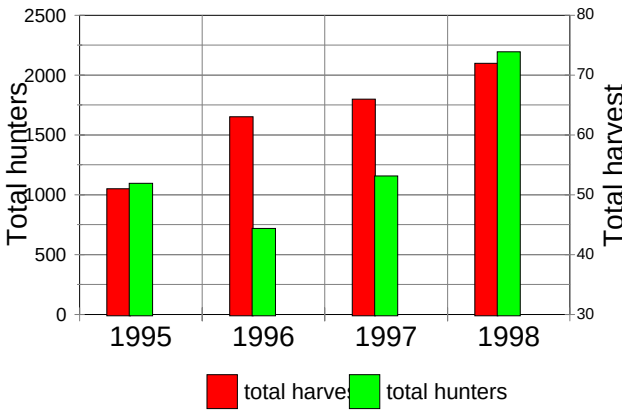

Figure 2. Total number of hunters compared to total bear harvest from 1995 through 1998, BMU 3.

Species	Bear Unit Number	Black Bear Management Unit
Black Bear	**4**	**South Cascades**

Prepared by: Min T. Huang, Wildlife Biologist
Patrick J. Miller, District Wildlife Biologist

Population Objectives/guidelines

Black bears are managed in western Washington to provide maximum recreational opportunities without detrimentally affecting black bear population levels. Black bear population levels are monitored through harvest statistics (median harvest age for each sex, percentage of females in the harvest). Acceptable harvest parameters for black bears in the South Cascade Bear Management Unit (SC BBMU) are: <40% females in the harvest, with a median female harvest age ≥5, and a median male harvest age of ≥2. Bear harvest is also managed in an attempt to reduce timber damage, property damage, and black bear/human interactions.

Hunting Seasons And Harvest Trends

General Season

The general black bear season in the SC BBMU was from 1 August to 15 November, with a season limit of 2 bears. The 1998 general season was the second since the passage of Initiative 655, which banned the use of bait and hounds. Historically, bait and hound hunters had much greater success than boot hunters. Evidence from other states indicates that harvest by boot hunters will increase over time, as greater numbers of hunters choose to hunt bear and learn new methods of hunting them. Statistics from the 1998 general season followed this trend. Although overall hunter success (0.03%) was still lower than before passage of I-655, the reported 1998 general season black bear harvest in the SC BBMU was the second highest in the 1990's (Table 1). The high harvest was due, in part, to the increased number of hunters in the field. A record number of bear hunters participated in the 1998 general season (Table 1). A slight ($3.00) decrease in the cost of bear permits may well have contributed to the overall increase in hunter pressure. An overall failure of the huckleberry crop at mid to high elevations also contributed to the high harvest, as bears moved out of the high country and into areas where they were more susceptible to harvest. These general trends in harvest and hunter participation were consistent with the statewide trend in 1998.

Spring Depredation Season

In addition to general season hunting, black bear depredation permits continued to be issued to landowners during the spring of 1998 to address timber damage. The use of hounds and baiting were allowed in the taking of bears on depredation permits. In the Region 5 GMU's that comprise the SC BBMU, a total of 30 depredation permits were issued (Table 2). A minimum total of 21 bears were taken on these permits.

Table 2. Depredation permit black bear harvest in the Region 5 GMU's within the South Cascades Black Bear Management Unit, April-August 1998.

GMU	Permits issued	Male	Female	Unk	Total
510	2	1	0	0	1
513	2	0	1	0	1
516	2	1	0	0	1
520	8	3	1	2	6
550	8	1	3	0	4
558	3	1	1	0	2
564	1	1	0	0	1
572	5	2	3	0	5
Total	30	10	9	2	21

Population Status And Trend Analysis

Harvest data from general season take indicate that historic bear harvest levels in the SC BBMU are within acceptable limits. However, recently high harvest pressure in the SC BBMU has resulted in some negative trends in harvest demographics. The median age of harvested females in 1998 was well below acceptable levels (Table 3). For the second consecutive year, the percentage of females comprising the general season harvest was also above the desired level. The percentage of sub-adult females in the harvest (>56%) is also indicative of high mortality within the female segment of the population. The percentage of female sub-adults in the harvest has been increasing for the past three years.

Table 3. Median age of black bear harvested in the South Cascades Black Bear Management Unit, 1991-1998.

Year	Male	Sample	Female	Sample	Sexes Combined	Sample
1998	4.5	28	3.0	16	4.0	44
1997	2.5	7	5.0	14	3.5	21
1996	3.5	21	7.0	18	5.5	39
1995	3.5	32	5.5	8	4.0	40
1994	5.5	13	6.5	5	5.5	18
1993	4.5	31	3.5	23	4.5	54
1992	4.5	26	3.5	14	3.5	40
1991	3.5	33	8.5	23	3.5	56

Surveys

Due to budgetary constraints, no surveys were conducted in the SC BBMU in 1998-99.

Nuisance and Damage

During the time period 1 January to 30 December 1998, enforcement officers responded to a total of 71 black bear complaints. As urbanization continues to encroach on bear habitat in the SC BBMU the volume of complaints will likely increase. Although acceptable harvest parameters have recently been exceeded in the SC BBMU, human health and safety concerns will continue to justify localized high harvest levels and removal of 'problem' bears.

Damage to certain industrial and private timberlands continues to be addressed through the issuance of depredation permits (see Hunting Seasons and Harvest Trends). Many industrial timber companies, however, continue to administer feeding programs to lessen spring bear damage to young trees. Feeding programs have generally resulted in the desired decrease in damage, without lethal removal of bears.

Habitat Condition and Trend

Black bear habitat is affected by both timber and land-use practices. In the SC BBMU timber harvest levels have remained relatively constant. Due to the creation of late successional reserves, harvest of USFS lands within the SC BBMU will continue to be low to moderate, while industrial timber harvest will continue to be high. Encroaching residential development, however, poses the greatest threat to black bear habitat in the SC BBMU. Since 1990, the human population in the area encompassed by the SC BBMU has increased by 37.2% (Office of Financial Management). The statewide population increase over the same time period was 25.1%. Increasing development will reduce suitable habitat and lead to an increase in bear-human encounters and conflicts.

Management Conclusions

Despite widespread public perception of an increasing black bear population in the SC BBMU, recent harvest statistics indicate that present harvest intensity may be too high. Recent harvest demographics indicate potentially detrimental harvest levels. The percentage of females in the harvest, and a general 5 year decline in the median age of harvested females indicate that bear populations in this BBMU are under heavy pressure. Tooth sample sizes of the harvest, however, must be increased; particularly from spring depredation permit hunting. Due to the extremely small tooth sample size (n=2 in 1998) the overall effect of spring depredation hunting on bear population demographics is unknown. Combined data from 1996 and 1997 indicate that 40% (n=5) of females and 100% (n=6) of males taken during spring depredation hunts were sub-adults.

Recent short-term habitat conditions (i.e. berry crop failures) and long-term habitat changes (i.e. encroaching human development) have contributed to higher vulnerability to hunting and depredation take. Continued long winters with heavy precipitation will likely result in lower overall bear productivity in this Unit. With continued heavy hunting pressure we may see substantial declines in this population should present conditions continue.

Species	Bear Unit Number	Black Bear Management Unit
Black Bear	**5**	**Okanogan**

Prepared by: Scott Fitkin, District Wildlife Biologist

Population Objectives/guidelines

The management objective in Black Bear Management Unit 5, is to provide maximum recreational harvest opportunity, minimize nuisance and damage complaints, while maintaining a productive and well distributed population. The health of the population is monitored by examining the median age of bears harvested, and the percentage of the harvest that are females. Minimum thresholds are a median male age of 3, a median female age of 5, median age for all bears of 4, and a female harvest percentage of less than 40%.

Hunting Seasons And Harvest Trends

The 1998 black bear season in the Okanogan BBMU ran from August 1 - November 8. Hunting conditions were generally favorable, and access remained good throughout the season.

In recent years, legal action and public sentiment have imposed strict regulations governing techniques used to harvest black bears in Washington. A court ruling banned bait and hound hunting in the North Cascades Grizzly Bear Ecosystem beginning in 1996. This effectively eliminated these practices in the Okanogan BBMU. The passage of Initiative 655 banned public hound hunting and baiting of bears statewide, following the 1996 season. The elimination of hound hunting and baiting was expected to reduce black bear hunting pressure and harvest throughout the state. WDFW attempted to mitigate for this effect by lengthening black bear seasons statewide in 1997, and significantly reducing the tag fee in 1998.

Bear hunter numbers in BBMU 5 declined in accordance with general license sales in 1996 and 1997 (Figure 1, Table 1). This was expected, since many bear hunters buy tags with expectation of taking a bear incidentally while hunting other species. Conversely, bear hunter numbers in the Okanogan BBMU nearly doubled from 1997 to 1998, fueled largely by the reduction in tag fee.

In 1998, BBMU 5 bear harvest rebounded to levels common before recent restrictions. This is not completely unexpected since much of the unit is rugged and roadless, and traditionally received less overall pressure from baiting and hound hunting than other areas of the state. It appears as though low tag fees and longer seasons may have successfully mitigated for harvest technique restrictions in the Okanogan BBMU.

Population Status And Trend Analysis

Bear population parameters for the Okanogan BBMU have

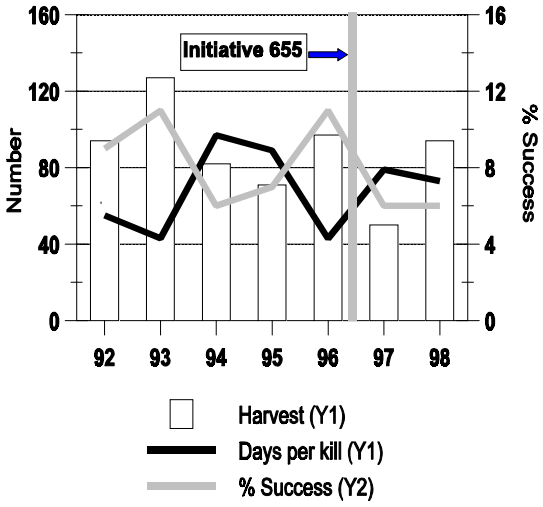

Figure 1. Harvest, number or hunters, days per kill, and percent success for black bears harvested in BBMU 5.

Table 1. Black bear harvest, hunter effort and median age for BBMU 5.

								Median Age		
Year	Male	Female	Total # of hunters	% Success	Hunter Days	Days / kill		Males	Females	% females
1990	--	--	--	--	--	--	--	2.5	4.5	36%
1991	--	--	--	--	--	--	--	3.5	3.0	36%
1992	54	40	94	990	9%	5,124	55	3.5	3.5	43%
1993	85	42	127	1153	11%	5,448	43	3.5	3.5	33%
1994	53	29	82	1384	6%	7,979	97	3.5	2.5	36%
1995	59	12	71	1047	7%	6,343	89	5.5	8.0	23%
1996	73	24	97	889	11%	4,181	43	2.5	4.5	36%
1997	30	20	50	858	6%	3,967	79	6.5	6.5	38%
1998	62	32	94	1514	6%	6,823	73	4.5	5.0	34%

improved in recent years and no longer hover at or below minimum thresholds. In particular, the percentage of sub-adults in the harvest has steadily declined, especially for females (Figure 2). This bodes well for future cub production; however, if hunter pressure continues to rise with longer seasons and cheap tag fees, this trend could reverse. Age data will need to be monitored closely and seasons adjusted accordingly.

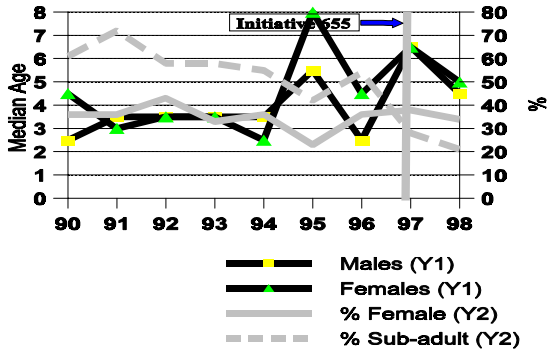

Figure 2. Median age and percent females in black bear harvest in BBMU.

Bears have always been a difficult animal to survey and/or census. Population estimates for Washington are rather speculative, and often based on criteria borrowed from other states. WDFW is currently engaged in intensive black bear research. One of the study's primary objectives is to develop new, more reliable techniques for estimating bear numbers in a variety of habitat types throughout the state. The results of these efforts should be available within the next year. At present, no population estimate exists for the BBMU 5.

Past dramatic statewide reductions in harvest, combined with the relatively young age structure of recent years, suggest black bear numbers declined significantly after the middle part of the century. To what extent this was a function of harvest pressure versus habitat loss is unclear. These statewide trends probably also applied to the Okanogan BBMU.

More recently, bear numbers have likely stabilized and now appear to be slowly increasing. This is supported by improvements in population parameters.

Nuisance and Damage Activity

Wildlife officers routinely respond to complaints of bears damaging property or threatening human safety near rural residences or campgrounds. The number of complaints varies widely year to year as a function of weather and changes in the food base. Nuisance complaints increased significantly in 1998. A hot dry summer and spotty berry crop reduced available forage, and bears often came into conflict with people while seeking alternative food sources.

Habitat Condition And Trend

Last summer's dry conditions and marginal berry crop may hamper cub production in 1999. Fortunately, early indications are that 1999 will be a good berry year.

At lower elevations throughout bear range in the Okanogan BBMU, human development continually nibbles away at bear habitat, and noxious weeds continue to displace native grasses and forbs. The combination of these impacts is systematically reducing the quantity and quality of black bear spring and early summer habitat components. This is likely to result in increased incidence of human-bear conflict and associated control mortality. The potential for predator control mortality on domestic sheep leases in designated wilderness areas still exists. This mortality intrudes on areas that would otherwise be relatively secure bear habitat.

On the other hand, successful efforts to recover wild salmonid stocks would increase the bear forage base. Also, black bears are benefitting from more aggressive road management occurring on public lands on behalf of a variety of different wildlife species.

Management Conclusions

It appears that recent hound hunting and baiting restrictions briefly reduced hunting pressure and harvest, boosting production and improving population age structure. Hunting pressure and harvest have rebounded in response to lower tag fees and longer seasons. Also, hunters appear to be adjusting well to the change in regulations governing harvest techniques. As a result, future population trend will likely be a function of hunter pressure, modified by annual variations in forage availability. If success remains constant and pressure increases, a reduction in season length may be needed to maintain healthy population age structure.

Threats to habitat continue, and these will affect overall carrying capacity. The effort to pursue more aggressive road management should be supported. This is especially true for habitat at low to mid elevations containing bear spring/summer range, the time and place where bears are often most vulnerable to illegal harvest. WDFW's ongoing land acquisition in the Methow will help protect low elevation habitat and movement corridors. This program should be supported to the fullest extent possible.

All WDFW lands and facilities in bear habitat should be outfitted with bear proof garbage containers. In addition, existing recommendations concerning proper sanitation in bear country should be adopted as regulations and enforced. Other agencies should be encouraged to do the same. Proper sanitation will greatly reduce the potential for bears to become conditioned to human food, and reduce the potential for human-bear encounters. This will in turn reduce the number of nuisance complaints and associated expenditure of resources.

Existing WDFW culvert traps should be modified or replaced with more modern versions that minimize tooth and claw damage to captured bears.

Species	Bear Unit Number	Black Bear Management Unit
Black Bear	**6**	**East Cascades**

Prepared by: Jeff Bernatowicz, Wildlife Biologist
John Musser, District Wildlife Biologist

Population Objectives/guidelines

Black bear management is based on sustained yield. The objective is to provide maximum recreation opportunity without negatively affecting the black bear population. The guidelines used to establish acceptable black bear harvest levels are given in Table 1.

Table 1. Guidelines for acceptable black bear harvest.

Criteria	Over Harvest	Acceptable Harvest	Desirable Harvest
%Females in harvest	≥40%	≤36% to 40%	≤35%
Median harvest age	≤ 3 Years	≥4 Years	≥5 Years
Median female harvest age	≤4 Years	≥5 Years	≥6 Years

Hunting Seasons And Harvest Trends

Black Bear Management Unit (BBMU) 6 encompasses the the damage bear tag area in eastern Washington (GMUs 304, 306, 308, and 316). A second bear (in addition to the general tag) bear may be taken in this area.

BBMU 6 harvest in 1998 was >100% higher than 1996 and the 10 year average (Table 2). Hunter numbers and effort were 105% and 184% above average. Median age and percent females in the harvest were within the desirable and acceptable categories. Hunter success average. Mast is not surveyed in the region, but casual observations and reports indicate 1998 was a poor year for huckleberries due to dry summer weather. Numerous damage complaints were received in August. Low success was expected because of the poor mast and ban on hounds and bait. The large harvest and success are difficult to explain.

Population Status And Trend Analysis

Harvest statistics suggest the bear population in BBMU 6 is not being over-harvested. The percentage of females in the harvest has declined the last 5 years while average age of bears harvested has remained stable. Population models on the statewide scale suggest the bear population is growing slowly.

Nuisance and Damage Activity

Bear damage in BBMU 6 is concentrated in Chelan County. Nuisance/damage complaints have increased since fires burned large areas in 1993. Complaints increased in 1998 possibly because of a poor huckleberry crop. On average, complaints should decrease as the burned areas recover and begin to provide cover and foraging habitat.

Habitat Condition And Trend

Mast production in BBMU 6 is typically better in cool, moist years. Annual precipitation had been above average until 1998. Plant growth and production had been good. While abundant vegetation has been beneficial over the BBMU, there have been large fires in Chelan County. Short term impacts have been negative, but long term forb and soft mast will be beneficial.

Large sections of BBMU 6 are in remote or wilderness areas where no habitat alterations occur. Forest management has not changed significantly in recent years. Localized fringe areas have seen an increase in recreational development and

Table 2. Black bear harvest, hunter effort and median age for BBMU 6.

							Median Age		
Year	Male	Female	Total	# of hunters	% Success	Hunter Days	Males	Females	% females
1987	62	44	106	1829	5.8	8,340			41
1988	62	27	89	841	10.7	6,648	3.5	7.5	30
1989	112	65	175	2392	7.4	9,550	4	4.5	37
1990	No	Harvest	Data				3.5	8.5	
1991	126	101	227	2886	7.8	13,615	3.5	4.0	44
1992	129	84	213	2847	7.4	13,125	4.5	4.5	39
1993	117	42	159	3758	4.3	20,780	3.5	5.5	26
1994	93	48	141	2620	6.0	15,709	4.5	6.5	34
1995	86	35	121	2724	4.3	12,291	3.5	4.5	29
1996	130	16	146	3429	4.3	15,317	4.5	7.5	11
1997	102	44	146	4229	3.5	20,271	4.5	4.5	30
1998	230	109	339	5661	6.0	38,557	4.5	5.0	32
10 YR	102	51	152	2756	6.1	13,565	4	5.7	33

orchards. The orchards provide abundant soft mast, but create damage situations.

Management Conclusions

The black bear population in BBMU appears to be healthy. The perception was for bear populations to expand without bait and hounds. In 1998, hunters and harvest was well above the 10 year average. The age and sex ratio in the harvest must be monitored closely with the increased harvest.

The bear damage area (2 bear limit) in Chelan County will likely increase the harvest as was intended. Chelan County has accounted for over 50% of the harvest (10 year average) in BBMU 6. The need to minimize damage in this specific area may ultimately conflict with overall acceptable harvest goals for black bear.

Species	Bear Unit Number	Black Bear Management Unit
Black Bear	7	Northeastern

Prepared by: Steve Zender, District Wildlife Biologist

Population Objectives/guidelines

The objective for BBMU 1 is to sustain a well dispersed and healthy bear population. Hunting opportunity will be maximized consistent with statewide bear harvest guidelines and trends in depredation and nuisance complaints. Harvest guidelines are based on median age and percentage of females in the sample of harvested bears. Males should average >2 years, females >_5 years, and the average percentage of females in the harvest should not exceed 40%.

Hunting Seasons And Harvest Trends

The bear seasons and regulations in BBMU 1 were consistent with the August 1- November 8 eastern Washington season, with the exception of the northern portion of GMU 113, Selkirk where the season did not open until September 8. The bag limit was one bear. There were no special damage hunts in this BBMU so there was no opportunity to take a second bear.

Hunter numbers increased 83% and hunter days of effort increased 152% over 1997, (Table 1, Figure 1).

The 1998 harvest was up 106% from 1997 and 50% from the 1991-97 average (Table 1). It appears the lower tag price and longer season attracted many more bear hunters and resulted in a significant increase in the bear harvest.

This later opening in the northern portion of the Selkirk Unit was to address concerns for potential grizzly bear mortality related to black bear hunting. The Selkirk Unit still maintained a success rate (9%) near the average for the Northeast BBMU (10%). While we want to maximize recreational hunting opportunities where feasible, WDFW also has the responsibility to protect and manage for recovery of native wildlife classified as endangered, threatened, or sensitive. The highest priority for grizzly recovery efforts in the Selkirk Recovery Zone (northern portion of GMU 113 in Pend Orielle County) is to eliminate human caused grizzly mortality during hunting seasons. The mortalities that have occurred in the past are primarily in relation to black bear hunting seasons. There was no indication that bear hunters caused any grizzly mortalities in Washington in 1998.

Table 1. Black bear harvest, hunter effort and median age for BBMU Northeastern.

								Median Age		RCards
Year	Male	Female	Total	# of hunters	% Success	Hunter Days	Days per kill	Males	Females	% females
1991	226	124	350	2,356	15%	15,136	43	3	5	36
1992	266	196	462	2,971	16%	16,234	35	3	6	43
1993	262	134	396	2,876	14%	14,820	37	2	5	34
1994	183	162	345	2,870	12%	15,391	45	3	4	45
1995	215	107	322	3,240	10%	18,884	59	3	5	38
1996	214	122	336	3,055	11%	17,400	52	3	4	37
1997	166	90	256	2,889	9%	16,171	63	3	4	35
1998	347	180	527	5,301	10%	40,687	77	4	5	34

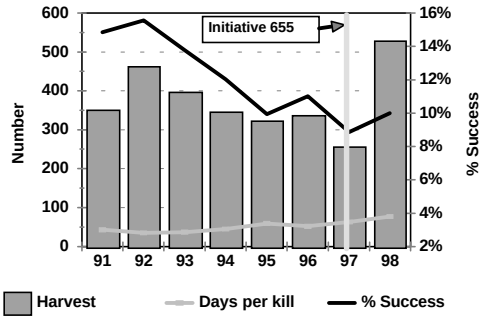

Figure 1. Harvest, days per kill, and percent success for black bears harvested in Northeastern BMU.

Hunter success in 1998 was 10%, up from 9% in 1997. The average number of hunter days per bear kill was up from 1997 (77 in 98 vs. 62 in 97).

The Colville Confederated Tribes offered a boot hunt and a hound hunt on the North Half (GMUs 101, 105, and 204). The Tribal Fish and Wildlife Department issued 24 tags but no bear were reported taken (Colville Confederated Tribes, 1999).

Population Status And Trend Analysis

The median age of harvested female bears in BBMU 7 was below the acceptable harvest guidelines in 1996 and 1997 but increased from 4 to 5 years in 1998 (guideline is >_ 5). The median male age was 4 which equals the desirable harvest guideline (>_4). Females made up 34% of the harvest. This is

well below the over harvest level of >_40% and near the desired harvest level of <_35% (Table 1 and Figure 2). Sub-adults (<_3.5) accounted for 44% of the harvest in 1998. This was

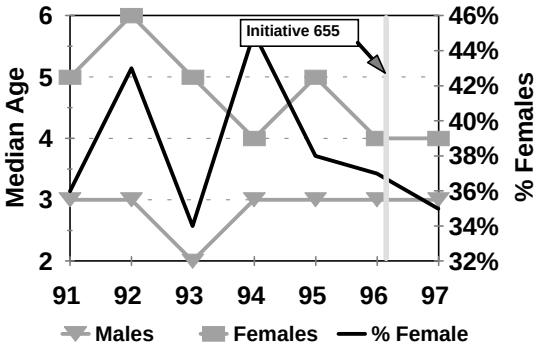

Figure 2. Median age and percent females in black bear harvest in Northeastern BBMU.

down from 51% in 1997 and the long term average which is near 50%.

Nuisance and Damage Activity

Fish and Wildlife Officers confirmed 375 black bear complaints in the Northeast BBMU in 1998. Most of the problems were in Stevens County (25%) followed by Pend Oreille County (17%). Complaints were very high during the period July to September due to poor natural berry production. The poor huckleberry crop in the high elevations forced bear to forage at low elevations where their efforts often resulted in an unwanted encounter with humans or their property.

Habitat Condition And Trend

While the long-term habitat conditions and trend appear favorable there is concern for the immediate future. Bear recruitment in northeast Washington is likely dependent on berry production, especially huckleberries. The huckleberry crop has been relatively poor or spotty at best for the past three years due to unusual weather conditions. This could mean two or three years of poor recruitment and subsequent reduced bear populations in the future as these age classes are depended on more for hunter harvest and bear population recruitment.

Management Conclusions

The harvest increased significantly in 1998. The age data suggests fewer sub-adults than usual in the population. While it is encouraging to see our percentage of females in the harvest well within guidelines and the median ages of males and females within guidelines, we need to be watchful of the number of bears in the sub-adult age classes. Anecdotal observations of huckleberry production in the last several years indicates the potential for poor nutrition in sows and thus potential low productivity.

Literature Cited

Fish and Wildlife Department Colville Confederated Tribes. 1998. 1998 North Half Colville Tribal Harvest, Nespelem.

Species	Bear Unit Number	Black Bear Management Unit
Black Bear	**8**	**Blue Mountains**

Prepared by: Pat Fowler, District Wildlife Biologist

Population Objectives/guidelines

Black bear populations will be managed at a level that provides optimal recreational opportunity for both consumptive and non-consumptive users, while minimizing conflicts with other management objectives.

Hunting Seasons And Harvest Trends

The black bear hunting season has changed dramatically over the last ten years. Since the passing of Initiative 655, the general bear season was lengthened to offer hunters more opportunity and to achieve an adequate bear harvest. The 1998 bear hunting season ran for 100 days, from August 1 to Nov 8. Hunters harvested a total of 82 bear in the Blue Mountains in 1998. This compares favorably with the 1992-95 average of 86 bears/year. The number of days per kill decreased substantially in 1998, from an average of 413 days/kill in 1997, to 130 days/kill.

Much of the bear harvest (66%) occurred on the westside of the Blue Mountains, in GMU's 154, 162, and 166. The Dayton unit (162) produced the highest harvest at 26 bears, followed by Blue Creek (unit-154) with 22 bears, for a combined average of 59% of the total harvest. This is a direct result of bears concentrating in the fall to feed in natural foraging areas such as blackberry patches, old orchards, and Hawthorne thickets within these two units. Bear in other units of the Blue Mountains do not concentrate during August and September due to the lack of natural forage areas, which makes hunting them much more difficult and results in a lower harvest level in those units.

The composition of the general season bear harvest did not change dramatically compared to 1997. The 1998 harvest consisted of 40 males and 42 females. This is probably a reflection of hunters not being selective and taking the first bear observed. The age of harvested females ranged from 1.5 - 11.5 years (N=6), with a median of 5.5 years. The age of harvested males ranged from 1.5 - 16.5 years (N=10), with a median of 2.5 years.

A permit controlled spring bear season was established in the Blue Mountains in 1999. The season started April 15 and closed May 16. A total of 70 permits were issued in seven GMU's. A questionnaire was sent to all permit holders after the season. Of the 70 permit holders, 45 responded to the questionnaire (64%), and another 17 were contacted by telephone, for a total of 62 hunters (88.5%). Of the 62 hunters

Table 1. Black Bear General Season Harvest Summary 1992-98, Blue Mtns., Washington

	Bear Harvest							Median Age	
Year	Male	Female	Total	# of hunters	% Success	Hunter Days	Days per kill	Males	Female
1992	30	16	46	494	9%	2740	69	--	--
1993	25	32	57	491	12%	1988	35	—	--
1994	71	38	109	903	6%	5450	50	3.0	5.0
1995	88	46	134	1024	13%	7363	55	3.0	3.5
1996	43	18	61	1325	5%	8543	140	3.0	4.0
1997	14	14	28	1486	2%	11567	413	10.5	5.5
1998	40	42	82	1566	5%	1567	130	2.5	5.5

Table 2. Black Bear Spring Season 1999, Blue Mtns., Washington

GMU	Permits	Hunters	Bear Males	Harvest Females	Hunter % Success	Days/Htr.	Bears Seen/Htr.
154	10	7	0	0	0%	5.0	4.6
162	10	10	2	0	20%	5.2	7.2
166	10	9	1	0	11%	3.4	0.7
169	15	8	1	0	13%	3.9	3.3
172	10	5	0	1	20%	5.6	5.8
175	10	8	1	0	13%	4.4	3.5
186	5	5	0	1	20%	4.5	4.2
total	70	51	5	2	14%	4.5	4.2

reporting, 51 actually hunted (84%). The participating hunters observed a total of 216 bears for an average of 4.2 bears per hunter, and stayed in the field an average of 4.5 days (Table 2).

Permit holders found difficult hunting conditions in the spring of 1999. Unusually heavy snowfall during the winter sealed off areas at high elevation that would normally be accessible, and spring temperatures were the lowest on record. This resulted in bears emerging from the den later than usual, and a later green-up, so bear were not foraging in the usual areas. As a result, hunter success was lower than expected

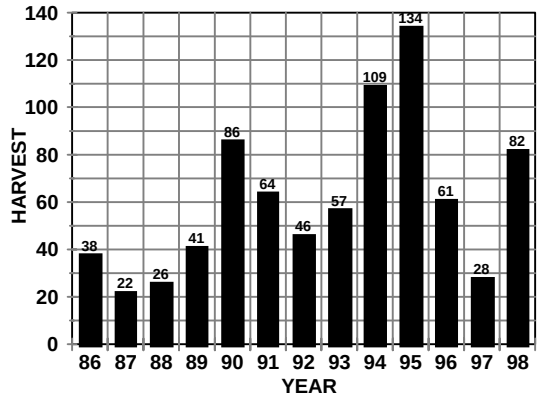

Figure 1. Bear harvest 1986-98, Blue Mtns. WA.

(13.7%), with seven bear harvested; 5-males, 2-females. The harvest was well distributed throughout the Blue Mountains, which is a result of the permit controlled system.

Concerns raised by opponents of the spring bear season did not materialize, such as, a large number of females with young being killed, resulting in numerous orphaned cubs. The harvest consisted of five males and two non-lactating females. Females comprised 51% of the fall general season bear harvest, compared to 29% for the spring season, a significant difference. Although spring bear hunters observed 92 sows and cubs, which was 42% of the bear observed, none were harvested. This is probably a result of the hunter education video WDFW sent to all permit holders that shows how to differentiate between male and female bears in the field. Concern that the Department would be inundated with orphaned cubs did not materialize, and no orphaned cubs were picked up by Department personnel.

Although the public was not fully informed as to the availability of permit applications for the spring bear season, the Department did receive 518 applications for 70 permits. This shows a tremendous interest in the recreational opportunity provided by a spring bear season.

Population Status And Trend Analysis

Based on field observations, sightings, and damage complaints, bear populations in the Blue Mountains remain at fairly high levels. Bear density trend transects have been discontinued due to budget limitations, and questionable reliability of the data.

Bear densities appear to be highest on the westside of the Blue Mountains and in the Wenaha-Tucannon Wilderness. The bear population on the eastside of the Blue Mountains has increased in recent years, because sightings and damage complaints are becoming more frequent.

