

STATE OF WASHINGTON

1998 Game Status and Trend Report



Washington Department of
FISH AND WILDLIFE
Wildlife Management Program

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GAME STATUS AND TREND REPORT

July 1, 1997 - June 30, 1998

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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 for 1997 to 1999 by the Fish and Wildlife Commission are much more restrictive and have already resulted in improved buck escapement. These restrictive measures involved a three-point restriction for all mule deer in eastern Washington and a shortened modern firearm deer hunting season. The general modern firearm deer seasons were reduced to nine days. For whitetail deer, the seasons remain similar to past years except for northeastern Washington where the whitetail season overlap with elk was deleted. In western Washington, the general blacktail seasons are similar except some late buck hunts north of Seattle and along the Columbia Gorge have been dropped. Antlerless opportunity for muzzleloader hunters was deleted except in damage areas.

The 1997-98 winter was mild and deer survival was much improved over last year. Fawn/doe ratios were generally good. The deer season overlap with elk season in Selkirks was eliminated last year for the first time in many years. A new opportunity for youth, senior, and disabled to take antlerless whitetail deer during general buck seasons was initiated in northeast Washington. Antlerless permits were reduced in anticipation of higher general season success for these hunters. Mule deer buck success declined dramatically as a result of 3 Pt. Minimum restriction and short nine day modern firearm season throughout eastern Washington. The Washington Department of Fish and Wildlife forecast a dismal deer hunting season on the eastside of the state and hunter numbers were down substantially. Statewide deer hunter numbers were down nearly 21 percent.

We started a new system to get better data on permit hunter success. This past year, every permit hunter was 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.

Tribal Input

More and more tribes are hiring wildlife biologists and collecting biological data on wildlife populations. We are working cooperatively with tribes on management issues.

Effectiveness of Regulations

The 3 Pt. Minimum restriction and nine day modern

firearm season for mule deer was effective in increasing buck escapement (Table 1). In central Washington, buck escapement went from historic levels of 2 to 4 bucks per 100 does to 8-11 bucks per 100 does in many units. This is still below management goals, but a dramatic improvement in one year.

Blacktail deer harvest near the Canadian border west of the Cascade Crest took a significant decline in 1997. 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 slightly, but harvest was down. Warm dry conditions during the hunting season are believed responsible for harvest declines. Hunter pressure and harvest on the Olympic Peninsula declined in 1997.

The 1997 statewide deer harvest of only 31,071 declined a little over 20 percent from 1996 (Table 2). Hunter numbers also declined nearly 21 percent statewide (Table 3). On the westside, however, deer harvest actually increased over 1996. Mule deer and whitetail harvest, however, declined by about 50 percent over 1996.

Surveys

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.

For mule deer in fairly open habitat, pre and post season surveys are conducted. Some pre-season surveys are conducted from the ground and post season surveys conducted from a helicopter. Preseason surveys are done in August and September and post season surveys are done in late November and December.

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 southwest Washington and in some other areas of the state, surveys are conducted to gather necessary data for sex, age, kill, population, 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.

The sex, age, kill reconstruction effort has revealed several important management concepts. The overall buck mortality rate in any buck units is about 44 percent. Buck mortality rates of 40-50 percent are indicative of a lightly exploited population. Long term estimates of doe mortality is about 22 percent in

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

Region	GMUs	Name	Type Unit	Mule or Black-tailed Deer		White-tailed Deer		
				Pre- season	Post- season	Regulations	Post- season	Regulations
1	149-181	Blue Mountains			25	3 pt. min.	22	3 pt. min.
	127-142				25	3 pt. min.	24	3 pt. min.
	101-124				11	3 pt. min.	no data	any whitetail
2	242	Alta	Quality		23	3 pt. min. permit only		
	290	Desert	Quality		no data	3 pt. min. permit only		
		PLWMA 201	Quality		35	3 pt. min. permit only		
	218-231, 239	Methow	General		12	3 pt. min.		
	209, 215, 233	Okanogan	General		9	3 pt. min.		
	300-314	Chelan PMU	General		22	3 pt. min.		
	248-262	Douglas	General		14	3 pt. min.		
	272	Grant PMU (outside PLWMA 201)	General		14	3 pt. min.		
	284	Kahlotus	General		no data	3 pt. min.		
	204-224, 233, 239, 248-284, 300						no data	any buck
3	302-334	PMU 32			11	3 pt. min.		
	335-346	PMU 33			8	3 pt. min.		
	352-368	PMU 35, 36			no data	3 pt. min.		
	329, 330	Quilomene, West Bar	Quality		no data	3 pt. min. permit only		
	342, 371	Umtanum, Alkali	Quality		no data	3 pt. min. permit only		
4	460		General		7	any buck		
	485		Quality		37	any buck permit only		
5		Any Buck Units		49	25*	any buck		
		2 Pt. Buck Units		53	27*	2 pt. min.		
6	667			24	10*	any buck		

*calculated

southwest Washington.

Spring surveys in southwest Washington indicate better fawn survival this past year than average. Long term averages are about 41 fawns per 100 adults, but this year the ratios were 47 fawns per 100 adults. This is a good predictor of 1998 hunting seasons.

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 have not recovered from the 1996-97 winter. Fawn survival was low this year despite last year's mild winter weather. Whitetail deer in northeast Washington have excellent fawn survival. It looks like whitetail in northwest

Washington are once again building to population objectives.

Historical trends of whitetail harvest reflect winter dieoffs 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. 1). Mule deer populations along the east slope of the Cascades were severely impacted by the 1996-97 winter, but this past year's winter was very mild. 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 1997 harvest was very low because of restrictive hunting seasons (Fig. 2).

In lowland western Washington, blacktail deer populations are impacted more by human population growth and

Table 2. Deer harvest 1974-1997

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

*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.

development than winter severity. 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 quite stable (Fig. 3).

Habitat Condition And Trend

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

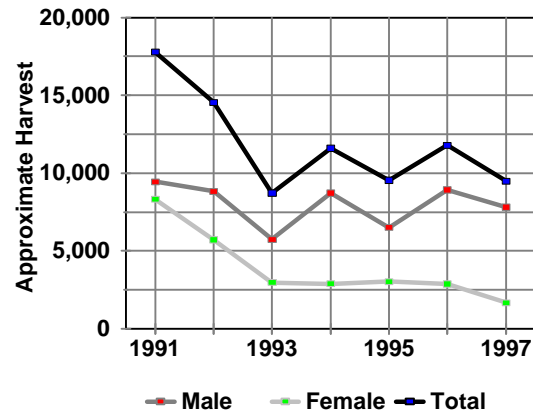


Figure 1. Recent whitetail deer harvest in Washington.

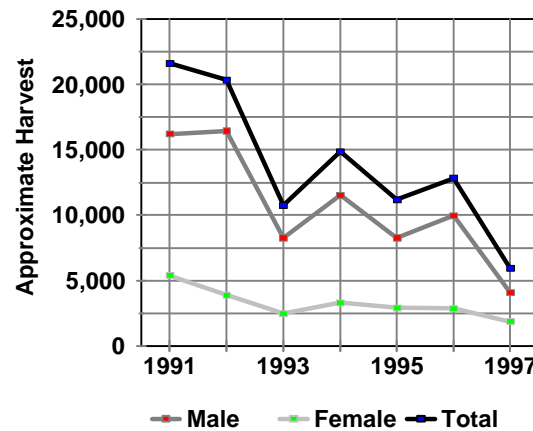


Figure 2. Recent mule deer harvest in Washington.

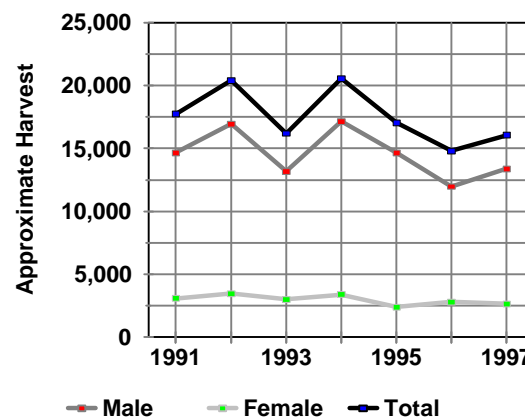


Figure 3. Recent blacktail deer harvest in Washington.

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

Year	Total	Stamp Sales			Deer Tag Sales		
	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

*Archery and muzzleloader separate stamp initiated in 1982.

**Resource Allocation initiated in 1984.

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 northcentral Washington during the last 5 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.

Habitat Enhancement

Landowners in the Conservation Reserve Program will be replanting some of their existing Conservation Reserve acreage with new wildlife mixtures. Other Conservation Reserve acreage may be burned to improve habitat. On the other hand, wildfire burns continue to pose a threat to critical winter ranges. In addition, residential and orchard development continue to

eliminate winter ranges.

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 & 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 disabled to reduce damage potential. In central Washington, deer damage to orchard crops is an ongoing issue. 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. 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 is 15 bucks per 100 antlerless. The Blue Mountains have had a 3 Pt. Minimum restriction and short modern firearm season for several years. Starting in 1997, the 3 Pt. 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 recovery from the losses in the 1996-97 winter. Whitetail deer are responding much faster than mule deer to last year's wild winter and whitetail populations are rebuilding in northeast Washington.

In central Washington buck escapement is improving, but is still below 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 will not reach buck escapement goals in general hunting seasons. The other units should achieve buck escapement goals within five years.

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, kill modeling to manage deer in the 20th 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 needs to be verified. Other surveys--pre season, post season, and harvest data need to be enhanced to determine population status and trends in all parts of the state.

Species	Region	PMUs	GMUs
Deer	1	11 & 13	101-124

Prepared by: Steve Zender, District Wildlife Biologist

Population Objectives/guidelines

White-tailed deer are the most abundant species in northeast Washington. Mule deer are present, especially in the higher elevations and most significantly in Ferry County.

The whitetail harvest management objective is to provide abundant hunting opportunity while maintaining an average of <55% yearling bucks in the harvest. Pre-season surveys should exceed 35 bucks per 100 does. Antlerless harvest goals vary greatly with winter severity and agricultural damage. The general goal is to average 60 or greater antlerless per 100 bucks in the harvest. Antlerless hunting is an important portion of the recreational opportunity and a significant factor in maintaining herd health, and addressing problem wildlife issues.

The objective for mule deer is to reduce hunting mortality, improve buck ratios and, increase productivity and population levels.

Hunting Seasons And Harvest Trends

Mule Deer bucks were limited to 3 point minimum for all weapons. There was no antlerless opportunity. The modern firearm season was only 9 days, 10/11-19.

There were no antler restrictions on white-tailed deer bucks in units 101-124. A significant change was the split in the general whitetail buck season 10/11-24 and 11/3-23 in GMUs 105-124. This change was made to eliminate deer hunter pressure during the Northeast elk hunt. It also serves as a means of slightly reducing pressure on whitetail bucks. Youth, Senior, and Disabled (Y/S/D) could take whitetail of either sex in PMU 13 from October 11-24. There were an additional 1,100 antlerless permits issued which were valid 10/13-28. Including the permit hunters in the general season rather than pre-season was also a significant change from past years.

There was considerable area added to the early Muzzleloader season this year, however, muzzleloaders were restricted to bucks only for the first time. Lastly, the late Muzzleloader hunt in GMU 113 was extended to 12/15.

Late Archery opportunity was increased when the traditional late season in GMU 103 was expanded following the merger of GMUs 100 and 103 (new GMU 101).

Hunter pressure for the general opener was down 23% from 1996 at the Deer Park Check Station (Table 1) and down 26% over the entire season for all weapons combined (Figure 1). Most of the decline in hunter pressure can likely be attributed to the well publicized reduction in the deer herd due to severe winter kill of 1996/97.

The mule deer buck kill decreased dramatically (report card returns declined 80% in Ferry County, 135 in 1996 to 27 in 1997). The short season and antler restrictions certainly accomplished the goal of reducing harvest on mule deer.

Table 1. Opening Sunday Deer Park check station, 1989-97.

Year	Hunters	Percent			
		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

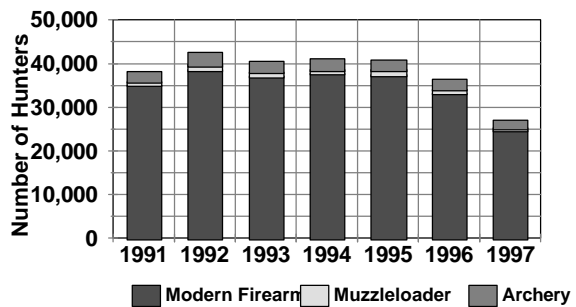


Figure 1. Trend in deer hunter pressure, GMU's 101-124.

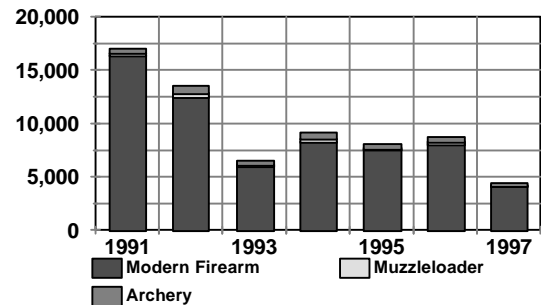


Figure 2. Total deer harvest trend, GMU's 101-124.

The closure of the general whitetail season during elk season was appreciated by elk hunters, and the reduced pressure on the whitetail bucks was appropriate given our relatively low buck:doe ratios.

I am not aware of any problems with having the antlerless permits valid during the general season rather than prior to the season. It does provide more opportunity for families or hunting partners to be together and addresses the complaints of

many landowners that seasons are too long and they have to interact with hunters too much.

Snow conditions in November play a significant role in the whitetail harvest in northeast Washington. November was exceptionally mild with little or no snow until about the last weekend of the season.

Hunter numbers and deer taken were both considerably lower in 1997 than in 1996. Success at the opening check station was 9% compared to the average of 10% (Table 1). More deer are checked at the late checks and success at Deer Park was 14% compared to the 16% average.

This year we have good data on the success rate 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 need 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. Special permit hunters were surveyed by mail to determine success by GMU, (WA Dept. Fish and Wildlife, 1998). The response rates were very good, averaging about 80 percent. Our deer population was relatively low in 1997 so success was likely lower than other years. The highest success rate was in GMU 101 at 57%. The lowest rate was in GMU 113 at 14%, and the average for GMUs 101-124 was 37%. Obviously this is critical data for biologists or other interested parties when formulating recommendations or opinions regarding antlerless permit levels.

Colville Confederated Tribes (CCT) retain hunting rights in GMU's 101 and 105. The total deer tag sales for the North Half to Colville members were down by 6% while the total harvest was up 10% (Colville Confederated Tribes, 1998). The most significant change occurred in the percentage of harvest to CCT members relative to State license buyers. In Unit 101 the CCT projected harvest increased to 43% compared to 23% in 1996. In Unit 105 CCT projected harvest was only 22% in 1997 compared to 24% in 1996. The significant increase in Unit 101 and not Unit 105 is due to the first year of the very short season and 3 point restriction on mule deer for State hunters; Unit 101 harvest includes far more mule deer than Unit 105. The CCT also shortened the season for members by closing mule deer hunting November 30 rather than December 31.

Regular dialog and information sharing occurs between WDFW and CCT biologists regarding survey results, harvest results, and season recommendations.

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 (Table 2).

Table 2. Pre-season whitetail composition counts, GMU's 101-124.

Year	August		September		Ratios	
	Bucks	Doe	Fawn	Doe	B:D	F:D
1990	203	585	348	436	35	80
1991	321	692	587	683	46	86
1992	418	1210	662	933	35	71
1993	64	222	197	339	29	58
1994	219	766	80	168	29	48
1995	79	378	91	213	21	43
1996	NA	NA	NA	NA	34	NA
1997	155	618	151	273	25	55
1998	347	1005	588	771	35	76

The fawn:doe composition surveys are conducted in September. The technique remains the same as in August.