Nuisance and Damage Activity

The number of bear complaints registered in 1998 increased significantly over 1997, from 3 to 10 complaints, respectively. Five bears were trapped and relocated. The number of bear complaints may be increasing.

Habitat Condition And Trend

Although habitat conditions have changed due to fire suppression, the bear population remains at a high level. The implementation of controlled burning on National Forest lands will improve habitat for bear by increasing the forage base, such as huckleberry fields in the mountains.

Management Conclusions

Black bear population growth in the Blue Mountains has probably stabilized at a fairly high level. However, our ability to adequately harvest bear by GMU was severely crippled by Initiative 655. The Mill Creek Watershed and Wenaha-Tucannon Wilderness have high density bear populations that receive little to no hunting pressure and very low harvest rates, which supplements bear populations in adjacent units. These areas help to maintain the bear population at a high level. Combining the general bear season with a permit controlled spring bear season enhances our ability to provide a well balanced harvest by game management unit.

Species

Cougar **Statewide**

Prepared by: Steve Pozzanghera, Carnivore, Furbearer, and Permit Species Section Manager

Population Objectives/guidelines

Cougar management objectives are to maintain healthy, self-sustaining cougar populations within each of 9 different cougar management units. Population management for this species includes fulfilling our mandate and desire to provide recreational hunting opportunity for purposes of population control, while protecting public safety and property. Given current levels of cougar nuisance and damage activity and the restrictions on the use of hounds, increasing harvest opportunities is a priority.

Hunting Seasons And Harvest Trends

Cougar seasons have changed significantly over the last several years. Initiative 655 which banned the use of hounds for hunting cougar and bobcat, and the use of bait and hounds for hunting black bear, was passed by Washington voters in the November 1996 general election. Initiatives become effective 30 days after passing in Washington, therefore, the use of hounds for hunting cougar became prohibited 8 days into the 1996 cougar permit season. In an effort to mitigate the anticipated decrease in cougar harvest (i.e., post I-655), permit-only seasons were replaced with general seasons, and cougar seasons were lengthened from approximately 6 weeks, to 7 and one-half months. Legislation was also passed that provided the authority to the Fish and Wildlife Commission to establish reduced costs for cougar and black bear transport tags. Despite these efforts, the 1997 cougar harvest declined 26% from 1996, (132 versus 178) and declined 24% when compared to the 1991 to 1995 average harvest of 174 cougar per year (Table 1.). A significant reduction in harvest is noted if 1995(i.e., last full season when hounds were allowed) is compared to 1997 (i.e., first full season with hounds prohibited). In this comparison, the prohibition of hounds resulted in a 53% decline in the cougar harvest (1995 harvest, 283 versus 1997 harvest, 132). This decline was actually less than anticipated, and some individuals have speculated that the illegal use of hounds contributed to the reported "legal" harvest of cougar.

Population Status And Trend Analysis

Based on some preliminary work using population reconstruction methods and harvest age data, the statewide cougar population in Washington is a minimum of 2,400 animals. This represents a doubling of the estimated cougar population since 1980. The model also suggests that the population continues to increase.

The median age data presented in Figure 1. may also suggest a highly productive population. An excellent discussion of this can be found in the Northeastern cougar unit report (Unit 8), within the "Population Status and trend Analysis" section.

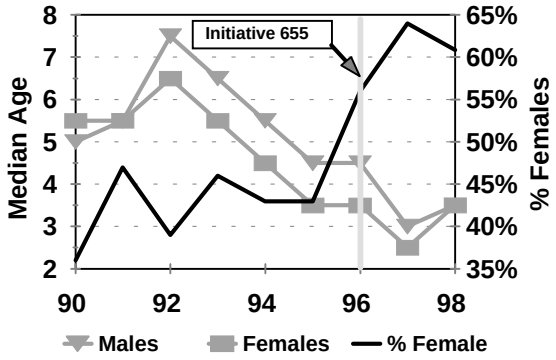

Figure 1. Median age and percent females in cougar harvest in Washington State.

No current field surveys independent from harvest analysis are conducted to monitor local cougar populations. Yet anecdotal information including widely distributed cougar sightings, and reported high levels of nuisance and depredation activity support the concept that cougar are currently at high levels. Potential exists to modify current black bear hair snag protocol to make this technique a valuable method of monitoring cougar populations.

Nuisance and Damage Activity

A long-term, standardized report on cougar nuisance and

Table 1. Statewide cougar harvest and percent females in harvest, 1991 - 1997.

Year(s)	Hunt Type	Harvest	% Females
1991-1995 Average	Permit Only. Hounds Allowed	174	43%
1996	General Season. Hounds Allowed in Limted Areas	66	62%
1996*	Permit Only. Hound Use Shortened by Initiative 655	112	53%
1997	General Season. No Hounds Allowed	132	64%
1998	General Season. No Hounds Allowed	184	61%

*Initiative 655, which prohibited the use of hounds for cougar hunting became effective on 12/5/96. Thus, the 1996 permit season was shortened from one and one-half months to 8 days.

damage activity is not available for Washington. However, a statewide problem wildlife field report was instituted in March of 1995. The use of this report form has allowedWDFW to begin to collect baseline information related to the levels of cougar nuisance and damage activity in the state (Table 2.) The 1998 field reports indicate that the total number of confirmed cougar/human complaints reported by the public increased 65% between 1997 and 1998 from 563 to 927, respectively. Unlike with black bear, nuisance and damage activity by cougar is likely a reasonable indicator of the status of the cougar population.

As cougar complaints continue to increase, WDFW staff have become more reluctant to trap and relocate cougar. This is reflected by the increase in the number of cougar that are killed in damage and complaint situations (Table 2.). While Washington has not conducted public opinion surveys on the relocation of cougar, information from Colorado suggests that a majority of the general public prefers nuisance or depredating cougar to be relocated rather than euthanized. Public education on cougar population dynamics and on the fate of relocated cougar is essential if WDFW is to continue to euthanize nuisance cats.

Table 2. Statewide cougar/human complaint summary, 1995-1997.

			# Killed		
Year	Total Complaints	# Relocated	By WDFW	Other	Human Attacks
1995*	247	14	6	4	0
1996	495	11	27	16	1
1997	563	2	21	26	0
1998	927	8	23	11	2

Management Conclusions

As local cougar populations respond to current reduced levels of harvest that have resulted from the prohibition on the use of hounds, a greater emphasis on monitoring populations within individual cougar management units will be necessary. The information on population increases is critical if we are to continue modifying cougar seasons, and tag fees as we seek to minimize levels of human/cougar conflicts by using general season hunting, public education, and depredation control.

Species	Cougar Unit Number	Cougar Management Unit Name
Cougar	**1**	**Coastal**

Prepared by: H. M. Zahn, District Wildlife Biologist

Population Objectives/guidelines

The goal for cougar management in the Coastal Unit is to reduce the population through harvest to approximately 1993 population levels to address concerns about human safety as well as control predation on ungulates, specifically elk.

Hunting Seasons And Harvest Trends

The 1998 cougar season extended from August 1, 1998 through March 15, 1999. There were no permit or pursuit only season. Initiative 655 prohibits the use of hounds.
A total of 15 cougars were taken during the 1998 season, nine females and six males. The median ages of males and females harvested were 2.5 and 5.5 years, respectively. Figure 1 illustrates the trend in median ages for males and females, as well as percent females in the harvest from 1990 through 1998 for the Coastal Unit.

Population Status And Trend Analysis

Indirect indications, such as encounters in the field and nuisance reports suggest that cougar numbers are still increasing. This is also born out by population reconstruction based on age data which suggests that cougar numbers have increased since 1987.

Management Conclusions

Harvest has not been able to increase with increasing cougar populations. Increasingly cougars are being killed by Fish and Wildlife Officers or by landowners in damage situations. Seasons need to be further liberalized and some hound hunting damage seasons need to be reinstated to increase efficiency and allow the stabilization of the cougar populations.

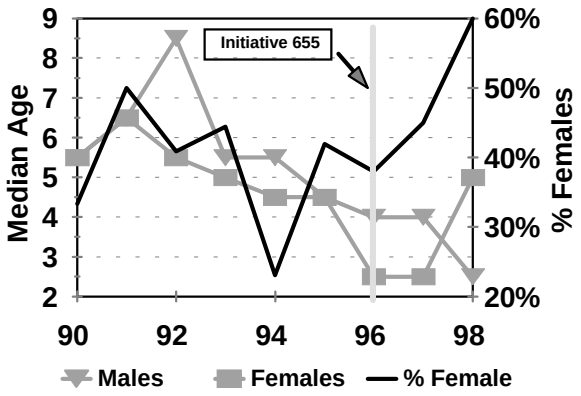

Figure 1. Median age and percent females in cougar harvest for 1990-1998.

Table 1. Cougar harvest and percent females in harvest for1996-98.

Year(s)	Hunt Type	Harvest	% Females
1996	Permit Hunts	14	57
1997	Permit Hunts	11	45
1998	General Season	15	60

Species	CMU	Cougar Management Unit
Cougar	**2 and 3**	**Puget Sound and North Cascades**

Prepared by: Rocky Spencer, District Wildlife Biologist

Population Objectives/guidelines

Attempt to reach a harvest level in the Puget Sound and North Cascades CMUs that maintains population slightly below current levels. This, in theory will provide recreational viewing opportunity and control the population which may help reduce but will not eliminate human\lion encounters.

Hunting Seasons and Harvest Trends

Lion harvest is often dependent on snowfall and hunter access; therefore, harvest can vary from year to year. Harvest level and trends for the Puget Sound and North Cascades CMUs are presented below in Table 1.

Table 1. Harvest, Depredation and Other Mortality Sources for Cougars CMU's 2-Puget Sound and 3-North Cascades for Years 1997-1998.

	Female				Male				
	Hunter	Depredation		Female	Hunter	Depredation		Male	
Year	Harvest	Take	Other	Total	Harvest	Take	Other	Total	Total
1997	14	1	1	16	7	0	0	7	23
1998	20	0	1	21	13	1	3	17	38
Total	34	1	2	27	21	1	3	24	61

The general lion hunting season runs from August 1, 1997-March 15, 1998. A hunting licence and a cougar tag are required to hunt.

The passage of Initiative 655 in 1996 restricted the use of hounds to hunt lions. Subsequently, we should theoretically expect a decrease in hunting related mortality but likely and increase in human related non-hunting mortality (hit by vehicle, depredation kills etc. Spencer et. al. 1996). Estimation of the number of the non-hunting human related lion mortalities is difficult to predict. However, based on modeling efforts it appears lion populations will continue to increase about 1.5% per year for the next few years (Bender unpubl. report 1997). This increase is in part due do the current regulations governing harvest of lions.

Hunting conditions for the 1997 season were characterized by below average snowfall at the lower elevations making tracking of lions more difficult. In 1998 snowfall levels reached record depths at elevations above 2800 feet, likely forcing lions to lower elevations thereby increasing vulnerability to hunting. This coupled with the extended season, compared to the past, and reduced license fees and a subsequent increase in license sales may all have, in part, and contributed to the increase in harvest in 1998.

In the Puget Sound and North Cascades CMU thirty eight (38) lions were killed (all sources combined) during the 1998 season, an increase of 65% from 1997 (23 lions); including 17 males and 20 females in the harvest (Table 1). In these CMUs the average percent female lions in the hunting harvest for the 7-year 1990-96 period is about 39%, compared to 63% for 1997-98. Excessive harvest levels are characterized by a high proportion of females in the harvest (WDFW Draft Cougar Mgmt Plan 1997 p. 49). However this statement should be evaluated with caution. This increase in the proportion of females in the harvest is likely primary do to the "random" harvest by boot hunters, meaning they shoot what they see. This is generally contrary to the lion harvest approach by hound hunters, as they more often had the opportunity to, and "selected" males. With increasing lion populations, yearly harvest that includes a high percentage of females should be followed and averaged on a three-year basis prior to evaluation of potential impacts to the population in these CMUs.

Population Status and Trend Analysis

Statewide population status and trend analysis are projected from two methods: 1) habitat availability and lion numbers based on density of 2.9 lion\ 100 km2 and 2) involves using sex and age ratios, cohort reconstruction, and computer simulation modeling (POP11) simulation (Bender unpubl. rep.).

Based on computer modeling, the lion population in Washington has increased by about 1.5% per year since 1989 (Figure 1). Projections at the CMU level are difficult and less precise, but these CMUs likely have between 275-450 lions.

The 1997 statewide population estimate from the computer simulation method is about 2375 lions compared to 2566 based on habitat availability.

The increase in the lion population is occurring during a period of notable habitat alteration and loss. This is likely due in part to lion adaptability, recolonization of previously unoccupied habitats and lion adaptability and subsequently utilizing vacant rural, suburban, limited urban, and other marginal habitats.

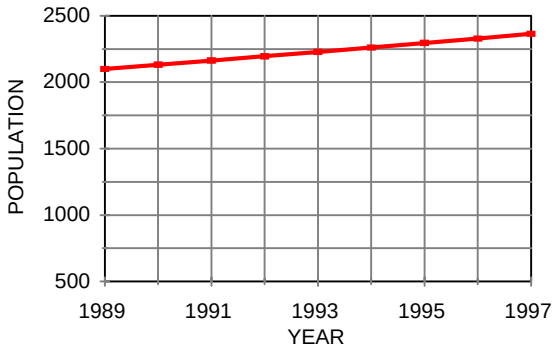

Figure 1. Estimated Lion Population Growth Based on Reconstruction (after Bender 1997 unpub. rep.)

Nuisance and Damage Activity

Lion damage to private property primarily involves killing and injury to pets and livestock and little information is available to quantify this activity.

The incidents of nuisance lions reported to the WDFW has increased significantly. There were 247 reports in 1995 and a 50% increase to 495 in 1996, rising to 563 in 1997 (WDFW Draft Cougar Mgmt Plan 1997). Much of this increase in lion complaints has been in the Puget Sound CMU; were approximately 75 lion nuisance reports were filed.

Habitat Condition and Trend

There are currently about 8,849,668 ha of habitat available to lions in Washington, the Puget Sound CMU covers 12% of this range (1,052,410 ha). Habitat loss and alteration, coupled with human population growth can have significant long-term negative impacts to wide-ranging carnivores such as lions. These impacts will likely be most significant in the rapidly urbanizing western counties in the Puget Sound CMU. For example, in King County alone there are approximately 9,750 homes constructed to house the 16,285 new people every year, much of this construction will occur in the suburban and rural areas currently occupied by lions. King County is projected to have an additional 146,250 homes and 244,275 people by the year 2010 (King County Comp. Plan 1994). This will have an influential effect on lion habitat availability, juvenile and adult survival, and population levels.

Management Conclusions

There are currently about 8,849,032 ha (21,872,532 acres) of mountain lion habitat within the overall range of lions in Washington State; these cougar management units (CMUs) cover about 23% of this range, or about 1,673,000 ha (9,510,000 acres). Much of the western portions of this lion habitat is adjacent to major metropolitan areas such as, Seattle, Tacoma, Everett etc. and within dispersal range of subadult lions. These rapidly urbanizing areas of western Washington pose unique circumstances that affect lion survival. These include 1) a reduced capacity of the landscape to support lions, 2) the increased potential for and likely more frequent human-lion encounters, 3) an increase in intra-specific cougar interactions and mortality, and 4) an increased likelihood for non-hunting human-related lion mortality versus hunting mortality (hit by vehicle, depredation kills etc.).

Currently, more than 42% (2,248,000 people) of Washington State's 5,335,000 total population live within the Puget Sound CMU. The continued human population growth and subsequent habitat loss will have a profound effect on the population dynamics of all wide ranging carnivores, including mountain lions.

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Species	Unit Number	Cougar Management Unit Name
Cougar	**4**	**South Cascades**

Prepared by: **Min T. Huang, Wildlife Biologist**
Patrick J. Miller, District Wildlife Biologist

Population Objectives/guidelines

Management goals for cougar populations in the South Cascades Cougar Management Unit (SC CMU) are to maximize recreational opportunities and attempt to minimize potentially dangerous cougar-human conflicts.

Hunting Seasons And Harvest Trends

The cougar hunting season was from 1 August to 15 March. The bag limit was one cougar. The suspected reduction in cougar harvest after the passage of Initiative 655, which banned the use of hounds, has not been manifest in the South Cascades Cougar Management Unit (Table 1). Harvest report cards indicate that cougar harvest in the SC CMU has increased since passage of the Initiative.

Table 1. Cougar harvest in the South Cascades Cougar Management Unit (SC CMU), 1994-1998.

Year	Male	Female	Total
1998	9	8	17
1997	5	8	13
1996	1	5	6
1995	9	7	16
1994	6	2	8

Population Status and Trend

Based upon harvest and complaint data, the cougar population in the SC CMU is stable to increasing. The prey base and habitat in the SC CMU is well distributed and cougar are probably utilizing most if not all available habitat.

Habitat Condition And Trend

The major problem facing cougar in the SC CMU is the encroachment of human civilization. In the six counties that roughly comprise the Unit, human populations have increased 37% since 1987 (WA Office Financial Management 1998). This trend is likely to continue, as the Region's economic prosperity continues to draw new residents. Encroaching human habitation will lead to increased human/cougar conflicts, as cougars follow the prey base into an increasingly urban environment.

Management Conclusions

Despite a two-year increase in the reported cougar harvest in the SC CMU, the continued prohibition on hound hunting, in conjunction with an increasing human population will result in increased cougar/human conflicts. Increasing urbanization will force cougar to utilize areas frequented by humans, leading to increased risk for public safety. The Department lacks adequate funding to address these issues. Proper levels of General Fund allocations need to be set in place.

Species	Cougar Unit Numbers	Cougar Management Unit Names
Cougar	**5, 6**	**East Cascades North, Columbia Basin**

Prepared by: John Musser, District Wildlife Biologist

Population Objectives/guidelines

Management objectives for Cougar Management Units 5 and 6 are to: maintain healthy cougar populations in suitable habitat; and prevent increases in depredation and threats to human safety by responding to cougar complaints and encouraging recreational cougar hunting.

Hunting Seasons And Harvest Trends

Until 1996, about 70% of the cougar harvested in Washington were taken by hunters using hounds. Approximately 70% of Washington's cougar harvest comes from eastern Washington.

During the last 60 years, cougar management in Washington has progressively become more conservative. Cougar were classified as a predator and were bountied prior to 1961. Although cougar were still classified as a predator, they were not bountied from 1961 to 1965. In 1966, cougar were reclassified as a game animal, but no bag limit was imposed. In 1973, the yearly bag limit for cougar was reduced to one animal. In 1982, a special tag was required (in addition to a hunting license) to hunt for cougar. Beginning in 1987, cougar were managed as a trophy big game animal with hunting restricted to those persons drawing a limited numbers of tags. On December 5, 1996 the use of hounds to hunt for cougar was banned by public initiative.

Cougar hunting season is long, extending from August 1 to March 15. Cougar tags are $5 each and are not limited. Hunters are allowed two cougar per year.

Cougar Management Unit (CMU) 5 includes the mountainous habitats within Okanogan, Chelan, Kittitas and Yakima Counties. CMU 6 includes the drier low-lands of Okanogam, Chelan, Kittitas and Yakima Counties as well as all of Douglas and Grant Counties. Since 1991, cougar harvest in units 5 and 6, has averaged 38 animals, 22 percent of the average statewide harvest (Figure 1). Harvest has been nearly evenly divided between males and females for these units with 148 males and 154 females killed since 1991. Since 1991, average age of cougar killed by unit and sex varies from 4 to 6 years old. The combined 1998 harvest for these units totaled 42 (Table 1).

Population Status And Trend Analysis

We have no population estimates for cougar in CMUs 5 and 6. Based on the number of reports received from hunters and landowners, cougar have been at a relatively high level for several years.

Habitat Condition And Trend

Loss of mule deer winter habitat due to wild fire is indirectly affecting cougar in Chelan County. Expanding human population is a more serious long-range threat to cougar. Increased human population results in more cougar encounters and reduced prey base.

Management Conclusions

Washington's human population continues to grow and displace wildlife. More people, and rural home-sites result in increased cougar encounters and depredation. It may take several years to evaluate changes in hunting regulations and the ban of hound hunting. Until populations are reduced, human encounters will continue.

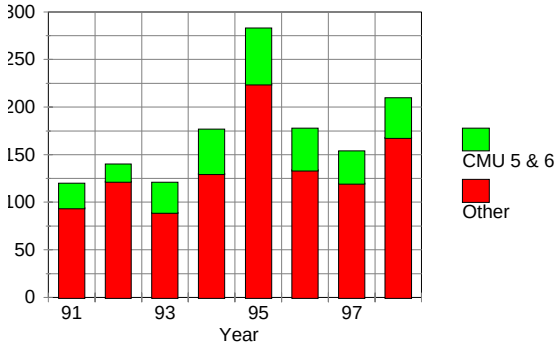

Figure 1. Washington cougar harvest from CMU 5 & 6 compared to other areas.

Table 1. Cougar harvest and median age for units 5, East Cascades North and 6, Columbia Basin.

	Harvest Unit 5		Harvest Unit 6		Age Unit 5		Age Unit 6	
Year	M	Fe	M	Fe	M	Fe	M	Fe
1991	9	4	9	4	7	5.5	5.5	4.5
1992	8	4	5	1	7.5	3	5.5	6.5
1993	7	11	7	7	6.0	6.5	9	6
1994	15	7	13	12	5.5	4.5	4.5	5.5
1995	18	16	10	15	4.5	4	2.5	3.5
1996	10	20	5	9	5.5	4.5	2.5	2.5
1997	11	14	5	4	4.5	2.5	1.5	3.5
1998	12	22	4	4	4.2	2.6	6.2	4.5

Species	Cougar Unit Number	Cougar Management Unit Name
Cougar	**7**	**East Cascades South**

Prepared by: Jeff Bernatowicz, Wildlife Biologist

Population Objectives/guidelines

Management objective for Cougar Management Unit (CMU) 7 is to maintain a cougar population at a socially acceptable level while providing recreational opportunity.

Hunting Seasons And Harvest Trends

Eight cougar were taken during the 1998-99 season (Table 1). The harvest is surprising since it was believed cougar could not be effectively taken without dogs. Long term data specific to CMU 7 is not available prior to 1995. The 5 year average harvest is now 3.8 cougar.

Population Status And Trend Analysis

Table 1. Cougar harvest and percent females in harvest for CMU 7.

Year	Hunt Type	Harvest	% Females
1995	Permit Hunts	8	37
1996	Permit Hunts	0	NA
1996	General Season	0	NA
1997	General Season	3	100
1998	General Season	8	25

Prior to the 1970s cougar were rare in Yakima County and no cats were reported in Klickitat County until recently. One cat was taken in Klickitat County The limited harvest and anecdotal information suggests the population has grown, but is still limited in distribution and size.

Nuisance and Damage Activity

None.

Habitat Condition And Trend

Cougar populations in CMU 7 are probably limited more by prey base (especially deer) than habitat. The deer population reached historic lows after the winter of 1996-97, especially in the northern portion of CMU 7. Elk populations remain healthy.

Management Conclusions

Data is limited on cougar in CMU 7, but suggests the population is still small. There are currently no major nuisance or damage complaints. Maintaining an adequate harvest if the cougar population expands will be the challenge since hound hunting has been banned.

Species	Cougar Unit Number	Cougar Management Unit Name
Cougar	8	Northeastern

Prepared by: Steve Zender, District Wildlife Biologist

Population Objectives/guidelines

Long-term objectives are to maintain healthy cougar populations within the Northeast Cougar Management Unit (CMU) while limiting numbers compatible with public safety and property protection. Opportunity for recreational hunting will be provided at levels consistent with achieving these objectives. Nuisance and depredation complaints continue at a relatively high level, so increasing harvest opportunity is the short-term goal.

Hunting Seasons And Harvest Trends

Hunting season in the Northeast Cougar Management Unit was consistent with the rest of the statewide season of August 1, 1998 - March 15, 1999. One cougar was allowed per hunter. In 1998 the price of a tag to hunt cougar dropped from $24 to $5 creating a significant impact on cougar harvest. Certainly far more recreational hunters now possessed a tag and had the capability of taking a cat opportunistically while hunting other game. There is also anecdotal evidence that many rural people bought a tag so that they did not have to rely on WDFW personnel to alleviate concerns regarding depredation or human safety. At $5 it was much easier to have the legal authority to hunt or kill a cougar at the landowner's discretion.

The primary objective of the long season and low tag price was to provide hunter participation and effort sufficient to mitigate the loss of the use of hounds and address the high level of cougar complaints. The strategy has been effective. The 1998 kill of 83 cats exceeds the 5 year 1993 - 1997 average kill of 76 (Table 1), and is well above any harvest level from 1983 - 1993 (Figure 1).

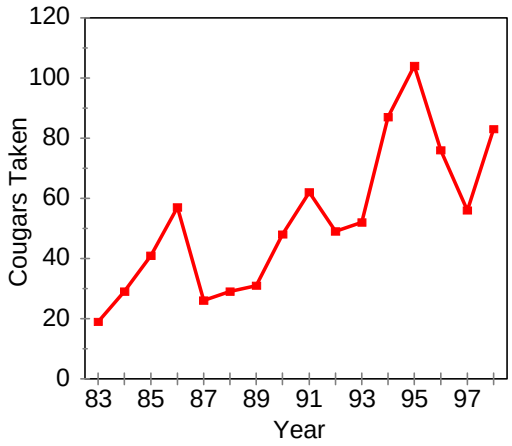

Figure 1. Cougars taken by hunters, depredation or other means in the Northeastern Cougar Unit (GMU's 101-133 and 204).

1998. The 1998 Game Harvest Report indicates 15 cougars killed due to depredation (18% of the total harvest), however that would cover the hunting season dates extending from summer 1998 to spring 1999. This would compare to 12 killed on depredation complaints during the same time period in 1997-98.

Population Status And Trend Analysis

The most significant data regarding impact of the harvest on the Northeastern Unit cougar population was likely the fact that 63% of the cats killed were female. The 1993-97 average female harvest was 45% (Table 1), so jumping from a consistent <50% females to 63% with a total kill of females at 52 will likely impact population growth.

The mean age of harvested cougars in the Northeastern

Table 1. Cougar hunter harvest, other kills, and percent females for Northeastern Unit 8.

	Female			Male			Combined Harvest			
Year	Hunter Harvest	Other Take	Female Total	Hunter Harvest	Other Take	Male Total	Hunter Harvest	Other Take	Total Harvest	Percent Female
1998	42	10	52	22	9	31	64	19	83	63%
1997	22	4	26	20	10	30	42	14	56	46%
1996	32		32	36		36	36	8	76	47%
1995	39	6	45	53	6	59	98	12	110	46%
1994	38	3	41	41	5	46	79	8	87	47%
1993	18	2	20	29	3	32	47	5	52	38%

Human Safety and Wildlife Damage

There were a total of 263 complaints regarding cougar registered in the Northeastern Unit during the calendar year of

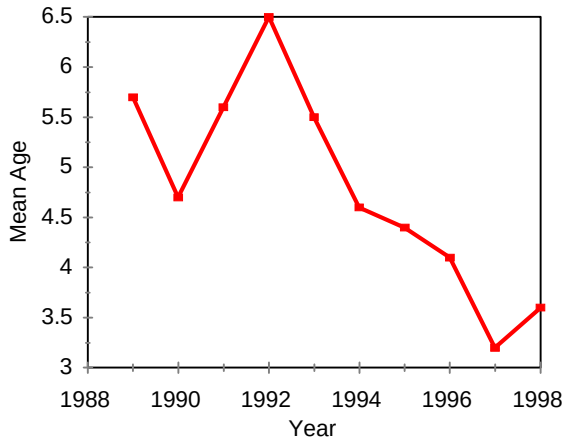

Figure 2. Mean ages of all cougars harvested (N range 30-92) from Northeastern Cougar Unit 8.

Unit was 3.6 this year vs. 3.2 in 1997 (Figure 2). It would seem reasonable that this would be an indication of a population with excellent recruitment but a high mortality rate (i.e., hunting, depredation removals). Younger cats are likely represented to a greater extent now than when hounds were used; as it's generally yearling cats that are involved in the increased human conflict complaints, and younger animals are more vulnerable in a season which relies on incidental hunter contact. Hound hunters tended to select for larger (i.e., older) cougar.

Cougar sightings and resultant concern by the public continue at relatively high levels and are broadly distributed throughout the Northeast Unit. This suggests cougar population levels in the Northeast Unit remain near or above human tolerance levels at this time.

Habitat Condition And Trend

Deer populations were relatively low following the severe winter of 1996/97 but mild winters in 1997 and 1998 have allowed white-tailed deer to increase rapidly. While mule deer have benefitted from the mild winters they continue to struggle through a period of long-term declines in the mountainous regions of the Northeast Unit. The result may be relatively low prey base for cougar in the higher mountain habitats while the valleys and foothills generally have an abundance of deer.

Management Conclusions

Cougar numbers appear to be high. The very young mean age of harvested cats is likely a result of high mortality (i.e., hunter kills, depredation kills) in combination with excellent recruitment of young. The current years age data may also reflect a shift to a younger age structure in the harvest as a result of the prohibition on hound hunting. Sub-adult cougar constitute a large proportion of the total population and are also the most vulnerable to incidental harvest. At this time there seems to be very good production so we will have to maintain high harvests until human/livestock complaints begin to decline.

We have yet another new tag system for the 1999/2000 season. Indications are that many hunters have opted for the cougar tag as part of their big game hunting package. Also new for 1999/2000 is a two cougar limit statewide.

While cougar populations in the Northeast Unit seem relatively high at this time, I would caution that the high harvest of females in the past season combined with the relatively low mean age of the population could easily result in population declines. This would meet with present objectives but we certainly want to be alert to overreaching our goals.

Species	CMU	Cougar Management Unit
Cougar	9	Blue Mountains

Prepared by: Pat Fowler, District Wildlife Biologist

Population Objectives\Guidelines

Cougar populations will be managed at a level that provides optimum recreational opportunity for consumptive and non-consumptive users, minimizes conflicts with other resource management objectives, and is compatible with public safety and property protection.

Hunting Seasons And Harvest Trends

Mountain lion hunting has evolved from general open seasons allowing the use of hounds prior to 1987, to permit controlled hunting allowing hounds from 1987-1996, to general seasons prohibiting the use of hounds after Initiative-655 passed in 1996. The 1998 cougar season started on August 1 and closed on March 15, 1999 (227 days), and was open to any hunter possessing a valid 1998 cougar tag.

The cougar harvest declined slightly last year from 13 cougar in 1997, to 7 in 1998 (Figure 1.). The percentage of females in the harvest was comparable between 1997 and 1998, at 69% and 71%, respectively. The percentage of females in the harvest averaged 45% prior to the passing of Initiative 655. The dramatic increase in the percentage of females in the harvest may indicate hunters are not selective and harvest the first cougar observed. (Table 1).

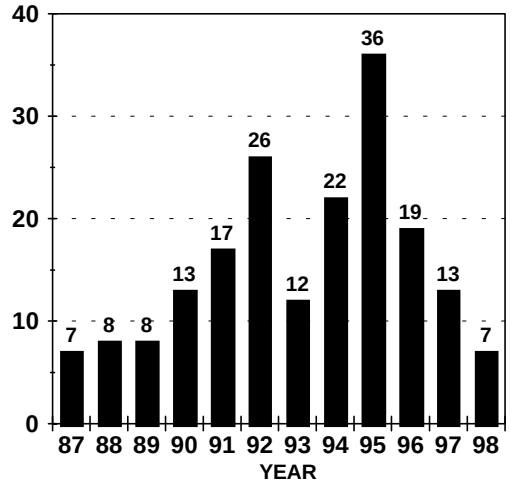

Figure 1. Cougar Harvest, Blue Mtns. Wash.