A sample size goal of 1,000 does was set for each survey in 1998. During August 1771 whitetails were classified (347 Bucks, 1005 Does, 419 Fawns). The Buck:Doe ratio was 35:100 which is a significant improvement over the 1997 ratio of 25:100. This is near the 10 year (1988-1997) average of 33:100.

The September total classified was 1510 (151 Bucks, 771 Does, 588 Fawns). The Fawn:Doe ratio was 76:100 which is a welcome improvement over the 1997 ratio of 55:100. The fawn production exceeds the 10 year average ratio of 64:100.

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 138 total mule deer in August and September of 1998 for a B:D:F ratio of 21:100:68.

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 but at present we are struggling to do a few ground surveys.

In December and January, prior to antler drop, we were able to classify only 72 mule deer in northeast units for a ratio of 11:100:24.

We surveyed some traditional mule deer 'green-up' ranges in GMUs 101 and 105 to document deer trends and fawn:adult ratios. 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 was 215 mule deer and the results continue to indicate poor recruitment at 28 fawns:100 adults.

A sample of 584 whitetails on green-up in Stevens County yielded a fawn:adult ratio of 48 fawns:100 adults. We

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

Year	Early Checks		Late Checks		All Checks		Rprt Cards
	Sample	% Yrlg	Sample	% Yrlg	% Yrlg	% 5pt+	% 4pt+
1990	84	62	66	33	52	19	36
1991	62	61	106	29	41	24	40
1992	88	68	34	37	52	16	42
1993	21	52	44	27	31	28	45
1994	50	46	61	23	35	20	46
1995	29	83	0				41
1996	53	64	0				39
1997	40	65	63	30	39	22	36

know whitetail buck ratios are higher than mule deer so this points out the low productivity of our mule deer at this time.

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). Traditionally we have combined early and late checks as we felt the early checks were biased toward yearlings. We are currently reconsidering how to collect yearling age data as it will be a necessary component of SAK modeling efforts.

Recommendations for antlerless whitetail hunting opportunity are an important task each year. 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 to determine the antlerless to antlered harvest ratio by species. Since we have basically eliminated mule deer doe hunting we are really looking at managing whitetail antlerless harvests (Table 4).

Table 4. Whitetail report card data for antlerless harvest recommendations, 1997.

PMU	Tot. Bucks	Total %WT		WT		WT Ratio
		Does	% B	WT D	Does	
11	165	48	84	88	138	42 30D:100B
13	1253	439	98	99	1228	435 35D:100B

There are several ways antlerless whitetails can be taken so these ratios must be considered when recommending permit levels or season length. This year permittees were mailed questionnaires so we have good permit success rate data. The total permit kill is conservative as it is only based on those (about 80%) that returned the questionnaire (Washington Department of Fish and Wildlife, 1998). The general hunter questionnaire estimates the rest of the antlerless harvest so we now have an idea what our Youth/Senior/Disabled hunters take during their either-sex opportunity. Table 5 indicates the various antlerless harvest results by GMU and PMU. Success rates certainly improve when deer populations increase so the rates we are looking at now may be a good baseline but will likely increase. It is also interesting to note the wide range of antlerless harvest rates by various groups at the GMU level. Lumping GMUs may provide some simplification but certainly puts management at the mercy of managing for the weak link in the chain.

Population Status And Trend Analysis

The situation for mule deer continues to look bleak. The restrictive regulations reduced the harvest dramatically so buck ratios should improve. Recruitment continues to be the problem. Sample size and distribution is poor but all sources point to recruitment levels (24 fawn:100 does-post-season, 28

Table 5. Questionnaire harvest estimates, PMU's 11 and 13, 1997. In PMU 13 99% of does and 98% of bucks are whitetail. Y/S/D = Youth/Senior/Disabled Hunters.

PMU	GMU	Archery		Y/S/D Antlerless	Y/S/D per 100 Buck	Total		
		Antlerless	Permit Kill			Antlerless	Bucks	D:100B
11	101	31	52	0	0	83	477	17
13	105	5	11	50	37	66	134	49
	109	2	56	105	28	163	369	44
	113	7	3	10	6	20	176	11
	117	12	27	118	22	157	538	29
	121	23	61	203	21	287	963	30
	124	23	71	95	9	189	1077	18
Total	13	72	229	581	18	882	3257	27

fawn:100 adults at green-up) that generally represent declining deer herds. These are ratios following a mild winter so there are other sources of mortality involved.

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. The extremely high whitetail populations of 1992 followed several winters with relatively little snow. This past winter was very mild (Figure 3) and will result in an increasing population trend. Summer fawn ratios were only 55 fawn:100 does because does were coming off the severe winter of 97/98. There was excellent survival of fawns through the winter with (48 fawn:100 adults at green-up). The whitetail

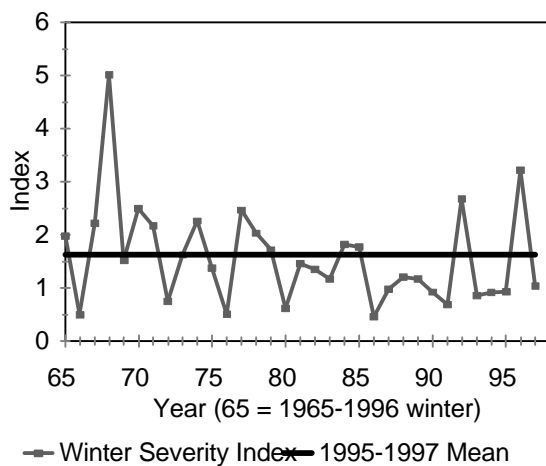


Figure 3. Chewelah winter severity index, based on mean temperature and total snowfall, 1965-1997.

herd has the potential to increase dramatically if we are fortunate to have two mild winters in a row. If we avoid a severe winter, antlerless harvests will have to be increased significantly to maintain herd health and maintain social acceptance of population density.

Habitat Condition And Trend

Many land use practices are conditioned or give consideration to deer needs, e.g., forest practice activities on private lands, USFS land management practices. However, most residential development in northeast Washington proceeds without regard to impacts on deer. Impacts on whitetails may balance out as they often thrive near development. Mule deer seem to retreat to the more secluded areas and marginal habitats. In many cases we see whitetails begin to occupy ranges mule deer historically used, at some locations filling a void but at other locations creating competition for forage and cover. Residential development in rural northeast Washington appears to be seriously impacting mule deer habitat, especially mule deer in Ferry County.

Wildlife Damage

There were 39 problem wildlife complaints involving deer in the northeast district from July 1997 through June 1998. Damage by whitetails to 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 reduce deer damage. Officers also issued a few Landowner Access Permits on a case by case basis to avoid damage claims. 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.

Management Conclusions

The short season (9 days) and 3 point antler restriction reduced mule deer buck harvest levels to a greater extent than may have been necessary in these timbered habitats. Shorter seasons or antler restrictions alone may have been an adequate adjustment to achieve buck escapement goals. Prohibition mule deer doe during this period of such low recruitment should continue.

The closure of whitetail hunting during elk season was a loss of opportunity to deer hunters but was well received by elk hunters. The deer kill during this time of the season was very low but a slight reduction in pressure on whitetail bucks appears wise as buck ratios continue to be below objectives.

The mild winter will result in whitetail population increases. Antlerless permit level increases often lag a year because public acceptance comes only the year after deer increases are seen, too late to adjust permit levels. The either-sex harvest opportunity for youth, senior, or disabled hunters partially compensate for harvest lag as participation and success rates increase automatically with deer populations.

For 1998 we will be expanding the whitetail either-sex opportunity for youth, senior, or disabled to Unit 101 in Ferry County. This is a great opportunity to increase recreation. I also believe it may be helpful for recovery of the mule deer population to more intensively harvest whitetails. If competition is a factor, the increased harvest on whitetails may provide an edge for mule deer.

Pre-season composition surveys work best for whitetails so these will be intensified. Post-season and spring surveys will be done only as specifically needed. For mule deer we need to expand efforts 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.

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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, WDFW offered a short nine day season with a 3-point minimum regulation for both deer species plus a late whitetail buck hunt with a three point minimum. Archery seasons were 3-point minimum September 1-5, and 3-point minimum or antlerless from September 6-15. For whitetail the season is extended to September 6-30 3-point minimum or antlerless. Late archery was limited to GMU 127 and hunters could take a 3-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 often experience damage from deer to agriculture.

Hunting Seasons And Harvest Trends

In general, the 97/98 winter was 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 (GMU 127 and 130).

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

Harvest of whitetail bucks increased in 1997 (Figure 1) because of the late buck hunt in November. The harvest of antlerless animals has decreased steadily since 1995 (Table 2). It will be necessary to increase the harvest of the antlerless component of the deer population in the in the Central District or we face the prospect of a winter die off in the near future.

Table 2. Deer harvest antlerless 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

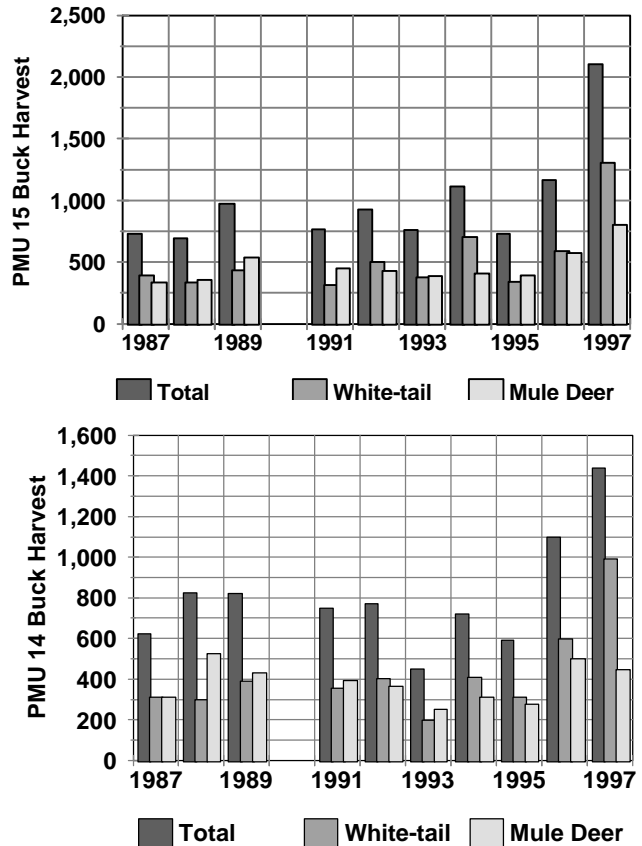


Figure 1. Buck harvest, Central District.

Current habitat conditions will support increased antlerless animals until a severe winter or a significant drought. The possibility of an outbreak of EHD in whitetail habitat within the Central District is a very real threat 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 but this hunt had no adverse affect on the mule deer population (Tables 3, 4, 5). Whitetail deer were easily surveyed post-season and the ratios and herd composition indicate that the harvest was commensurate with the total population in the Central district. Post-season surveys for both deer species indicate a very healthy doe to fawn ratio (Table 6).

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

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

Table 4. Deer harvest by species and sex, 1997.

GMU	Mule deer		Whitetail	
	Bucks	Antlerless	Bucks	Antlerless
127	0	0	458	55
130	164	70	282	16
133	282	168	252	68
136	272	106	95	7
139	195	22	717	117
142	336	86	491	85

Table 5. Percent hunter success by GMU.

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

Surveys

The deer populations in the Central district are surveyed by ground and aerial methods. In 1997, the Spokane District office of the Bureau of Land Management helped support our survey effort by providing aerial survey time in GMUs 139 and 136. The surveys produced pre-season doe: fawn ratios which are not representative of the good to excellent population characteristics in most areas of this deep soil, rich habitat area. The post-season ratios are more accurate in depicting the health of these herds (Table 6). Pre-season surveys do reflect mule deer buck:doe ratios reasonably well. However, whitetail bucks, often are difficult to survey because of nocturnal behavior and habitat selection at nearly any time of the year.

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, and though 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 the whitetail deer in GMUs 127 and 130 from 1993 thru 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 permit, archery, muzzleloader, youth and senior seasons in these two units near the urban area of Spokane especially for whitetail deer.

Management Conclusions

Current season structures seem to be 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 reflect the fact that for social reasons WDFW does not conduct summer deer surveys with spotlights. If WDFW was willing to "take the heat" from landowners' concerns about spotlighting we could survey more bucks in the pre-season. I believe the landowner's comfort is of more value to WDFW than the buck ratios which will be verified by post-season surveys.

It seems that with three point regulations, WDFW cannot 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. The deer in these units meet management guidelines and respond well to private land management efforts. 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 by WDFW personnel to coordinate the sportspersons with the landowner 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.

Table 6. Deer survey, Central district

Species	Year	Unit	Pre-season			Post-season		
			Buck	Doe	Fawn	Buck	Doe	Fawn
Mule deer	1996	133	18	58	37	39	93	126
		136	12	17	15	4	21	15
		142	2	5	4	47	284	189
		Ratios	40	:100:	70	23	:100:	83
	1997	130	3	3	4	0	0	0
		133	21	63	39	58	195	257
		136	10	30	10	1	12	19
		139	0	0	0	2	4	8
		142	33	103	86	35	178	183
		Ratios	34	:100:	70	25	:100:	120
Whitetail Deer	1996	133	7	111	85	20	89	97
		136	2	8	3	0	0	0
		142	0	2	0	4	28	30
		Ratios	8	:100:	73	21	:100:	108
	1997	124	5	16	14	2	14	16
		130	1	2	0	6	3	2
		133	15	87	65	28	29	33
		136	0	0	0	0	0	0
		139	3	6	5	4	18	23
		142	2	2	3	24	155	157
Ratios	23	:100:	77	29	:100:	105		

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

Prepared by: **Pat Fowler, District Wildlife Biologist**

Population Objectives/guidelines

Deer populations in the Blue Mountains will be managed to maintain and/or increase the percentage of mule deer in the deer population in specific Game Management Units. At the present time, mule deer bucks comprise approximately 60% of the harvest, which is down from 75% 10 years ago. Whitetail deer have increased in numbers and could have a negative impact on mule deer if whitetail populations continue to expand. We will attempt to stabilize the whitetail deer populations in order to minimize competition with mule deer. This will be accomplished by increasing the whitetail antlerless harvest in units where whitetail populations appear to be expanding at the expense of mule deer.

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 have improved significantly since 1990 (Figure 1, Table 1). The general season is followed in November by controlled hunts for antlerless deer, both mule deer and whitetail deer, and a late permit controlled hunt for three-point or antlerless whitetail.

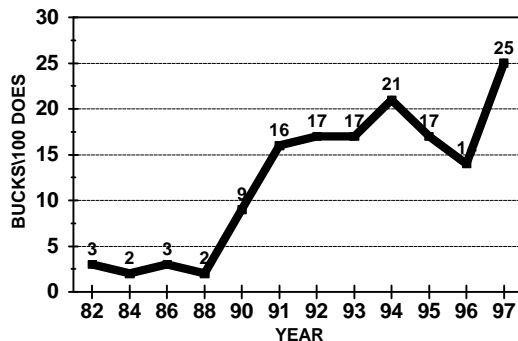


Figure 1. Mule Deer Post-season Buck Ratios 1982-97, Blue Mtns.

Issuing permits for antlerless whitetail deer is effective in preventing whitetail deer numbers from expanding in specific game management units.

The buck harvest declined significantly when the three-point regulation was implemented, which was expected. The buck harvest has increased from a low of 1,317 in 1991, to a high of 2,332 and 2,418 bucks in 1996 and 1997, respectively. This compares favorably with an average District buck harvest of 2,340 bucks between 1985-89 during the pre three-point era.

Table 1. 1997 Post-season Mule Deer Surveys, Blue Mtns., WA.

GMU	Bucks			Doe	Fawn	Deer Total	Deer Per 100 Does F:100:B
	Adult	Yearling	Total				
145	11	36	47	249	176	472	71:100:19
154	2	0	2	10	8	20	--:100:--
162	2	2	4	5	4	13	--:100:--
163	3	5	8	40	23	71	58:100:13
166	0	1	0	1	0	1	--:100:--
172	1	3	4	19	14	37	74:100:21
175	3	5	8	20	10	38	50:100:40
178	14	59	73	262	137	473	52:100:28
181	9	39	48	190	99	337	52:100:25
186	2	7	9	26	18	53	69:100:35
Total	47	157	204	822	489	1515	60:100:25

Hunters lucky enough to draw a late whitetail permit enjoyed an excellent hunt (Table 2). The average hunter success rate for both the Blue Mountains A and B hunts was 66%, with 32% of the bucks harvest being 5 point or larger. A total of 220 permits were issued and hunters harvested 79 bucks and 17 does.

Table 2. Late Whitetail Permit Hunt Harvest Summary, BlueMtns., WA.

Year	Permits	Bucks	Does	Total	% Bucks		
					Succ	≥ 5 point	
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

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 1992-96. In 1997, 1,771 antlerless deer permits were issued resulting in a harvest of 768 does at 32 does per 100 bucks. The success rate on antlerless permits was high for general antlerless permits (60-80%), and moderate for hunters with antlerless whitetail permits (35-40%). If fawn production and survival remains at a high level in 1998, antler less permit levels will be increased in 1999. However, following drought years, and years of low fawn production\survival, the harvest rate for antler less deer will be

reduced in order to maintain the deer population.

Hunting pressure during the general rifle season has increased in the Blue Mountains since implementation of the three-point regulation. The number of modern firearm hunters increased 47% between 1991 and 1997, from 9,320 to 13,671, respectively (Figure 2). 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% of the mule deer bucks harvested in 1996 and 1997 were four point or larger.

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.

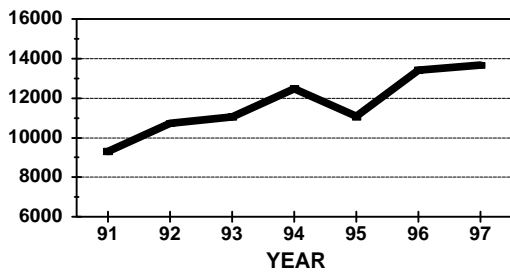


Figure 2. Modern Firearm Deer Hunter Trend, Blue Mtns.

Population Status And Trend Analysis

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 high levels. Deer populations south of Asotin and in the mountains are severely depressed. Good forage conditions in 1996, followed by a mild winter resulted in minimal over-winter mortality and excellent fawn production in 1997. A total of 564 mule deer were classified from the ground during pre-season surveys (Table 3.). Pre-season fawn ratios in 1997 were very comparable to 1996 at 63 fa.\100 does (Table 4). Only 159 whitetail deer were classified with a fawn ratio of 58 fa.\100 does.

Post-season deer surveys were conducted between late November and early January, using both helicopter and ground counts. A total of 1,515 mule deer were classified. The mule deer fawn ratio declined 14% compared to 1996, from 70 fa.\100 does to 60 fa.\100 does (Figure 3). The mild winter of 1997-98 resulted in excellent fawn survival.

Table 3. Pre-season Mule Deer Surveys 1989-97, Blue Mtns., Washington (August & September)

Year	Bucks			Doe	Fawn	Total	Per 100 Does F:100:B
	Adult	Yearling	Total				
1989			73	256	120	449	47:100:29
1990			106	302	140	548	46:100:35
1991			300	637	396	1333	62:100:47
1992			297	503	227	1027	45:100:59
1993			313	384	234	931	61:100:84
1994	90	196	289	624	404	1267	65:100:46
1995	28	49	77	226	108	411	48:100:34
1996	28	45	73	214	142	429	66:100:34
1997	42	108	150	254	160	564	63:100:59
1998	61	76	137	238	169	544	71:100:56

Table 4. 1997 Pre-season Mule Deer Surveys, Blue Mtns. WA.

GMU	Bucks			Doe	Fawn	Total	Per 100 Does F:100:B
	Adult	Yearling	Total				
	15	34	49	89	75	213	84:100:55
149	1	9	10	14	12	36	--:100:--
154	0	3	3	7	6	16	--:100:--
162	3	0	3	3	2	8	--:100:--
163	8	12	20	38	21	79	55:100:53
178	9	38	47	56	28	131	50:100:84
181	6	12	18	47	16	81	34:100:38
Total	42	108	150	254	160	564	63:100:59

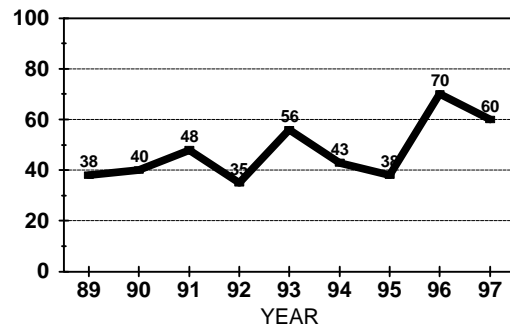


Figure 3. Mule Deer Winter Fawn Ratio 1989-97, Blue Mtns (November-December Surveys)

The mule deer post-season buck ratio increased from 14 bucks\100 does in 1996 to 25 bucks\100 does in 1997 (Table 5) with yearlings comprising 76% of the bucks counted. The increase in the post-season buck ratio is due to the large number of yearling (sub-legal) bucks in the population. However, adult bucks are probably under represented in the post-season surveys because they have dispersed after the rut and are more difficult to locate.

It is difficult to obtain an adequate sample of whitetail deer

Table 5. Post-season Mule Deer Surveys 1989-97, Blue Mtns., Washington (November-December)

Year	Bucks			Doe			Per 100 Does	
	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	

in post-season surveys; lack of time and manpower. A total of 244 whitetail deer were classified producing a ratio of 22 bucks and 68 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 provided thousands of acres of good deer habitat in traditional agricultural crop lands. The four counties in southeast Washington were successful in the last CRP sign-up. Walla Walla County received 99% of the acreage requested (81,469 ac.), Columbia County 78% (9,818 ac.), Garfield county 94% (11,796 ac.), and Asotin County 63% (15,260 ac.). 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 a high level into the foreseeable future if weather conditions remain moderate with mild winters, and no drought.

Yellow-star thistle is a major problem in the foothills and along the breaks of the Snake River above Anatone. 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 that will allow prescribed and naturally occurring fires in the wilderness, and use prescribed fires in other areas of the forest to improve habitat conditions is being implemented.

Augmentation/habitat Enhancement

Landowners enrolled in the CRP program will be required to re-plant approximately 50% of their existing CRP with new wildlife mixtures, including sagebrush. The remaining 50% 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.

Management Conclusions

Mule deer and whitetail deer populations are healthy along the Snake River breaks down river from Clarkston, and in the foothill units west of the Tucannon River. Deer populations south of Asotin and in the mountains are depressed.

Antlerless permits should be increased in 1999 if fawn production\survival remains high along the lower Snake River breaks and in the foothills.

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. 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 success rates that are among the highest in the state. 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's 203 and 231 have carried a 3-point minimum restriction in an effort to provide greater buck escapement. Quality hunt units are managed for 20 bucks per 100 does, and for a greater proportion of older age-class bucks.

Hunting Seasons And Harvest Trends

The general season was reduced to nine days to improve buck escapement, particularly for mule deer. In addition, a 3-point minimum restriction for all mule deer in Eastern Washington was implemented in 1997. Antlerless mule deer permits were eliminated to maximize reproduction, and help the population rebound from recent winter mortality.

GMU 242 (Alta) is designated as a quality hunt unit and is managed as permit only to achieve adequate buck escapement, and recruitment of older age-class bucks.

Hunter numbers in Okanogan, west of the Okanogan River, dropped precipitously, down 71% from the previous five-year high (Fig. 1). The short nine day season, the 3-point antler restriction, and low hunter expectation precipitated the decline. Before the season, many hunters commented that they felt the season should be closed following the severe winter of 1996-97, and many likely did not hunt.

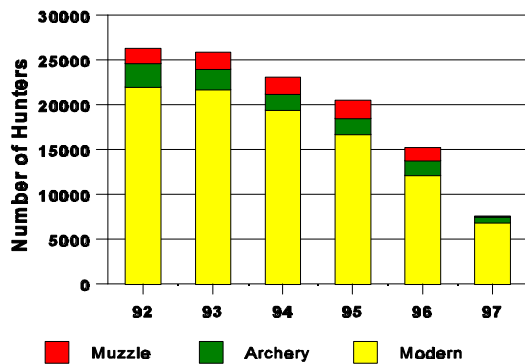


Figure 1. Number of hunters by user group for PMU 21.

Hunter pressure in Okanogan, east of the Okanogan River, dropped steeply as well, down 48% from the five year high (Fig. 2). A greater percentage of hunters in this unit are local, and as a result, hunter numbers are typically a bit more stable than in the remainder of the Okanogan. Hunter-days declined correspondingly in both management units as well (Fig. 3).

The shortened general season and 3-point restriction

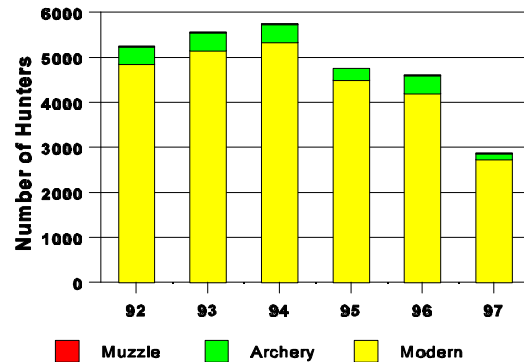


Figure 2. Number of hunters by user group in PMU 22.



Figure 3. Hunters days by user group for PMU 22.

reduced hunter pressure and buck harvest, and noticeably increased post-season buck:doe ratios in PMU 21, as evidenced by survey results (Table 1). Even so, post-season recruitment of older age class bucks fell, likely a result of the 3-point restriction, which focused harvest pressure on mature animals. The percentage of bucks post-season with three or more antler points dropped from 43% in 1996, to 36% in 1997.

In GMU 242 (Alta), the permit only unit, buck escapement was above the goal of 20 per 100 does, but recruitment of older bucks was no better than the surrounding units. This is not surprising, since many deer that are counted in this unit post-season have migrated from adjacent units that are open during the general season.

Hunters enjoyed generally favorable weather conditions, with adequate moisture and good access. The early start and mild weather during the general season meant that deer were still well distributed at this time. Significant seasonal

Table 1. Post-season population composition counts from 1997, by area. F:100:B is fawns and bucks per 100 does.

Area	Unit(s)	Buck Antler Class			Does	Fawns	Total	F:100:B
		3 pt +	< 3 pt	Subtotal				
Alta	242	8	15	23	102	61	186	60:100:23
Other Methow	218-231, 239	48	88	136	1171	852	2159	73:100:12
Methow Subtotal	218-231, 239, 242	56	103	159	1263	913	2345	72:100:13
Okanogan	209, 215, 233	8	10	18	201	148	367	74:100:9
Total		64	113	177	1464	1061	2712	72:100:12

migration had not yet begun and hunters had to search widely to locate animals.

With the implementation of the nine-day season and 3-point antler restriction, in response to the severe winter of 1996-97, harvest fell to an all-time low (Figs. 4, 5), and overall hunter success reached a six-year low in both PMU's (Fig. 6, 7). Correspondingly, hunter days per kill reached a six-year high (Fig. 8, 9). These trends are also supported by data from the Chewuch check station, where only 5 deer were checked in two weekends (Table 2). It is important to note that two of the five deer were 3-point yearlings, indicating that the 3-point harvest restriction is likely to select against animals with early antler point development, exactly the opposite of what is preferable.

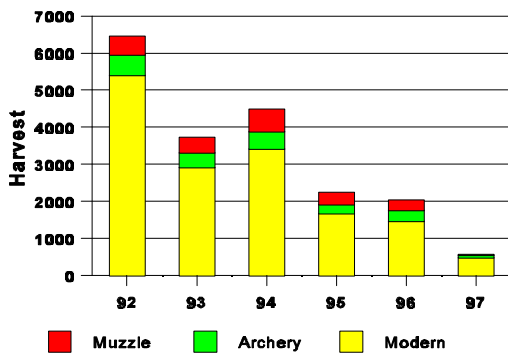


Figure 4. Harvest by user group for PMU 21.



Figure 5. Harvest by user group for PMU 22.

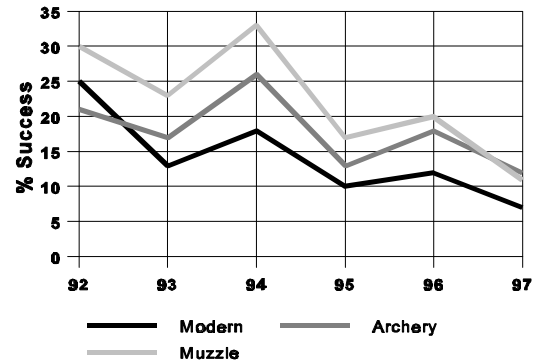


Figure 6. Success by user group for PMU 21.

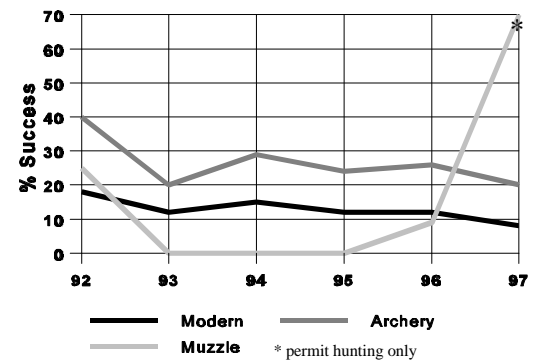


Figure 7. Success by user group for PMU 22.

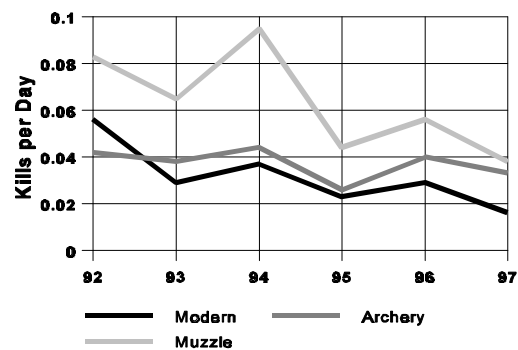


Figure 8. Kills per day by user group for PMU 21.

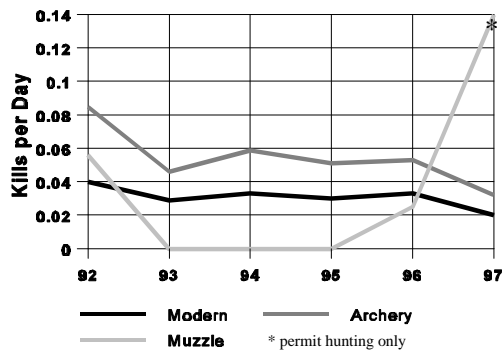


Figure 9. Kills per day by user group for PMU 22.

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 upcoming research in North Central Washington.