The cougar harvest was evenly distributed between the east and west Blue Mountains. Of the seven cougar harvested in 1998, three came from Unit-162 (Dayton), three from Unit-181 (Couse), and one from Unit-169 (Wenaha).

The age of female cougar harvested ranged from 2.5 years to 15.5 years, with a median of 3.5 years. No age data for male cougar was collected.

Population Status And Trend Analysis

Surveys are not conducted to determine population trend. Cougar populations are undoubtedly at high levels considering the abundance and frequency of sightings, harvest, and the level of damage complaints. Cougar sightings in the Blue Mountains continue to be a common occurrence, especially in the foothills and mountains. Multiple sightings have occurred in areas where cougar have not been reported in the past, such as areas to the west of Walla Walla (suburbs), in the agricultural areas to the north near the Snake River, and in or near towns. Several cougar sightings have occurred over the last year in a small area between Fort Walla Walla Park and the Veteran's Hospital. This is an isolated area of habitat containing a small population of whitetail deer, and is between the city of Walla Walla and College Place. The park is frequented by many people using nature trails. Wildlife agents set a live trap in the summer of 1998, but failed to capture a cougar.

Table 1. Cougar Harvest Trend 1992-98, Blue Mtns. Wash.

Year	Hunt Type	Male	Females	Total	% Females
1992	Permit Hunts	14	12	26	46%
1993	Permit Hunts	7	5	12	42%
1994	Permit Hunts	14	9	23	45%
1995	Permit Hunts	19	11	30	37%
1996	Permit\General	9	10	19	53%
1997	General Season	4	10	13	69%
1998	General Season	2	5	7	71%

Nuisance and Damage Complaints

Cougar nuisance and damage complaints increased significantly from 34 complaints in 1997, to 44 complaints during the period January 1998 to April 1999. This is a 26% increase in cougar complaints in one year.

Complaints registered in 1998-99 consisted of six that involved the killing of domestic livestock or attacks on dogs. One cougar was immobilized and removed from near a residence outside of Dayton, and another was killed by a car at Field Springs State Park in Asotin county.

Prior to 1990, cougar complaints and sightings were rare in southeast Washington.

Management Conclusions

The passing of Initiative 655 has greatly limited our ability to harvest mountain lion. Cougar populations in the Blue Mountains have increased significantly over the last 10 years, and remain at a high level. If the cougar population does not stabilize and\or decline in the near future, complaints and other problems may continue to increase.

Species

Band-tailed Pigeon / Mourning Dove

Statewide

Prepared by: Don Kraege, Waterfowl Section Manager

Population Objectives/guidelines

Pacific Coast band-tailed pigeons and mourning doves are managed cooperatively with the U.S. Fish and Wildlife Service (USFWS) and western states through the Pacific Flyway Council (PFC). The PFC has developed management plans for these populations, and has established a population objective for band-tailed pigeons in Washington as the five-year average call-count survey index for 1980-84. This objective is based on a population level capable of sustaining recreational harvest. PFC is currently working to develop a population objective for mourning doves.

Hunting Seasons and Harvest Trends

The band-tailed pigeon season has been closed in Washington since 1991. The mourning dove season has run September 1-15 since 1980, with bag/possession limits of 10/20.

Surveys

In 1998, WDFW coordinated two surveys for band-tailed pigeons in Washington. The call-count survey was initiated in 1975, and was patterned after the mourning dove survey. WDFW initiated a mineral site survey for band-tails in 1993, designed similarly to the Oregon Department of Fish and Wildlife's mineral spring survey conducted in late August and early September. WDFW also participates in the annual mourning dove survey coordinated by U. S. Fish and Wildlife Service (USFWS). This report describes the results of band-tailed pigeon surveys completed in the summer of 1998 and mourning dove surveys completed in the late spring of 1999.

Methods

(1) Band-tailed pigeon call-count survey

The band-tailed pigeon call-count surveys are similar to mourning dove call-count routes. A total of 50 routes, 5.7 miles in length comprise the survey, conducted in western Washington below 1,000 ft. elevation. Surveys are completed during a 16-day period beginning the Saturday closest to June 21. Routes are distributed fairly uniformly throughout western Washington, and are selected based on logistics concerns in known or likely band-tail habitat. Routes are started exactly 10 minutes before sunrise and are made up of 20 listening stations along roads. At each stop observers record the time at the stop, the number of individual band-tails heard calling, the number of band-tails seen, the disturbance level, and any comments related to conditions at the stop. Additional details on survey design can be found in Jeffrey (1989) and WMUGBTC (1976).

Routes which have band-tails present and subsequently are without band-tails for a three year period are relocated in the vicinity of the existing route, and are added to the database as an automatic zero (without additional survey) for use in the data analysis. New routes without band-tails present are relocated without further consideration. Routes were evaluated in 1988, 1992, and 1996 to determine which were to be relocated, dropped, or converted to automatic zeros.

Data are entered into the WDFW mainframe computer by data entry staff and then are evaluated to ensure that routes were conducted within allowable survey dates and start/stop times. Beginning in 1992, data from acceptable routes completed and zero routes have been sent to USFWS in Laurel, MD (Bill Kendall) for analysis using route regression programs developed for the mourning dove survey. The number of acceptable routes completed and zero routes is shown in Figure 1, while the number of routes selected for use in the route regression analysis is shown in Figure 2.

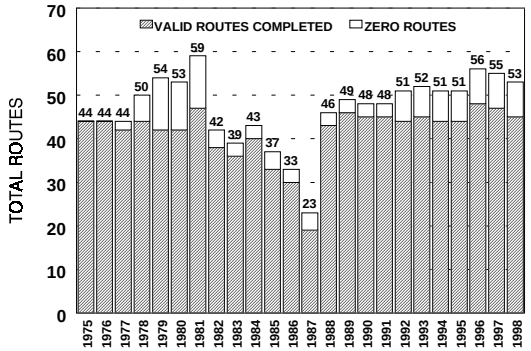

Figure 1. Washington band-tailed pigeon call-count survey. Valid routes completed and zero routes

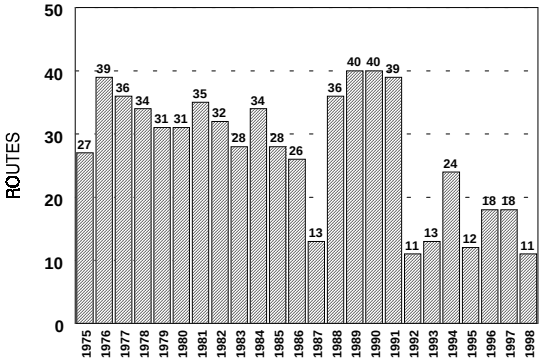

Figure 2. Washington band-tailed pigeon call-count survey. Number of routes contributing to index

(2) Band-tailed Pigeon Mineral Site Survey

The band-tailed pigeon mineral site survey was initiated in 1993 as a pilot project to evaluate the technique in providing a population estimate for band-tails. Eleven sites were selected initially based on the number of birds observed using the site (usually >50) in an earlier study (Savage, 1992) and accessibility. Of these sites, nine proved acceptable for monitoring, including one in Region 4 (Red Salmon Creek), five in Region 5 (Newaukum, Altoona, St. Martin's, Cedar Creek, and Upper Kalama), and three in Region 6 (Potlach, Mud Bay, and Lilliwaup).

Surveys were conducted between sunrise and noon on days without precipitation. The survey period was defined as the last week in August and first week in September. The accumulated number of pigeons entering and leaving the site were recorded, and the site index count was taken as the higher of the two counts. Feeding habits, human disturbance, and other observed behavior are recorded in the comments section of the survey form.

(3) Mourning Dove Survey

The mourning dove survey was completed between May 20-31, following methods in Dolton and Smith (1999). Routes were completed by cooperators from WDFW, USFWS, Yakama and Colville Tribes, and Chelan P.U.D. Data were sent to USFWS in Laurel, MD.

Table 1: Results of 1992-96 Band-tailed Pigeon Call-count Surveys

Start Year	End Year	Change in Index	Lower 90% CI	Upper 90% CI	Routes Used	Sig. Level
1975	1992	-7.8%	-14.0%	-2.0%	63	p<0.05
1991	1992	10.1%	-50.0%	75.0%	11	n.s.
1975	1993	-6.0%	-11.0%	-1.0%	65	p<0.05
1992	1993	44.0%	-49.0%	152.0%	13	n.s.
1975	1994	-3.4%	-8.2%	1.4%	69	n.s.
1993	1994	71.0%	1.4%	141.0%	24	p<0.05
1975	1995	-2.7%	-9.8%	4.5%	70	n.s.
1994	1995	12.1%	-31.3%	55.3%	12	n.s.
1975	1996	-0.8%	-6.5%	4.9%	59	n.s.
1992	1996	24.3%	10.4%	38.2%	30	p<0.01
1995	1996	36.4%	-35.9%	108.7%	18	n.s.
1975	1997	-0.8%	-6.0%	4.3%	62	n.s
1993	1997	8.9%	0.2%	17.6%	32	p<0.10
1996	1997	-14.3%	-35.4%	6.7%	18	n.s.
1975	1998	-1.5%	-5.5%	2.4%	65	n.s.
1994	1998	2.1%	-8.7%	13.0%	34	n.s.
1997	1998	-11.0%	-45.8%	23.9%	11	n.s.

Results

(1) Band-tailed pigeon call-count survey

The Washington call-count survey results are presented in Table 1 and Figures 1-3.

(2) Band-tailed pigeon mineral site survey

Results from the mineral site survey are presented in Table 2 and Figure 3.

(3) Mourning Dove Survey

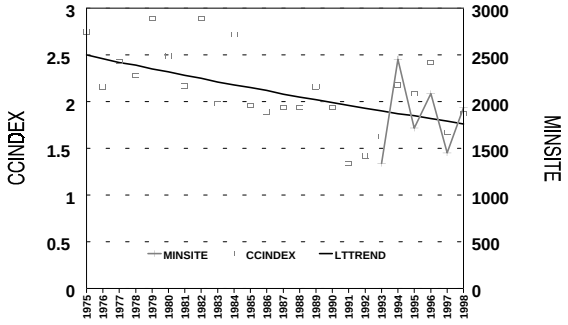

Figure 3. Washington band-tailed pigeon call-count index vs. mineral site survey.

Table 2: Results of 1993-97 Band-tailed Pigeon Mineral Site Survey

Region	Site	Mineral Site Index 1993	1994	1995	1996	1997	1998
4	Red Salmon Cr	89	88	89[a]	109	95[a]	50
5	Cedar Creek	112	361	121	285	150	86
5	Newaukum	86	42	108	104	0	4
5	Upper Kalama	388	399	379	463	403	406[a]
5	Altoona	120	297	141	168	10	59
5	St Martin Hot Spr	228	371	151	275	332	318
6	Potlatch	107	382	217	228	175	438
6	Mud Bay	150	271	245	271	215	346
6	Lilliwaup	58	243	265	183	71	227
		1338	2454	1716	2086	1451	1934

[a]not surveyed - average from past counts

The mourning dove analysis and report were completed by Dolton and Smith (1999).

Population Status And Trend Analysis

Table 1 and Figure 3 show that based on the call-count survey, the band-tailed pigeon population has undergone a significant decline since 1975, but has increased recently. The route regression method is not as precise in determining short-term trends, as evidenced by the large confidence intervals for the two year trends in Table 1. The large spans of these intervals are caused by low sample size due to changing observers from year to year. However, the confidence intervals for the long-term trends are much narrower, pointing to the utility of the survey in monitoring the population. The 1997 index of 1.87 was below the 1980-84 population objective index (this index varies each year because of route-regression analysis methods, but was 2.45 for the 1998 analysis).

The call-count survey showed a significant correlation ($p<0.05$) with the mineral site survey for the period 1993-98 using Spearman and Kendall tests.

Acknowledgments

These surveys would not have been possible without the efforts of nearly all WDFW District Wildlife Biologists, as well as personnel from USFWS (Nisqually, Columbia, and Turnbull NWR), Fort Lewis, Colville, and Yakama Tribes, and

volunteers. Analysis of band-tailed pigeon call-count data was provided by Bill Kendall of USFWS, while dove survey coordination was provided by Dave Dolton of USFWS.

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Species **Region**

Waterfowl **Statewide** **Washington Waterfowl Breeding Populations And Production**

Prepared by: Matthew J. Monda, State Waterfowl Biologist

Introduction

This report summarizes data collected during 1999 for breeding waterfowl populations, duck broods, pond indexes, and goose nest surveys for the state of Washington. Data were collected by Washington Department of Fish and Wildlife, U.S. Army Corps of Engineers, Yakama Indian Nation, Colville Indian Nation, Umatilla Wildlife Refuge, and Chelan County Public Utility District.

Breeding Waterfowl Survey (*Pair Surveys*)

Methods

The 1999 breeding-duck population surveys were conducted between April 5 and May 26. Surveys were conducted within the seven strata in eastern Washington: West Okanogan Potholes, Omak-Douglas Potholes, Far East Potholes, Northeast, Palouse Streams, Columbia Basin Irrigated, and Yakima Irrigated (Fig. 1). Surveys were conducted on historical transects and sampling quadrates (sections or 1/4-sections)(Fig. 1). Samples are multiplied by weighting factors to provide an index to the total number of breeding ducks and coots within the defined areas (Table 1). Weighting factors are determined from the proportion of areas within the strata that are sampled. Observations are treated as complete counts within sampling units (transects or quadrates) with no corrections for visibility bias. Surveys are conduct by ground counts, except helicopter counts are used for 1/4-sections in the Columbia Basin Irrigated strata.

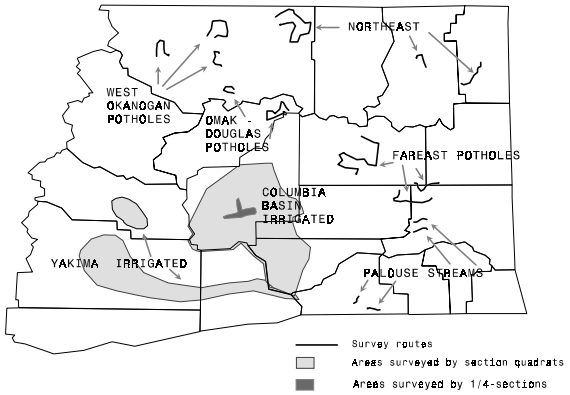

Figure 1. Breeding duck surveys in eastern Washington

In 1997, breeding duck surveys were initiated in western Washington using a stratified random quadrate design. Survey plots were defined by section lines, or square mile areas, selected at random from strata delineated based on knowledge of breeding duck densities. Most areas were surveyed by helicopter.

Methods for estimating total number of breeding ducks follow the Standard Operating Procedures of Aerial Waterfowl Breeding Ground Population and Habitat Surveys in North America (USFWS & CWS 1987). Breeding populations are estimated by multiplying the number of pairs, lone drakes, and flocked drakes (<5 male birds) by 2, and grouped birds (mixed or >5 males) by 1. Lone hens are multiplied by 1 for redhead, scaup, ring-necked duck, and ruddy duck only. These diver species are known to be late nesters and males significantly outnumber females. Wilcoxon signed ranks test was used for analyzes of differences between 1999 and 1998, and between 1999 and the long-term average for mallards and total ducks. This analysis is provided to USFWS for the annual season setting process and Population Status Report.

Table 1. Breeding duck routes, weighting factors and percent of area surveyed for areas and subareas surveyed for weighting breeding duck, goose, and ponds indices in Washington.

Area	Subarea	Weighting Factor	% of Area Sampled
Potholes			
West Okanogan		14.06	7.1
	Methow Valley		
	Salmon Creek		
	Sinlahekin		
Omak Lake		9.83	10.2
Douglas County		15.26	6.5
Far East Potholes		18.69	5.3
	Ewan-Revere		
	Sprague-Lamont		
Lincoln County		47.59	2.1
Highland			
Northeast		25.53	3.9
	Colville		
	Cusick		
	Moulson-Sidley		
Palouse Streams		32.52	3.1
	Union Flat		
	Palouse River		
	Walla Walla River		
	Touchet River		
Irrigated			
Columbia Basin	65 sections	37.25	2.7
Waste Ways[a]	19 1/4-sections	10.05	9.9
Yakima	21 sections	25.49	3.9

[a]Surveyed by helicopter beginning in 1994.

Results

The index of breeding duck population in eastern Washington was up 8% from 1998 (p = 0.88) and up 23% from the long term average (p = 0.96) (Fig. 2, Table 2). Mallard numbers were up 9% from 1998 (p =0.91) and 60% from the long-term average (p = 0.99)(Fig. 3, Table 2). Statistical analysis is included in Appendix A. Our statistical analysis is not sensitive when changes are not consistent among strata. This year there were increases in all strata. All strata except the Palouse are above long-term averages (Fig. 4, Table 3).

Most of the long-term variability in our breeding-duck index has come from surveys in the Potholes area (Fig. 4). This area has inconsistent precipitation patterns and many semipermanent and ephemeral wetlands. This year 51% of the breeding ducks in all strata were found in the Potholes strata. Duck numbers in this stratum were up 4% over 1998 and 56% from the long term average. Numbers in the Potholes strata have been building since 1992 (Fig. 4, Table 3). Current numbers are still below the highs of 1985 and 1988.

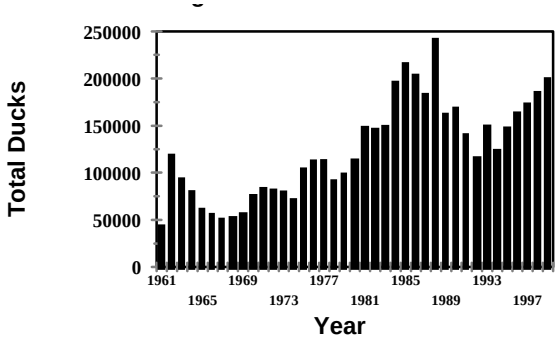

Figure 2. Breeding duck population in eastern Washinton.

The irrigated strata have been relatively stable since 1987 and were about the same as last year and up 11% from the long-term average (Fig. 4, Table 3). Numbers within the Columbia Basin part of the Irrigated strata have been decreasing steadily since 1985 (Fig. 5). Declines have occurred in both the Wasteway and Irrigated substrata. Decreases in the availability of open water, caused by advanced wetland succession and invasion of Purple Loosestrife and Pharagmites, may be part of the reason for the decline.

The rate of decrease for ducks that actually breed in the Columbia Basin is more substantial than total survey data indicates. The name Breeding Duck Survey is somewhat misleading, since all waterfowl are counted and many do not breed. Along with the decline in common breeding species

Table 2. Weighted breeding duck population indices by species for Washington, 1990-1998.

Species	1992	1993	1994	1995	1996	1997	1998		1979-96 AVG	% change from 1996	% change from AVG
mallard	41,009	54,988	52,675	58,908	61,615	66,666	78,962	86243	**54042**	9	60
gadwall	7,594	12,021	10,520	11,028	14,996	15,306	17,077	17130	**11033**	0	55
wigeon	2,710	5,095	4,477	3,761	6,010	8,392	7,039	5721	**6333**	-19	-10
green-winged teal	1,195	1,783	1,607	2,987	3,953	7,040	3,983	3665	**3196**	-8	15
blue-w.+cinn. teal	28,690	27,686	19,768	16,362	14,080	16,903	20,228	20916	**32441**	3	-36
northern shoveler	3,462	4,409	3,921	5,194	6,092	11,770	12,580	14926	**6346**	19	135
northern pintail	243	1,990	931	1,164	1,849	2,802	2,110	2145	**2138**	2	0
woodduck	3,634	2,018	2,342	1,256	2,056	1,584	1,836	2496	**1664**	36	60
redhead	9,434	15,059	13,323	12,943	14,042	12,363	12,399	13568	**16739**	9	-19
canvasback	274	728	121	677	640	1,362	619	1032	**730**	67	41
scaup	6,321	13,106	5,010	9,942	11,762	8,433	7,674	10697	**9113**	39	17
ring-necked duck	2,031	1,346	1,059	5,938	3,815	2,490	2,490	3835	**2719**	54	41
goldeneye	1,784	1,502	1,383	2,459	2,358	1,877	1,308	1993	**2411**	52	-18
bufflehead	666	1,169	77	2,462	4,886	5,355	805	1094	**1256**	37	-13
ruddy duck	6,755	6,887	6,476	9,956	14,511	9,837	15,474	14566	**10929**	-6	33
merganser	181	51	224	2,277	593	270	668	182	**411**	-73	-66
Total Ducks	116,264	149,836	123,912	147,312	163,259	172,776	185,251	200210	**161515**	8	23
coot	12,568	19,219	20,079	27,737	34,797	62,074	49,629	43832	**33607**	-22	30
Canada goose	9,483	9,190	9,396	15,017	12,758	13,019	11,199	22598	**7577**	102	198

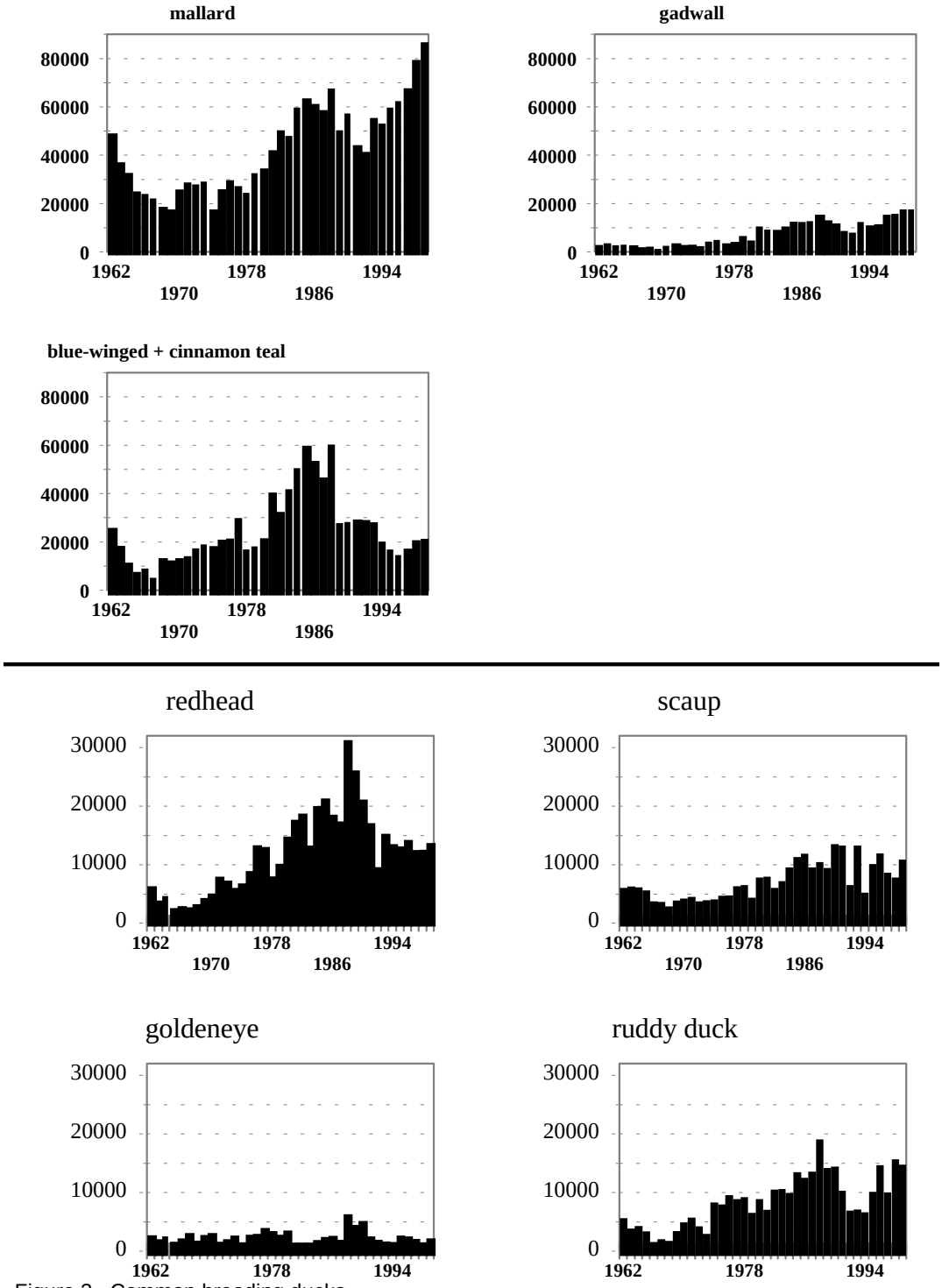

Figure 3. Common breeding ducks.

(Fig. 5), has come a large and steady increase in the number of nonbreeding scaup. Scaup broods are uncommon but scaup numbers from our surveys are currently six times higher than they were in the early 1980s. These scaup may be too young to breed, since many do not breed until they are 2 or 3 years old. The breeding duck population within the Northeast strata was up 14% from 1998 and 6% from the long-term average (Fig. 4, Table 3). Palouse strata were up 32% from 1998, and

Table 3. Weighted breeding duck population indices by areas for Washington, 1979-1999.

Year	Irrigated	Potholes	Palouse	Northeast	Total
1979	28,948	57,784	1,951	9,960	98,643
1980	36,870	58,752	3,057	15,063	113,742
1981	74,711	58,026	2,341	13,173	148,252
1982	66,161	63,150	4,455	12,663	146,429
1983	84,969	48,044	3,545	12,969	149,527
1984	101,486	73,478	4,618	16,697	196,278
1985	94,789	95,463	5,984	19,990	216,226
1986	97,901	79,899	3,837	22,135	203,771
1987	72,503	80,100	5,073	25,887	183,564
1988	78,137	103,452	7,068	53,143	241,799
1989	73,411	50,663	2,341	35,908	162,323
1990	77,838	56,462	5,138	29,474	168,912
1991	65,698	50,293	3,382	21,420	140,793
1992	69,547	22,581	3,252	20,884	116,264
1993	75,969	42,335	3,577	27,955	149,836
1994	64,537	43,502	2,699	13,173	123,912
1995	71,513	46,068	2,797	26,934	147,312
1996	73,364	62,221	2,016	25,658	163,259
1997	68,589	85,137	2,992	16,058	172,776
1998	65,503	96,982	2,341	20,424	185,251
1979-98 AVG	72122	63720	3695	21978	161515
% change from last year	11%	4%	32%	14%	8%
from AVG	1%	56%	-16%	6%	24%

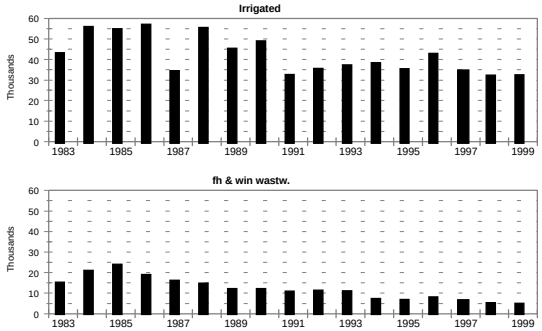

Figure 5. Columbia Basin breeding ducks.

down 16% below the long-term average (Fig. 4, Table 3).

Breeding dabbling ducks have responded positively to the end of the drought cycle in 1993 (Table 2, Fig. 3). However, breeding diving ducks are still declining (Table 2, Fig. 3). Much of the emergent vegetation in the wetlands within the potholes stratum is still sparse after the recent drought. Dense stands of emergent vegetation are necessary for nesting diving ducks. Further recovery of emergent vegetation may be necessary for diving ducks to respond.

Cinnamon and blue-winged teal have not been separated in the long-term database because of differences among observers in recording data. About 80-85% of these teal are cinnamon teal. Next to mallards, cinnamon teal are the most common breeding duck in eastern Washington. These birds are down 36% from the long-term average, but are up 3% from last year (Fig. 3, Table 2). This downward trend has occurred since 1985. In the mid-1980's we had about 3.25 times as many teal as we have currently.

In western Washington, breeding numbers of mallards have increased during the three year period of the survey. Results are presented in Figure 5a.

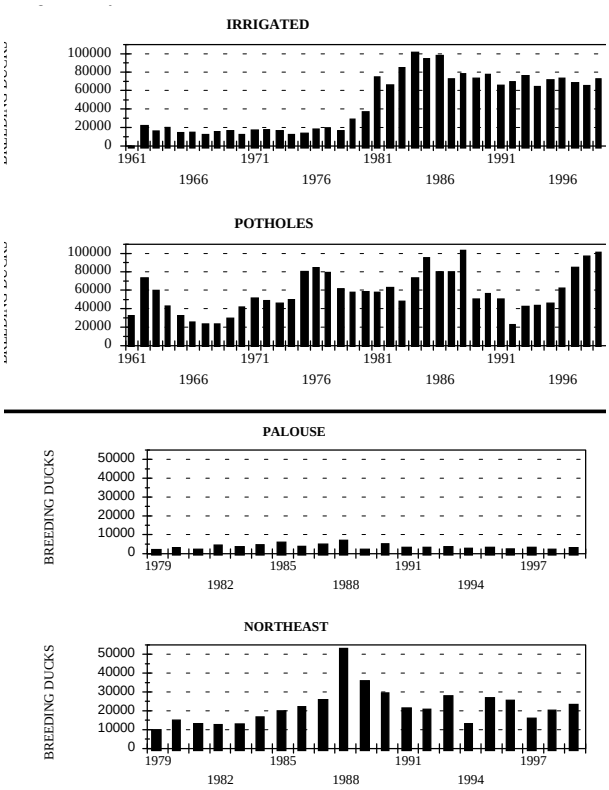

Figure 4: Breeding ducks by stratum

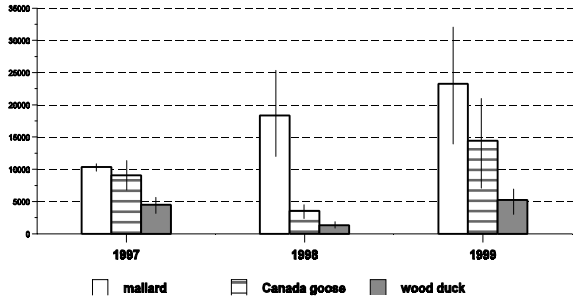

Figure 5a. W. Washington breeding ducks.

Pond Index

Ponds are counted on 8 transects within the Potholes Area (Fig. 1), during the breeding-duck survey to index water

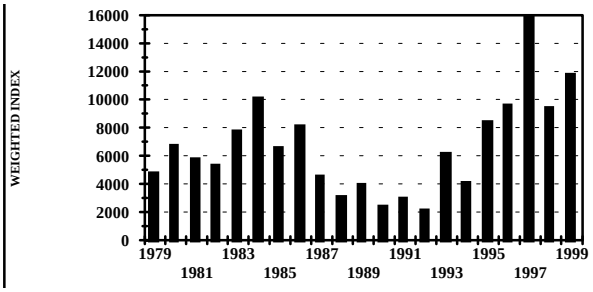

Figure 6. Index to pond numbers in the Potholes strata in.

Table 4. Weighted pond index from transects within the Potholes Area of Washington, 1979-1999.