Surveys

Post-season surveys are conducted to collect mule deer herd composition data and monitor progress towards 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 \geq 3-pt buck, < 3-pt buck, doe, or fawn.

Hiking surveys are conducted in early spring just as winter

Table 2. Chewuch Check Station Results.

Year	Deer Age Class		Total	%		
	Adults	Yearlings		Yearlings	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	0.007

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 whitetails. Tribal members were not subject to the 3-point restriction on mule deer, and could harvest either sex during the later portion of their season. As a result, the tribal portion of the overall harvest increased to 68% in 1997, roughly double the long-term average (Fig. 10). Tribal tag sales decreased 6% in 1997, yet harvest in PMU 22 increased 30%, in sharp contrast to state harvest figures. Reasons for this are unknown.

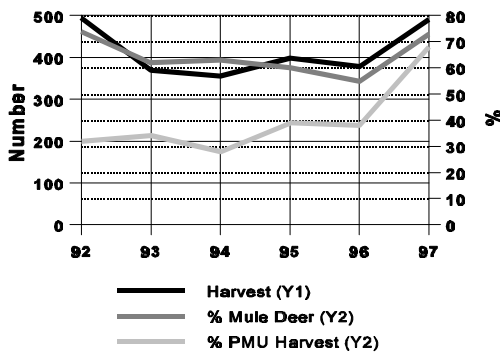


Figure 10. CCT harvest statistics.

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.

Biologists classified a total of 2,712 mule deer during helicopter surveys in PMU 21 in mid-December, 1997 (Table 3). The counts yielded overall buck:doe and fawn:doe ratios of 12:100 and 72:100 respectively. 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. If we could correct for these biases, we would likely come close to achieving the general management goal of 15 bucks per 100 does, and the quality unit (242) goal of 20 per 100. Under the current regulation scheme, we expect to reach these targets by next year. However, as noted earlier, the percentage of bucks with \geq 3-pts declined from 1996. 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 very close to the historical average of 71:100. This is a pleasant surprise, considering the nutritional stress placed on does during the severe winter of 1996-97.

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

Year	Buck Antler Class		Does	Fawns	Total	F:100:B	
	3 pt +	< 3 pt					
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

Table 4. Spring population composition counts from 1998, 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	1057	394	1451	37:100
Okanogan	209, 215, 233	222	68	290	31:100
Total	215	1279	462	1741	36:100

During hiking surveys in late March and early April, 1998, biologists classified 1,741 mule deer in PMU 21 (Table 4). Data analysis produced an overall fawn:adult ratio of only 36:100. This represents a significant improvement over 1997 results, but is lower than expected, within the context of a mild winter and high post-season fawn survivorship (Table 5). This might be partially explained by increased numbers of bucks present in the adult cohort, which would lower the fawn:adult ratio relative to years past. This is contradicted; however, by the subset of data from the Okanogan watershed, where both post-season buck:doe and spring fawn:adult ratios are lower, and post-season fawn:doe ratios are higher than in the Methow. This could be a function of small sample size in the Okanogan.

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

Year	Adults	Fawns	Total	F:100
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

Population Status And Trend Analysis

Helicopter quadrat 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. Reliable pre-season counts are difficult to obtain due to the migratory nature of this herd. Counts are artificially skewed toward does and are not accurate enough for use in population models.

Current herd management is based on demographic parameters generated from check station data, post-season counts, and spring surveys. Qualitative observations from land managers, biologists, and long time residents, as well as harvest figures, suggest the population may be half of what it was in the mid 1980's and early 1990's.

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 indicate that even during periods of mild winter weather, the population is not rebounding to the historic highs of the 1950's and 60's.

Reduced herd size is likely a function of loss of winter range, due to increased human population and associated development. 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. As a result, the long-term decline in mule deer numbers is expected to continue.

White-tailed deer, on the other hand, 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 white-tails. White-tails 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. The long-term expansion of the white-tail population and range is expected to continue in concert with human development.

Unlike population size, herd composition is tied to harvest rather than habitat. Heavy hunting pressure on antlered mule deer has 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, should improve sex ratios in the long-term. This in turn should lead to higher pregnancy rates and more synchronous breeding, improving overall herd demographics.

Severe winter weather has depressed mule deer numbers significantly since 1992. The Methow Valley in PMU 21 has been hardest hit. White-tails have also sustained losses, but in general, have been more resilient than mule deer.

Last winter's mild weather has helped deer populations begin to rebuild, and more restrictive hunting regulations have helped boost the buck:doe ratio. As a result, the population is poised to rebound, barring another severe winter. Two factors; however, will likely temper any expansion. First, the 3-point antler restriction will shift the buck age structure towards younger animals. This may reduce breeding efficiency and synchronicity, and increase whitetail-mule deer hybridization. Additionally, with populations at such low levels, mortality from road kills, domestic dogs, and wild predators are probably having a greater relative effect than would be expected at higher deer densities.

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 orchards 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 rapid subdivision and residential construction associated with a booming recreation industry. These trends are likely to continue and even accelerate, particularly in the Methow.

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 will likely receive between \$2 and 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 orchards 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.

Much of Okanogan County is intensively grazed. In some areas, livestock compete with mule deer for grasses and forbs. More importantly, livestock grazing accelerates the spread of noxious weeds that aggressively displace many deer food species. 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. Much of the range in this area is higher and wetter than in PMU 21. It is hoped that this will slow weed invasion to a manageable level.

Noxious weed invasion continues to be a major concern. Both agencies and private land owners are developing more aggressive integrated weed management programs.

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 restoring winter range in the Sinlahekin with prescribed burning.

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 are currently depressed from a series of severe winters, but are beginning to rebound. A gradual long-term population decline will likely continue, due to habitat loss and reduced habitat quality. 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 3-point restriction.

White-tailed deer numbers have also dipped during harsh winters in recent years, but will likely rebound faster than mule deer. The long-term prognosis is for range and population expansion. This is a function of changes in habitat associated with human development, and the difficulties in achieving adequate harvest on private lands where white-tails 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 stress on deer herds, improving winter survivorship. And 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 3-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 3-point restriction is counterproductive for improving herd vitality. First, harvest pressure is being increased on the segment of the population you are trying to conserve. Second, more bucks are being killed and left in the field due to misidentification of 2-points as 3-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.* If improving mature harvest opportunities is a priority, enlarge the number of limited entry units to include GMUs 231 and 300.

Rationale. Combining these three units would protect older age class bucks that don't migrate into unit 242 until after the general season.

5. *Recommendation.* Harvest antlerless mule deer by permit only until populations have rebounded enough to support harvest during an open season.

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.

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

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

Methow and Okanogan valleys.

7. *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. In many cases similar results might be achieved with low intensity burning.

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 31-Chelan	248-269 300-316

Prepared by: John Musser, District Wildlife Biologist

Population Objectives/guidelines

Management objectives for PMU 23, Douglas, are to maintain deer populations and increase post season buck ratios to at least 15:100 does. Management objectives for PMU 31, Chelan, are to increase deer populations as habitat recovers from fire, and increase post season buck ratios to at least 15:100 does. Post season surveys will be used to monitor population progress toward these 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. These population and season factors resulted in record low deer harvest for the Wenatchee District in 1997.

Deer season begins with early archery, which runs through the first 2 weeks of September. Early buck season runs from September 15 - 25 in GMUs 301 and 302, and is open to all weapon users. Early muzzleloader season is open in 3 units for 7 days in early October. Modern firearm season is open for 9 days in mid October. Our season framework is designed to allow limited permit hunting for modern firearm and muzzleloader hunters in late November, however currently population status precludes offering any late permits. Late archery season is open in 2 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 3 point or greater bucks with little opportunity for antlerless harvest. The 3 point regulation was new in 1997. Unless changed by the Fish and Wildlife Commission, the regulation will remain in effect through 1999 hunting seasons. A new 3 year hunting season package will be developed in 2000.

Deer harvest for the Wenatchee District in 1997 was the lowest ever recorded (Figure 1). The reduction in harvest was caused by several factors; severe winter of 1996, Tye and Dinkelman fires (affected PMU 31), short 1997 modern firearm hunting season, and 3 point minimum regulation in 1997. Conservative hunting seasons are moving herd composition close to management objectives.

Washington deer hunter numbers have declined steadily during the past 6 years, and were 35 percent below the 1992 level in 1997. Within the Wenatchee District deer hunters have declined to less than half the 1991 level (Figure 2). Although the deer population is doing relatively well in the Douglas PMU, the amount of hunter number decline is similar between Douglas and Chelan PMUs.

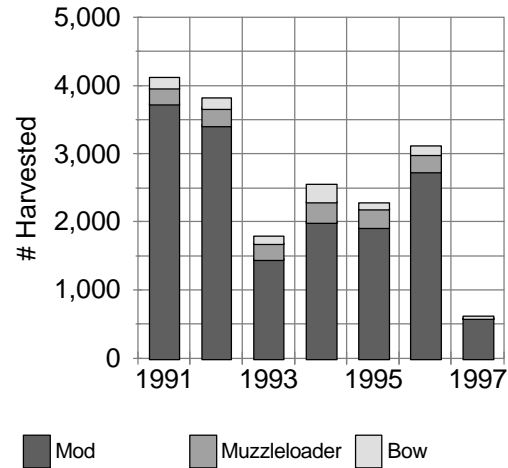


Figure 1. Deer harvest in Wenatchee District.

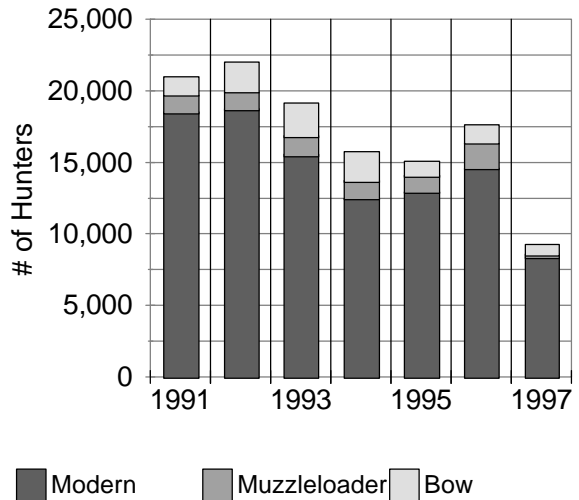


Figure 2. Number of deer hunters in the Wenatchee District.

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 ratios. Surveys done in February and March are most useful in assessing winter mortality and population level. This year budget cuts restricted December deer surveys and eliminated February- March surveys.

Based on limited sample size, December 1997 ratios were 22 bucks and 70 fawns per 100 does in the Chelan PMU (n=271). In Douglas PMU, December ratios were 14 bucks and 62 fawns per 100 does (n=370). Mild winter weather and low deer density resulted in excellent winter survival, however we have no survey data to support this observation.

Population Status And Trend Analysis

Deer population status is quite different between the 2 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 wintering conditions for these deer have been improved by the habitat development associated with CRP, the Desert Wildlife Area, and the Stevens Ranch near Wilson Creek. This population will probably be fully recovered from the 1996-

97 winter in another year and should continue to increase as long as habitat trends remain positive.

Habitat Condition And Trend

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

Human population is increasing by nearly 2 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 3 point regulation, current hunting regulations are well suited to local conditions and populations. The 3 point regulation has not worked well in most other states because it focuses mortality on the segment of the population most hunters and 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 mortality of mule deer and winter ecology in areas recently burned would be helpful in managing deer in the Wenatchee District. We need to greatly increase current monitoring efforts to successfully manage these deer.

Species	Region	PMUs	GMUs
Deer	2	24 & 25	272, 278, 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 (formerly part of GMU 278) the management objective is to increase herd size to the long-term carrying capacity of habitat available on the Desert and Potholes Wildlife Areas (WAs) without increasing damage claims/complaints from agricultural land adjacent to the WAs. 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

All units except GMU 290 had a 15-day early archery season in 1997 (Sept. 1-5, 3 point buck minimum and Sept. 6-15, 3 point buck or antlerless except in GMU 278 no antlerless hunting was allowed and GMU 290 was permit only). In addition GMU 272 had a 3 point minimum late archery season (Nov. 26-Dec. 8). GMU 290 had a permit only archery season for 8 hunters (Sept. 1-15) that was 3 point minimum.

All units except 290 had a 9-day general (modern firearm) 3 point buck minimum season in 1997 (Oct. 11-19). In GMU 290, 26 permits were issued for a 16-day 3 point buck minimum hunt (Nov. 8-23).

In 1997, a legal buck had to have a minimum of 3 antler points on one side.

The only muzzleloader season in the Columbia Basin units reported here was in muzzleloader area 925 (contained in GMU 284). This season was antlerless only (Dec. 1-31).

In GMU 272, 200 antlerless only permits were issued for a 9-day season (Oct. 11-19).

Special seasons and regulations were in effect in PLWMA 201 (contained in GMU 272). That part of GMU 278 within the Wahluke Slope WA had a firearms restriction limiting deer hunters to use archery, muzzleloaders, and shotguns.

In the 1997 season, 2,800 hunter-days were expended by 7,634 deer hunters who hunted in the four GMUs (Table 1).

This represented 50% of Region 2 hunters and 5% of Region 2 hunter-days. Hunter pressure, as measured by hunter-days, in the four GMUs combined increased 16% in 1997 compared to 1996. Hunter-days increased in all GMUs.

Table 1. Mule deer harvest in GMUs 272*, 278, 284, and 290 from 1992 - 1997.

Year	Harvest			Success	Hunter		Days/ Kill
	Buck	Doe	Total		Number	Days	
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
Mean	493	162	655	0.23	2800	7634	12

* Includes PLWMA 201

Hunting conditions during the 1997 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 decreased 11% from that of 1996 but was 4% above the 5-year mean of 1992-1996 (Table 1). In 1997, success was higher than that of 1996 in GMUs 284 and 290. Highest success (0.73 deer/hunter) was in GMU 290.

Buck harvest in the four units combined was 629 in 1997 and decreased 21% from that of 1996 (799 bucks) and was 35% over the 1992-1996 mean of 466 bucks (Table 1). Fifty-one percent of the buck harvest in the four units was from GMU 284, 37% from GMU 272, 9% GMU 278, and 3% from GMU 290. The decreased buck harvest was expected because of the 3-point requirement imposed in 1997. A high percentage of the buck harvest in past years has been 2-point bucks.

In GMU 290, 24 of 26 modern firearm permit holders hunted and harvested 21 bucks. One of three muzzleloader hunters hunted and harvested one buck. Five of the eight archery permit holders 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 has had antlerless permits in all of the past six years but the number has varied from 50 to 200 annually. GMU 278 has had no antlerless permits in the past six years. GMU 284 had no antlerless permits in 1994-1997 but had 150 permits in 1992 and 1993. The mean 6-year harvest of antlerless deer in the four units combined was 162 (range, 114 to 194).

Harvest of deer by archery and muzzleloader in the four units is small, accounting for 4 percent each of the total harvest

in the past six years.

The four Columbia Basin GMUs produced 33% of the buck, 20% of the antlerless, and 29% of the total deer harvest in Region 2 in 1997. Hunter success in the four Columbia Basin GMUs was 24% compared to 10% 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, I feel at least 90% of deer are counted.

Post-season herd composition surveys were made in GMU 290 from a helicopter in December 1995, 1996 and 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.

A herd composition survey was made from a helicopter in GMU 284 during May and June 1997 in conjunction with surveys for another species. This survey provided data on buck:doe ratio in the unit. Bucks had adequate antler growth to be recognized as bucks. No post-season herd composition surveys were made in GMU 284 in 1997.

During December 1997, 370 deer were classified in that part of GMU 272 outside PLWMA 201 (Table 2). Post-season ratios were 14 bucks and 62 fawns per 100 does. Approximately 31% of the bucks were judged to be adults. Surveys in 1993 and 1995 produced sample sizes too 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 7 bucks and 60 fawns per 100 does.

In PLWMA 201 the pre-season survey in early September 1997 indicated a decrease in the "resident" herd size. The "total" count on the area was 496 deer with 80 bucks and 62 fawns per 100 does (Table 3). Seventy-two percent of the bucks were adults. The pre-season survey in early September 1998 indicated a continuation of the decline observed first in 1997. The "total" count on the area was 312 deer with 115 bucks and

Table 2. Post-season mule deer herd composition in GMU 272 from 1992-1996.

Year	Bucks	Does	Fawns	Total Deer	%Adult per 100 Does		
					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	62

52 fawns per 100 does (Table 3). As in 1997, 72 percent of the bucks were adults.

Table 3. Pre-season mule deer surveys in PLWMA 201. 1988 and 1993-1997.

Year	Bucks	Does	Fawns	Unid.	Total Deer	%Adult per 100 Does		
						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

The post-season survey conducted in December 1997 indicated a decrease in the "wintering" or "migrant" herd size on the PLWMA (Table 4). The "total" count of 1,177 deer represented an 18% decrease from 1996. Most of the migrant segment of the wintering herd was does and fawns which increased 154% and 221%, respectively from the 1997 pre-season count. Bucks increased by only 12%.

Table 4. Post-season mule deer surveys in PLWMA 201. 1988 and 1990-1997.

Year	Bucks	Does	Fawns	Unid.	Total Deer	%Adult per 100 Does		
						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

During the December 1997 post-season herd composition survey 85 deer were classified in GMU 290 with 3 bucks and 51 fawns per 100 does (Table 5). This small sample size was inadequate to estimate composition of the herd and make

Table 5. Post-season mule deer surveys in GMU 290 Desert in 1995 and 1997.

Year	Bucks	Does	Fawns	Total %Adult per 100 Does			
				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

comparisons to 1995 and 1996.

The 1995 estimate of herd size within the 250 square mile GMU 290 based on a helicopter survey and intensive ground count was 264 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.

GMU 284. No surveys were conducted in GMU 284 in 1997.

Population Status And Trend Analysis

Total "population" (herd) size estimates were made only for PLWMA 201 in 1997 and 1998. The pre-season (resident) herd size for PLWMA 201 was 496 mule deer in 1997 and 312 in 1998. Post-season (migrant+resident) wintering herd size was 1,177 mule deer in 1997. In GMU 290, the herd size was estimated to be 264 mule deer in 1995. No estimates of herd size have been made in this GMU since 1995.

Little data other than estimates of harvest are available 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 similar trend 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 1980s. The 1980 harvest was 10 bucks compared to 54 in 1997.

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 only 3-point (adult) bucks were legal in 1997. In GMU 284, deer numbers appear to have declined significantly from 1992 to 1995, but rebounded just as strongly in 1996 and 1997, based on buck harvest. Incidental observations of deer density combined with herd composition data in 1995 and 1996 showing a very high recruitment rate indicate herd size in GMU 290 has increased rapidly in the last five years. On PLWMA 201, both resident and wintering herd size increased from 1993 through 1996 but decreased in 1997.

Post-season buck ratio in GMU 272 in 1997 was slightly below the objective of 15:100. Post-season buck ratio in GMU 290 in 1997 was unknown due to small sample size of the herd composition count.

Deer damage claims/complaints in the winter of 1997-98 were few in number in all GMUs due to the mild winter weather.

Habitat Condition And Trend

The winter of 1997-98 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 new growth forbs. During the winter of 1997-98, 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 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 several hundred acres of irrigated food plots annually, 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.

The spread of Russian Olive in GMUs 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 include orchard, alfalfa hay stacks, alfalfa fields, various row crops, and ornamental trees and shrubs.

Orchard tree damage and damage to alfalfa haystacks 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 haystacks 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 1997-98, 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 7 days. The 3-point regulation and 9-day buck season established in 1997 will reduce buck harvest and increase post-season buck:doe ratios above 1996 levels, but, unfortunately, will likely reduce the percentage of older bucks available to hunters over the long term. The 3-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 cannot 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 are available.

Applied research effort to determine the influence of PLWMA 201 on adjacent GMUs should continue.

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. In agricultural areas, management is directed toward minimizing conflicts with crop depredation.

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 36, 35 (excluding the southern portion of GMU 360), and GMU 346. There is no late muzzleloader season and only GMUs 336, 352 and 360 are open during the early season.

The regulations in 1997 were successful in increasing the buck escapement but the number of hunters decreased. The buck escapement (bucks:100 does) increased from historic levels of 2-4 to 8-11 in 1997 (Table 2). Deer hunter numbers in Region 3 in 1997 were at an all time low (Table 1). Apparently hunters did not view the general season 3 point restriction as a desirable “recreational opportunity”. The preceding hard winter and forecast for a poor harvest undoubtedly influenced hunter numbers. Modern firearm, muzzleloader, and archery hunter numbers were 43%, 72% and 39% below the ten year average.

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

Year	Muzzle-			Total	Success
	M. Firearm	loader	Archery		
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	13637 (79)	176 (1)	3450 (20)	17263	.03
1986-96					
AVG	23836 (79)	638 (2)	5666 (19)	30149	.09

Hunter success was also at a record low (3%). However, permit hunters had a 38% success and accounted for 25% of the harvest. Success was also at the historical average (13%) in GMU 372. The 1998 deer harvest for Region 3 was 464 bucks, down 84% from 1996 (Table 3). The average for the previous 6 years was 2892 bucks. No does were harvested in 1997.

Table 2. Deer surveys conducted in Region 3 during December 1997 and February 1988.

Month	Area	Total	Adult		Buck	Dead Deer
			Antlerless	Fawn		
Dec	P32	265	153	95 (62)	17 (11)	0
Dec	P33	440	298	117 (39)	25 (8)	1
Feb	P32	989	640	349 (61)	NA	0
Feb	P33	2134	1511	616 (44)	NA	1
Feb	P35	193	127	66 (56)	NA	0
Feb	P36	223	149	73 (53)	NA	0
Feb						
Total	Yakima	2550	1787	755 (46)	NA	1

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

Surveys

In December 1997, 265 and 440 deer were classified with ground surveys in PMUs 32 and 33 (Table 2). Aerial surveys (helicopter) in February resulted in 989 and 2,550 deer being classified in PMU 32 and the Yakima units (PMUs 33, 35 and 36). Survey units were directed to high density winter ranges. Attempts were made to ground survey PMUs 35 and 36 in December, but few deer could be located.

The December buck:doe:fawn ratios were 11:100:62 and 8:100:39 for PMUs 32 and 33 (Table 2). The buck ratio is below the goal of 15, but up from 2:100 and 4:100 in December 1996. Bucks were probably underestimated in 1996 because surveys were done by helicopter. However, buck escapement was undoubtedly higher in 1997 under the 3 point minimum regulation and limited entry hunts. Ground surveys in December, 1995 found 4 and 3 bucks per 100 does in PMUs 32 and 33.

The PMU 32 fawn ratio in the 1997/98 was 62:100, the highest since 1990. The total number of deer surveyed (989) was the largest since aerial surveys began in 1990.

The results in PMUs 33, 35 and 36 were mixed (Table 2). A relatively large number of deer were seen in PMU 33, but the fawn ratio was low. In PMUs 35 and 36, the number of deer surveyed was below normal, but the fawn ratio was above average. In all 3 units, numerous skeletons from the previous winter were obvious. The high number of deer seen in PMU 33 was a result of ideal survey conditions and surveying high density deer areas. The high fawn ratios in PMU 35 and 36 may have been the result of the previous winter’s mortality. The loss fawns and older deer may have left mostly prime reproductive age does in the population.

Table 3. Deer harvest by PMU in Region 3.

Year	PMU 32		PMU 33		PMU 34		PMU 35		PMU 36		REGION 3	
	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
1991-96 AVG	1,018	162	998	119	162	10	427	85	287	79	2,892	455

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 the only long term index available. The buck kill has increased over the last 2 decades (Table 3). The buck harvest for 1991-1996 was 28% and 18% higher than the average for the 1970s and 1980s. The trend is contrary to the belief of the public and some biologists. 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.

The current deer populations are probably well below average. Harvest peaked in 1992 after 7 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 spring 1993 averaged 42. The harvest and presumably populations increased until the winter of 1996-97. Fawn ratios in the spring of 1997 averaged 33 in the region. The deer populations are currently rebounding. The lack of harvest and mild winter in 1997-98 should result in a growing population.

One of the main concerns in Region 3 is the possibility of over harvest from tribal members. A recent court decision gave all tribes in the "Northwest Territory" authority to hunt any "open and unclaimed" (public) land. The majority of deer winter range in Region 3 is on public land. At least a few tribal members took advantage of the decision during the winter of 1997/98. The tribal harvest is expected to increase in the future.

In PMU 33, train collisions are a concern. Large portions of winter range are adjacent to tracks. Field observations in spring 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 through out 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, was beginning to show signs of recovery. 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 season has resulted in increased buck ratios. In the next few years the objective of 15 bucks per 100 does will be reached. GMUs 329, 330, 342, and 371 should remain under the current permit system. The 4 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. Populations need to be developed to estimate acceptable doe harvest.

Species

Region

Deer

4

Helicopter Deer Survey - Experimental

Prepared by: Rocky Spencer, District Wildlife Biologist

Introduction

Very little is known about many of the population dynamics aspects of black-tailed deer (*Odocoileus hemionus*). This is primarily due to secretive life history strategy of black-tails and the dense habitat they occupy in the western Washington Cascade mountains. Herd composition counts are one of the more common methods used to obtain direct measures of deer herd composition that assess herd population status (McCullough 1993). Collection of this type of information typically involves standardized survey routes driven in the early morning or at night when artificial lights are used to classify deer. Random counts conducted over a broad area for extended periods can also be effective to obtain composition information. Typically, herd composition counts for black-tails have a high variance because sex and age classes are observed differentially by season, which biases sex and age class (McCullough 1993). Collection of deer herd composition by these traditional methods can also be time and labor intensive; which often limits the number of deer classified thereby

years old following timber harvest.

Methods

A Bell 206B helicopter with a pilot and three observers was used for the surveys. Flights were designed to essentially to “flush” deer while bedded or feeding in these sites for herd composition and group size. Flight speed and distance above ground were about 30 mph and 75-100 feet respectively. Flushed deer were classified by direct viewing or with the aid of 7x50 binoculars. Sometimes deer were pursued to ensure accurate classification. Flights were conducted on January 8 and 9, 1998 in GMUs 485 and 460 respectively. This was prior to antler drop.

Results

In GMU 460, we saw eighty (80) deer and classified seventy-one (71) in about 1.8 hours of flight time. In GMU 485, we classified fifty-four (54) deer in about 1.5 hours of flight time (table 1).

Discussion

Based on age data collected during hunts in both GMUs

Table 1. Classification and composition of black-tailed deer counted on composition surveys

Unit	Date	Doe	Fawn	Buck Antler Points				Unclass	Total	per 100 Does			
				Spike	2	3	4			Spike	Br. Buck	Total Buck	Fawn
GMU 460	1\09\97	45	23	3	0	0	0	9	80	6.6	0	6.6	51
GMU 485	1\08\98	30	13	0	7	1	3	0	54	0	36.6	36.6	43

affecting data reliability.

These factors, coupled with limited personnel and time prompted an experimental approach to gather black-tailed deer herd composition in the western Washington Cascade mountains. This involved using a helicopter to classify deer over randomly selected portions of selected game management units (GMUs).

Study Area

The Snoqualmie GMU (Unit 460) has been managed under an any buck harvest strategy for well over 30 years. Harvest has varied, averaging about 460 deer per year.

The Green River GMU (Unit 485) has had restricted public access and limited harvest of deer for about 20 years and in 1984 deer harvest became regulated to permit only hunting and only about 100 deer per year harvested, with a generally even split between antlered and antlerless animals .

Both GMUs have similar habitats that consist of privately owned second growth timber stands that are intensively managed for timber production. These lands have many openings created by timber harvest activities that offer good forage and cover habitat for deer. Generally the best sites for helicopter viewing to classify deer are stands between 1 to 12

460 and 485 there is a notable difference in the age structure of the male population segment. GMU 485 has an average buck age from hunter harvested deer of 4.25 years compared to 2.7 years for GMU 460 (R. Spencer un.pub.data). This is reflective of the different management strategies.

Intuitively I would expect to see more branched antlered bucks in composition surveys in GMU 485 compared to 460, which the buck:doe ratio results indicated.

Helicopter deer composition surveys, based on our past surveys and this data, resulted in larger and more reliable sample size in a short period of time. While traditional ground composition techniques are used in the western Washington Cascade mountains, my experience suggests it would cost more and the results may be less reliable. Traditional surveys require more people power to conduct (for ample sample size) and can be unreliable because of the inability to accurately classify deer at distances beyond 125 meters, particularly using spotlight surveys.

Experience suggests it may take 20-30 or more hours to get a sample size of about 100 deer from standard ground composition surveys. This equates to less than five deer per hour, compared to 25-45 deer per hour from the helicopter. Funds permitting we may expand this survey technique for

further evaluation as a technique to gather composition on black-tailed deer in western Washington.

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 in association with available habitat base.

Hunting Seasons And Harvest Trends

Hunting season formats differ between individual Game Management Unit's (GMU's) based upon geographic variation. GMU's 407 and 410 are island and coastal areas with 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 recommended in island and coastal units as deer populations are generally higher with less public access to private lands. GMU's 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 GMU's 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. GMU's 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 declines have been documented in all mainland GMU's in north Region 4 as compared to the period 1990-96 (Table 1).

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

GMU	Mean Harvest		Percent Change
	1990 - 96	1997	
407*	261	280	+ 7.8%
410**	414	528	+27.5%
418	285	78	-72.6%
426	18	3	-83.3%
437***	426	131	-69.2%
450	29	10	-65.0%
Total	1433	1030	-28.1%

* GMU 405 converted to 407

** GMU 410 (created 1995- combined GMU's 406 and 436)

***GMU 437(created 1997- combined GMU's 433 and 440)

Harvest declines in GMU's 418, 426, 437, and 450 averaged - 72.5 percent decrease as compared to the period 1990 - 96 (Table 1). GMU's 407 and 410 indicated a +7.8 and +27.5 percent increases, respectively. The two units with increased harvest are characterized as island and/or coastal habitats.

These areas support moderately high deer populations in combination with high human populations and extensive road access. The documented harvest declines in GMU's 418 - 450 may be a result of reduced deer population levels or a result of decreased land access related to road closures and increasingly posted lands throughout Whatcom and Skagit counties.

Surveys

No deer population surveys were conducted during the 1997 season in any north Region 4 Game Management Units

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 5 - 10 years. Harvest data in Table 1 may support the possibility of reduced deer populations.

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 3 - 5 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 GMU's 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. This information related to age and sex composition in the harvest is necessary to drive the population modeling effort. Tooth envelope distribution replaces the need for

costly and logistically difficult field check and check station operations.

Species	Region	PMUs	GMUs
Deer	4	46	448

Prepared by: Ruth Milner, District Wildlife Biologist

Population Objectives/guidelines

Population objectives are to maintain maximum 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 11-31 October, 1997.

Access to private and state lands continues to be limited 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 to some hunters.

The Swinomish tribe reported no deer harvested from unit 448. We do not yet have reports from the Sauk Suiattle, Stillaguamish or Tulalip tribes, which are resident tribes in Snohomish County.

Surveys

No deer population surveys were conducted in GMU 448 during 1997.