Year	Douglas Co.	Omak Lake	Fareast	W. Okanogan	Lincoln Co.	Total
1979	443	576	236	2,475	1,065	4,795
1980	641	633	167	4,378	935	6,754
1981	809	675	344	3,189	785	5,801
1982	717	661	236	2,808	935	5,356
1983	1,312	492	452	4,283	1,252	7,792
1984	1,312	815	482	5,996	1,514	10,120
1985	1,251	581	403	3,046	1,327	6,608
1986	1,099	591	334	4,664	1,458	8,145
1987	824	478	315	2,380	579	4,576
1988	717	544	256	1,142	449	3,107
1989	794	520	216	1,713	729	3,972
1990	626	422	226	666	486	2,426
1991	504	534	233	1,047	673	2,990
1992	275	394	157	904	430	2,160
1993	855	366	157	3,998	822	6,197
1994	717	492	138	2,046	729	4,122
1995	1,022	548	403	4,902	1,551	8,427
1996	1,236	633	442	5,663	1,645	9,619
1997	1,938	1,125	875	9,232	2,691	15,862
1998	1495	900	423	4949	1663	9431
1999	1389	998	442	7234	1757	11820
1979-1998 AVG	**929**	**599**	**325**	**3474**	**1086**	**6413**
% change from lst yr	-7	11	5	46	6	25
% change from AVG	49	67	36	108	62	84

conditions (Fig. 6, Table 4). The 1999 index was the highest ever recorded. The index was up 6% over last year and 62% above the long-term average. Pond numbers have been building since 1994. Transects in all areas showed increasing pond numbers.

Ponds counted this year are correlated with next year's breeding-duck population (r=0.623, df 16, P=0.007)(Fig. 7). About 39% of the variance in next year's breeding-duck survey is associated with this year's pond count. Ponds counted this year are poorly correlated with this year's breeding-duck population (r=0.252, df 17, P=0.136). Only about 6% of the variance in this year's breeding-duck population is associated with this year's pond count. The breeding duck population in the potholes stratum was exceptionally high in 1999, as predicted. However, pond numbers decreased this year and next years breeding ducks should decrease (Fig. 7).

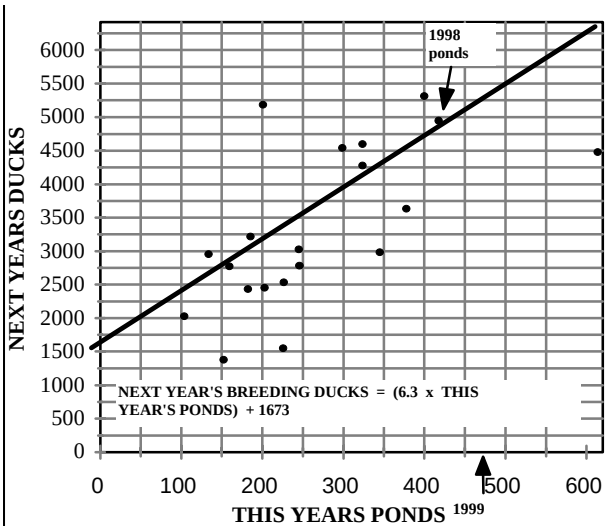

Figure 7. Regression of next year's ducks on this year's.

Duck Production (Brood Surveys)

Methods

The same sampling transects used for breeding duck surveys are used for brood surveys in the Potholes, Palouse, and Northeast strata (Fig. 1). These surveys are conducted in late June to early July. All broods observed are recorded by species. The numbers of broods observed are multiplied by the weighting factors for each stratum to provide an index to duck production (Table 1). Average brood size is very difficult to estimate. Historic surveys in the Irrigated areas were designed to estimate average brood size. As a result the survey effort varied somewhat among years. Surveys in the Columbia Basin were redesigned in 1995.

Broods for most species are highly secretive and difficult to observe. The current year's growth of emergent vegetation is more developed than during breeding population surveys in May. Production surveys should be viewed as a rough estimate of production with greater value for long-term trends than for year-to-year changes.

Results

The 1999 duck production survey data indicated a 23% decrease in total number of broods seen over 1998 (Table 5, Fig. 8). This year's count was up 21% from the long-term

Table 5. Weighted duck brood indices by species for the Potholes, Palouse, and Northeast areas of Washington, 1990-1997.

	1993	1994	1995	1996	1997	1998	1999	AVG	%97-96	%97-AVG
mallard	1514	1954	1189	2054	2316	2978	3226	1810	8	78
gadwall	261	331	107	277	433	842	332	445	-61	-25
wigeon	86	162	45	305	96	93	153	345	65	-56
green-winged teal	5	61	15	474	104	641	306	136	-52	125
blue-winged teal	190	185	76	251	340	466	357	771	-23	-54
cinnamon teal	10	675	14	252	131	699	153	104	-78	47
northern shoveler	82	0	0	350	41	406	255	181	-37	41
northern pintail	143	114	0	199	77	342	77	141	-78	-46
woodduck	0	65	26	77	128	70	0	41		
redhead	207	407	143	726	227	684	536	547	-22	-2
canvasback	0	26	51	51	0	26	51	24	100	110
scaup	54	52	0	5	228	127	102	60	-20	70
ring-necked duck	79	48	19	16	26	31	77	58	151	32
goldeneye	77	127	70	97	192	282	332	132	18	152
bufflehead	0	0	0	0	0	0	0	0		
scoter	0	0	0	0	437	0	0	22		
ruddy duck	119	109	189	500	530	411	255	279	-38	-9
merganser	0	0	0	15	29	14	26	50	82	-49
coot	782	1582	2260	1844	6188			2625	-100	-100
Canada goose	102	164	508	141	199			147		
TOTAL BROODS	2825	4316	1943	5649	5334	8112	6239	5146	-23	21

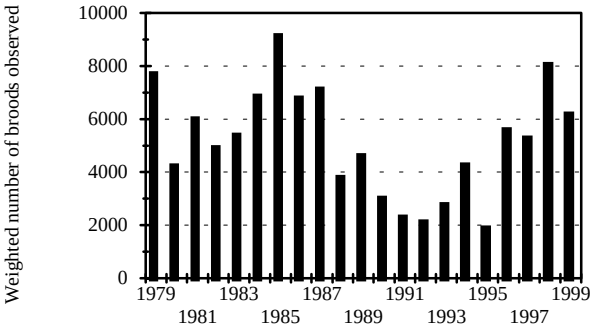

Figure 8. Duck brood index.

average. Changes were inconsistent among species, most common diving duck species increased and diving ducks decreased. The index increased in the Okanogan and decreased in the other strata (Table 6).

Canada Goose Breeding Population Index

Methods

Canada goose breeding populations are indexed by nest searches conducted within four major geographic areas (Table 7), mainly along the Snake and Columbia rivers. Surveyed are conducted annually, biennially, or periodically. Twelve surveys were added between 1975 and 1982. Survey areas have been constant since 1982. Total number of goose nests found are used to index the goose breeding population. Geese are also recorded on the breeding duck surveys (see above). Geese observed during the breeding duck surveys (Fig. 1) are weighted (Table 1) and provide an index to the goose population. Our nest surveys are conducted on areas with high densities of nesting geese. The breeding duck surveys cover a much larger area with low densities of nesting geese. Data from both nest surveys and breeding-duck routes are interpreted together to index to Washington's breeding-goose population. Areas with relatively recent goose population expansions, particularly north of Spokane and in western Washington are not surveyed. Geese are counted in the western Washington breeding duck survey.

Results

Our index from goose-nest surveys decreased 8% from last year and 7% from the long-term average (Table 8, Fig. 9). This is the lowest index since 1986. Declines occurred in all survey areas, except the Columbia River that remained unchanged. This index increased between 1982 and 1987, and remained relatively unchanged (Fig. 9, Fig. 11, Table 8). This years decline is likely related to the initiation of a statewide September Canada goose hunting season that was started in 1997.

Surveys in the Upper Columbia have increased over the

Table 6. Weighted duck brood indices by areas for Washington, 1979-1999.

	Scablands	Okanogan	Northeast	Palouse	Total	Columbia Basin
1979	6,274	420	868	195	7,757	
1980	2,598	936	715	33	4,281	
1981	4,435	1,041	485	98	6,059	
1982	2,296	1,131	1,123	423	4,973	
1983	3,349	1,080	715	293	5,437	
1984	4,806	1,123	791	195	6,915	
1985	6,133	1,614	1,123	325	9,196	
1986	4,743	965	842	293	6,843	
1987	4,574	1,206	1,072	325	7,177	
1988	1,557	1,112	749	434	3,851	
1989	2,395	1,023	894	358	4,669	
1990	1,099	946	894	130	3,068	
1991	246	472	1,506	130	2,355	
1992	317	434	1,021	390	2,163	
1993	1,232	590	613	390	2,825	
1994	2,587	672	928	130	4,316	
1995	555	504	689	195	1,943	160
1996	3,922	554	945	228	5,649	218
1997	1,703	1,584	1,864	184	5,334	179
1998	5193	1837	919	163	8112	
1999	2681	2681	715	163	6239	
1979-98 AVG	2885	916	939	250	4990	186
%change last year	-48	46	-22	0	-23	-18%
%change AVG	-7	193	-22	-35	25	-4%

past 20 years, with numbers being more stable in recent years. Results from 3 surveys are noteworthy: Rocky Reach, Rock Island, and Hanford. A game reserve was removed from Rocky Reach and Rock Island pools in 1997, partly because urban goose problems occurring. Nest numbers on these 2 pools grew 8.1% per year between 1975 and 1997. Goose nest numbers decreased on these pools from last year by 17% and 2% from the long term average. Increased harvest of these geese likely caused the decline. The Hanford survey increased at a rate of 5.5% per year from 1974 to 1991 where numbers peaked at 325. Since 1991 the number has decreased at a rate of 8% per year. Reasons for these declines are uncertain. The increase in daily bag-limit in 1993 from 3 to 4 birds may have contributed to the decline in local areas.

The total number of nests found on the Lower Columbia has remained stable since about 1988 (Table 7). However, results have varied by area. Surveys on the John Day pool were similar to the changes discussed above for the Hanford Reach. The index for John Day Pool rose 9.6% per year from 1979 to a peak of 323 in 1991. After 1991, the index has declined 7.8% per year until 1997. Between 1998 and 1999 the index rose 5%. The increased bag-limit from 3 to 4 geese in 1993 may have contributed to the decline. Last year a 7-day early-Canada goose season was initiated on John Day pool. Oregon has also increased harvest opportunities on this pool. The index for the survey in the Tricities area has increased at a rate of 14.4% per year since the survey was initiated in 1982. These geese are responsible for the urban goose problems that this area has been experiencing. The Dalles and Bonneville geese have been on the decline. The survey on the McNary pool jumped from 125 in 1995 to 237 in 1997 and 242 in 1998, but was not surveyed in 1999. Reasons for these increases are unknown but may have resulted from changes in personnel, survey timing, and survey coverage on McNary National Wildlife Refuge.

The weighted number of geese observed during the breeding duck survey was included in this report in 1995 (Table 8, Fig. 10). This index provides information about the expansion of Canada geese in areas of eastern Washington outside of our traditional goose nest index areas. This index provides parallel results to the information obtained from the goose nest index (Fig. 9, Fig. 11). The 1999 index declined 132% from last year the largest number ever recorded.

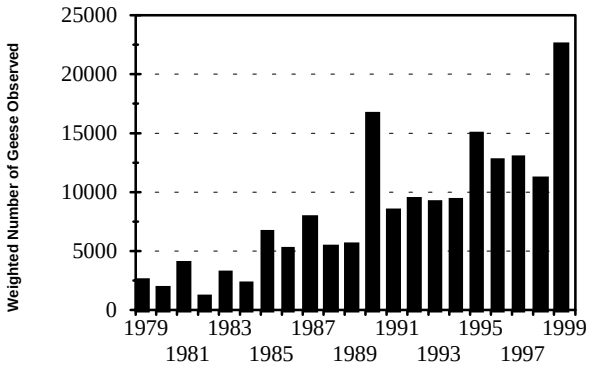

Figure 10. Geese during duck survyes.

Potential Improvements to Breeding Waterfowl Surveys

Breeding Duck Survey

* Continue to evaluate duck surveys in western Washington.
* Expand databases to include older data.
* Explore the possibilities of including data from National Wildlife Refuges and National Forests.
* Clearly delineate strata and check accuracy of weighting factors and sample size.
* Calculate a "Lone Drake Index" from past data to determine the chronological timing of past surveys.

Pond Index

* Include pond counts that are made during production

Table 7. Goose nest surveys conducted in Washington.

Survey Area	Year Initiated	Agency Conducting Survey	Frequency of Survey	Annual Rate of Change 5 Year Periods 1984-88	1989-93	1994-98	One Year 98-99
Upper Columbia				5%	5%	-3%	
Hanford	<1974	Battelle & WDFW	Biennial				
Priest Rapids	<1974	WDFW	Annual				
Wanapum	<1974	WDFW	Periodic				
Rocky Reach	1975	Chelan Co. PUD	Annual				
Rock Island	<1974	Chelan Co. PUD	Annual				
Wells	1980	WDFW	Annual				
F.D.R.	1981	WDFW	Periodic				
Ruffus Woods	1981	Army Corps	Annual				
Mouth of Yakima	<1974	WDFW	Historic				
Snake River				10%	8%	-5%	-11
Snake River	1975	Army Corps	Annual				
Snake River Cliff	1979	Army Corps	Periodic				
Lower Columbia				21%	4%	-1%	-5
McNary	<1974	Army Corps	Annual				
John Day	<1974	Army Corps	Annual				
Dalles	<1974	Army Corps	Annual				
Bonneville	1982	Army Corps	Annual				
Tri-Cities	1982	WDFW/Umatilla NWR	Annual				
I-5 to Boneville	1981	WDFW	Periodic				
I-5 to Puget Island	1981	WDFW	Annual				
Columbia Basin				5%	-12%	9%	-48
Moses Lake	1981	WDFW	Biennial				
Potholes Res.	1981	WDFW	Biennial				
Lenore, Alkali and Park	1981	WDFW	Biennial				
Total				10%	2.5%	-2%	-8%

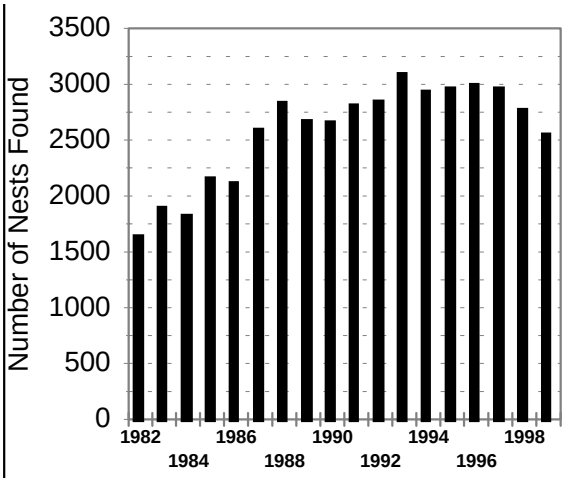

Figure 11. Number of nests observed during Canada goose nest surveys.

surveys in future reports.

Duck Production

* Standardize brood surveys in the Yakima Irrigation areas and continue to modify where necessary.
* Utilize the number of broods seen during the Breeding Duck Population Survey for an additional index to early nesting duck broods. Current methods do not utilize broods seen during these surveys.

Goose Surveys

* Increase survey efforts in other areas particularly northeastern Washington. Explore the possibilities of including data from National Wildlife Refuges.
* Expand the database to include goose data from breeding duck surveys prior to 1979.
* Change annual surveys to biennial and use time savings to expand survey coverage.

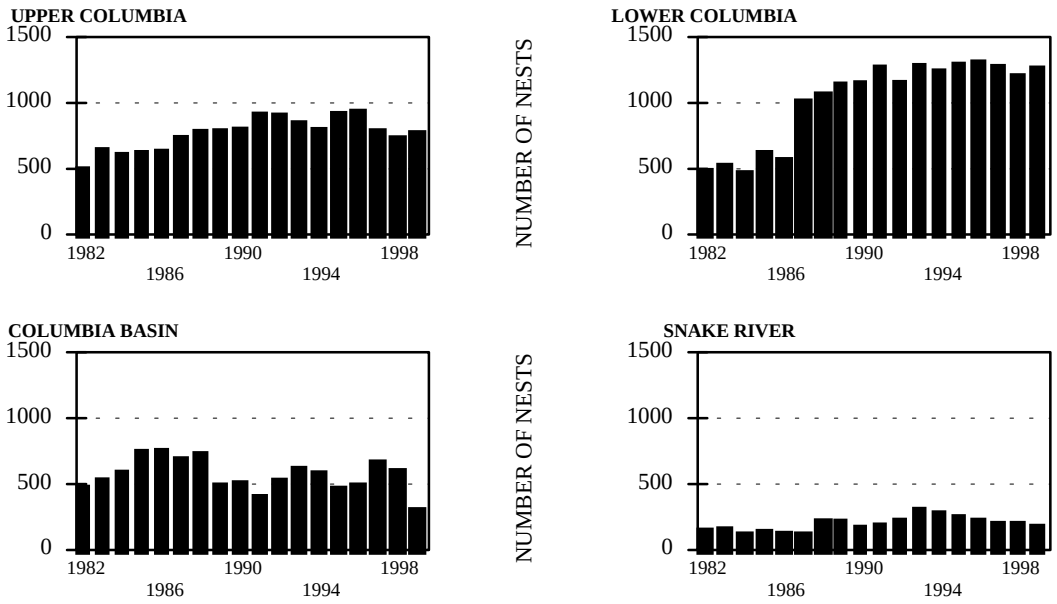

Figure 9. Canada goose nest surveys.

Table 8. Canada goose nest survey results in important areas of Washington, (1974-1999) and weighted number of geese observed during breeding duck population surveys (1979-1999).

	Number of Nests					Geese observed
YEAR	Upper Columbia	Snake River	Lower Columbia	Columbia Basin	TOTAL	during breeding duck surveys
1974	279	0	363	0	642	
1975	297	50	344	0	691	
1976	310	51	345	0	706	
1977	358	51	384	0	793	
1978	329	51	330	0	710	
1979	303	87	292	0	682	2570
1980	393	112	339	0	844	1925
1981	500	145	332	249	1226	4053
1982	509	160	495	484	1648	1203
1983	656	171	535	541	1902	3225
1984	618	132	481	601	1831	2305
1985	630	150	631	757	2168	6674
1986	641	136	580	765	2122	5225
1987	745	130	1024	702	2601	7938
1988	794	229	1076	742	2841	5426
1989	799	227	1154	500	2680	5605
1990	808	180	1161	518	2667	16695
1991	923	199	1282	414	2818	8483
1992	916	236	1164	538	2854	9483
1993	858	319	1293	628	3098	9190
1994	806	290	1251	595	2942	9396
1995	929	261	1302	477	2969	15017
1996	944	236	1321	501	3002	12758
1997	798	210	1286	676	2970	13019
1998	744	210	1215	610	2779	11199
1999	783	187	1273	315	2558	22598
1985-98 AVG	810	215	1124	602	2751	9722
% CHANGE						
FRM AVG	-3	-13	13	-48	-7	132
FRM L-YR	5	-11	5	-48	-8	102

[a]Helicopter surveys were conducted by U.S. Army Corps of Engineers to count cliff nesting Canada geese on the Snake River.

APPENDIX A. Wilcoxon signed rank test of Washington breeding duck survey.

mallards			20 year	1999-				20 year	
ROUTES	**1998**	**1999**	**1979-98 avg**	1998	RANK	RANK^2	average	RANK	RANK^2
Colville #5	1072	664	965	-408	-7	49	-302	-5	25
Cusick #4	3574	2196	1371	-1379	-12	144	825	9	81
Moulson-Sidley-Muskrat Lake	1021	3549	2210	2527	15	225	1338	12	144
Union Flat Creek	650	1593	944	943	11	121	650	7	49
Palouse River	455	325	580	-130	-2	4	-255	-3	9
Tochet River	260	65	334	-195	-3	9	-269	-4	16
Walla Walla River	130	455	425	325	5	25	30	2	4
DOUGLAS CO. (Potholes)	2777	3174	2336	397	6	36	839	10	100
Methow Valley	787	2193	645	1406	13	169	1549	14	196
Salmon Creek	1603	2039	988	436	9	81	1050	11	121
Sinlahekin	1040	1040	1017	0	0	0	24	1	1
OMAK LAKE (Reserv.)(Potho.)	1573	2192	1446	619	10	100	746	8	64
LINCOLN CO. (Potholes)	20702	16466	6115	-4236	-16	256	10351	18	324
Ewan-Revere	5308	4897	1820	-411	-8	64	3076	16	256
Sprague-Lamont-Downs	1719	3813	1414	2093	14	196	2399	15	225
CB Irrigated	15645	15943	14462	298	4	16	1481	13	169
fh & win wastw.	1296	1347	1934	50	1	1	-587	-6	36
Yak. Irrigated	19347	24292	15037	4945	17	289	9255	17	289
			1997-1996	T+	105		20 year	153	
				T-	48		average	18	
				N	17			18	
				SUM RANKS	57			135	
				SUM RANKS^2	1785			2109	
				T	1.35			2.94	
				P	0.91			0.999	

TOTAL DUCKS			20 year	1998-				20 year	
ROUTE	1998	1999	1979-98 avg	1997	RANK	RANK^2	average	RANK	RANK^2
colville #5	3651	2093	3347	-1557	-12	144	-1254	-8	64
cusick	9293	6076	3842	-3217	-15	225	2234	10	100
moulson-sid	7480	15114	14789	7633	18	324	325	4	16
union flat	1236	1984	1910	748	10	100	74	2	4
palouse riv	715	520	862	-195	-2.5	6.25	-342	-5	25
touchet riv	260	65	351	-195	-2.5	6.25	-286	-3	9
walla walla riv	130	520	572	390	6	36	-51	-1	1
douglas co	15901	15260	12161	-641	-8	64	3099	13	169
methow v	2193	4260	1678	2067	13	169	2582	11	121
salmon creek	3501	3979	2927	478	7	49	1052	7	49
sinlahekin	3684	4387	3381	703	9	81	1006	6	36
omak lk	8680	9801	8314	1121	11	121	1487	9	81
lincoln co	44259	41213	24326	-3046	-14	196	16887	18	324
ewan-revere	12821	13046	4639	224	4	16	8407	16	256
sprag-lamont	5943	9195	6294	3252	16	256	2902	12	144
columbia bas	32445	32594	40128	149	1	1	-7534	-15	225
wasteways	5427	5105	10192	-322	-5	25	-5086	-14	196
yakima	27631	34998	21803	7367	17	289	13195	17	289

APPENDIX A. Continued.

1999-1998	T+	112	18 year	125
	T-	59	average	46
	N	18		18
	SUM RANKS	53		79
	SUM RANKS^2	2108.5		2109
	T	1.15		1.720
	P	0.88		0.96

Wilcoxon Signed Ranks Test described on pages 280-288:
Conover, W. J. 1980. Practical nonparametric statistics, 2nd edition. John Wiley and Sons, New York. 493pp.

Species **Region**

Waterfowl Statewide Washington Waterfowl Regulations, Winter Populations, and Harvest

Prepared by: Matthew J. Monda, State Waterfowl Biologist

Introduction

This report summarizes the 1998-99 waterfowl hunting season regulations, aerial-waterfowl surveys, and waterfowl harvest. This report compares current data with data collected over the past 25 years. These data are archived and part of a long-term database for Washington Department of Fish and Wildlife's (WDFW) waterfowl section. Several of the data sets extend back to the late 1940's.

Hunting Season Regulations

The 1998-99 waterfowl harvest was conducted under Washington State regulations (Table 1). Flyway waterfowl populations have increased over the last four years, which has allowed for longer seasons and larger bag limits (Table 2). The season length was 106 days eastside and 106 westside, one day

Table 1. Waterfowl hunting season regulation summary 1997-98.

Ducks Youth Hunters Only Statewide Sept. 26th only

Western Washington Oct. 3-11, and Oct. 13 - Jan. 17 (106 days)

Eastern Washington Oct. 3-11, and Oct. 13 - Jan. 17 (106 days)

Bag Limit --7d(day)/14p (possession) ducks -- not more than 2d/4p hen mallard, 1d/2p pintail, 2d/4p redheads, 1d/2p canvasbacks, 1d/1p harlequin, 4d/8p scoters, and 4d/8p oldsquaw.

Geese (See Map 1 for goose management areas)

Western Washington

EARLY CANADA GOOSE Bag Limit 3d/6p

Sept. 8-14. Statewide

WESTERN GOOSE MANAGEMENT AREA 1. Bag Limit 3d/6p.

Oct. 10-11 and Oct. 13- Jan. 17. Written authorization required to hunt snow geese.

WESTERN GOOSE MANAGEMENT AREA 2.

Open in Clark, Cowlitz, Pacific, and Wahkiakum counties South of the Kalama River and Clark County on the following dates from 8:00am to 4:00pm: Mon., Wed., Sat. Nov. 25 - Jan. 17

Bag Limit 4d/8p not more than 3d/6p snow geese, not more than 1/season dusky Canada geese. Written authorization required.

WESTERN GOOSE MANAGEMENT AREA 3.

Oct. 11- Jan. 18 Bag Limit 4d/8/p not more than 3d/6p snow geese.

Eastern Washington Bag Limit 4d/8p

EASTERN GOOSE MANAGEMENT AREA 1.

Oct. 10 - Jan. 10, Sat., Sun., & Wed., and Holidays; and everyday Jan. 11-17.

EASTERN GOOSE MANAGEMENT AREA 2.

Oct. 10-11 and Oct. 12 - Jan. 11, Everyday

Snow Geese Bag Limit 3d/6p included in the above limits.

Brant Open in Pacific County, Jan. 2, 4, 13, 16, 17

Skagit Counties: Jan. 9, 10, 13, 16, 17

Written authorization required. Bag limit - 2d/4p

Coots Open during the same areas as ducks. Bag limit - 25d/25p

Snipe Open during the same areas as ducks. Bag limit - 8d/16p

Table 2. Significant historical changes in duck hunting regulations.

Hunting	Season Length		Bag Limit		Special Limits		Stamp Fees		Hunting	
Season	East	West	East	West	Mallards	Pintail	State	Federal	License	Steel shot Regulations
73-74	100	93	6	5	-	+2 extra	-	$5.00	$6.50	-
74-75	100	93	6	5	-	-	-	5.00	6.50	-
75-76	100	93	7	7	-	-	-	5.00	6.50	-
76-77	100	93	7	7	-	-	-	5.00	7.50	-
77-78	100	93	7	7	-	-	-	5.00	7.50	3 zones[1]
78-79	100	93	7	7	-	-	-	5.00	7.50	" "
79-80	100	93	7	7	-	-	-	7.50	7.50	" "
80-81	100	93	7	7	-	-	-	7.50	7.50	1 zone[2]
81-82	100	93	7	7	-	-	-	7.50	7.50	" "
82-83	100	93	7	7	-	-	-	7.50	10.50	" "
83-84	100	93	7	7	-	-	-	7.50	10.50	" "
84-85	100	93	7	7	-	4	-	7.50	10.50	" "
85-86	84	79	5	5	1 hen	1 hen	-	7.50	12.00	" "
86-87	86	79	5	5	4 (1 hen)	4 (1 hen)	$5.00	7.50	12.00	Large zones[3]
87-88	86	79	5	5	4 (1 hen)	1	5.00	12.00	12.00	" "
88-89	66	59	4	4	3 (1 hen)	1	5.00	12.00	12.00	" "
89-80	66	59	4	4	3 (1 hen)	1	5.00	12.00	12.00	" "
90-91	66	59	4	4	3 (1 hen)	1	5.00	12.00	12.00	" "
91-92	66	59	4	4	3 (1 hen)	1	6.00	15.00	15.00	Steel statewide
92-93	66	59	4	4	3 (1 hen)	1	6.00	15.00	15.00	" "
93-94	66	59	4	4	3 (1 hen)	1	6.00	15.00	15.00	" "
94-95	76	69	4	4	3 (1 hen)	1	6.00	15.00	15.00	" "
95-96	100	93	6	6	6 (1 hen)	2	6.00	15.00	15.00	Bismuth also allowed
96-97	100	93	7	7	7 (1 hen)	2	6.00	15.00	15.00	" "
97-98	107	107	7	7	7 (2 hens)	3	6.00	15.00	15.00	Tungsten-iron also allowed
98-99	106	106	7	7	7 (2♀)	1	6.00	15.00	15.00	Tungsten-polymer

[1]Non-toxic shot zones were established at Barney Lake, Skagit Bay, and the Columbia River flood plain.
[2]Only Barney Lake was retained as a non-toxic shot zone.

was given to the Youth Hunt. The bag-limit was 7 ducks with 2 hen mallard. The season length between 1988-89 and 1993-94 were the most restrictive in the State's history. Current regulations are among the most liberal ever offered in Washington. Only in 1964-65 and 1970-71 were seasons as long at 107 days on the east side. Fees for stamps and licenses did not increase for the 1998-99 season (Table 2).

Goose hunting regulations have been dynamic in recent years. Changes have resulted from efforts to protect declining populations of particular Canada goose subspecies, increase recreational opportunities on expanding populations of Canada geese, simplify regulations, and address damage/nuisance complaints.

The number of goose management areas were remained at 5 for 1998-99 (Fig. 1).

Long-standing waterfowl closures on the Columbia River at Rock Island, Rocky Reach, and Chief Joseph reservoirs were removed for the 1996-97 season. These closures were originally put in place to protect the resident Canada Geese and wintering ducks after the dams were built. The closures were removed to allow harvest of the expanding resident Canada Goose populations that are creating nuisance problems, and provide waterfowl hunting opportunities close to Wenatchee and East Wenatchee. Positive results were observed for both these objectives. Nest survey data (see waterfowl production report) indicates that the breeding goose population was reduced in these areas, which have been steadily increasing since 1974. The Canada Goose and duck harvest in Chelan County has increased significantly.

Midwinter Inventory

The 1998-99 midwinter waterfowl inventory was completed by WDFW and U.S. Fish and Wildlife Service (USFWS) personnel. Washington's data showed a 54% increase from last year and 50% from the long-term average (Table 3).

Ducks

During the 1980's, ducks declined in the Pacific Flyway midwinter survey (Fig. 2), from about 7,000,000 in the 1970's to the 4,500,000 in recent years. Numbers have been more stable since the 1989-90 season. Numbers this year increased from 6,607,263 in 1997-98 to 7,047,864 in 1998-99. Winter weather in eastern Washington was relatively mild. Breeding surveys indicate increasing breeding duck populations. The highest midwinter duck survey in the last 25 years was 8,255,185 and occurred in 1979-80. The 1992-93, 1994-95, and 1995-96 surveys were incomplete in other parts of the flyway.