Population Status And Trend Analysis

Figure 1 shows hunting trends from 1988 to 1997. The number of persons hunting in GMU 448 has declined over the last decade, as has the number of animals harvested, while the amount of effort (hunter days/kill) required to harvest a deer has increased. These data support the anecdotal observations of WDFW wildlife agents and biologists that deer numbers have declined in GMU 448.

Habitat Condition And Trend

Anecdotal evidence continues to suggest that deer numbers have declined over the last 15 to 20 years. During that time, we have seen increasingly accelerated trends toward urbanization

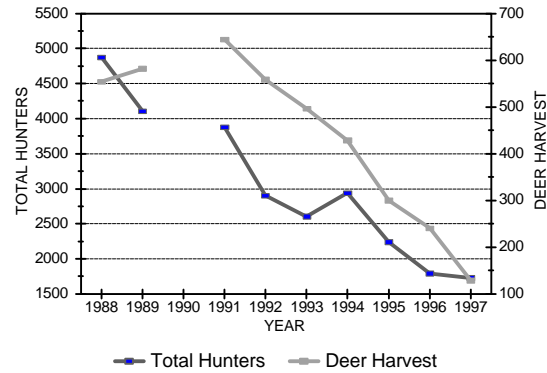


Figure 1. GMU 448 Stillaguamish Total Number of Hunters and Deer Harvest 1988-97

in the lowlands; many forest stands are now in the 6 to 20 year age class, which does not provide good habitat for black-tailed deer. 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.

Management Conclusions

Continued human development in GMU 448 will further reduce the habitat available to black-tailed deer. We expect to see increased restrictions for land access to hunters, as well, with the increasing use of gates, posted private lands, and the establishment of “no shooting” zones.

In the coming year we will be contacting industrial private land owners to assess their willingness to implement habitat enhancement schemes targeting black-tailed deer and assessing techniques to monitor population trends for this species.

Species	Region	PMUs	GMUs
Black-tailed Deer	5	All	All

Prepared by: **Min T. Huang, Wildlife Biologist**
Pat Miller, District Wildlife Biologist
David Anderson, 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. Check 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 3-year hunting packages, the latest of which is the 1997-1999 package.

Several harvest strategies are employed in Region 5. During the general gun 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 GMU's (558, 574, 578, 582, and 588) are managed under a 2-pt or better harvest regime. Muzzleloader harvest is primarily restricted to any buck, except for those seasons which fall under the branched antler GMU's above. Archery hunters are allowed any deer, except in GMU's 558, 574, 578, 582, and 588; where there is a 2-pt minimum on bucks. Antlerless deer during archery is still legal in these GMU's. Apart from the archery harvest, antlerless permits are allocated based on the damage history and minimum estimated population of selected GMU's.

In 1997, 42,925 hunters spent a total of 287,203 days deer hunting in Region 5 (Table 1). This represents a 1.9% increase in hunter numbers from 1996 and a 11.6% increase in the total number of days spent deer hunting.

Current regulations have resulted in relatively stable harvest trends in Region 5. Black-tailed deer harvest in Region 5, however, seems to be more closely related to weather conditions than deer numbers.

Hunting conditions during the 1997 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.

Table 1. Summary statistics for deer harvest in Region 5, 1991-1997.

Year	Number of Hunters	Days afield	Harvest	% Success
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

Success, however, increased in 1997.

Overall hunter success in 1997 was 18.6%, with a total of 42,925 hunters harvesting 7,963 deer (Table 1). Total deer harvest increased for the first time in three years, but the 1991-1997 trend remains non-significant $r = -0.321$, $P = 0.481$.

Surveys

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

Check stations designed to collect deer biological data were established in 1993. Five voluntary deer check stations were established throughout Region 5 during the opening weekend of the general firearm deer season, 17-18 October 1998. Check stations were located in Cougar, Randle, Toutle, Chehalis, and Longview. 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 check stations allowed for coverage of the entire Region. Prior to 1998, samples from 2-PT units were collected from a check station located in Home Valley. Data from 2-PT units has been dropped from the SAK model.

Deer brought to check 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 are used to determine the percentage of yearling bucks in the total adult buck harvest (≥ 1.5 years old). In age-stable stationary populations this percentage is equal to the overall buck mortality rate. The pertinent assumption in this

determination is that all bucks are equally vulnerable to harvest.

Adult sex ratios were determined by dividing the long-term estimate of annual doe mortality in Region 5, 22.2% (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 1997. 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 bucks, does, fawns, or unknowns.

A fawn:doe ratio was determined from survey results. Ninety-percent confidence intervals about the mean were constructed following Czaplewski et al. (1984). Mean monthly 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 16-17 March 1998. Transects were driven on the evening of the 16th and morning of the 17th. 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 103 deer were checked during 17-18 October 1998. The annual yearling buck percentage (AYBP) from any-buck GMU's was 0.582, compared to 0.444 in 1997. This increase is marginally non-significant from 1997 ($P < 0.10$), but a significant increase from the five-year trend ($P < 0.05$). The five-year trend in AYBP is non-significant, but indicates increasing mortality ($r = 0.778$, $P = 0.12$). Assuming an age-stationary, stable population, the overall buck mortality rate in any-buck GMU's from October 1997-October 1998 was ~58%. Annual buck mortality rates in the range of 40%-50% are indicative of a lightly exploited population. The long-term estimate of doe annual mortality rates in the Region is 22.2%. Sample size of does is inadequate to annually determine mortality rates.

Check-station data continue to indicate good survivorship among the male segment of the black-tailed deer population in the Region. The substantial increase in mortality observed in 1998 may be an anomaly, or indicative of increased non-hunting mortality. The AYBP also indicate that black-tailed deer continue to be 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 buck-to-doe ratio in any-buck GMU's before the hunting season is 49 bucks per 100 does.
2. Unless natural mortality is limiting recruitment, the continued older age structure of the harvest in 1997 (~44%) indicates that harvest is not a limiting factor driving black-tailed deer population dynamics. Substantial

changes in 1998 (~58%) warrant close scrutiny. If mortality rates in the Region continue to increase, and harvest remains at present levels, causative factors such as increased predation, disease, etc will have to be investigated. With respect to overall buck mortality, AYBP is still very low in Region 5 compared to most white-tailed deer populations. The AYBP in the Region, however, is higher than reported by McCullough et al. (1990) in California, but similar to other exploited populations in Washington (L. Bender, pers. comm.). 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 excellent survivorship and an extremely high adult sex ratio.

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 similar to 1997 (0.619 fawns/doe). 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.

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 328 deer were observed during the 16-17 March 1998 Klickitat deer survey (Table 3). Of these, 287 were classified, resulting in a fawn:adult ratio of 0.47 ± 0.07 . The long-term mean (1985-1998) ratio for this area is 0.41.

Long-term correlations (1985-1997) between the spring fawn:adult ratio and the overall buck harvest in GMU 588 the following fall are significant ($r = 0.71$, $P = 0.01$). These analyses indicate that spring surveys are a good predictor of eastside fall hunting success.

The biological significance of this relationship is straightforward. 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, check station data indicate 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

Table 3. Historic fawn:adult ratios for the Klickitat deer survey, 1985-1998.

Year	Total	Classified	Fawn:adult ratio
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

poor fall hunting in Klickitat County.

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 1996 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 fawn production as fetuses are re-sorbed.

Increasing urbanization in several GMU's (504, 554, and 564) is resulting in a loss of quality deer habitat and an increase in deer/human conflicts. 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% is now in LSR. This will ultimately result in a 41% 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. Evidence suggests, however, that harvest is more closely dependent upon weather conditions than deer numbers in southwestern Washington. Buck seasons and lengths should continue to be set with the goal of maximizing

hunter opportunity.

Antlerless permit allocation can be increased 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 continue to show the effects of the harsh winter of 1996. In a year in which westside harvest was up in virtually all GMU's, harvest in GMU's 574, 578, 582, and 588 were all down in 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.

Little is known of black-tailed deer population dynamics, especially responses to exploitation. The Region 5 modified SAK population model was the first attempt to estimate and model black-tail populations on a large scale. This model, however, is dependent upon several important assumptions; (1) yearling bucks are equally vulnerable to harvest as adult bucks (age-stable stationary population), and (2) legal buck harvest constitutes 75% of overall annual buck mortality. A mortality study presently being initiated in Region 4 will hopefully address these questions, results of which can be used to 'fine tune' the SAK model.

For several years, deer west of the Cascade Crest have been sporadically reported with extensive hair loss. 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 should be thoroughly investigated. The attached Figure 1 documents the distribution of reported cases in SW Washington in 1997/1998.

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, (2) being limited by factors other than direct mortality, or (3) have a decadent older age structure which is limiting productivity. The relationships between current deer populations and habitat need to be clarified for westside populations.

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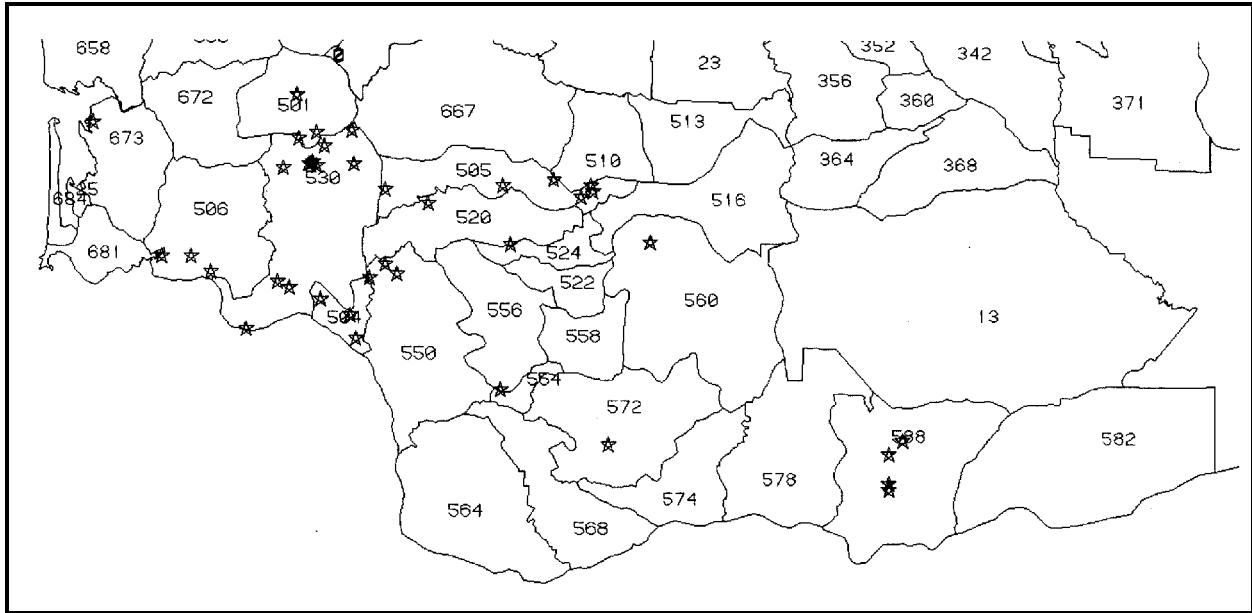


Figure 1. Reported observations (*) of black-tailed deer with some degree of hair-loss characteristic of the unknown disease process, Region 5, 1997-8.

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

Prepared by: **H. M. Zahn, 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 2 point or better units.

The 1997 season was the first year in a three year season package and, given the good state of the regional deer population, no significant changes were deemed necessary.

Hunting Seasons And Harvest Trends

Based on the analysis of the Game Harvest Questionnaire, hunting pressure as measured by numbers of hunters declined by about 19 percent in 1997 over the previous year. The average number of days required per kill for all hunters declined slightly from 30 to 28 days (Table 1). Thus, fewer hunters had a slightly higher rate of success.

Estimates of total annual mortality rates (i.e. from all

Table 1. Hunters and hunter days in Region 6.

	1995	1996	1997
Hunters	31,449	27,733	22,414
Hunter Days	192,221	162,717	140,108

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 2 points determined a regional buck mortality rate of 34 percent (n=1537). An analysis of 168 antlered deer at the Vail checkstation showed that 58 percent were yearlings. An aerial survey in that same unit determined that just over 50 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 19 percent (n=27).

In general, the hunting regulations continue to be conservative with doe harvest targeted at less than 20 percent of buck harvest. Antlerless harvest could be increased in some units.

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

Hunter success increased slightly in 1997: from 0.20 to 0.22.

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 5 percent of the total regional harvest.

Surveys

A pre-season helicopter survey was again conducted in GMU 667 (Skookumchuck): A total of 86 deer were classified. The ratios of fawns and bucks per 100 does were 43 and 24 respectively declining somewhat over the previous year. A severe icestorm 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. If this reflects the population as a whole the buck/doe ratio would be about 33 to 100.

No post seasons surveys were conducted during the reporting period.

The ratio of yearling to older deer was checked at the Vail check station. Of 168 antlered deer checked at the Vail Station 97 (58 percent) were yearlings. Of 27 does checked at Vail 5 (19 percent) were yearlings.

Deer check stations were run at Vail on 2 weekends in 1997 (Table 2).

Table 2. Vail check station results for 1997.

Date	Hunters	Deer Checked
10/11/97	447	87
10/12/97	518	42
11/18/97	580	45
11/19/97	614	26

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 somewhat lower than 1996. This is most likely due to lower fawn recruitment. A severe ice storm during the 1996-97 winter may have contributed to this.

Management Conclusions

Deer populations are utilized at less than the maximum sustainable rate. Harvests have remained fairly stable over the last decade. Managed forest lands have the potential to maintain good deer habitat.

Table 3. SAK population estimate by PMU.

PMU	Estimated Population
66	4,571
65	3,958
64	13,474
63	9,550
62	13,584
61	11,794

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 5,500; Olympic Peninsula - 10,400 to 14,400; and Nooksack - 350 to 1,000. We are evaluating the potential to increase elk distribution and 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 15 bulls per 100 cows in quality management areas.

Hunting Seasons And Harvest Trends

In 1997, elk hunting seasons were very unusual. The hunting season was a week earlier than usual and the weather was warm. Elk were still on their highest summer ranges and hunting conditions were poor. As a result, harvest was very low. 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 as any bull and will be managed as a separate tag area in 1998. 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 3 Pt. Minimum units. In 1997, hunting season rules similar to the eastside (spike only general seasons, branched bull by permit) were adopted in much of western Washington. Westside elk hunters voiced their preference for the 3 Pt. Minimum rule. At the same time, the Fish & Wildlife Commission elected to drop agency recommendations for a goal of at least 5 mature bulls per 100 cows in post season surveys. As a result of this situation, western Washington elk seasons were changed to 3 Pt. Minimum general seasons except for damage areas. Agency biologists believe bull escapement goals of 12 bulls per 100 cows can be met in most westside units with a 3 Pt. Minimum restriction and a 9 day modern firearm season.

Statewide elk harvest declined over 30 percent in 1997 (Table 1). On the eastside, the decline was 3,597 to 2,310 or 46 percent and on the westside, the decline was 3,356 to 2,609 or 32 percent. The weather conditions during the general modern firearm elk season were far from ideal in 1997. There was no snow to drive elk down from the high country and the season was nearly a week earlier than usual. This resulted in poor

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

eastside hunting conditions and excellent bull escapement. On the westside, the spike bull only general seasons undoubtedly limited hunter take. Since branched bulls were limited by permit, a number of mature elk survived the hunting season. We should expect most of the westside bull harvest in 1998 to be older, more mature animals with spike and two-point bulls not legal.

As with deer, all elk permit hunters were sent a questionnaire this year requesting information on success and 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. Calf survival in 1997 increased from 15 calves per 100 cows in 1996 to 24 calves per 100 cows in 1997 which should result in more yearlings in 1998.

Elk populations in northeast Washington continue to expand their range and increase in size. Several of the northeastern Game Management Units are open to any elk because of damage problems, but escape cover is excellent and elk populations continue to grow. Tribal elk hunting north of the Colville Reservation increased last year. The Colville Tribe extended this season by 6 weeks in units 101 and 105. These liberal seasons in Ferry County are in cooperation with WDFW objectives to control elk expansion.

For the first time in many years, bull escapement for the Yakima elk herd has met management goals. After 4 years of spike only general seasons with branched bulls by permit, bull post season ratios were over 12 bulls per 100 cows. We are still short of the bull escapement goal for the Colockum herd, but conservative bull permit quotas will help achieve that objective.

This past year, we had very limited antlerless harvest in eastern Washington. Cow harvest was down 77 percent in Region Three. This was partially because of reduced permit quotas after the 1996 winter loss and partially because of poor success due to poor hunting conditions.

On the westside, about half the units were spike bull only

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

*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.

in 1997 with branched bulls by permit. In addition, the modern firearm hunting season length was reduced from 12 to 9 days. Elk hunting on the Olympic Peninsula was made 3 Pt. Minimum in 1997. 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.

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% of the elk units. In the Colockum and Yakima areas we survey about 25% of the elk herd areas and in the Blue Mountains we survey about 80% 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 excellent calf survival. Calf survival was 62 calves per 100 cows in this area compared to 24 calves per 100 cows in the Blue Mountains.

Post season surveys in the Colockum and Yakima areas revealed the poorest calf survival in over ten years. February 1998 helicopter surveys revealed only 30 calves per 100 cows in the Colockum and 33 calves per 100 cows in the Yakima areas. Bull survival increased to 13.6 calves per 100 cows in the Yakima areas, but declined to 5.3 bulls per 100 cows in the Colockum 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 of 44 to 49 calves per 100 cows in September. For bull ratios, the best units are the permit only units--Margaret and Toutle (Table 4). The poorest bull ratios were in the any bull units where bull ratios are about 24 bulls per 100 cows prior to the hunting season. On the Olympic Peninsula, post season calf ratios range from 32 to 34 and bull ratios range from 5 to 8 in the units surveyed. In the Willapa

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

Region	GMUs	Name	Pre-season	Post-season
1	101-124	Northeast		12
	145-186	Southeast		13
3	300-334	Colockum		5
	334-372	Yakima		14
4	418-437	Nooksack		32
5	500 series	Any bull units	24	7*
		3pt. Min. units	27	12*
	524	Margaret	48	32*
	556	Toutle	35	21*
6	602	Dickey	26	12*
	615	Clearwater	22	5
	673	Williams Creek	25	8
	681	Bear River		19

*calculated

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

Year	Total Elk Tag Sales	Stamp Sales			Elk Tag Sales		
		Archer/ Muzz. Stamp	Archer Stamp	Muzzleloader Stamp	Modern Firearm	Archer	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

*Archer and muzzleloader separate stamp initiated in 1982.

**Resource Allocation initiated in 1984.

Hills, both bull and calf ratios are better with 30 to 57 calves to 100 cows and 8 to 19 bulls per 100 cows.

Population Status And Trend Analysis

Blue Mountains -

Stable at 4,300 \pm 500

1,300 below management objectives

Elk populations on the westside of the Blue Mountains are stable while elk numbers on the eastside have declined.

Spokane Area -

Stable at 180 elk in GMUs 127 and 130

Northeast Area -

Inadequate surveys to calculate population estimates. Elk numbers appear to be increasing.

Colockum -

Stable at 6,000

Yakima -

Stable at 14,000

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

Hanford -

Growing at 600 plus, all private land with limited hunting opportunity. This population will continue to grow until some harvest 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 was the lowest in many years (Fig. 1).

Nooksack -

Currently, numbers only 350 to 400 animals. This herd once numbered over 1,000 elk. Approximately 150-200 of these elk are in a damage area with liberal hunting seasons to alleviate this damage problem.

St. Helens -

Stable at 16,000

Willapa Hills -

Stable at 8,000

North Rainier -

Declining at 2,300

South Rainier -

Declining at 1,400

Olympic Peninsula -

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

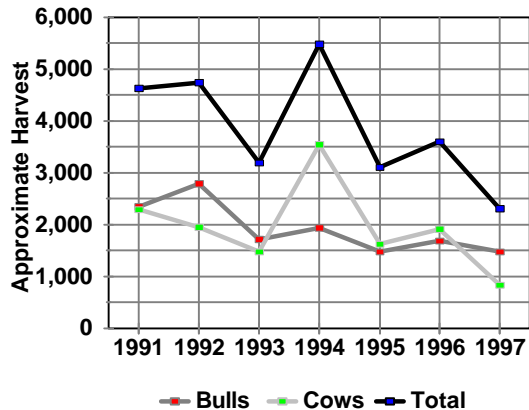


Figure 1. Recent Rocky Mountain elk harvest in eastern Washington.

therefore total 10,400.

Westside elk harvest has declined since 1994. Last year's harvest was low because of poor weather for hunting, shorter season and more restrictive seasons (Fig. 2).

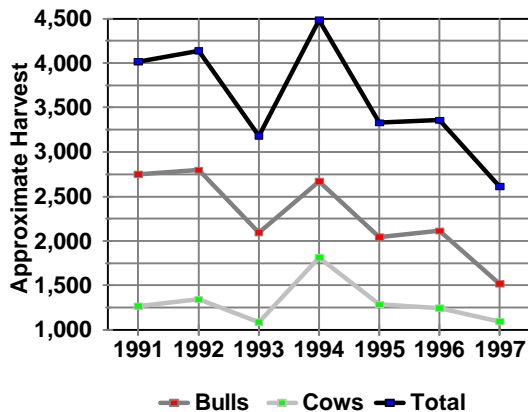


Figure 2. Recent Roosevelt elk harvest in western Washington.

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, so 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.

Augmentation/habitat Enhancement

No elk transplants for augmentation were planned or

completed in 1997. There are some habitat improvement projects that are ongoing or planned. In the Blue Mountains, weed control projects on Wooten and Asotin Wildlife Areas were initiated. 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 project is planned for 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 also are 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 are changing to 3 Pt. 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 3 Pt. Minimum rule protects younger bulls, but over time may not be as effective.

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 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 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 overharvest and habitat loss.

Species	Region	PMU	GMUs
Elk	1	11	127, 130

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 Seasons And Harvest Trends

In 1997, 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 graduates was open from October 20 thru November 20 for elk of either sex. The weather and elk distribution during the fall resulted in a reduced harvest over 1996 (see Table 1). These special seasons over the past 5 years have helped to manage the elk population so that at the time of this writing, there are no crop or tree damage claims in either of the units.

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

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 by late seasons either muzzleloader or by AHE graduates. If these seasons are not successful, then WDFW must rely on hot-spot hunts around areas of crop damage. All of these efforts were necessary both in 1996 and 1997.

Surveys

Ground and aerial surveys are used to gather population and herd composition estimates for GMU's 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.

Population Status And Trend Analysis

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 1998 indicates that we will be able to successfully manage these elk at a level that will provide recreation without the expensive damage claims. The bull to cow ratio is below the state guideline but this may be necessary to prevent future damage claims. The cow to calf ratio is down over the past three years but is similar to 1994. The surveys conducted in April did not include the Tekoa Butte area which in the past had a component of this population. Refer to Tables 2 and 3 for data on population trends. WDFW used the 1997 survey results to begin to model the Hangman subherd. The initial POP II modeling effort indicated that intensive efforts by WDFW to manage the herd level commensurate with social tolerance for ag damage have been successful and total numbers have declined since 1992.

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

Year	Bulls	Cows	Total	Hunter	
				Hunters	Days
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

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

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. We need to consider the level of management intensity for this subherd; we may not have funds to model this subherd.

Management Conclusions

Most of the elk studied in the mark-resight project this year 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 paintball study and 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).

Species	Region	PMUs	GMUs
Elk	1	11, 13, 14	101-124

Prepared by: Steve Zender, District Wildlife Biologist

Population Objectives/guidelines

The harvest management objective in the Pend Oreille PMU is to maintain the overall bull mortality rate at <50% and/or a post-season bulls per 100 cows ratio of 15 or greater. Antlerless hunting opportunity is by permit only, except that archers may hunt either sex. Elk populations are managed to increase with the exception of specific damage areas.

The objective in the Upper Columbia/Kettle PMU is to reduce expansion of elk into mule deer habitats and control elk in agricultural areas.

Hunting Seasons And Harvest Trends

All units were open for the early archery either-sex hunt 9/1-14. Late archery was open (either-sex) in GMUs 101, 105, 117, 121, and 124 from 11/26-12/15 (basically all units that have late archery deer seasons). A new muzzleloader season was offered in Unit 109 for bulls only from 10/4-10. The modern firearm general bull season was reduced to only 9 days long, 10/25-11/2. Antlerless permits were valid 10/29-11/2. These permits were again issued for the entire Pend Oreille PMU rather than by individual units. There are no special bull restrictions in northeast Washington, any bull is legal.

Elk hunter numbers for northeast Washington (Figure 1) increased significantly from 1991 to 1995 when they reached a peak. Deer and elk hunting seasons overlapped during this time which may have been a contributing factor to the increased hunter pressure. I suggest a significant factor for increasing hunter numbers was the added antler restriction regulations in other eastern Washington elk areas. There was a 44% drop in hunters from 1996 to 1997. The primary factor was likely the closure of deer season during elk season in 1997.

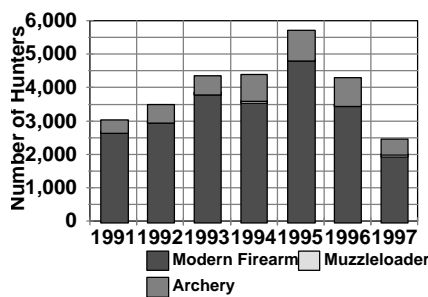


Figure 1. Elk hunters by weapon choice, GMUs 101-124.

Elimination of the deer season during the elk hunt certainly provided a higher quality experience for elk hunters. The most contentious issue with the deer/elk overlap was the concern from elk hunters that deer hunters were taking elk and then purchasing a tag. That argument was resolved.

Reducing the modern firearm elk hunt to 9 days was primarily an issue of maintaining simple statewide regulations.

The reduction from 12 days to 9 was a significant issue with many hunters. While our herd composition data is very limited it does not suggest a need to reduce harvest so the regulation to limit hunting days did not contribute to herd objectives.

Many elk hunters were concerned when WDFW issued antlerless permits for the entire Pend Oreille management area rather than at the GMU level. A special survey of all permit holders (Rieck, 1998) revealed that success by permit holders was only 15.7%. The 75 permits issued resulted in a take of only 11 animals (70 hunted), so fears of a high cow kill in any one particular drainage were unwarranted. This regulation provides hunters optimum opportunities while minimizing complications, and still maintains adequate control of the antlerless harvest.

The either-sex season in the elk control units may not be controlling expansion of elk into uninhabited forest environments but does seem to be limiting elk in agricultural areas where damage might occur. Harvest of bulls continues to approximately equal cows. It may indicate those hunters knowledgeable enough to locate elk in these units are selecting bulls at a rate higher than they occur in the population, thus reducing the "control" effectiveness of the either-sex season.

Our first muzzleloader only season (GMU 109) appeared to be successful. The intent was to provide muzzleloaders with some elk hunting opportunity in northeast Washington. Hunter participation was good without being crowded and success (7%, 3 bulls taken) was very good.

Elk are always hard to hunt in northeast Washington because of cover, but the early opening date and unusually mild weather made locating elk especially difficult. Best success is usually associated with late openers and snow.

Elk harvest was down 64% (Figure 2). Our hunter report card returns were similarly down 59% (Table 1). Losses during the severe winter of 96/97 likely contributed to the low harvest, but as mentioned above, weather and a 44% reduction in hunters were also factors. Modern firearm and archery hunters average 2.7% success on elk in northeast Washington. Success dropped even lower in 1997.

The north half tribal elk hunt (includes Units 101 and 105) was lengthened by 6 weeks and ran from 9/15-12/31 for either-sex elk. A total of 330 tags were issued and 2 elk were taken in 101 (1 bull, 1 cow). A 2-week archery hunt was offered in GMUs 101 and 105 but no tags were issued. (Murphy, 1998). Liberal seasons are offered by the Colville Confederated Tribe (CCT) because WDFW elk objectives on the north half are to control elk expansion.

The Spokane Tribe of Indians' biologist has expressed

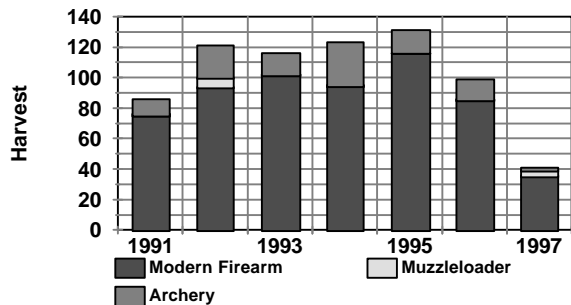


Figure 2. Elk harvest by weapon, GMU's 101-124.

Table 1. Elk report cards by GMU, 1993-97

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

concern for the increased elk harvest by state licensed hunters adjacent to the reservation. Specific data on harvest, elk numbers and movements, and current or potential crop damage is needed.

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 expend the necessary money or manpower. 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).

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%)	37
1997	11 (52%)	4 (19%)	6 (29%)	21

Our best opportunity to observe elk is from mid-March to mid-April. Flight money was not available so we began a program of involving volunteers to classify elk groups. At the same time, WDFW biologists made counts as time permitted. Basically the observations are made of elk that concentrate on 'green-up' fields or openings in early mornings or late evenings.

Our bull harvest in 1997 was relatively low so our sample of antler data is likewise low. Recognizing the biases with low sample size, we are a bit higher on the percentage of yearlings showing up than our objective of <50 (52% yearling in 1997).

The post-winter surveys yielded a ratio of 12 bulls per 100 cows (N=106). This is a bit below the objective of >15 bulls per 100 cows but we know this is not a good time to find all the bulls with cows, therefore we consider this to be an absolute minimum ratio. We do not have adequate data at this time to develop population estimates through modeling efforts.

The cow:calf ratio is likely the most reliable data gathered on the post-winter surveys. This year's efforts yielded a very high ratio of 62 calves per 100 cows (N=154), no doubt good calf survival but also likely low percentage of yearling cows in the cow sample too. We were pleased with the results of the first year's efforts using volunteers. There are problems with duplication of counts and unclassified animals but it is a very cost effective way of getting some general baseline data. We are working on better forms and a broader distribution system for next year.

Population Status And Trend Analysis

The elk harvest in the traditional areas was down in 1997. Some of this was due to reduced hunter pressure and poor hunting weather but much of it was likely due to less elk available following the severe winter of 1996/97. The percentage of yearlings in the harvest was a little higher than we would like in 1997 but the average is still within objectives. I don't think there is really a trend here yet.

Habitat Condition And Trend

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 primary technique in this area is selective logging so while forage to cover ratios are increasing rapidly there is still considerable cover. 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

Two chronic complaints in the Metaline Falls area of elk foraging on hay crops were addressed with payments. There were no formal elk complaints filed in the Upper Columbia/Kettle elk management area where we have the either-sex hunt. 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. Several projects have been approved for implementation next year

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 calf:cow ratio data and some minimal bull:cow ratios. We will continue to expand our

involvement with volunteers to survey during this time period and late summer pre-season surveys. If funds become available we will certainly try helicopter flights during late September as suggested 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.