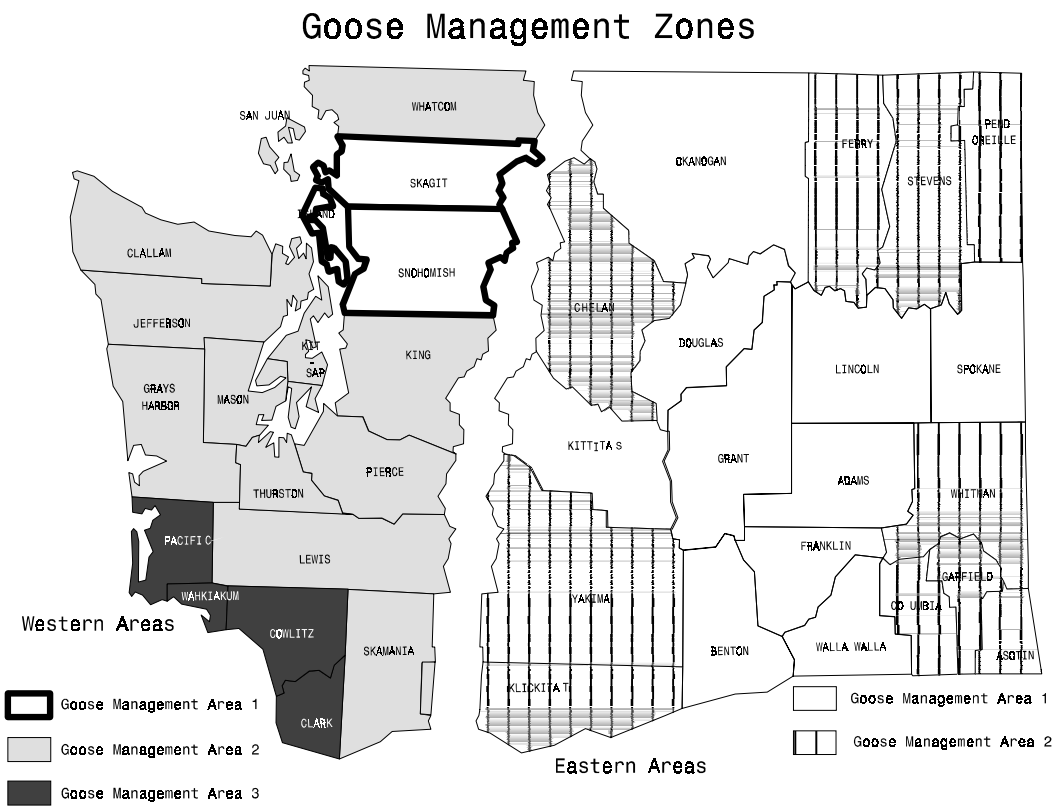

Figure 1. Washington goose management zones.

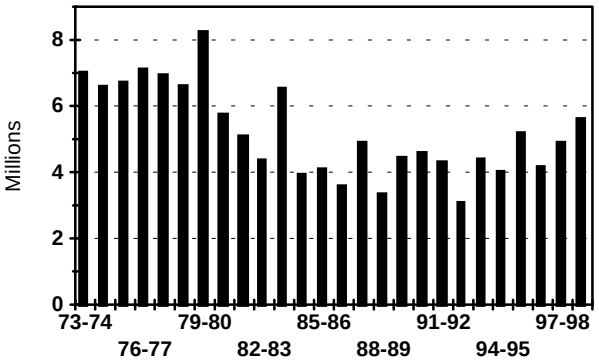

Figure 2. Pacific flyway midwinter.

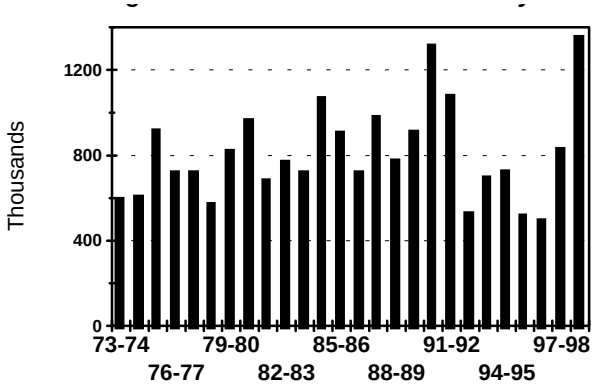

Figure 3. Wash. midwinter duck survey.

Northern pintails have contributed most to the long-term decline (Fig. 2, Table 3). In the mid-70's there were about 3.5 million pintails in the Pacific Flyway compared to 1.5 million mallards. Current surveys indicate less than 1.3 million pintails and 2.1 million mallards. Midwinter surveys are not accurate estimates of population numbers, due to survey inconsistencies and changes in weather patterns. At best these surveys give us information of the relative distribution of waterfowl within the Pacific Flyway in any year.

Ducks counted in Washington during the Midwinter Survey do not follow the Flyway's trend. There is a weak but negative correlation between winter duck numbers in the flyway and Washington (Figs. 2, 3). During the 1980's, the number of ducks wintering in Washington increased as the flyway total has decreased. The 1998-99 survey was the highest ever recorded (Fig. 3). Washington holds an average of 32.5% of mallards and 16.2% of the total ducks in the Pacific Flyway (long-term average). This year we were near above the average at 46.3% and 24.2% respectively (Fig. 4, Table 3).

Table 3. Washington Department of Fish and Wildlife annual waterfowl inventory - January 1998.

SPECIES	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	99 vs. 98	89-98 ave.	99 vs. ave.
Mallard	485948	594709	861433	764514	211497	421864	419005	310724	240838	547134	979679	79%	539741	82%
Gadwall	5674	5232	5908	4528	2218	4556	2565	3165	6304	7482	5243	-30%	5292	-1%
Wigeon	96074	116486	175887	101733	81998	95801	116748	73771	68478	117536	172049	46%	116057	48%
GW Teal	15355	14857	8361	11466	8612	11834	18247	10993	7121	6729	12486	86%	12619	-1%
Bw/Cn Teal	0	45	0	100	19	54	425	0	0	0	2	0%	71	-97%
Shoveler	1236	1151	1149	1681	571	1060	1305	2310	1313	3100	2890	-7%	1653	75%
Pintail	78612	74837	141149	62813	38361	35896	56808	48227	39156	43763	81653	87%	68847	19%
Wood Duck	240	24	90	105	48	381	454	162	30	72	329	357%	178	84%
Redhead	1354	5036	5077	4014	4673	3744	6779	1517	6782	2495	2335	-6%	4608	-49%
Canvasback	4041	3517	4352	2423	3439	1401	2941	4673	6115	6261	4841	-23%	4351	11%
Scaup	15943	20743	43477	25685	39719	26590	40644	32261	36545	28684	28274	-1%	34477	-18%
Ringneck	6553	3780	4188	3709	6526	1419	5456	4314	3782	3327	3240	-3%	4784	-32%
Goldeneye	13430	9365	16572	15730	19277	16910	22360	19663	16951	12894	10851	-16%	18128	-40%
Bufflehead	7313	13611	12421	24750	51571	21317	26724	19441	20818	14780	17185	16%	23638	-27%
Ruddy Duck	2558	2516	1865	2039	1918	3588	3372	4248	3417	2712	2476	-9%	3137	-21%
Eider	2	0	0	0	0	0	0	0	0	0	0	0%	0	0%
Scoter	34285	40060	27326	42356	30165	23952	35437	26059	26939	21386	21507	1%	34218	-37%
Oldsquaw	121	166	467	162	464	356	1550	636	1046	575	645	12%	616	5%
Harlequin	170	8	91	164	507	750	884	1077	909	791	696	-12%	595	17%
Merganser	9256	7346	5757	9099	10282	11212	10971	9830	7039	5750	6653	16%	9616	-31%
Unidentified Ducks	836	1210	2289	4496	19468	16336	8338	8064	4304	7364	3527	-52%	8078	-56%
Snow Goose*	36084	15062	32054	21855	30912	34867	36681	32340	44441	42666	38185	-11%	36329	5%
White-fronted Goose	2	0	2	0	0	2	2	25	20	1	0	-100%	6	-100%
Canada Goose	82549	79527	86658	113333	65248	90780	67383	76884	47901	95444	88698	-7%	89523	-1%
Black Brant	18538	13756	16221	13505	13054	13595	20308	7082	9753	10881	15252	40%	15188	0%
Tundra Swan**	2101	939	2248	3209	883	2616	1332	4118	3211	3424	2802	-18%	2676	5%
Trumpeter Swan**	962	183	1263	308	55	171	75	3017	2817	2352	3215	37%	1245	158%
Unknown Swan**	0	626	124	113	575	129	251	85	103	371	11	-97%	264	-96%
Coot	33549	19478	28152	43690	36341	33378	52746	59652	64956	58199	104706	80%	47793	119%
TOTAL	952549	1044277	1484585	1277581	642060	841181	959791	764338	671089	1046173	1609430	54%	1075958	50%
*B.C. Snow Geese	1438	18290	0	17244	2342	12371	5179	7206	806	1418				
Skagit/B.C. Total	37522	33352	32054	39099	33254	47238	41860	39546	45247	44084	45944	4%	43695	5%

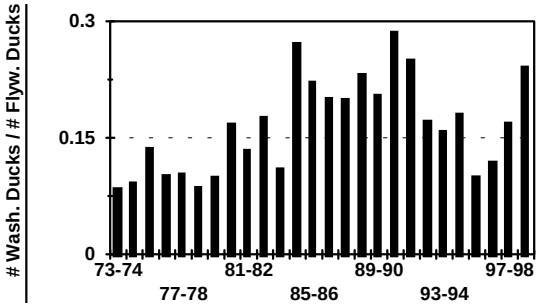

Figure 4. Proportion of Pacific Flyway ducks during the.

Geese

Canada geese are not well represented in midwinter surveys because geese feeding in fields are not well represented. The 5 highest counts of Canada geese during the Pacific Flyway's Midwinter Survey have occurred within the last 7 years. The 1995-96 count of 484,175 was the highest on record. For 1998-99 469,909 geese were recorded. The number of geese wintering in Washington has been variable over the past 20 years, but recent counts are average to high (Fig. 5, Table 3). The 20-year trends for snow geese counted within the Flyway (Figs. 5,7) have been dynamic with no discernable trend and Washington's snow geese have increased slightly during 5 of the last 6 years (Figs. 5,7). This year's midwinter count was 44,084. Washington's brant survey was above the long-term average at 15,252 but higher than the previous two years (Fig. 6).

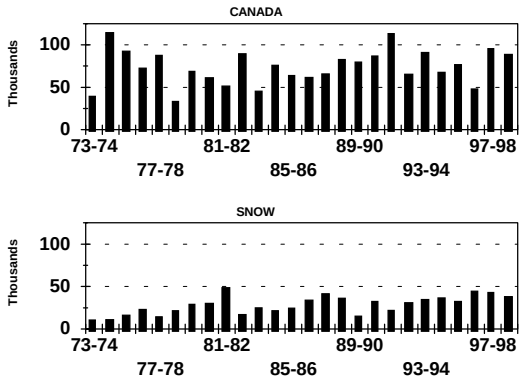

Figure 5. Geese in Wash. in midwinter. *Canada goose numbers are vastly underestimated during midwinter surveys in Washington and these numbers represent minimum estimates. Methods for surveying snow geese are more accurate.

Traditional Aerial Surveys

Aerial waterfowl surveys in northern Puget Sound were accomplished by WDFW (Table 4). Surveys in the Columbia

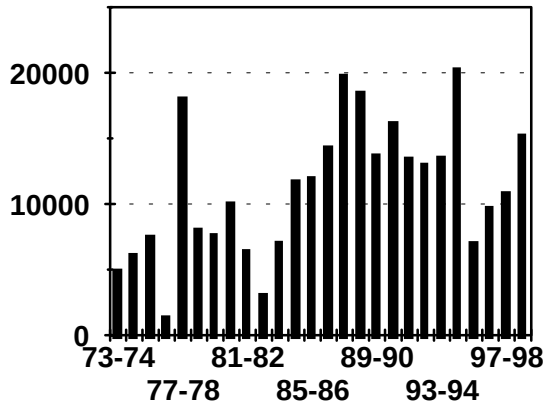

Figure 6. Brant in Wash. in midwinter.

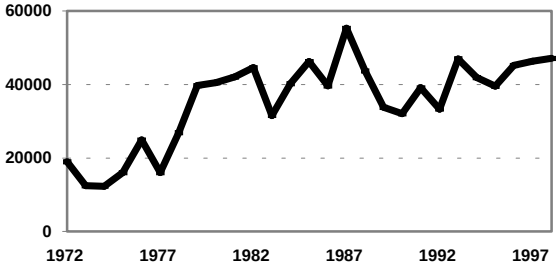

Figure 7. Skagit snow goose population.

Table 4. Waterfowl surveys conducted in the Northern Columbia Basin and Northeastern Puget Sound, snow goose photo counts, and aerial brant surveys, 1996-97.

Columbia Basin[1]	Oct. 5	Nov. 2-3	Dec. 8	Jan. 11
Mallard	26,006	96,421	170,790	373,020
Total Ducks	80,879	229,976	209,307	414,704
Total Geese	17,489	12,533	15,330	47,060
Total Swans	0	494	152	25
Total Waterfowl	98,368	242,706	224,789	461,789
Northeastern Puget Sound[2]	Oct. 15	Nov. 6	Dec. 4	Jan. 4
Mallard	20,635	117,869	137,221	126,554
Northern pintail	27,835	45,486	68,169	49,606
American wigeon	26,585	64,224	81,885	87,969
Green-winged teal	4,645	4,851	7,005	6,161
Dabbling Ducks	79,700	232,430	294,280	270,290
Brant			75	550
Snow Goose Photo Counts	Skagit/ Snohomish	Fraser	TOTAL	
Dec. 2	20,744	26,388	47,132	
Jan. 4	38,185	7,759	45,944	

[1]Includes Northern Columbia Basin only, not Tricities or Yakima area.
[2]Includes coastal areas from northern Port Susan Bay to the Canadian boarder.

Basin were conducted cooperatively between USFWS and WDFW. The highest count in the Columbia Basin occurred during the January with 461,789 waterfowl. The highest count in Northeastern Puget Sound occurred during the December survey with 294,280 dabbling ducks.

Snow goose number from photo counts was 47,132 (Table 5). Prior to the hunting season 14.3% of the snow geese in northwestern Washington were juveniles.

Harvest Survey

Harvest estimates were based on the Game Harvest Questionnaire sent to 10% of the hunting license buyers. Hunters were asked to report the numbers of ducks and geese they harvested by counties. The species composition of the waterfowl harvest was derived from a Daily Waterfowl Harvest Report Card Survey. In this survey, cards were sent to waterfowl hunters prior to the start of the season to record the species of the birds they bagged. These data were used to tabulate the species composition of the waterfowl harvest (Table 6). Harvest of snow geese and brant are also estimated by mandatory hunter report cards. Dusky Canada geese are counted at mandatory hunter check stations.

The waterfowl harvest was separated by WDFW regions (Table 7, Fig. 8). Three regions had similar percentages of the harvest. The largest harvest occurred Region 2 (25.5%), followed by Region 4 (21.7%), and Region 3 (21.3%).

Duck Harvest

The 1998-99 duck harvest of 608,097 was lower than in 1997-98, which was 676,976 (Fig. 9). The harvest in Washington has declined steadily from more than 1,000,000 in the late 1960's, to a low of 242,517 in 1993-94 (Fig. 9). Since that time there has been a slow and gradual increase in the population. Mallards made up 56.9% of the harvest, and

Table 6. Waterfowl harvest by species in Washington (1996-97).

Species	# Harvested	% of Total
Mallard	317,580	56.9
Northern pintail	29,056	5.2
American wigeon	74,026	13.3
Green-winged teal	58,937	10.6
Other ducks	111,118	19.9
Total Ducks	**557,705**	**100.0**
Large Canada	27,496	54.6
Small Canada	19,549	38.8
White-fronted	468	0.9
Snow	916	1.8
Total Geese	**50,392**	**100.0**
TOTAL WATERFOWL	**608,097**	

[1]The number of each species harvested is estimated from the Daily Waterfowl Harvest Report Card Survey. The total number of ducks and geese harvested is estimated from the more extensive Game Harvest Questionnaire.

Brant harvest report summary.									
Year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Permits Issued	490	654	747	1194	1069	1207	1445	1331	1348
Hunters	338	330	319	496	287	343	254	197	243
Days (Successful)	763	647	709	765	484	552	549	326	350
Season Days	11	11	11	11	6	11	11	5	5
Harvest									
Skagit	808	790	950	1347	825	918	1493	597	611
Whatcom	0	3	9	7	0	0	0	0	0
Pacific	73	52	18	53	23	44	41	59	19
Total	881	845	977	1407	848	962	1534	656	630
Snow goose harvest report summary.									
Permits Issued				2298	2588	2313	2363	2795	3086
Hunters				572	433	221	427	424	341
Days (Successful)				1096	664	373	996	812	585
Harvest									
Island				58	60	57	39	38	29
Skagit				677	496	99	381	545	678
Snohomish				1124	522	331	1400	749	262
Total				1859	1078	487	1820	1332	969

These figures are based on analysis of mandatory harvest report returns, corrected for nonresponse bias.

Table 5. Snow goose population and harvest summary.

	%Young			Estimated		Harvest			
Year	Preseason	Postseason	Harvest	Population	Wash	Fraser	WA-BC	Aknativ	Total
1948	34.9	16.3	79.6	29400	5790		5790		5790
1949	10.0	10.4	50.0	18160	600		600		600
1950	5.5	4.1	40.6	16075	800		800		800
1951	34.6	24.1	77.5	25700	5500		5500		5500
1952	25.0	14.8	63.9	17230	6000		6000		6000
1953	14.6	13.4	54.3	22558	6150		6150		6150
1954	18.8	9.9	68.9	19091	8200		8200		8200
1955	22.7	4.6	61.7	15100	5300		5300		5300
1956			54.9	20400	5120		5120		5120
1957	33.0		75.6	26986	9100		9100		9100
1958	2.0		66.7	14246	3650		3650		3650
1959	36.0		59.4	24425	4500		4500		4500
1960	3.4		42.9	22180	2900		2900		2900
1961	25.0		63.4	27641	3600		3600		3600
1962	0.0			23600	1710		1710		1710
1963				21800	2800		2800		2800
1964	30.3	15.8	49.8	26100	8760		8760		8760
1965			0.0	15800	2670		2670		2670
1966	35.4	31.1	64.4	17800	7750		7750		7750
1969	25.0		73.3	31676	8030		8030		8030
1970	25.0		63.9	35968	7520		7520		7520
1971	1.0			23800	6440		6440		6440
1972	1.0			18980	6680		6680		6680
1973				12450	2880		2880		2880
1974	0			12346	2050		2050		2050
1975	37.8	33.2	58.8	16017	2400	2972	5372		5372
1976	36.3		67.3	24904	4220	1102	5322		5322
1977	3.4		19.0	16075	1400	576	1976		1976
1978	40.0			26891	2850	401	3251		3251
1979	36.4			39700	5310	1917	7227		7227
1980	11.0	19.0		40500	4090	1725	5815		5815
1981	49.5			42090	15200	3378	18578		18578
1982	17.0	5.8	19.0	44626	2220	2666	4886		4886
1983		0.0	4.0	31600	3040		3040		3040
1984	16.3	12.6		40200	4460	2700	7160		7160
1985	32.0	24.0		46238	9360	3972	13332		13332
1986	29.0	25.0		39640	2940		2940	2102	5042
1987	43.0	40.0		55350	2470	2329	4799	5201	10000
1988	7.8			43760	2383	1556	3939	889	4828
1989	0.0			33769	250	926	1176	1284	2460
1990	12.2			32058	250	748	998	863	1861
1991	30.3	28.6		39099	1410	1642	3052	1655	4707
1992	2.0			33300	883	1246	2129	2119	4248
1993	32.8			47000	1859	2232	4091	2115	6206
1994	5.4	8.5		41900	1078	1838	2916	2305	5221
1995	5.0	5.4		39600	487	629	1116	3834	4950
1996	23.0			45200	1820			1379	
1997	19.2	16.2		46983	1332				
1998	14.3	13.2		47,132	916				

Photo count covering Skagit / Fraser except: photo count Skagit / visual count Fraser in 1948, 51, 56, 69, 70, 75, 76, 77.

Fraser not counted in 1959, 61, 63, 65, 67, 68, 71

Table 7. Waterfowl harvest by regions.

Region	Ducks & Geese Harvested	% of State Total
Region 1	69,130	11.4
Region 2	154,637	25.5
Region 3	129,818	21.3
Region 4	132,071	21.7
Region 5	63,502	10.4
Region 6	58,940	9.7
Total	608,097	100.0

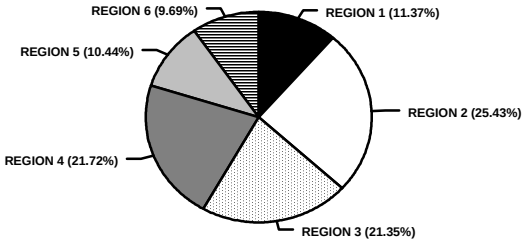

Figure 8. Waterfowl harvest by regions.

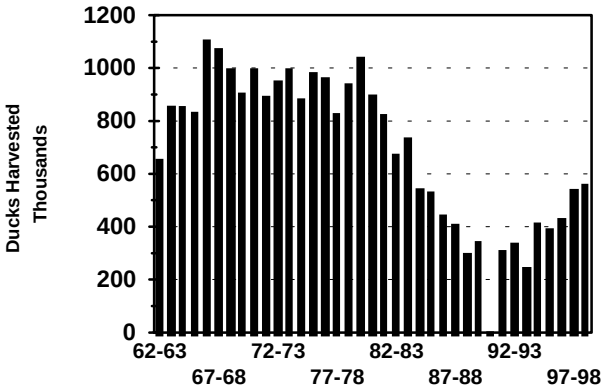

Figure 9. Washington duck harvest.

wigeon are a distant second at 13.3% (Table 6).

Goose Harvest

Total Canada goose harvest remains high and on a positive trend since the 1986-87 season (Fig. 10). Local production of large Canada geese has increased in Washington and has contributed to the increased large goose harvest. The harvest of large Canada geese has been on a positive trend since the early 1960's and reached its peak in 1996-97 at 37,799, this year it was 27,496. However, the harvest of small Canada geese has declined from 47,270 in 1979-80 to 14,284 in 1995-96. Small goose harvest decreased from 24,649 last year to 19,549 this year. Reasons for the decline in small goose harvest are

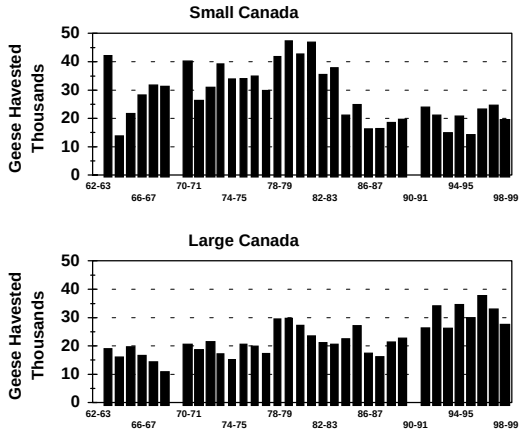

Figure 10. Wash. Canada goose harvest.

uncertain. A shift in wintering areas may be occurring, from central Washington to the mouth of the Columbia and Willamette Valley. Unfortunately, declines in Washington's small Canada geese have not been well documented. Banding information is minimal and aerial surveys are logistically difficult.

The snow goose harvest in Washington is highly variable (Tables 5 and 6, Fig. 7). Harvest of snow geese in Washington has been on a negative trend since the mid-1980's and related to limited recruitment. However, there was a slight drop this year to 1,332 (mandatory harvest report cards). Harvest of snow geese in northern Puget Sound is weather dependent. Cold and windy weather force geese from their estuaries to forage inland where they are more vulnerable to hunters. This factor may be of greater importance than annual recruitment, because the erratic annual harvest does not follow the number of geese counted in Washington during the midwinter count (Fig. 7).

The brant harvest in Washington has generally increased since the season was reopened in 1986-87 (Table 6, Fig. 11), and rose to 1,534 in 1996-97. Harvest dropped this year to 630. The season was closed from 1983 to 1986. The number of brant counted during the Washington midwinter survey was 15,252 which above the long-term average (Table 3). It is uncertain

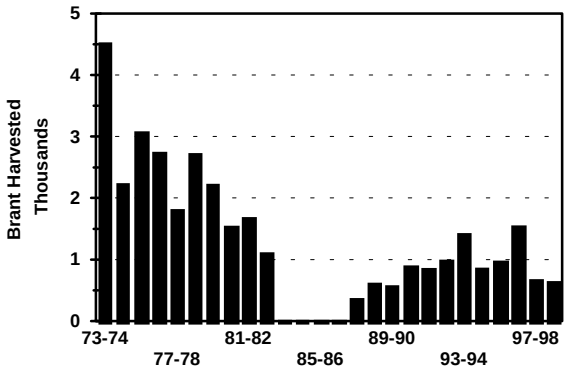

Figure 11. Washington brant harvest.

whether the long-term decline represents a population decline of a shift in wintering areas.

Hunter Numbers

The Washington hunter survey estimates the number of waterfowl hunters (Fig. 12). During the 1998-99 season an estimated 37,675 hunters participated in the waterfowl season, which was down 9.6% from last year. There was a steady decline in hunters through the 1980's. Hunter numbers have been increasing since 1990 (Fig. 12). The average number of ducks harvested per hunter in 1998-99 was 14.8, which was the highest ever recorded. The average number of waterfowl harvested per hunter per year has not decreased over the last 20

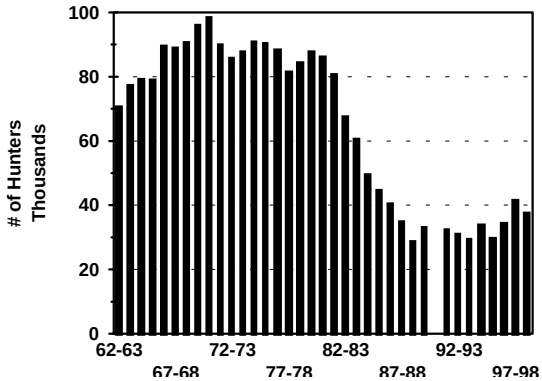

Figure 12. Washington waterfowl hunters.

years (Fig. 13). Thus, the downward trend in duck harvest (Fig. 9) is largely a result of decreased hunter numbers (Fig. 12) and not decreased annual hunter success (Fig. 13). The high success rate may indicate that we have retained the most avid and successful waterfowl hunters.

Members of the hunting public often believe the decline in hunter numbers is a result of the restrictive regulations that

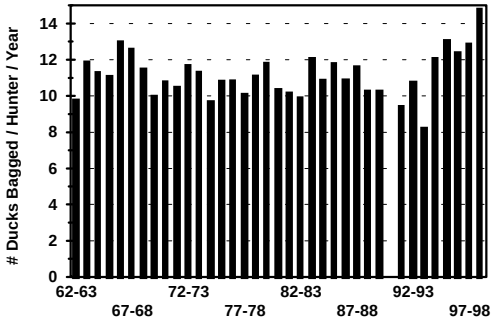

Figure 13. Duck hunter success rate.

began in the mid-1980's (Table 2). This may have contributed to the reduced hunter participation (Fig. 12), but the downward trend in hunter numbers began in the early 1980's when there was a 7 duck daily bag limit, no special restrictions on mallards and pintails, and season lengths were 93 west and 100 east (Table 2). The downward decline in hunter numbers is likely a result of changes in social views on hunting and lack of recruitment of new hunters.

The quality of waterfowl hunting opportunities in Washington is exceptional. Decreased hunter numbers result in lower hunter densities in the field and success has remained stable. In addition, this State is holding a large percentage of the Flyway's ducks. Canada goose regulations are being liberalized and harvest has been increasing since the 1987-88 season and more large Canada's were harvested in recent years than the previous 20 years.

Age Ratios

The following age-ratios were obtained from field observations in Northern Puget Sound:

Table 8.

Species	Date	Sample size	Juveniles
Brant	12/8/98	4 families	3.25 juveniles/family
Brant	12/11/98	49 families	2.51 juveniles/family
Brant	12/14/98	4 families	2.00 juveniles/family
Snow Geese	Preseason	8500	14.3%
Snow Geese	Postseason	5000	13.2%
Trumpeter Swan	Midwinter	3086	16.6%
Tundra Swan	Midwinter	1595	13.2%

Species

Wild Turkey **Statewide**

Prepared by: **Dave Ware, Upland Game Section Manager**
Clifford G. Rice, Game Surveys Coordinator
G. J. Hickman, District Wildlife Biologist
Scott Fitkin, District Wildlife Biologist
Jeff Bernatowicz, District Wildlife Biologist
Ruth Milner, District Wildlife Biologist
Jeff Lewis, Survey Wildlife Biologist
Bryan L. Murphie, Wildlife Biologist

Population Objectives/guidelines

Turkeys have been released in Washington over a period of 70 years. The primary objective of these releases was to provide additional hunting recreation. In the past twelve years, an aggressive release project has been conducted by the Department of Fish and Wildlife. Three subspecies of turkeys were introduced or reintroduced throughout Washington.

Merriam's turkeys were released in Ferry, Klickitat, Lincoln, Okanogan, and Stevens counties; Rio Grande turkeys were released in Chelan, Kittitas, Yakima, Walla Walla, Garfield, Columbia, Asotin, Lincoln, Whitman, and Okanogan counties; and the eastern subspecies was introduced in Pacific, Cowlitz, Thurston, Lewis, and Grays Harbor counties.

Current operations are focused on translocation of turkeys as a landowner incentive to enhance wildlife habitat and to provide additional opportunities on public lands (i.e. Wildlife Areas). This activity is being implemented through the Upland Wildlife Restoration Program. Additional releases are also planned in southwestern Washington in order to increase distribution and enhance population establishment.

Hunting Seasons And Harvest Trends

Estimated harvest of wild turkeys is based on successful hunter report card returns. Successful hunters are required to submit a harvest report card with date, location, sex, and age of the harvested bird. Reporting rate is estimated at 70 percent so harvest is projected by expanding reported harvest by 43 percent.

Hunting seasons for wild turkeys have varied from a two day, fall season in 1965 to the current 31 day spring season statewide and 5 day fall season in the Blue Mountains and in Klickitat and Skamania counties. The statewide, April 15 to May 15, spring season was established in 1994. The short fall season has existed since 1965. The fall season was moved to late November in 1990.

Beginning in 1995, hunters could kill one bearded turkey per day from each of three subspecies for a total of three per year. Subspecies are defined by county of kill. Multiple tags could only be purchased prior to the spring hunting season. After the spring season starts, only one turkey tag may be purchased.

Turkey hunting is open to shotgun and archery hunting only, the use of dogs is not allowed, decoys are legal, and hunting hours begin one-half hour before sunrise to sunset.

Current regulations are considered relatively conservative. The spring season results in the harvest of gobblers after the peak of breeding. The season ends before most hens are incubating and before nests hatch, so disturbance is minimized. The fall season occurs long after brood break-up and minimizes the harvest of adult hens.

Statewide harvest has increased each year as have hunter numbers (Figure 1). In 1998, 1,000 turkeys were taken and 6,659 tags were purchased. Prior to the turkey augmentation activity in the late 1980s, hunter numbers were down to a low of 428 (1987) and turkey harvests averaged 65 birds per year (1983-1987).

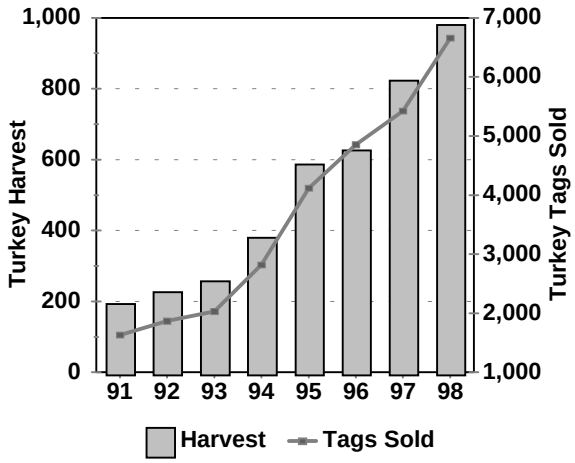

Figure 1. Turkey harvest and tags sold in Washington State.

In 1998, 807 wild turkeys were harvested in Region 1 (Table 1). This up from 651 taken in 1997. Some hunting areas are becoming so popular that hunter crowding and safety are becoming a concern on opening day and weekends. 1997 was a very good production year in Lincoln county of Region 1.Northern Lincoln county near the Columbia and Spokane River breaks is the highest quality and density of birds for the

central district of Region 1. Stevens and Ferry counties both have good habitat areas along the Columbia River.

In Okanogan County (Region 2), most harvest occurs on or near the WDFW Chiliwist Wildlife Area. A cool moist spring produced favorable hunting conditions. The mild winter of 1997-98 translated into good over-winter turkey survivorship. As a result, harvest in 1998 increased 67% over 1997. (Table 1)

Only 2 birds have been harvested in Region 3 in the last 5 years. Severe winters in 1992-93 and 1996-97 has nearly eliminated the population. No birds were harvested in 1998.

Table 1. Turkey harvest by county.

County	1992	1993	1994	1995	1996	1997	1998
Region 1							
Asotin	9	8	22	25	16	16	29
Columbia	31	23	50	62	67	74	67
Garfield	22	22	23	21	10	9	20
Walla Walla	3	12	13	42	17	26	25
Whitman				1	3	7	4
Ferry	12	12	29	36	33	62	87
Pend Oreille	0	1	3	4	18	7	12
Spokane		1	0	3	9	16	25
Stevens	22	36	61	130	150	277	395
Lincoln	31	40	57	104	101	157	143
Total	130	155	258	428	424	651	807
Region 2							
Grant	0	4	0	0	0	1	0
Okanogan	10	12	17	12	22	10	20
Total	10	16	17	12	22	11	20
Region 3							
Chelan	3	1	0	0	0	0	0
Kittitas	1	0	0	0	0	0	0
Yakima	3	3	0	1	0	1	0
Total	7	4	0	1	0	1	0
Region 5							
Cowlitz							3
Klickitat	62	66	83	109	140	121	129
Lewis							7
Skamania	5	0	3	3	5	2	3
Total	67	66	86	112	145	123	142
Region 6							
Grays Harbor	1	0	0	1	1	1	3
Pacific	1	1	0	7	4	5	10
Thurston	3	5	7	5	7	13	16
Pierce							1
Total	5	6	7	13	12	19	30

Region 6 turkey harvests have gradually increased in recent years reflecting positive recruitment rates, as well as an increase in turkey numbers associated with additional releases (Table 1)

Population Status And Trend Analysis

In the Blue Mountains (Region 1), turkey releases were documented historically in Asotin and Walla Walla counties in 1929 and 1919 respectively. These were thought to be eastern subspecies raised on game farms. Turkeys were released again during the 1960s by the Department of Game in Walla Walla and Columbia counties. A total of 18 Merriam's turkeys were released in Walla Walla County on Coppei Creek and 16 were released on the W.T. Wooten Wildlife Area in Columbia County. These releases did not result in long term population establishment.

From 1988 to 1990 Rio Grande turkeys were brought in from Texas and released at several locations in Asotin, Columbia, and Garfield counties. In all, 87 turkeys were released in Asotin County, 40 were released in Columbia County, and 49 in Garfield County. Additional Rio Grande turkeys were trapped in these counties and relocated in other parts of the Blue Mountain foothills including Walla Walla County (34 birds) and along the Palouse River in Whitman County (56 birds). Turkey harvest in the Blue Mountains is high and increasing. Reported harvest in Whitman County is limited, but has increased from one bird in 1995 to 7 in 1997.

Based on harvest trends (Table 1), this population has expanded significantly. A moderate decline in the harvest occurred in 1996. The Blue Mountain foothills area seems to be providing excellent habitat conditions for this Rio Grande turkey population.

In northeast Washington, the eastern subspecies of wild turkey were also released without success in Stevens County in 1919. Then in 1961, 15 Merriam's turkeys were released in the Rice area of Stevens County which successfully established a population. Additional birds were trapped from this population and released throughout the state. A total of 14 were released in Ferry County over a three year period and 12 birds were released in Spokane County. Initially, turkeys did very well in Stevens County with a 1965 fall harvest of 120 birds. Harvest declined and stabilized around 20 per year. By the mid-1980s harvest had declined to about 10 birds per year.

In 1988 and 1989, 170 Merriam's turkeys from South Dakota were released throughout Stevens County. Spring harvest in Stevens County has climbed each year with a record harvest of 227 turkeys in 1997. During the 1988-89 time period, 32 Merriam's turkeys were also released in Ferry County. Harvest in Ferry County has generally increased since 1992 to 62 turkeys in 1997.

While the only release records for Pend Oreille County were 60 Merriam's turkeys released in 1996, a few turkeys have been harvested each year. This harvest is believed to be a combination of the 1996 releases, game farm raised turkey releases, and birds moving in from recent releases in Idaho and Washington. In addition, the harvest in Spokane County increased from 9 in 1996 to 16 in 1997.

Harvest records suggest that the populations in Ferry and Stevens Counties continue to expand their range and density (Table 1). This population should continue to expand depending on wintering conditions and pine seed production. While severe winter conditions have been shown to limit turkey populations in other parts of the United States, the harsh winter of 1995/96 did not appear to significantly impact the northeast Washington population.

In central Washington, the earliest records of releases in Lincoln County occurred in the Hawk Creek area in 1970. Ten Merriam's turkeys were trapped in Stevens County and released in Lincoln. One or two birds per year were harvested until 1981.

Beginning in 1988, there were several turkey releases in Lincoln County. In 1988, 37 Merriam's were released; in 1989, 39 Rio Grande turkeys were released; and in 1990, 33 more Rio Grande turkeys were released. Turkey harvest in Lincoln County has been increasing dramatically. Harvest went from 23 gobblers in 1991 to 157 in 1997 (Table 1). The overall turkey population is expanding into new habitats as available in Region 1.

This turkey population also continues to expand and should provide high harvests depending on weather. Nesting season weather during both 1998 and 1999 has been near normal precipitation levels, and production has been only moderate to good. During the drought years of the early ninties, production was often excellent in many areas of Region 1. Observations of wild turkey broods has been very limited in both 1998 and 1999, but averaged between 8 and 9 young per brood over these two years in the Central District of Region 1.

Over the same period the winters have been very mild so there has been an excellent carryover from year to year. These birds in Region 1 are often close to wheat stubble fields during winters and may show little winter mortality unless snow is unusually deep for long periods.

Weather affects turkeys by controlling insect production levels during the nesting season. In dry, warm summers the young turkeys have an abundance of grasshoppers to utilize for protein and rapid growth results. In normal or above normal precipitation years chick survival often suffers.

The wild turkey populations are located in appropriate habitats in Region 1. The birds are gradually occupying new areas as numbers increase and as trapping and transfer projects remove excess turkeys from areas of concentration (Table 2). The general trend over the past ten years has been a steady increase in all of these localized areas in spite of periodic severe winter conditions. A release of transplanted Rios in Whitman county is expanding into all available habitat in that densely agriculturalized county with the Palouse River drainage being the highest quality feeding and roosting areas for birds.

Table 2. Turkey trap and transfer records for Region 1.

Year	Sub-Species	Source County	#	Release County
96/97	Rio Grande	Lincoln	8	Garfield
96/97	Rio Grande	Lincoln	13	Whitman
96/97	Rio Grande	Lincoln	21	Lincoln
96/97	Rio Grande	Lincoln	17	Idaho
96/97	Merriam's	Stevens	60	Pend Orielle
97/98	Merriam's	Spokane	32	California
97/98	Merriam's	Stevens	70	Ferry
97/98	Merriam's	Stevens	68	Pend Orielle
97/98	Merriam's	Stevens	13	Klickitat
98/99	Merriams's	Ferry	64	Pend Orielle
98/99	Merriams's	Ferry	57	Yakima
98/99	Merriams's	Stevens	121	Yakima
98/99	Rio Grande	Lincoln	26	Whitman

Eight turkeys were released in Douglas County (Region 2) from the Stevens County population in 1965. Up to 12 turkeys per year were harvested from Douglas County. Harvest eventually dropped to zero by 1974. A single turkey was harvested in Grant County in 1969.

In Okanogan County, the earliest records of turkey releases in Okanogan County occurred in 1931. Merriam's turkeys were trapped in Stevens County and released in Okanogan County in the early 1960s. Four were released on the Sinlahekin Wildlife Area in 1960, six more were released in 1963, and 10 more in 1966. A total of 9 birds were released on the Methow Wildlife Area in 1967. A few birds were harvested in Okanogan County in 1968 and 1969 (Table 1), but no harvest was reported after that until additional releases were made in the late 1980s and early 1990s.

Thirty Merriam's turkeys were released in eastern Okanogan County in 1989. Records do not indicate any harvest in eastern Okanogan County after these releases. However, Rio Grande turkeys released in western Okanogan County on Chiliwist Wildlife Area have resulted in sustained harvests in this area (Table 1) indicating that the population is probably stable or increasing slowly. The population likely declined as a result of the 1996-97 winter; however the mild weather of the next two winters is fostering a population rebound.

No population estimate has been calculated for the Okanogan County turkey population. This appears to be a small, but slowly growing and expanding population. Turkeys are expanding into drainages west and south of traditionally inhabited areas of the Chiliwist watershed. The lack of grain farming in the area may eventually limit population growth. Turkeys are also colonizing tributary streams of the lower Methow. At least some of these birds likely originated from releases by private individuals. The subspecies of these birds is unknown. Turkeys also appear to be expanding from Canada onto private land near the border just west of Oroville. In Region 3, attempts to establish wild populations of turkeys in Yakima County between 1913 and 1931 were unsuccessful. In all, 94 turkeys were released. These early releases relied on game farm reared birds of the eastern subspecies.

The Oak Creek Wildlife Area in Yakima County was the target of some of the early wild trapped releases in the early 1960s. Twenty Merriam's turkeys were released, but no significant population was established.

In the mid-1960s four Merriam's turkeys were trapped from Stevens and Spokane counties and released on the Colockum Wildlife Area in Kittitas County. This release was unsuccessful.

More recent releases in Region 3 began in 1984. Thirty

eight Rio Grande turkeys were released in Yakima County in 1984 and 1985. Only 2 turkeys have been harvested in the last 5 years in this area (Table 1), indicating that it has not seen the same success as turkey introductions in other areas of Washington.

Although pockets of Rio Grande habitat occur throughout Region 3, the overall habitat is probably better suited for the Merriam's subspecies. In 1999, 178 wild trapped Merriam's turkeys from Stevens County were released in Yakima County. More releases, including Kittitas County are scheduled for 2000.

In south-central Washington, in Klickitat County was also one the first areas in Washington where several early attempts were made to establish wild turkeys. Between 1930 and 1946, 93 turkeys were released in four different attempts to establish a population. These releases again did not result in population establishment. Then in 1960, 12 wild trapped Merriam's turkeys were released.

This release resulted in the establishment of Washington's largest, most stable turkey population from 1960 through 1990. Turkey harvest started slowly in Klickitat County in the 1960's but built up to a high harvest of 98 turkeys in 1970. Harvest was relatively stable through the 1970s and early 1980s. By 1986, harvest had dropped to under 50 turkeys. In 1988 and 1989 approximately 125 Merriam's turkeys were released in hopes of rejuvenating the population. Harvest reported for the county has increased substantially since the last releases, and the average for the last four years (1995-1998) is above 120 birds (Table 1).

The south-central turkey population appears to be stable or increasing. Recent increases in harvest may be tied to improved weather conditions in combination with the additional brood stock released in the late 1980s. However, the population may be is expanding its range and increasing in number as previously-unoccupied habitats become colonized.

From 1925 and 1931 several documented turkey releases were made throughout western Washington. Most releases were limited in number and widely scattered. Releases were more numerous in San Juan County with over 35 birds in three different releases (over six years) and Clark County with 50 birds released in two years. In the early 1960s, turkeys were also released on Protection Island in Jefferson county, and then Orcas Island in San Juan County.

The Department of Game trapped Merriams turkeys in Klickitat and Stevens counties and released four on San Juan Island, six in Lewis County, and 12 on the Scatter Creek Wildlife Area in Thurston County. In addition, several turkeys were taken from Northwest Trek Wildlife Park and released on Bangor Naval Base property. Most of these releases did not result in population establishment.

In 1987 the Department of Wildlife began releasing eastern wild turkeys in Lewis County and 13 in Pacific county. Thirty-one additional eastern turkeys were released in Lewis County from 1989 to 1992, and 39 in Cowlitz County. Subsequently, in 1993 and 1994 a few additional (>10) turkeys were trapped in Pacific County and some were released in Cowlitz county. Additional eastern turkey transfers are shown in Table 3.

Table 3. Eastern wild turkey trap and transfer records for Region 5, 1992-1998

Year	Source County	#	Release County
1992	Thurston	7	Cowlitz
1992	Thurston	1	Cowlitz
1994	Pacific	1	Cowlitz
1997	(Iowa)	2	Wahkiakum
1997	(Iowa)	10	Wahkiakum
1997	Pacific	5	Wahkiakum
1997	Cowlitz	3	Wahkiakum
1998	(Iowa)	10	Wahkiakum
1998	Klickitat	25	Klickitat

Turkey harvest in western Washington has increased over the past six years as a result of the recent releases and increasing hunter effort, although harvest in Lewis and Cowlitz counties is small (Table 1).

The turkey harvest in Lewis and Cowlitz counties remains at a very low level, and although much suitable habitat exists, population expansion has been slower than in some other parts of Washington.

Starting in 1987 the then Department of Wildlife began releasing eastern wild turkeys in Region 6. These birds, trapped in the State of Missouri, were released initially in the north-eastern portion of Pacific County. Since the initial release of 13 birds, additional birds have been released in Pacific, Grays Harbor, Mason, and Thurston counties. Gradually increasing harvest and observation of birds suggests that turkeys are adjusting well to their new environments. In 1997, five turkeys (3 adult gobblers and 2 adult hens) were fitted with radio-transmitters and released in Thurston County near Summit Lake. All of these birds were found dead of unknown causes in 1998, however data collected from these birds was insufficient to determine what, if any, relationship these mortalities had with the overall population.

Habitat Condition And Trend

The most significant impact to statewide turkey habitat is similar to most wildlife species, which was the end of an eight year drought in 1994. Vegetation conditions have improved and with minimal snowfall in wintering areas, turkey populations should do well.

Normal or near normal precipitation levels in the far eastern counties of the state have benefitted the turkey habitat in those ten counties. Abundant insects have provided good chick survival in the timbered areas of Lincoln, Stevens, Ferry, Pend Orielle, Asotin, Garfield, Columbia, Walla Walla and Whitman counties. Most of the turkey range is in close proximity to agricultural lands which provide abundant food in the form of waste grain as well as some berries and fruits through the winter months.

In Okanogoan County, vegetation conditions continue to improve during the wetter weather of recent years. In general, occupied turkey habitat in Okanogan county is less productive than some other areas of the state, due to a lack of extensive mast or berry crops. Much of the habitat is intensively grazed, and turkeys may compete with livestock for certain plant foods. In addition, the lack of grain farming in the area may be hampering population expansion.

Most of Region 3 is probably marginal turkey habitat. The forested zone (Merriam's habitat) is on the edge of higher elevations and significant snowfall. Deep snows in 1992-93 and 1996-97 plagued the region. In 1999, the lower 10% of forest was usually snow free, while higher elevations received had significant snow cover into June. A cool, dry spring in 1999 resulted in slow vegetation growth, late insect emergence and poor Poult production.

There is probably suitable Rio Grande habitat in the lower Yakima Valley around Sunnyside. The area rarely receives significant snow and food is abundant. However, there maybe conflicts with agriculture (vineyards, orchards) in the area.

In Region 4, selected landings and roads in the vicinity of the release sites were seeded with a clover/grass mix, at the Pilchuck Tree Farm's expense in spring, 1999. Results of this attempt to improve forage conditions for turkeys and other species are not yet known.

Winter conditions in the eastern portion of Klickitat County (Region 5) can sometimes be severe. In particular the winter of 1996-97 may have caused some mortality in resident turkeys which may have resulted in the small decline in turkey harvest in 1997.

The eastern subspecies has been trapped and transferred in southwest Washington largely by UWEP staff in coordination with volunteers. These transplant were conducted to better distribute turkeys over available habitats.

Habitat conditions in much of Region 6 are favorable for turkeys. The wet spring and summer seasons of recent years should provide adequate food supplies for turkeys. Average annual snowfall in much of the lower elevations of the region is minimal and should contribute to better over winter survival of turkeys.

Augmentation/habitat Enhancement

Rio Grande turkeys continue to be trapped and transferred in parts of Region One through WDFW's Upland Wildlife Restoration Program (UWRP). These birds are mostly being released on private land as part of UWRP's landowner incentives program.

In addition, the eastern subspecies has been trapped and transferred in southwest Washington largely by UWRP staff in coordination with volunteers through the Senior Environmental Corps. Additional turkeys were brought in from Iowa and distributed in Snohomish, Wahkiakum and Thurston counties. Because funding is limited, no additional releases using out of state birds are planned for 1999.

The Upland Wildlife Restoration Program continues to enhance upland game habitats within wild turkey range. Several new habitat and hunter access agreements have been signed in 1997 with private timber companies and with the Department of Natural Resources. Several acres of habitat enhancements have been completed with several more planned in the next few years. These landowners have a great interest in working with WDFW to enhance habitats and establish huntable populations of eastern wild turkeys on their land holdings.

In the winter of 1997/1998 wild turkeys were trapped and transferred in Region 1. These birds are being used to enhance existing populations and to establish new populations in appropriate habitat and to trade with other states in cooperative conservation projects.

The Upland Wildlife Habitat Restoration program continues. Some hunting areas are becoming so popular that hunter crowding and safety are becoming a concern on opening day and weekends, to aggressively enhance habitats for all wildlife within the range of the wild turkey in Region 1. Appropriate habitat enhancements should focus on winter food improvements, especially grain, clovers, fruiting shrubs and mast producing trees.

During the winter of 1998-99, Merriam's turkeys were trapped in Stevens and released in Yakima County. Thirty of the birds were radioed. The project created a lot of enthusiasm from local hunters who formed a chapter of the National Wild Turkey Federation (NWTF). Releases and radio marking will continue in 1999-2000 with the help of NWTF. The local chapter will feed birds and is exploring habitat improvements as well as releasing Rio Grande turkey's in the Sunnyside area.

In Region 4, 12 banded turkeys were introduced into the Pilchuck Tree Farm (T32N, R5E, S11,10,7), Snohomish County, in January, 1998 by The WDFW Conservation Reserve Program. A brief habitat analysis was conducted at the site prior to release; no analysis of surrounding habitat or contact with surrounding landowners was made outside of the tree farm boundaries.

Since release, occasional sightings of turkeys have been reported. During winter, 1999, 4 turkeys including 1 banded tom and 1 banded hen were seen 1.5 mile north Bryant, on the north side of State Highway 9. The other 2 birds did not appear banded. This group was seen in livestock feeding areas or an associated unmown pasture on private property during the winter.

Two banded females were seen during spring, 1999 on the Bjorndahl Road, about 5 miles from the release sites. Two young birds were seen on Pilchuck Creek during fall, 1998, and 2 young birds were seen east of Lake Armstrong in fall, 1998. The latter sighting was about 5 miles south of the release sites, on another tract owned by the Pilchuck Tree Farm. The Pilchuck Tree Farm, at the farm manager's request, remains closed to hunting until a reasonably sized turkey population establishes itself from the initial release.

In 1998, turkey populations were augmented with release in Grays Harbor, Pacific, Mason, and Thurston counties. These additional birds should contribute to increasing the overall regional population of turkeys in Region 6. There were no

releases in 1999.

Management Conclusions

Harvest and hunter numbers continue to increase. In 1994 the regulations were changed to allow the harvest of up to three turkeys per year (one from each subspecies). As turkey populations continue to expand in the Blue Mountains, northeast, and north-central Washington, additional opportunity may be provided.

Habitat enhancement activities for wild turkeys should focus on food improvements (especially winter foods) in terms of grain, clovers, fruiting shrub, and mast producing tree plantings. These types of plantings would be most helpful in the northern portions of Washington's turkey range and other forested areas where food sources may be limited, especially after winter snow storms.

The populations of wild turkey in Region 1 continue to increase with management efforts by WDFW. Hunter interest and harvest have both increased over the past ten years. The release of wild turkeys in Pend Orielle County is encouraging expansion of the population into new areas of suitable habitat. Spokane County is seeing an increase of turkeys despite the urban nature of the area. Other areas are currently under expansion of a naturally increasing wild population and trapping and transfer will continue as funding and opportunities arise. The Blue Mountains support excellent Rio Grande populations.

The population of Rio Grande turkeys in south-central Okanogan County appears to be stable or increasing slightly, up to the 1996-97 winter. If the wet cycle continues, and winter weather moderates as it did in 1997-98, a rebound in numbers and expansion of range are possible. No changes in the harvest are recommended at this time. Even though deleterious competition between turkeys and other game birds in Washington has not been identified, any augmentation that could potentially put birds in existing sharp-tailed grouse habitat, should be avoided as a precautionary measure.

Releases of Merriam's Turkeys in Yakima and Kittitas Counties will continue in 2000. Radio tracking will help determine the success of the transplants and future management. Winter feeding will probably be needed to sustain a huntable merriam's population. The potential of releasing Rio Grande's will be explored.

Harvest and hunter numbers continue to increase, especially in Klickitat County. In 1994, the regulations were changed to allow the harvest of up to three turkeys per year (one from each subspecies). However the means to monitor both hunter numbers and harvest need to be refined. The harvest projections now used are based upon old assumptions about harvest report card compliance which may no longer be valid. With a point of sale licensing system soon to be implemented at least the latter problem will be resolved.

Expanding the density and distribution of the western Washington turkey population has been identified as a priority for turkey management. Research to determine limitations to dispersal and population expansion could better direct future efforts, but finding priorities within the Upland Game Section, place other issue higher.

Additional turkey in southwest Washington seem prudent in light of the potential habitat available and the current distribution of the turkey population. At this point, the completion of a "block stocking" model in southwest Washington should be given priority for additional efforts in turkey management. Cooperative efforts are moving forward to confirm adequate funding and ensure successful implementation of release activities.

Gradual increases in harvest observed in recent years suggests that turkeys are becoming a popular game species for Region 6 hunters. If turkey numbers continue to increase in Region 6 due to natural population growth and WDFW augmentation, hunting opportunities should increase as well.

There are currently three areas where forested habitat occurs in Washington that is not occupied by turkeys. One is the east slope of the Cascades. Turkeys have been released several times with limited success in this area. The habitat varies, but includes what appears to be suitable Merriam's habitat. Additional experimental releases that are carefully monitored for habitat use, productivity, and limiting factors might eventually lead to successful population establishment. Other areas that could be evaluated for future introductions include parts of Spokane County and northwest Washington.

In addition, expanding the density and distribution of the western Washington turkey population has been identified as a priority for turkey management. Research to determine limitations to dispersal and population expansion could better direct future efforts.

Species

Pheasant **Snake River Basin**

Prepared by: Pat Fowler, District Wildlife Biologist

Population Objectives/guidelines

The primary objective of pheasant management is to maintain well distributed populations and to provide appropriate levels of hunting recreation. Statewide objectives were last set in the 1988 Upland Bird Plan. The objectives in 1988 were: (1) Increase populations above the 1980-85 average level (as measured by population indices). (2) Increase hunter recreation days to 338,000 statewide. (3) Maintain the statewide harvest at the 1980-85 average level of 371,000 birds per year with a success rate of 4.5 birds per hunter per year.

Hunting Seasons And Harvest Trends

The eastern Washington general pheasant season, ran from mid October through December 31, 1998. In addition, a juvenile season ran for two days in late September. The bag limit was 3 cocks per day.

The pheasant harvest in Region One peaked in the 1960's with an average of 121,422 pheasants harvested per year. The harvest has continued a downward trend for the last 30 years (Figure 1). Compared to the 1960's, the ten year average harvest in the 1970's declined 15% to 103,359 pheas.\year, 30% in the 1980's to 84,540 pheas.\year, and 63% to 44,698 pheas.\year during the 1990's (Figure 2). The Regional pheasant harvest in 1997 increased 31% over 1996, and 70% over the 1990-96 average.

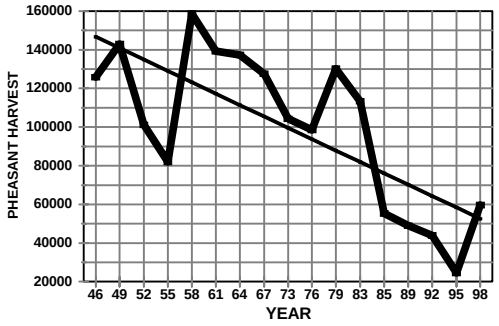

Figure 1. Pheasant harvest trend 1946-98, Region 1.

The significant increase in the 1997 harvest (64,402) may be a result of increased pheasant production and hunter participation. The 1998 harvest of 59,590 is a decrease of 7% compared to 1997, even in the face of better overall pheasant production in 1998. The 1998 harvest should have increased over 1997. The 1998 harvest was 36% above the 1990-97 average of 43,634.

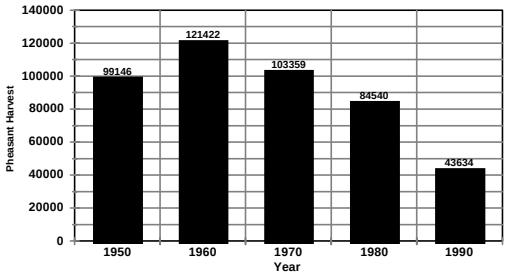

Figure 2. Region 1 pheasant harvest, decade average.

Although hunter trend information is limited, over the last thirteen years (1986-1998) the number of pheasant hunters in Region One has cycled from a high of 20,000 in 1986, to a low of 9,500 in 1995, and back up to 19,172 hunters in 1997 (Figure 3). Hunter numbers declined again in 1998 to 12,653, a decline of 34%, but the reasons for this decline are unknown. Hunter numbers in 1998 appeared comparable to 1997. What generated the sudden interest in pheasant hunting in 1997 is unknown, unless the re-implementation of the pheasant release program stimulated hunter interest.

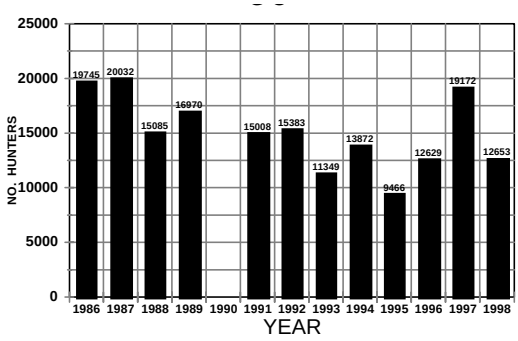

Figure 3. Pheasant hunter trend, Region 1.

Surveys

Three types of pheasant surveys were conducted up until 1995; 1) Sex ratio counts in February and March, 2) Crow counts in late April and early May, 3) Production counts in late July and August. Spring surveys to determine sex ratios and broodstock carryover were discontinued in 1996. Time constraints, emergent priorities, and weather have reduced the number of surveys done in Region One. Pheasant crowing counts are conducted in late April and early May if weather conditions and time allow. Pheasant production surveys are

conducted in late July and August. All surveys are conducted on established routes.

Although crowing counts have been conducted for many years, individuals running the surveys have changed as well as the hearing level of some individuals that have historically run the same routes. This combination of factors may impact results as much as fluctuations in the pheasant population. Production surveys along established routes will provide information on the number of pheasants observed per survey (obs.-day), and the level of production for the year (Table 1). However, these surveys should probably be conducted after the wheat harvest (mid or late August) in order to survey pheasants when sightability conditions are optimal. In late August 1999, volunteers were offered the chance to conduct production surveys in Whitman county and few pheasants were seen. Harvest of grain crops were several weeks late in 1999 and at the time of this writing it is still difficult to determine the potential for harvest this 1999 hunting season. One of the authors saw only one small (4 young) brood of pheasants in 1999.

Table 1. Pheasant Crow Counts per Station, Region 1.

Survey Route	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Walla Walla	14.9	8.9	7.5	8.4	10.0	8.5	9.4	ns	11.4	5.1	15.3	9.1	5.5	ns	ns
Touchet	9.8	6.4	6.1	8.5	7.1	11.8	ns	ns	4.5	1.9	5.5	6.3	1.8	ns	ns
Lambie	ns	ns	ns	3.0	5.1	2.7	9.0	ns	8.6	1.7	3.4	ns	ns	ns	ns
St. John	9.1	5.9	4.7	3.2	8.1	0.8	1.1	ns	2.9	6.9	15.6	18.6	5.8	9.1	9.2
Hay	10.7	11.3	5.9	8.5	4.4	5.5	5.0	ns	9.2	9.7	10.9	14.4	5.6	11.6	11.4
Average	11.2	8.2	6.1	6.3	6.9	5.9	6.1	ns	7.3	5.1	10.1	12.1	4.7	10.4	8.8

Surveys were not conducted in southeast Washington. However, the lack of pheasants observed by field personnel is a good indication that 1999 was a very poor pheasant production year. Weather during the peak of hatch (late May early June) was very cold with nighttime temperatures reaching the high 30s and low 40s. Low nighttime temperatures combined with cool days and heavy morning dew probably resulted in high chick mortality. Weather conditions also limited insect production. Both factors, weather and the lack of insects resulted in a combination that dramatically reduced pheasant chick survival.

Population Status And Trend Analysis

Based on surveys and harvest, pheasant populations have declined significantly over the last 30 years. The primary factor for the decline in pheasant populations is loss of habitat due to development and agricultural practices. In areas where alfalfa is a major crop, the first cutting usually occurs during the peak of nesting (mid-May) and results in a heavy loss of nests and young. Another factor that may have a significant impact on the pheasant population is the dramatic increase in predator populations, both numbers and species. Predation combined with fragmented habitat may be focusing multiple factors on the pheasant population which prevents a long term increase. Ag chemicals may have an as yet undetermined influence on the health of upland bird populations.

Weather conditions during the nesting season are also a significant factor that impacts the annual pheasant population. Cold, wet conditions during the peak of hatch (1999) can result in very high mortality of young pheasants, decimating annual production. Production can be down in one area and up considerably in another area due to variations in weather patterns during the nesting season. In Whitman County pheasant populations appear to have stabilized over the last four years. A general reduction in livestock grazing has helped to provide an increase in small acreages of upland bird habitat, especially in Whitman county. Riparian zones have shown some improvement when grazing of horses and cattle is reduced and upland birds positively react to such habitat improvements, limited as they may be.

Habitat Condition And Trend

Habitat conditions over the past 30 years have declined due to land development and changing agricultural practices. However, habitat for upland birds has improved with the advent of the Conservation Reserve Program (CRP). After current CRP contract expired, farmers had to reapply for CRP acreage in 1997 and many requests were rejected. The second sign-up period resulted in a significant amount of acreage being accepted into the program. In the southeast district CRP acreage will increase from 118,343 in 1998 to 217,171 by 2000. Overall, In Region One, CRP acreage will increase from 191,370 acres to over 250,000 by the year 2000. This program will provide large acreages of suitable habitat near agricultural crop lands, enhancing habitat conditions for pheasant, non-game and other species over the next 10 years.

Augmentation/habitat Enhancement

The Upland Habitat Restoration Program has developed over 5,849 acres of upland bird habitat in the southeast and central districts. The southeast district has developed 5,049 acres of habitat over the last five years consisting of grass mixtures for nesting cover, plus the planting of more than 35,975 trees and shrubs. The central district has developed in excess of 800 acres of upland bird habitat, but have planted approximately 280,000 trees and shrubs. In addition, 64 guzzlers were installed in 1999.

New acreage signed up under the CRP program will be planted with seed mixtures developed to enhance habitat for wildlife Farmers will be required to re-plant 50% of the existing CRP acreage with the new wildlife mixtures.

Management Conclusions

Pheasant populations in Region One are affected by numerous factors which hold the population below management

objectives. Land development, changing agricultural practices, pesticides, fragmentation of habitat and conflicts with other species may prevent significant increases in the pheasant population in the foreseeable future.

Species

Pheasant **Columbia Basin**

Prepared by: Jim Tabor, District Wildlife Biologist

Population Objectives/guidelines

The primary objective of pheasant management is to maintain well distributed populations and to provide appropriate levels of hunting recreation. Statewide objectives were last set in the 1988 Upland Bird Plan. The objectives in 1988 were: (1) Increase populations above the 1980-85 average level (as measured by population indices). (2) Increase hunter recreation days to 338,000 statewide. (3) Maintain the statewide harvest at the 1980-85 average level of 371,000 birds per year with a success rate of 4.5 birds per hunter per year.

Hunting Seasons And Harvest Trends

Pheasant hunting seasons and bag limits in the Columbia Basin have remained stable since 1984. The season has run from the first Saturday after October 10 (except 1999 when the season began on October 9) to December 31 with a daily bag limit of three cock pheasants and a possession limit of 15. In Grant and Adams counties, the number of pheasant hunters declined 52% in the 9-year period from 1987 to 1995, increased slightly in 1996, but increased to slightly above 1987 numbers in 1997 (Table 1.) The number of hunters decreased 39% from 1997 to 1998. The trend in hunter numbers is very similar for both counties.

Table 1. Number of pheasant hunters in Grant and Adams counties, 1987-1998.

Year	Grant	Adams	Total
1987	11948	4099	16047
1988	9052	2793	11849
1989	10615	2688	13303
1990	--	--	--
1991	7630	2337	9967
1992	8321	2644	10965
1993	7655	2151	9806
1994	8439	2443	10882
1995	5947	1749	7696
1996	7482	2486	9968
1997	12207	4392	16559
1998	7560	2536	10096

Current season structure and bag limits are conservative. Even with the restriction of cock only harvest, sex ratios in the basin have averaged 2.8 hens/rooster in the past six years. This low sex ratio indicates that cocks could be harvested at a higher rate without reducing breeding efficiency, productivity, or population growth.

Hunting conditions in the basin appear to change only moderately from year to year or on a "short-term" basis. Type of crops grown, timing of harvest, crop residues left in the field, and amount of ground left untilled does affect hunter use and success and has changed rather dramatically over the long-term. Most pheasant hunting in the Columbia Basin occurs on private farmland. The long-term trend shows a decrease in the amount of effective pheasant hunting cover in the irrigated farmland.

In the Basin, an unknown but significant amount of pheasant hunting occurs on the Columbia Basin Wildlife Area, private lands under agreement in Washington Department of Fish and Wildlife's hunter access program, and on lands owned and/or managed by WDFW under its Habitat Development Program. The Hunter Access Program in Grant and Adams counties had 148 cooperators with a total of 190,853 acres of hunting access in 1998. The Habitat Development Program had 37 parcels totaling 1,717 acres available to hunters.

Harvest estimates for pheasants in Grant and Adams counties were examined from 1984 through 1998. During this 15-year period, harvest declined 75% from a high of 58,912 in 1984 to a low of 14,827 in 1995. The 1996 harvest increased 58% from that of 1995 to 23,457 (Table 2). The 1997 harvest increased 57% from that of 1996 to 36,803 (Table 2). The 1998 harvest decreased 24% from that of 1997. Harvest trends have been similar in both counties.

Table 2. Number of pheasants harvested in Grant and Adams counties, 1984-1998.

Year	Grant	Adams	Total
1984	43921	14991	58912
1985	36225	10299	46524
1986	35932	11804	47736
1987	37631	11222	48853
1988	22928	7111	30039
1989	27322	7622	34944
1990	--	--	--
1991	15116	4206	19322
1992	20819	7267	28086
1993	14046	4422	18468
1994	18117	5001	23118
1995	11029	3798	14827
1996	15667	7790	23457
1997	27034	9769	36803
1998	22391	5602	27993

Data on pheasant harvest success from 1986 to 1997 were examined (Table 3). There were no data for 1987 and 1990. Pheasant hunter success in both counties combined as measured by number of pheasants harvested per hunter per day, has ranged from a high of 0.67 in 1996 to a low of 0.40 in 1991.

The 1998 success (0.63) was the second highest since 1986.

Table 3. Pheasant hunter success rate (number of pheasants harvested/hunter day) in Grant and Adams Counties, 1986-1998.

Year	Grant	Adams	Total
1986	0.57	0.69	0.63
1987	--	--	--
1988	0.57	0.66	0.62
1989	0.53	0.69	0.61
1990	--	--	--
1991	0.38	0.41	0.40
1992	0.53	0.58	0.56
1993	0.42	0.62	0.52
1994	0.46	0.52	0.49
1995	0.46	0.51	0.53
1996	0.53	0.87	0.67
1997	0.41	0.53	0.70
1998	0.64	0.62	0.63

Surveys

Data are obtained annually in the irrigated farmland portion of Grant and Adams counties to provide indices to breeding population size and production of pheasants. The population index is useful in determining long-term trends and major short-term population changes. The production index is a good predictor of hunting prospects for that year's hunting season and may provide information useful in determining reasons for annual changes in population size.

The breeding season population index is based on crowing counts. Data from crowing count routes provide an index to population size of roosters. The population index for hens (broodstock index) is derived from the rooster index and the hen to rooster ratio.

Six permanently established crowing count routes along farm roads and highways in Grant and Adams counties' irrigated farmland were surveyed twice annually (at least one week between surveys) during the period from April 25 to May 15 until 1997. Only one route was surveyed in 1997 and 1998. The index is presented as the mean number of crows per stop and is assumed to represent the number of roosters present in the vicinity of stops. Only the Warden crowing route was surveyed in 1997 and 1998.

Pheasant sex ratio surveys (counts) are made in farmland areas adjacent to the established crowing routes annually between March 15 and May 15. Data from all survey sessions in an area are totaled for the estimate of number of hens per rooster. Only one area was surveyed for sex ratio counts in 1997 and 1998. This area was adjacent to the Warden crowing route.

The production index is derived from surveys of six permanently established pheasant brood routes located in the same general areas as the crowing count routes. The production index is the number of broods or chicks seen per observation day.

This report contains results of 1999 surveys for breeding population size (one area only) and production.

The 1999 index to the breeding population size (limited to the Warden area of the Basin) showed a 108% increase in both the number of roosters and hens compared to that of 1998 (Table 4). This increase can be explained in part by the excellent production observed in 1998 and the increased number of pheasants entering the winter. In addition, the winter of 1998-99 was abnormally mild and should have been conducive to good over-winter survival.

Table 4. Pheasant breeding population indices for the Warden area of the Columbia Basin Irrigation Project, 1995-1999. (Data are from only 1 crowing route and 1 sex ratio sampling area).

		1995	1996	1997	1998	1999
Crows/Stop	Rooster Index	12.9	6.2	13.9	8.5	13.4
Hens/Rooster	Sex Ratio	2.7	1.8	3.1	3	4.0
Broodstock Index	Hen Index	34.8	11.3	40.5	25.8	53.6

The pheasant production index for 1999 as measured by the number of chicks seen per observation day on six brood routes decreased 80% from that of 1998 (Table 5). The decrease occurred despite the fact that there was 108% more breeding hens in 1999 than in 1998. The decreased production of chicks was clearly due to poor nesting success and/or chick survival. Pheasant production in 1999 was 64% below the 1989-1998 average and was the second lowest ever recorded. In 1991, production was slightly lower.

Population Status And Trend Analysis

Pheasant populations in the Columbia Basin Irrigation Project have plummeted since the early 1980s. The decline has been dramatic with very few single year hints of possible slowing of the downward trend or possible recovery. In the early 1980s, hen populations at the beginning of nesting season were at a density of approximately 100/section. In the spring of 1996, hen density was approximately 10/section. Hen numbers increased for the first time since 1991 in the spring of 1997. Hen numbers increased again in 1999 (Table 4). Breeding season density of roosters has declined as has hens but at a slower rate. Density in the early 1980s was approximately 20/section. In 1996, rooster density was about 6/section. Rooster density increased to nearly 14/section in 1997, decreased to about 8/section in 1998, and increased to 13/section in 1999.

Habitat Condition And Trend

The winter of 1998-99 was considerably more mild in the Basin than normal. Little snow fell and temperatures were well above normal. Pheasant survival over-winter should have been good.

Weather conditions in the Basin during May and June was colder than normal and dry and appeared to have resulted in poor nest success and/or chick survival. Only 73 percent of hens observed during summer brood counts in 1999 were accompanied by chicks compared to 95% of hens with broods seen in 1999. Reduced production could also have occurred as a result of hen mortality during the nesting season. There is circumstantial evidence to indicate that this may be a major cause of poor production in recent years.

Loss of permanent cover (untilled land) in the irrigated part of the Basin continues. Conversion of small fields with fence rows, ditches, and other adjacent cover to large circle irrigated fields is probably the major loss of habitat. Another major loss of pheasant habitat is the construction of homes and farm buildings in the farmland. This activity has greatly accelerated in recent years.

Increased acreage of alfalfa hay has replaced potentially beneficial agricultural crops with a known high-mortality factor for pheasants, especially hens, chicks, and nests. Orchards and vineyards have also replaced potentially beneficial crops. Farming practices appear to be constantly evolving and most of the changes have a negative impact on pheasants.

Augmentation/Habitat Enhancement

The Ecosystems/Upland Wildlife Restoration Program manages and develops habitat on 17 properties with 1,038 acres acquired since 1991 and 22 previously secured properties with 449 acres in Grant and Adams counties. In addition, the program has 278 private landowner cooperators with agreements to provide some form of habitat development including shrub planting and maintenance, vegetation control, guzzlers, feeders, and food plots.

In 1998, 4350 game farm rooster pheasants were released during September through November in Grant and Adams Counties. The intent of these releases was to provide increased hunting opportunity.

Management Conclusions

Pheasant populations in the Columbia Basin have declined dramatically in recent years and remain at very low levels compared to the past. The specific cause(s) of the decline is unknown. Speculation as to the reason(s) for the decline is frequently voiced by the lay public and wildlife managers alike. In reality, very little objective information specific to identification of potential causes of the decline is available.

If the pheasant is to continue to be the primary upland game species hunted in the Columbia Basin, there is a need to conduct research to identify the cause(s) of the decline, or more specifically, the current barriers to population increase. If the barrier(s) to population increase is identified, decisions concerning needed management can be made.

Table 5. Pheasant production index for the Columbia Basin Irrigation Project, 1989-1999.

	Per Day			Percent	
Year	Broods	Chicks	Total Pheasants	Juveniles	Hens with Brood
1989	5.0	26.4	32.0	83	78
1990	3.2	12.1	18.6	65	63
1991	1.1	3.9	7.0	56	58
1992	2.5	11.3	14.9	77	81
1993	1.8	7.9	10.5	75	94
1994	3.0	13.3	16.9	79	94
1995	1.4	6.4	9.6	66	71
1996	2.8	13.6	16.6	82	89
1997	1.2	6.3	8.5	74	62
1998	3.8	21.8	25.4	86	95
1999	1.4	4.4	6.7	66	73

Species

Pheasant **Yakima River Basin**

Prepared by: Jeff Bernatowicz, Wildlife Biologist

Population Objectives/guidelines

The primary objective of pheasant management is to maintain well distributed populations and to provide appropriate levels of hunting recreation. Statewide objectives were last set in the 1988 Upland Bird Plan. The objectives in 1988 were: (1) Increase populations above the 1980-85 average level (as measured by population indices). The 1984-85 (no surveys prior to 1984) Region 3 index was 36.9 birds per day. (2) Increase hunter recreation days to 338,000 statewide. In 1986, there were 117,630 recreation days in Region 3. (3) Maintain the statewide harvest at the 1980-85 average level of 371,000 birds per year with a success rate of 4.5 birds per hunter per year. The 1980-85 harvest average in Region 3 was 100,000.

Hunting Seasons And Harvest Trends

Hunter numbers decreased 28% and were 20% below the 10-year average in 1998 (Figure 1). Effort was 61,796 recreation days, 47% below the goal. Harvest reportedly decreased 20% (36,781 total), and was 63% below the goal of 100,000. Hunter success (birds per day) increased 36% and was 13% above the ten year average.

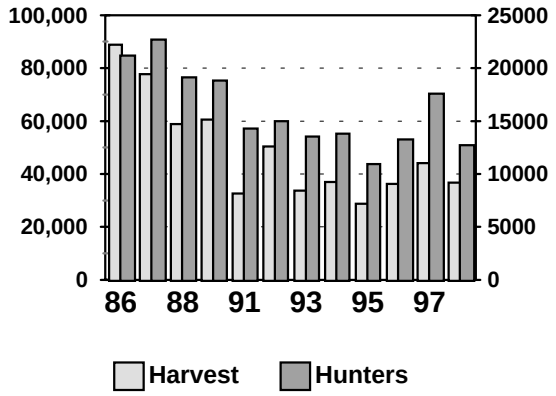

Figure 1. Pheasant harvest and number of hunters for Region 3.

Surveys

Brood count survey routes are driven by a lone observer at <20 mph along 20 miles of low-moderate traffic roads. The index is the average birds seen per transect per day.

The brood count index (birds per day) of 10.9 was up 24% from 1997 and 71% below the objective of 36.9 (Figure 2). Traffic is also becoming an issue on some routes. Vehicles along survey routes are probably flushing birds out of view of the survey vehicle. The West Franklin route was dropped because recent observers found the route dangerous and biased by traffic.

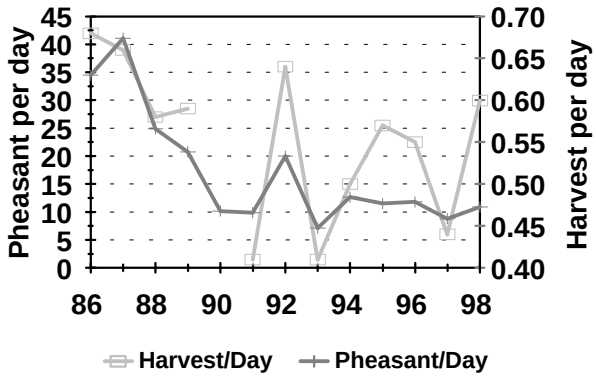

Figure 2. Pheasant seen per day of driving surveys .vs hunter success for Region 3.

Population Status And Trend Analysis

Harvest and survey data indicated the population has declined dramatically since 1986 (Figures 1 and 2). The five year average brood index and harvest have dropped 70% (37 vs. 11.1) and 53% (76,636 vs 36,574) for 1984-88 vs 1994-98. The five-year average hunter success has dropped 8% (0.58 vs 0.53). The reason for the decline is habitat loss. The conversion from row crops and idle land to orchard and vineyard has been dramatic. Ground cover along some brood routes now appears to be >90% cultivated. In areas with good habitat, pheasant populations are still healthy. Two brood routes (in good habitat) accounted for 65% of the birds observed and an index of 39 birds per day. The remaining nine routes had an index of 4.6. The downward trend is likely to continue as habitat is further degraded.

Habitat Condition And Trend

Pheasant habitat has declined for decades and continues to do so. The main degradation of habitat has been clean farming and conversion from annual crops (sugar beets, cereal grains) to perennial crops (orchards, vineyards, hops). Clean farming practices typically remove all cover bordering fields, riparian areas, and irrigation canals. Herbicides and pesticides are heavily used to keep the crops free of "weeds" and insects. Forbs, "weed" seeds, and insects are critical to the survival of pheasants. Removal or depression of the insect prey base has an especially deleterious effect on pheasant chick survival. Perennial crops do not provide enough year round food or cover. Vineyards and hop farms are typically kept free of ground cover while orchards are mowed.

The trend is likely to continue in the short term. One of the last strongholds for pheasant in Region 3 is the lower Yakima

Valley. The irrigation system is antiquated with numerous unlined, open canals. The canals are often surrounded by vegetation and wetlands created by leaks. The canals will be lined and piped in the near future. Pheasant habitat will likely deteriorate during the construction as canal bank vegetation is removed. The long term implications are unknown. If the project results in less open water, riparian vegetation, and idle land the pheasant population decline will continue.

There may be some positive change because of the economics of hop farming. Hop fields suffered from a fungal disease for the first time in 1997. The disease is persistent, costly to control, and global markets are saturated with hops. Hops, one of the worst crops for pheasant, may be converted in the future.

Augmentation/habitat Enhancement

The number of harvestable birds was augmented in 1998 with the stocking of 5,500 farm raised roosters. While the stocking did not enhance the wild population, it probably helps maintain hunter interest.

Several acquisitions in recent years have been completed by the Washington Department of Fish and Wildlife in Region 3. The acquired lands contain pheasant habitat and/or the opportunity to enhance populations. The Upland Wildlife Restoration Program and Pheasants Forever have also been actively working to enhance habitat for pheasants. Tree, shrub, food and nesting cover plots are being established throughout the region. These activities should help to moderate pheasant population, hunter use and harvest level declines over time. Acquired and developed lands are not presently keeping pace with habitat loss.

Management Conclusions

The pheasant population decline in Region 3 is likely to continue in the near future. Enhancements on state lands and private through the Upland Restoration Program and CRP are not likely to offset the large scale habitat degradation. The goals set in 1988 are not likely to be reached. Stocking pheasant, although unpalatable to wild bird enthusiasts, does maintain the interest in pheasant hunting for some people. To meet the goals of various factions of the hunting public, birds should not be stocked where there is good habitat and wild production.

Species

Chukar **Snake River Basin**

Prepared by: Pat Fowler, District Wildlife Biologist

Population Objectives/guidelines

The primary objective of chukar management is to maintain well distributed populations and to provide appropriate levels of hunting recreation. Statewide objectives were last set in the 1988 Upland Bird Plan. The objectives in 1988 were: (1) Increase populations above the 1980-85 average level (as measured by population indices). (2) Increase hunter recreation days to 338,000 statewide. (3) Maintain the statewide harvest at the 1980-85 average level of 371,000 birds per year with a success rate of 4.5 birds per hunter per year.

Hunting Seasons And Harvest Trends

The chukar hunting season has varied in length over the years. In the 1960's the chukar season was split into early and general seasons. The early season started in mid-late September and ran into early October. The general chukar season started at noon on the opening day of the general upland bird season, usually mid October, and ran to early-mid January. In 1997, the early-general season was eliminated in favor a standardized season running from October 1 to January 11, 1998; 103 days.

The bag limit for chukar was reduced after the population crash in the early 1980's, from 10 birds\day to six.

The chukar harvest in the Snake River Basin peaked in the 1970s at 60,790 birds\year, but declined at a steady rate during the 1980s and 1990's (Table 1, Figure 1). During the 1980's, the annual chukar harvest ranged from 7,535 to 93,680 birds, and averaged 35,104 birds\yr, a decline of 42% from the average harvest in the 1970's. The annual chukar harvest declined even more in the 1990's, ranging from 4,433 to 21,599 birds, and averaging 9,802 birds\yr., a decline of 84% compared to the 1970's, and 72% compared to the 1980's (Figure 2).

Table 1. Region 1 chukar harvest summary 1991-98

Year	1991	1992	1993	1994	1995	1996	1997	1998
Asotin	12310	5096	3734	4742	2790	6781	5111	5006
Columbia	730	949	227	439	374	695	561	273
Garfield	1861	1149	470	1387	187	864	2057	2648
Whitman	6698	2914	1461	994	1082	1531	1075	2319

Hunters harvested 10,435 chukars in Region One during the 1998 season, an increase of 16% over 1997, and 22% above the 1991-1997 average (8,309).

Hunter participation in chukar hunting also peaked in the late 1970's and early 1980's. After the population crash in 1982, hunter participation started a steady downward trend.

Surveys

Aerial surveys were started in 1987 and conducted annually through 1997. However, surveys were not conducted in 1998 or 1999 due to budget cuts.. Although the aerial survey was not conducted in 1999, Idaho F & G conducted their annual survey

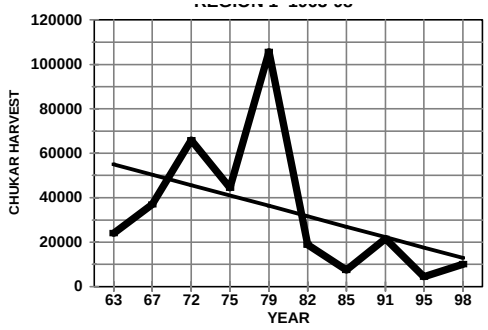

Figure 1. Chukar Harvest Trend 1963-98, Region One

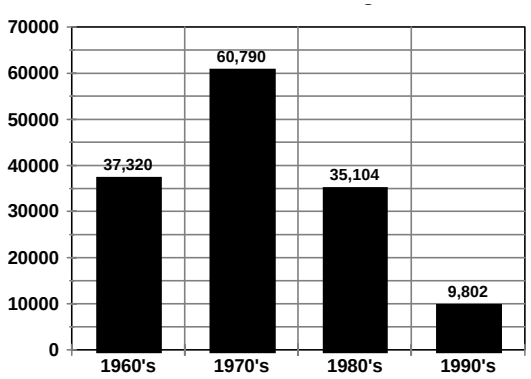

Figure 2. Chukar Harvest Trend - Region 1. Asotin, Walla, Columbia, Garfield, Whitman counties.

along the Snake and Salmon Rivers, and densities appeared to be comparable to 1998. However, results from aerial surveys in Idaho may not correspond with the current chukar population in Washington.

Population Status And Trend Analysis

Chukar populations have declined dramatically since the early 1980's. The reason for the sudden and dramatic decline that occurred in 1982 is unknown. Chukar populations have been plagued by habitat deterioration due to the spread of noxious weeds. Nesting chukar have been exposed to poor nesting conditions for many years consisting of drought or wet, cold weather during the nesting season. Both conditions contribute to poor nesting success and survival of young. Annual chukar population levels are highly dependent on the success of annual production.

The 1999 nesting season was plagued by cooler than normal temperatures, and some rain. However, chukar

production appears to have faired much better than pheasant production. Field observations indicate production levels slightly below 1998, which should provide for fair to good hunting during the 1999 season.

Habitat Condition And Trend

Habitat conditions for chukar partridge are deteriorating in southeast Washington due to the expansion of yellow-star thistle and other noxious weeds. Although most counties are making an attempt to control yellow-star thistle, the acreage impacted by this species is increasing annually. Poor land management practices, current and historical, are contributing greatly to this problem. Chukar partridge thrive on lands that tend to be over-grazed and infested with cheatgrass (*Bromus tectorum*). However, the conditions that promote cheatgrass also provide the conditions needed for yellow-star thistle. Cheatgrass is a staple in the chukar diet in spring and fall, and the availability of cheatgrass can have a significant impact on the chukar population. As the acreage of yellow-star thistle increases in the Snake River Basin, the availability of cheatgrass is declining significantly. This may be one of the reasons chukar populations have failed to reach historical levels since 1982.

Chukar densities in areas that contained good populations in the late 1980's and early 1990's have declined dramatically over the last six years. The greatest population declines are in areas infested with large acreages of yellow-star thistle. Hopefully, funding for aerial surveys will be restored in the near future, because it is a valuable tool for monitoring population trends and distribution.

Augmentation/habitat Enhancement

Weed control programs have been implemented by the various counties within the Snake River Basin. These programs consist of aerial application of herbicide, with some biological control agents. However, these programs have failed to halt the spread of yellow-star thistle.

Management Conclusions

Chukar populations are still quite low compared to the high levels experienced during the 1970's and early 1980's. Habitat deterioration and poor nesting conditions have prevented the chukar population from increasing to historical levels.

The future outlook for the chukar in southeast Washington is poor. If the expansion of yellow-star thistle and other noxious weeds is not halted or reversed, chukar populations will continue to decline, and will have little chance of returning to historic population levels that occurred in the 1970's.

Species

Chukar **Upper Columbia Basin**

Prepared by: John Musser Biologist, District Wildlife Biologist

Population Objectives/guidelines

Management objectives for chukar are to maintain healthy,chukar populations in all suitable habitat within the region; and provide maximum recreational opportunities consistent with population management objectives.

Hunting Seasons And Harvest Trends

For the last 2 years, chukar season has opened October 1 and ran through the second weekend in January. Bag and possession limit for chukar was 6 and 18. These season and limit regulations allow more recreation for chukar hunters than was available previously.

About 40 percent of Washington's chukar harvest comes from Region 2. Region 2 chukar harvest has varied from about 5,000 to 17,000 birds per year since 1991. Chukar harvest in 1998 was 10,900 birds (Figure 1).

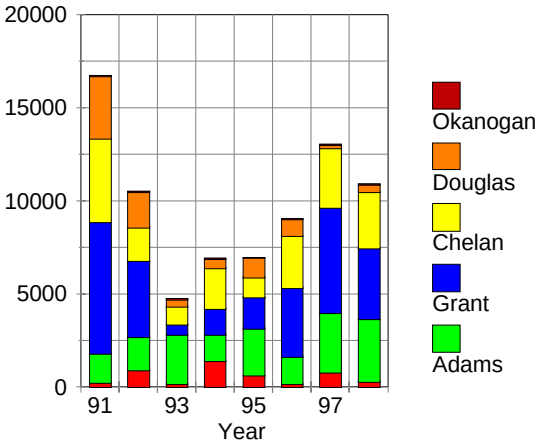

Figure 1. Chukar harvest in Region 2 by County.

Since 1991, number of chukar hunters using Region 2 has varied from about 2200 to 5000. Number of hunter days follow the same general pattern as harvest and number of hunters. Number of hunters and hunter days are related to abundance of birds, however there is less variation in hunters than in hunter days. Apparently about half the chukar hunters hunt every year regardless of abundance. In good years these regular hunters hunt more often. Remaining chukar hunters only hunt when chukar are relatively abundant (Figure 2).

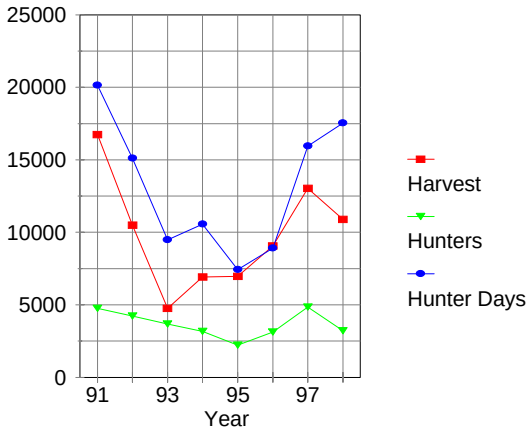

Figure 2. Region 2 Chukar harvest, hunters and hunter days.

Surveys

In Region 2, we believe helicopter surveys provided our most reliable and efficient method of monitoring chukar populations. These aerial surveys were discontinued after 1997 because of budget cuts. As a substitute, we have driven 3 routes (Colockum - Tarpiscan, Swakane - Nahahum and Chelan Butte) in July and early August to monitor chukar populations. Each route is approximately 20 miles long. Fish and Wildlife personnel as well as volunteers are used to count total chukar seen while driving these routes.

During July and August, 1999, the 3 survey routes were each driven 3 times. An average of 3.4 chukar were seen on each route driven. In 1998, average number of chukar per route was 10.8.

Population Status And Trend Analysis

The number of chukar seen this year on survey routes as well as incidental observations suggest poor production of chukar throughout Region 2. This year's harvest, hunters and hunter days will probably drop as a result of relatively low chukar population.

Habitat Condition And Trend

Chukar habitat is relatively stable in Region 2.

Management Conclusions

We feel currently used survey methods are inadequate. Although expensive, aerial surveys efficiently cover expansive chukar habitat and may provide more reliable indicators of chukar population status. We recommend funding aerial chukar surveys in Region 2.

Species

Chukar **Lower Columbia and Yakima River Basins**

Prepared by: Jeff Bernatowicz, Wildlife Biologist

Population Objectives/guidelines

The objective of chukar management is to increase the population to or beyond its historic levels. Harvest management is designed to provide maximum recreational opportunity without impacting populations.

Hunting Seasons And Harvest Trends

The mailed hunter questionnaire indicates hunter numbers in 1998 decreased 36% and were 30% below the 10 year average in Region 3 (Figure 1). However, the results of the questionnaire are debatable. The number of chukar hunters registering at the 2 most popular areas in Yakima County (Yakima Canyon .and Yakima Training Center) did not significantly change from 1997 to 1998.

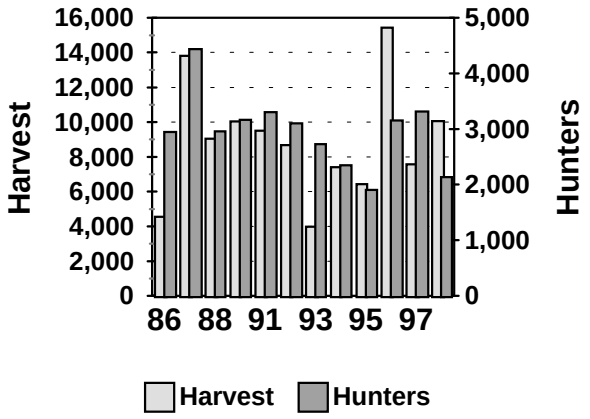

Figure 1. Chukar harvest and number of hunters for Region 3.

Total harvest has been cyclic and was 8% above the 10 year average in 1998. Chukar populations declined after the winter of 1996-97, but rebounded in 1998. Harvest is not believed to effect chukar populations. The steep rocky terrain chukar inhabit make it unlikely populations will be over harvested, especially with the relatively low hunting pressure. Some hunters have expressed concern that the October 1st opening may result in over harvest of local populations if the birds are concentrated near water sources. In 1998, October was warm and dry. Harvest success in the Yakima Canyon averaged 0.87 and 0.76 birds/hunter day for the first 10 days of October. Success averaged 1.07, 1.07 and 1.76 birds/hunter day for November, December and January. In the Yakima Canyon, it appears that the birds are least vulnerable during the early portion of the year.

Surveys

Surveys are flown in a Hiller 12 E helicopter with the pilot in the middle and observers on either side. The surveys are flown as low (<300 feet) and close to the terrain as the pilot and observers feel comfortable. Surveys along the Columbia follow canyon bottoms. In the Yakima Canyon, most of the route traverses steep, rocky terrain. The routes have been modified depending on funding. Surveys are conducted between August 15th and September 15th, preferably after a period of hot dry weather. Final tallies include all partridge as chukar because of difficulties in separating by species during the survey.

The number of birds per square mile increased in 1998 (Figure 2) and was 28% above the 10 year average. The density of birds along the Columbia River was higher than in the Yakima Canyon (212 vs 65 birds per square mile).

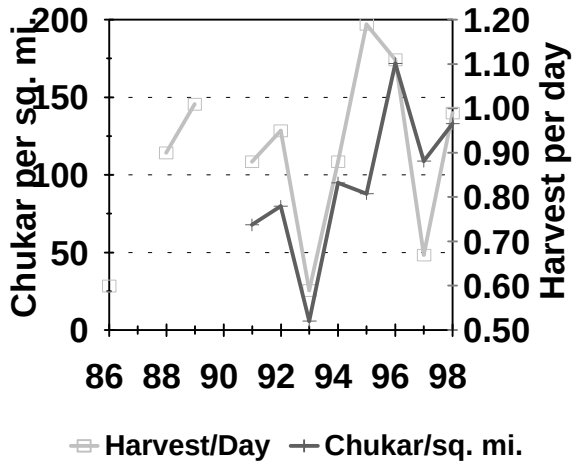

Figure 2. Chukar seen per square mile of helicopter surveys .vs hunter success for Region 3.

Population Status And Trend Analysis

Prior to 1991, the only indicator of population was harvest. Annual harvest in Region 3 indicate the chukar population peaked in 1980 and crashed in 1983. Harvest continued to decline until 1986. In 1986, hunter success estimates became available and the population was probably at a low with hunter success only 0.64 birds/day (Figure 2). The chukar population increased from 1986 to 1989 with hunter success rising to 1.01 birds/day. Harvest (Figure 1), hunter success and aerial surveys (Figure 2) indicate the chukar population has fluctuated dramatically.

Chukar populations cycles are related to weather. Consistent snow cover during the winters or 1992-93 and 1996-97 lead to rapid declines. Chukar populations have

rebounded quickly in recent years because of favorable nesting and brood rearing conditions. Chukar habitat has not changed significantly and hunting mortality does not seem to be a factor.

Habitat Condition And Trend

Chukar generally inhabit arid areas with steep slopes, deep valleys, and rocky outcrops. The topography, combined with shallow soils, prohibit extensive agriculture or development. In Region 3, the Washington Department of Fish and Wildlife (WDFW) and Department of Defense lands (DOD) own the majority of chukar habitat. WDFW lands have not changed significantly in the last decade. In recent years the DOD has excluded cattle grazing. Sections of both WDFW and DOD lands have burned in the last few years. The fires did not appear to significantly impact chukar habitat.

Augmentation/habitat Enhancement

An experimental release of 150 wild chukar from Nevada was made in the Yakima Canyon in August 1997. Five-hundred game farm birds were raised and released by a local sporting club in 1998. All birds were banded and voluntary hunter registration boxes installed. Band returns indicate a minimum of 30% and 10% of the Nevada birds survived until fall 1997 and 1998. A minimum of 50% of the game farm birds survived until fall 1998. The released birds made up 22% of the harvest in 1998-99 season and increased hunter success from 0.81 to 1.03 birds/hunter day. The number of hunters registering , increased in the release area from 136 to 288. Five-hundred more game farm birds were released in August 1999.

Management Conclusions

The chukar population in Region 3 appears healthy. The current challenge is to increase the hunter base. Limited information from the Yakima Canyon indicates releasing chukar may increase hunter numbers and success. Upland bird hunters also lack information on where and how to hunt. Providing information through a pamphlet and emphasizing chukar at sporting shows is suggested. Chukar should also be included as legal game for the early youth season.

Species

Quail **Snake River Basin**

Prepared by: Pat Fowler, District Wildlife Biologist

Population Objectives/guidelines

Management objectives for Valley Quail are to maintain healthy, chukar populations in all suitable habitat within the region; and provide maximum recreational opportunities consistent with population management objectives.

Hunting Seasons And Harvest Trends

The hunting season for Valley quail runs from mid October to early January, 87 days. In addition, a juvenile-senior season runs for two days in late September.

The bag limit for quail is 10 birds/day, with 30 in possession.

The season on Mountain quail is closed due to extremely low population levels.

The valley quail harvest has declined dramatically compared to the 1960's and 1970's (Figure 1). The regional quail harvest averaged 92,787 birds/year during the 1960's, declining 22% to 72,314 birds/year during 1970's, and crashing 73% to 25,000 birds/year during the 1980's and 1990's (Figure 1). The 1998 harvest was 27,263 birds, 27% above the 1990's average of 21,398 quail.

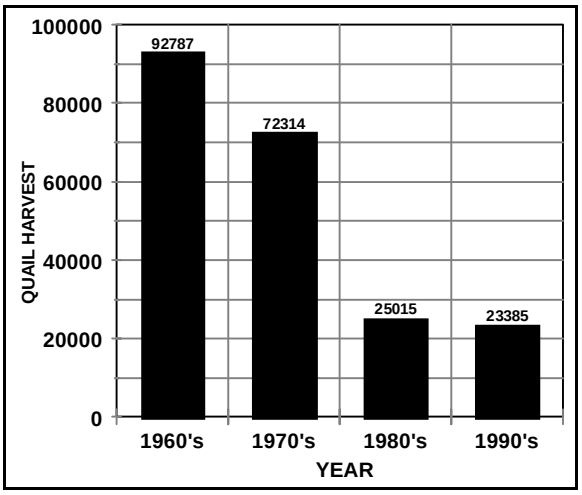

Figure 1. Decade average quail harvest, Region 1

Population Status And Trend Analysis

Valley quail populations have declined significantly based on harvest data (Figure 2).

Quail production data has not been tabulated for approximately ten years, due to the exclusion of sight frequency data, and a relatively low priority to establish new survey routes. However, quail production in 1999 appears to be average, and significantly higher than for other species of upland birds.

Quail nesting success and production was probably impacted by the cool, wet weather that occurred during May and early June. In 1999, precipitation was 2 inches less than normal by the end of August, so late nesting quail experienced better chick survival. Late summer observations indicate valley quail may provide the best hunting opportunity among the regularly hunted upland bird species in the Snake River Basin.

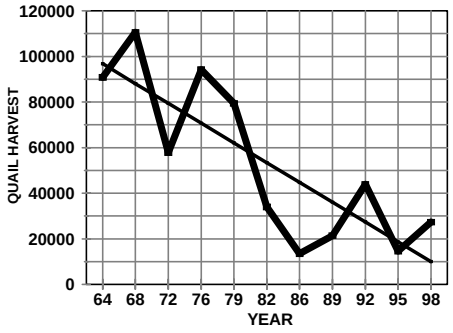

Figure 2. Quail harvest trend 1964-98, Region 1

Habitat Condition And Trend

Quail habitat is suffering the same fate as habitat for other upland bird species. Land development and agricultural practices have resulted in a major decline in available habitat. The spread of noxious weeds also threatens existing habitat.

However, habitat for upland birds has improved with the advent of the Conservation Reserve Program (CRP). After current CRP acreage expired, farmers had to reapply for CRP acreage in 1997 and many requests were rejected. The second sign-up period resulted in a significant mount of acreage being accepted into the program. In the major bird areas of the southeast and central districts of Region 1, a total of 217,171 acres of CRP are enrolled under the current program. This program will provide large acreages of suitable habitat near agricultural crop lands, enhancing habitat conditions for upland birds over the next 8-9 years.

Augmentation/habitat Enhancement

The Upland Habitat Restoration Program has developed 5,849 acres of upland bird habitat in the southeast and central districts. The southeast district has developed 5,049 acres of habitat over the last five years consisting of grass mixtures for nesting cover, plus the planting of 58,584 trees and shrubs. The central district has developed 800 acres of upland bird habitat, but have planted approximately 280,000 trees and shrubs. In addition, 64 guzzlers were installed in 1999.

New acreage signed up under the CRP program will be planted with seed mixtures developed to enhance habitat for wildlife. Farmers will be required to re-plant 50% of the existing CRP acreage with the new wildlife mixtures.

Management Conclusions

Valley quail populations will not increase significantly unless the loss of habitat is reversed. The planting of large acreages of CRP habitat may allow quail populations to expand slightly over the next ten years.

Mountain quail populations have declined to extremely low levels, even in areas where habitat still exists. Research is needed to determine the factors responsible for the dramatic decline in Mountain quail populations. Until those factors are identified, it will be difficult, if not impossible, to significantly increase Mountain quail populations.

Species

Valley (California) Quail

Columbia Basin

Prepared by: Jim Tabor, District Wildlife Biologist

Population Objectives/guidelines

The population objective for California quail in the Columbia Basin is to maintain viable populations that will provide hunting opportunity and harvest.

Hunting Seasons And Harvest Trends

Quail hunting seasons and bag limits have remained relatively constant in recent years. The season has run from the first Saturday after October 10 to early January with a daily bag limit of 10 quail. The only variation has been a slight difference (up to 8 days) in the closing date annually.

During the 1998 season, 28% of Washington's quail hunters hunted in Region 2. In 1998, 4291 hunters hunted quail in the Region, this was a 41 percent decrease from 1997 and a 15 percent decrease from the 1992-1997 average of 5056 (Table 1). The number of quail hunters in the region declined each year from 1992 to 1995, increased slightly in 1996, increased dramatically in 1997, and declined dramatically in 1998 (Table 1).

Table 1. Number of quail hunters in Region 2, 1992-1998.

Year	Adams	Douglas	Chelan	Grant	Okanogan	Total
1992	981	1184	1101	1241	1290	5797
1993	517	893	851	1583	986	4830
1994	579	1007	966	1635	980	4735
1995	556	838	654	1256	761	3391
1996	487	823	1144	1279	957	4312
1997	887	1542	1736	2063	1043	7271
1998	663	995	1015	1537	741	4291
Mean	667	1040	1067	1513	965	4947

During the 1998 seasons, 27% of the statewide quail harvest occurred in Region 2. Harvest estimates for quail in the region were examined from 1992 through 1998. The number of quail harvested during this 7-year period ranged from a high of 41,706 in 1997 to a low of 14,292 in 1993 (Table 2). The 1998 harvest of 29,365 quail decreased 30 percent from that of 1997 and was 7% above the 1992-1997 average of 27,563 birds. Okanogan and Chelan Counties have yielded the largest harvest in the region and Adams County the smallest. Chelan county has also had the greatest annual variation in harvest.

Table 2. Number of quail harvested in Region 2, 1992-1998.

Year	Adams	Douglas	Chelan	Grant	Okanogan	Total
1992	4024	7881	7123	3182	11653	33863
1993	839	2348	2142	3856	5107	14292
1994	1478	7352	6733	4056	6613	26232
1995	1261	4025	4433	4359	6585	20663
1996	2261	4784	8682	4558	8334	28619
1997	2285	7353	13872	4603	8297	41706
1998	2005	6990	7009	8564	4797	29365
Mean	2021	5815	7142	4740	7341	27820

Surveys

A summer adult population index and a production index for California quail are developed annually. The population index is useful in determining population trends. The production index is a good predictor of hunting prospects for the hunting season and may provide information useful in determining reasons for annual changes in population size.

Both the adult population index and the production index for 1999 were derived from surveys of 10 permanently established brood routes in representative quail habitat of Adams (2 routes), Douglas (3 routes), and Okanogan (5 routes) Counties. The number of routes in Okanogan County was reduced from 6 surveyed in 1998.

The summer adult population index is the number of adult quail seen per observation day.The production index is the number of chicks seen per observation day.This report contains results of the 1999 brood route surveys.

The 1999 index to the adult summer population size indicated a 5 percent decrease compared to that of 1998 and a 25 percent increase compared to the 1989-1998 average (Table 3).

Table 3. California quail summer adult population index and production index for Region 2, 1989-1999.

Year	Broods/ Obs. Day	Chicks/ Obs. Day	Total Quail/ Obs. Day	Percent Adults with Brood	Adults/ Obs. Day
1989	3.5	34.5	45.5	53	11.0
1990	4.5	33.2	47.0	50	16.8
1991	3.0	24.2	35.3	47	11.2
1992	3.1	23.1	31.9	56	8.9
1993	1.7	14.9	20.4	56	5.4
1994	6.3	54.0	69.0	77	15.0
1995	3.7	30.7	43.6	52	12.9
1996	3.2	30.3	40.1	58	9.9
1997	3.8	28.5	40.8	54	12.4
1998	5.6	49.4	66.2	70	16.8
1999	5.1	45.8	60.2	65	16.0
Mean	4.0	33.5	45.5	58	12.4

The production index for 1999 as measured by the number of chicks seen /observation day on the 10 brood routes was 7% below that of 1998 and 34% above the 1989-1998 average (Table 3). The number of chicks produced in Region 2 was slightly lower than that of 1998. The decreased production was likely due to the slight decrease in number of breeding pairs. Production was only 15% below that of the exceptional high of 1994.

Population Status And Trend Analysis

No long-term population trend in the Region is apparent from existing data of adult quail seen on summer routes. What is apparent is that major annual changes in population size are common. Major annual declines usually follow severe winters with persistent snow cover combined with poor production the summer before the harsh winter.

Habitat Condition And Trend

The winter of 1998-99 was mild in the Columbia Basin. The mild temperature and lack of snow cover were conducive to excellent over-winter survival. The adult population index in summer of 1999 showed a very slight decrease compared to that of 1998.

Most hunted populations of quail in the region occur in shrub steppe and riparian habitats. Additionally, a significant percentage of the quail population occurs in cities and towns. Few quail occur in the irrigated farmland area of the Columbia Basin. In general, quail habitat in the region is relatively stable. Changes in habitat quality appear to result primarily from amount and timing of precipitation.

Augmentation/Habitat Enhancement

The Upland Wildlife Restoration (UWR) program in Region 2 normally traps and re-locates quail annually. Quail are usually captured in cities of Okanogan County and released at acquisition sites and other habitat development areas in the Columbia Basin. In the winter of 1998-99, the UWR program did not trap quail because the mild weather was not conducive to effective trapping.

Enhancement of habitat for quail in Region 2 is conducted by the UWR program on WDFW properties and on private land through cooperative agreements and by Wildlife Area managers on WA lands. In addition to vegetation management for food and cover, management activities usually include feeders for providing grain feed during winter and often include development of water sources including guzzlers. In 1998-99, the UWR program conducted habitat enhancement on 37 WDFW properties with 1717 acres and had 148 private landowner cooperators with agreements to provide some form of habitat development on their private land.

During the mild winter of 1998-99, a much smaller than normal amount of wheat was provided to landowners and concerned citizens in Region 2 requesting grain for feeding quail.

Management Conclusions

The Valley Quail is a major upland game bird species in Region 2 and is also a species of major interest to wildlife viewers. Management activities in the region will continue to address the importance of quail by maintaining and developing habitat, relocating birds to vacant suitable habitat, and feeding during winter.

Species

Valley Quail **Lower Columbia and Yakima River Basins**

Prepared by: Jeff Bernatowicz, Wildlife Biologist

Population Objectives/guidelines

The objective of Valley quail are to maintain healthy, quail populations in all suitable habitat within the region; and provide maximum recreational opportunities consistent with population management objectives.

Hunting Seasons And Harvest Trends

Effort and harvest were 36% and 10% below 1997 (Figure 1), but were comparable with the 10-year average. Hunter success was 40% and 30% above 1997 and the 10 year average.

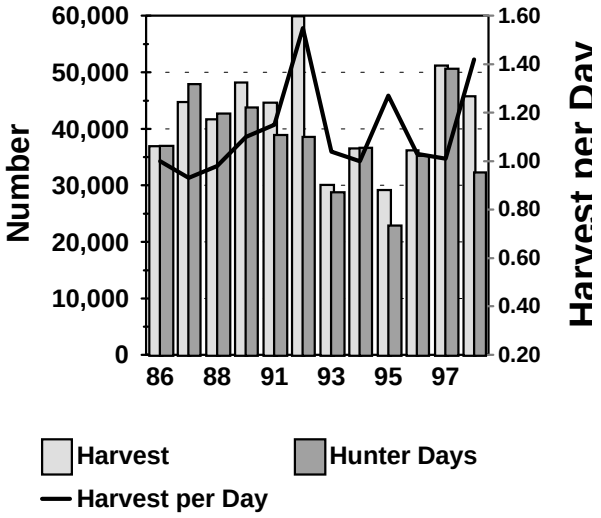

Figure 1. Quail harvest, hunter days, and harvest per hunter day for Region 3.

Surveys

Brood count survey routes are driven by a lone observer at <20 mph along 20 miles of low-moderate traffic roads. The index is the average birds seen per transect per day. Prior to 1996, quail were recorded secondarily to pheasant and some observers may not have adequately recorded quail.

Results (quail per day) were the second highest since 1983 (Figure 2). The distribution in 1998 was heavily weighted toward areas where quail feed through the winter (urban and state Wildlife Recreation Areas). Two (Sunnyside and Wenas) of the 10 routes accounted for 73% of all quail surveyed.

Population Status And Trend Analysis

Quail populations are difficult to index. Surveys conducted from 1947-76 indicate the quail population declined dramatically during the 1960s and 70s. The perception of biologists and hunters supported the survey data, despite the fact that harvest increased from 51,000 to 129,770 during the 1970s. Hunter success and brood counts indicate the population has been stable or increasing the last 10 years (Figure 1 and Figure 2).

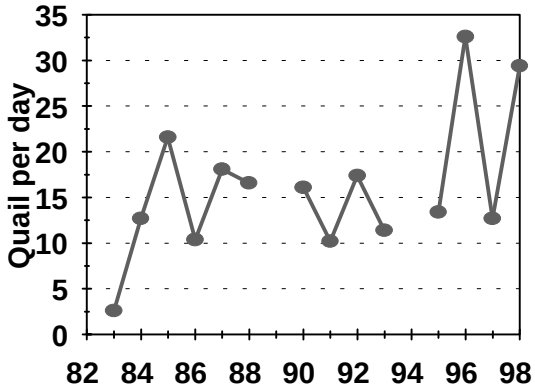

Figure 2. Quail seen per day of surveys for Region 3

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Habitat Condition And Trend

Long term habitat quality for quail has declined for decades. The highest quail densities are typically found in brushy riparian areas. The main degradation has been farming practices which remove all cover bordering fields, riparian areas, and irrigation canals. Herbicides and pesticides are heavily used to keep the crops free of "weeds" and insects. Removal or depression of the insect prey base has an especially deleterious effect on quail chick survival.

A relatively unknown impact has been urbanization. Quail have adapted well to the irrigated and landscaped neighborhoods. Residents often see the quail as semi-pets and feed them year round.

Augmentation/habitat Enhancement

An abbreviated effort was made to trap urban quail to augment populations reduced by the winter of 1996-97. Most residents did not want "their" quail being trapped and moved. When trapping attempts were made the birds were uncooperative because of a lack of snow and mild weather.

Management Recommendations

An emphasis should be placed on quail management in state WRAs, especially where pheasant are stocked. After hard winters (such as 1996-97) or heavy harvest, trapping quail from urban areas and transplanting to WRAs is recommended. Managing vegetation for thick "refuge" areas should also be considered.

Species

Forest Grouse **Statewide**

Prepared by: **Dave Ware, Upland Game Section Manager**
Clifford G. Rice, Game Surveys Coordinator
Dana L. Base, Wildlife Biologist
Jeff Bernatowicz, Wildlife Biologist
Mike Davison, District Wildlife Biologist
Jeff Lewis, Survey Wildlife Biologist
H. M. Zahn, District Wildlife Biologist

Population Objectives/Guidelines

Forest grouse in Washington include blue and ruffed grouse which occur throughout the forested lands in Washington and spruce grouse which are closely tied to higher elevation spruce/fir habitats. Management objectives are to sustain well distributed populations and provide appropriate levels of harvest. Harvest levels of forest grouse are generally tied to annual production and are closely dependant on weather conditions. Current population levels are considered healthy and sufficient to meet hunter demand.

Hunting Seasons and Harvest Trends

The statewide harvest questionnaire is the main technique currently used to monitor long term population trends. The questionnaire currently provides an adequate sample of blue and ruffed grouse hunters.

The current Sept. 1 to Dec. 31 hunting season structure has been in place since 1987. The daily bag limit of 3 of any of the 3 species has not changed since 1952. Hunter numbers have remained fairly stable over the past ten years.

Forest grouse harvest over the past ten years has been stable, although it fluctuates annually depending on production. The fluctuations appear to be similar for all three species.

Long term harvest estimates indicate a decline from the 1960's and '70's to the 1990's (Fig. 1). Most of that apparent decline can be attributed to a change in the method used to collect harvest data in 1984. It is more likely that harvest levels have been relatively stable for the past 30 years.

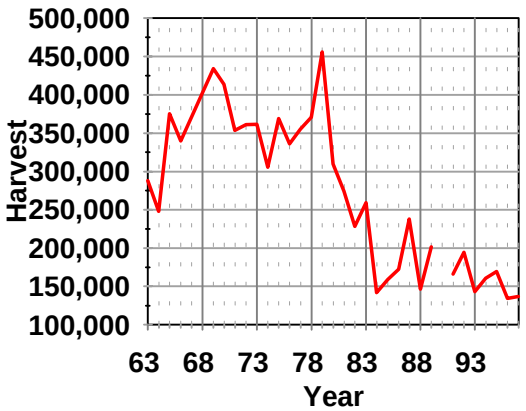

Figure 1. Long term trends in harvest of forest grouse from 1963 through 1998.

The number of hunters pursuing forest grouse has remained fairly stable in Region 1 at around 12,000 since 1991. Estimated harvest of forest grouse has varied between approximately 40,000 and 55,000 since 1991 (Figure 2). In 1998 an estimated 51,543 forest grouse were bagged by hunters.

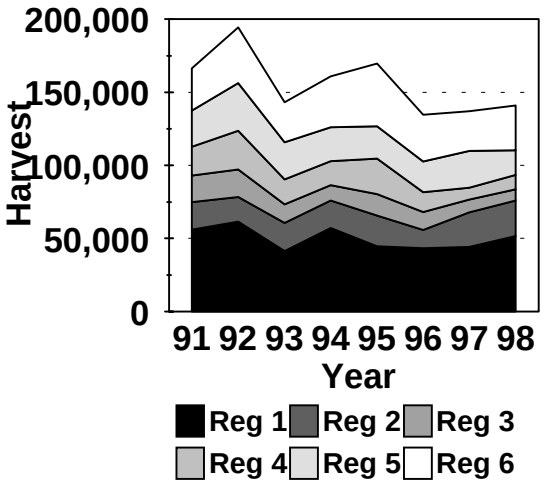

Figure 2. Recent forest grouse harvest by Region (1991 through 1997).

Staff at the Little Pend Oreille National Wildlife Refuge collected 139 grouse wings from hunters in 1998, double the number collected in 1997. Last years wings came from 135 Ruffed Grouse, 1 Blue Grouse, and 3 Spruce Grouse. Once again harvested Ruffed Grouse were overwhelmingly juveniles (108 juveniles versus 28 adults and 1 unknown age). The one Blue Grouse wing came from an adult. Spruce Grouse included 2 adults and 1 juvenile.

The number of grouse hunters had remained stable in Region 3 at around 6,600 hunters since 1994. The 10 year average is 7,600 hunters. The decline in 1998 (4068 hunters) was probably due to a change in the questionnaire. Previously,

hunters were tallied by species of grouse they hunted. Hunters pursuing each of the 3 species of grouse were then added together. Thus, a hunter pursuing both blue and ruffed grouse was counted twice. In 1998, all grouse were lumped for the questionnaire.

Harvest has cycled between 5,000 and 12,000 over the last 10 years in Region 3 (Figure 2). In 1998, the grouse harvest (7,786) was slightly below the 10 year average (8,224). Harvest success for forest grouse in Region 3 is the lowest of any upland bird. Success in 1998 was 0.33 birds per hunter.

Harvest levels for both ruffed and blue grouse in Skagit and Whatcom counties has declined slightly from historical levels. For the five year period 1984-88 an average of 6,443 (ruffed grouse) and 2,286 (blue grouse) were harvested in the combined areas of Skagit and Whatcom counties. During the last five years (1993-1997)the mean harvest level for ruffed grouse was 5,683 birds with a mean harvest for blue grouse of 1,844 birds. These numbers represent a decrease in harvest of 11.8% for ruffed grouse and 19.3% for blue grouse.

Increased road closures throughout Whatcom and Skagit counties have significantly limited hunting access the last two seasons in contrast to historical times. Considering that the majority of grouse hunters in western Washington " road hunt " as opposed to hiking, the impact of restricted road access on hunter participation is easily explained. However, it is the general consensus of hunters interviewed that harvest success behind locked gates is higher due to significantly lower disturbance levels. 1998 grouse harvest levels in Whatcom and Skagit counties (9727 birds) increased by 56% as compared to 1997 levels but remained 31% below average harvest for the period 1993-1997. Hunter effort continues to decline with an 8% drop in hunters from 1997 and a 40% decline in hunters as compared to the 1993-1997 period. Total hunter days in Whatcom and Skagit counties combined was 10,159 during the 1998 season. This number represents 42% of the hunter days expended in Region four but only 3.6% of the total 277,546 days of grouse hunting effort statewide.

Grouse harvest was lower in Region 5 in 1998 as compared to previous seasons and the 1997 season in particular. Harvests, number of hunters, and the number of hunter-days were lower in the northwestern counties of the region (Lewis, Cowlitz, and Wahkiakum) than previous years, while harvest and hunter success was much greater in the southern counties of the region (Klickitat, Skamania, and Clark) than in past years. September road closures due to fire restrictions on private timberlands likely limited the hunter effort and harvest in Lewis and Cowlitz Counties in particular. While the 1998 harvest was 13% lower than the 1997 harvest (16,968 vs. 19,503, respectively), the number of forest grouse harvested in Region 5 from 1988 through 1998 has remained fairly stable (Figure 2).

The combined 1998 Region 6 grouse harvest for ruffed and blue grouse was estimated as 30,599. The harvest is combined because field checks , and wing collection have shown that hunters were not successful at identifying female and juvenile blue grouse to species. The harvest results for the 1998 season indicates an increase in the numbers grouse taken compared to last year but still below the 5-year averages (1991-97).

Surveys

No surveys for forest grouse were conducted in 1998. In years, forest grouse wings were collected by placing barrels in strategic locations throughout Washington. Hunters voluntarily deposited one wing from each grouse killed. In addition, wings were collected by hunters mailing in wing envelopes. Wings were classified annually for three years from 1993-1995. The objectives of this survey were to:

1. document species composition in the harvest,
2. determine timing of harvest through the hunting season,
3. and determine if the wing barrel survey could provide an index to population trends and reproduction.

In the harvest questionnaire for 1993, 1994, and 1995, hunters indicated that they kill 68% ruffed grouse, 30% blue grouse, and 2% spruce grouse. Wings collected from hunters indicated that species composition was considerably different than depicted by the questionnaire. The data from wings indicated that 42% of the forest grouse harvest is ruffed grouse, 51% blue grouse, and 7% spruce grouse. It is most likely that hunters incorrectly identify female and juvenile (> one year) blue grouse as ruffed grouse. Spruce grouse are likely misidentified as both ruffed grouse and blue grouse.

In the past, wildlife managers in Washington often assumed that most of the forest grouse harvest occurred during general deer and elk seasons. In contrast, the data collected at wing barrels indicates that greater than 70% of the harvest occurs before the general deer season. An additional question answered by this study relates to how much of an impact to the grouse population occurs as a result of season length. The wing barrel data indicate that a very small percentage of grouse harvest occurs during the month of December. Therefore, season length as currently established likely has a limited impact on grouse populations.

Population Status and Trend Analysis

Based on long term harvest trends, it appears that forest grouse harvest and populations have remained stable over the past 30 years. Because of mis-identification problems, it is hard to evaluate trends for each of the three different species.

Annual production is greatly influenced by weather conditions during the peak of hatching (late May early June). Wet and windy weather reduces chick survival by exposure and reducing insect populations at the time when young grouse need a high protein diet. Weather patterns in the spring are often a good predictor of fall harvest and population.

Forest grouse harvest was previously shown to be related by a regression equation relating hunters and brood size (Schirato 1995). These equation calculates the average brood size of both species to be 5.1 for the 1998 season.

Habitat Condition and Trend

Timber harvest is the most significant issue statewide for influencing habitat condition and forest grouse population trends. In general timber harvest activities are beneficial for most species of forest grouse. Regeneration techniques

certainly play a significant role in the degree to which timber harvest provides benefits. Future benefits from timber harvest will depend on the degree of intensity of regeneration practices.

The pace of timber harvest in western Washington during the 1980's has had a significant impact on forest grouse populations. Blue grouse tend to benefit in the first ten years and the greatest ruffed grouse benefits occur between 10 and 25 years after clear-cut timber harvest. This time frame should result in high blue grouse populations currently with a peak in ruffed grouse populations over the next ten to twenty years.

The rate of timber harvest in western Washington has slowed in the 1990's and should result in somewhat lower, but stable forest grouse populations over the long term. Population levels will greatly depend on forest practices. Regeneration techniques that include extensive broad leaf tree and shrub control, reduced stocking rates and cover density through thinning and pruning, and replanting with tree species that provide less habitat benefits may negatively impact grouse populations. At the same time, a trend in reducing the length of timber stand rotation may benefit grouse populations.

Conditions are similar in eastern Washington, however recent timber market changes have resulted in some timber stands becoming more valuable than they were ten or twenty years ago. Specifically, lodgepole pine forests have increased in value so there is increased interest in harvesting the timber. In addition, mature lodgepole pine forests have become infested by pine beetles, killing the trees. Timber managers want to harvest those trees before they decay or burn in wild fires.

There is a significant potential to reduce spruce grouse habitat if the regeneration techniques are intensive. From a habitat standpoint the better lodgepole and spruce/fir sites may be converted to more merchantable species of trees and all harvested stands may end up at much lower stocking rates than are currently present. Both of these outcomes could reduce the value of the habitat for spruce grouse.

The majority of ruffed grouse habitat in western Washington occurs in the Tsuga heterophylla (western hemlock) zone between 0-2,000 ft elevation where there is a large component of deciduous timber. Blue grouse utilize higher elevation habitats on average 2,000-4,000 feet. Approximately 11,300,000 acres of forested habitat exists in western Washington. (Brewer, 1980).

Except for the major urban areas in north Puget Sound, little change has occurred in total volume of forested lands from historical levels.

Augmentation/Habitat Enhancement

Supplementation of forest grouse populations is generally considered unnecessary in Washington State. No large-scale and direct efforts were made to enhance habitat for forest grouse within in 1998. WDFW Habitat Program staff, however, frequently respond to Forest Practice Applications with recommendations to mitigate forest practice impacts on grouse. These recommendations commonly include the following: Leaving large down logs in timber harvest areas as drumming logs for Ruffed Grouse; retaining large, "wolf-tree" Douglas-firs on ridge tops for Blue Grouse winter foraging and roosting, and seeding skid roads and log landings with clover and other grouse forage plants.

A Ruffed Grouse (Bonasa umbellus) trapping project was conducted on four sites in Skagit and Snohomish counties during the month of August 1998. The objective was to capture and transport 12-15 grouse to the State of Missouri as part of an ongoing re-introduction program. The trapping method involved the use of cloverleaf traps placed in lowland riparian habitats during the period of August 15 to August 31. During the 16 period, 8 grouse were trapped. However, the capture protocol required that birds not be held for more than five days prior to shipping. The goal of capturing 12-15 grouse within five days was not met. Therefore, each grouse was held for four days and released back to forested areas on the 5th day. Five birds were banded on the right tarsus with green colored aluminum WDFW bands prior to release. It is recommended that future trapping efforts include multiple trapping teams throughout western Washington in order to accomplish targeted numbers of birds captured within the five day window.

Management Conclusions

Past strategic plans often identified goals of increasing interest in hunting forest grouse. The rationale was that forest grouse, especially ruffed grouse were harvested at a very low rate and could with stand higher levels of harvest. Much of that rationale was based on previous ruffed grouse research in which proportions of forest grouse species harvested as estimated by the harvest questionnaire were assumed to be within ten percent. Recent wing collections have cast doubt on that assumption.

Harvest strategies appear to be functioning appropriately at this time. Population levels of forest grouse appear to be fairly stable and are likely to remain so. The main questions or concerns regarding forest grouse are:

1. spruce grouse population impacts as related to timber harvest trends
2. hunter harvest rates on public lands, especially those managed for wildlife
3. long term population monitoring for each species of grouse
4. more accurately monitoring harvest of each species of grouse

Until monitoring of harvest can be refined and a better determination of the proportion of the population that is harvested can be developed, no change in recreational opportunity is prudent.

Management recommendations for north Region Four include: 1) Increase population monitoring efforts on both species in order to document population status in hunted areas, 2) increase public awareness and interest in grouse hunting(a relatively under utilized resource) thru enhanced information and education programs.

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