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 good knowledge of elk distribution and preferred habitats, e.g., enhancement projects,

current or potential crop damage, and interaction with tribes. As we expand our efforts toward more survey data, I suggest expensive helicopter surveys may be most appropriate to address these issues rather than ground surveys.

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

Prepared by: Pat Fowler, District Wildlife Biologist

Population Objectives/guidelines

Management objectives for the Blue Mountains elk herd will be to increase the elk population to approximately 5,600 head post-season. The current post-season elk population is estimated at 4,300 head (± 500). Elk populations in GMU 169 Wenaha, GMU 175 Lick Creek, GMU 166 Tucannon, and GMU 172 Mt. View are below population management objectives by approximately 1,300.

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%). This 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 has declined approximately 67 percent since 1985. Hunters harvested 831 bull elk in 1985, compared to a five year average bull harvest of 276 since 1993 (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), 1992-97

Year	Bulls			Antlerless Harvest		
	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

The yearling bull harvest increased substantially in 1997, due to better calf survival in 1996-97. Post-season calf ratios increased from a low 15 calves \ 100 cows in 1996 to 24 calves \ 100 cows in 1997, which resulted in more yearling bulls available for harvest.

Controlled hunt permits for "any bull" were implemented in 1991 after post-season bull ratios reached management objectives. Hunters that draw a controlled permit for bulls can still look forward to a very high quality hunt (Table 2). Permit holders in 1997 averaged 51% success; rifle-69%, muzzleloader-57%, archery-22%. The quality of bulls harvested is exceptional with 79 percent of the bulls being six point or larger.

Table 2. Permit Controlled Bull Elk Harvest - All Weapons, 1992-97, Blue Mtns. WA. (excludes GMU-157 Watershed)

Year	Bull		Hunter Success	Percent 6 Point+	Bulls Obs. Per Hunter
	Permits	Harvest			
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

Hunters in GMU 157 Watershed experienced fair success and the area remained accessible throughout the hunting season. The permit level for the 1997 season was reduced from 100 to 75. Hunters harvested 19 elk (18 bulls, 1 cow) for a success rate of 31%. The quality of bulls harvested remained high, with 67% of the bulls being six point or larger.

The cow elk harvest decreased slightly from 109 in 1996 to 67 in 1997 (Table 1). A limited number of cow elk permits were issued in 1997 to address landowner complaints; 50 muzzleloaders in GMU 154, 124 muzzleloader permits GMU 181 Couse, and 50 general rifle permits in GMU 178. Permit holders in these three units harvested a total of 28 cow elk, while 39 were harvested under general muzzleloader hunts in the Couse and Peola units.

The implementation of the spike-only program, combined with low availability of yearling bulls has impacted hunter participation. Since 1989, Blue Mountains elk tag sales have ranged from a high of 10,000+ , to a low of 7,700, however, with northeast Region 1 and the Blue Mountains within the same zone, it is difficult to determine how many hunters hunt in the Blue Mountains verses the northeast. That problem will be solved in 1998 when the northeast becomes a separate zone.

Surveys

Pre-season surveys are conducted to determine calf production when elk re-group after calving. Post-season surveys area conducted to determine population trends and herd composition in late winter.

The annual survey in March of 1998 was designed to follow protocol for the Idaho Elk Sightability Model using the Hiller 12-E helicopter. A total of 38 survey zones were developed and mapped; 17 high density, 3 medium density, and 18 low density. Surveys were conducted in 25 zones; 16 high density, 2 medium density, and 7 low density. Although the data analysis is not complete, initial results indicate a high level of sightability; approximately 79%.

A paintball marking project was also used in GMUs 166 and 175 to cross-check the sightability model and biologist's

estimates of elk numbers in these units. Although the data is not complete, it appears the sightability, paintball, and biologist's estimates will be within 50-75 elk in both units. Some expansion of the numbers will occur in final analysis, but the population estimates should still be very close

Population Status and Trend Analysis

Pre-season survey results are given in Tables 3 and 4.

Table 3. 1997 pre-season elk surveys, Blue Mtns. Wa.

GMU	Bulls			Cows	Calves	Elk Total	Per 100 Cows	
	Adult	Yearling	Total				Bu.	Ca.
154	7	3	10	125	57	192	8	46
162	17	12	29	209	126	364	14	60
172	13	4	17	111	63	191	15	57
175	11	8	19	215	102	336	47	47
178	12	2	14	14	14	5	---	---
181	7	1	8	42	23	73	19	55
Total	67	30	97	719	376	1189	14	53

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

Year	Bulls			Cow	Calves	Elk Total	Per 100 Cows	
	Adult	Yearling	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 in March 1998 produced a total count of 3,118 elk, compared to 3,405 elk in 1996. Based on estimated sightability, the Blue Mountains elk herd contains approximately 4,300 elk (± 500), which is 1,300 elk below management objectives. It will be extremely difficult to increase elk populations in GMUs 166, 169, 172, and 175 unless the

major problems impacting these populations are addressed; habitat effectiveness, calf survival, agricultural damage control, and the level of cow elk mortality.

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 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 1998. The line of demarcation between stable and declining elk populations appears to be the Tucannon River (Figure 1).

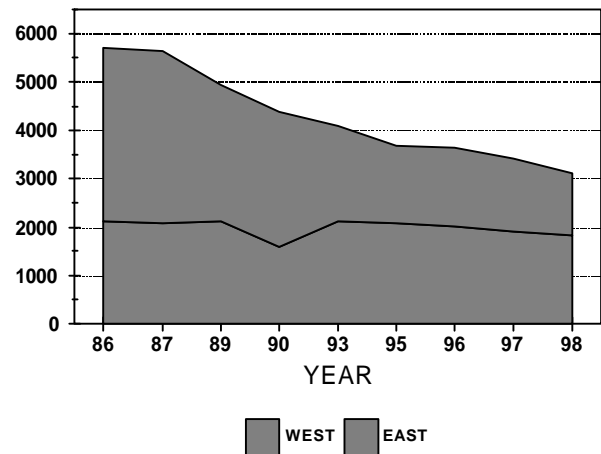


Figure 1. Elk Population Survey Trends, Blue Mtns. WA.

Elk populations on the westside of the Blue Mountains are relatively stable, while elk populations on the eastside have declined significantly. 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 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 help recover elk populations in GMU 166 Tucannon and GMU 175 Lick Creek.

The level of cow mortality in the Wenaha will be difficult

Table 5. 1997 Post-season elk surveys, Blue Mtns. Wa.

GMU	Bulls				Cows	Calves	Total	Per 100 Cows	
	Adult	Raghorn	Yearling	Total				Bu.	Ca.
154	18	9	10	37	371	71	479	10	19
157	0	0	7	7	109	28	144	6	26
162	43	19	25	87	586	157	830	15	27
166	9	5	9	23	274	72	369	8	26
169	17	9	9	35	106	12	153	33	11
172	19	8	12	39	326	89	454	12	27
175	13	3	16	32	504	92	628	6	18
181	2	0	1	3	19	4	26	---	---
186	2	1	0	3	30	2	35	11	23
Total	123	54	89	266	2325	547	3118	11	24

to monitor and control, because most of the mortality probably occurs during the Oregon antlerless elk season in the Mt. Emily, Walla Walla, 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 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, which is a result of more adult bulls in the breeding population (Table 6). However, heavy mortality during late summer and over winter continues to be a problem. Cow to calf ratios declined 60% between June 1997 and March 1998; from 53 ca.\100 cows to 23 ca.\100 cows.

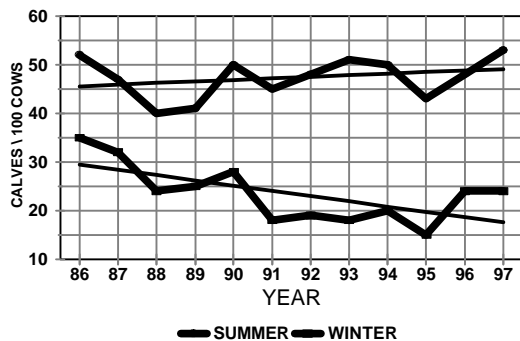


Figure 3. Calf Ratio Trend, Blue Mtns. WA.

Post-season bull ratios declined slightly, but this may be a reflection of lower sightability caused by a late green-up and ever increasing pressure from shed antler hunters. However, bull permits should remain conservative, because the average 1997 post-season bull ratio in spike-only GMUs dropped to 13 bulls \ 100 cows (Figure 2, Table 5), with a range of 6 - 33 bulls \ 100 cows.

Habitat Condition and Trend

Habitat conditions on National Forest land continue to

decline due to logging and fire suppression. However, the Pomeroy Range District is implementing a new fire management program that will greatly improve habitat conditions over the next 10 years. 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 program on the Walla Walla Ranger District is completed.

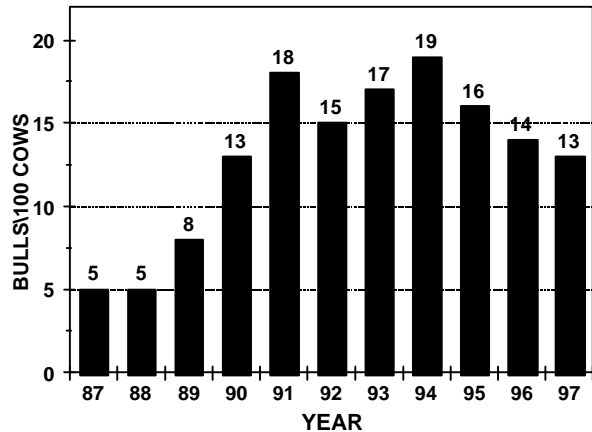


Figure 2. Post-season Bull Ratios, Spike-only GMUs, Blue Mtns. WA.

The release of the Columbia Basin Ecosystem Projects management recommendations includes a proposal to increase logging on National Forest lands by up to 50%. This would greatly impair efforts to maintain and improve habitat effectiveness for elk on the Umatilla National Forest, and could result in a continuing decline in elk populations in the Blue Mountains.

Augmentation\Habitat Enhancement

number of habitat improvement projects were initiated by the WDFW, USFS, RMEF, and Blue Mountain Elk Initiative. Weed control projects were initiated on the Wooten Wildlife Area, and Asotin Wildlife Area. A controlled burn was completed on Abel's Ridge on the Pomeroy Ranger District. Most habitat improvement projects will be directed at controlling the spread of yellow-star thistle and reversing the affects of 80 years of fire suppression.

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

Year	Bulls			Cows	Calves	Elk Total	Per 100 Cows C:100:B
	Adult Raghorn	Yearling	Total				
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

Elk Damage

Elk damage complaints continue to be a major management problem in historical damage areas: GMUs 154, 162, 178, 172, and 181. Approximately 130 elk moved into the Couse Unit during the winters of 1995-96 and 1996-97. A permit controlled, antlerless only muzzleloader season was implemented in GMU 181 Couse from December 1, 1997 to January 31, 1998. This was an attempt to use a low impact season to move elk back into traditional wintering areas in GMU 172. Surveys conducted in March produced a count of only 26 elk in the Couse area, while the count in GMU 172 Mt. View increased from 345 elk in 1997 to 454 elk in 1998, indicating the muzzleloader season moved this group of elk back into Mt. View.

During cool, wet springs, elk tend to stay longer on agricultural ground resulting in a higher level of landowner discontent. The long, cool, wet spring of 1998 produced conditions that resulted in a high level of landowner complaints. Hotspot hunts and landowner permits were issued in GMUs 154, 162, and 178. A total of 43 antlerless elk were taken under hotspot (24) and landowner (19) permits; Columbia County-30, Walla Walla County-12, Garfield County-1.

Hotspot and Landowner Antlerless Permits are excellent tools for targeting offending elk. However, the number of permits issued, and the conditions and procedures under which these permits are issued must be carefully coordinated in order to accomplish damage goals without jeopardizing this important damage control tool.

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, 1998, no elk were observed outside the fence where we traditionally count 100-150. 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 westside of the Blue Mountains are relatively stable and near management objective, with the exception of GMU 166 (Tucannon) east of the Tucannon River. Elk populations on the eastside of the Blues, and in Unit 169 Wenaha are below management objectives by approximately 1,300 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/WDF&W 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 the negative factors impacting this elk herd.

Acknowledgments

I would like to thank Woody Myers and Lou Bender for their assistance in digitizing survey maps and analysis of the sightability model data, and Jim Pope (Valley Helicopter Service) for his assistance in collecting herd composition data.

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

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

Population Objectives/guidelines

The Yakima elk population has increased to a population size of 13,000 elk with post season bull ratio's near 15 bulls per 100 cows. The objective is to maintain this population size and bull ratio. Spike only seasons have helped attain this objective and those seasons will be recommended for the near future.

The Colockum elk population is currently at 5,000 animals with a post season bull ratio of 5 bull per 100 cows. The objective is to increase the population to 6,500 elk with a bull ratio of 15 bulls per 100 cows. Spike only seasons will be retained through the 1999 hunting season to determine whether this strategy will allow the bull ratios to increase. Cow permits were decreased for 1998 to allow for increases in this herd.

Hunting Seasons And Harvest Trends

Hunting seasons were changed to a standard opening date in 1997 for all eastside elk populations. This changed the way elk are harvested in the Colockum units. Elk move into the open country, where they are more accessible, in late October. We have tended to open the Colockum season earlier to intercept elk before they reach the open country enabling hunting pressure to be more dispersed. With the standardized opening date we now have elk hunters concentrating on the fringe of the forest which tends to increase the harvest.

We are now in the fourth year of spike only bull management. Hunters have had to apply for a branched antler bull permit in order to take a large bull. This enabled us to increase our branched antler bull segment of the population and we have reached our management goals in the Yakima herd under this scenario. We are short of reaching this goal in the Colockum herd and the standardized opening date will likely prevent us from reaching our post season bull ratio objectives due to heavy harvests of spike bulls in the open range.

The peak of the elk rut occurs during the last two weeks of September. We avoid hunting during this period in order to minimize disturbance related problems with extended rut and calving. 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 runs for seven days in selected units. Historically modern firearm season began in late October for Colockum units and early November for Yakima units but are now both open concurrently starting in late October. Our season length is now 9 days. We have late muzzleloader and bow seasons that run from late November through early December and late modern firearm permits that run through December in selected areas. The late muzzle loading and modern firearm seasons are designed to reduce elk damage to crops.

Elk hunter numbers have varied from 25 to 38 thousand in

Region 3 since 1986. In 1997, the number of elk hunters in Region 3 was 25,872. This is the lowest number of elk hunters in this time period and represents a 20% decrease from 1996. Overall hunter success has varied from 7 to 15 percent and averaged 10.2% over the previous 10 years but dropped to 5% in 1997. All weapons choice users showed declines in hunter numbers and is the lowest of the past 11 years (Figure 1).

Harvest in Region 3 during 1997 was 917 bulls and 387 antlerless elk. Bull harvest declined 34% from 1996 and antlerless harvest declined 77% from 1996. Overall harvest was down over 56% from 1996 (Figure 1). Heavy rains during the 1997 seasons kept hunters in camps. The opening date was before elk began major movements and contributed to reduced harvest. Spike only regulations continue to keep antlered harvest at a lower level than previous seasons and antlerless permits in the Colockum herd, which were reduced by more than half the previous season, contributed to this reduction as well.

Surveys

A total of 464 elk were classified during late September 1997 in Yakima elk areas. The composition was 15 bulls and 38 calves per 100 cows. Fifty four percent of the observed bulls in the Yakima units were yearlings. This compares with 21 bulls and 35 calves per 100 cows and 41% yearling bulls in 1996. We did not survey the Yakima units in September of 1998 but did do a ground survey for the Colockum. Over 417 elk were surveyed in August and September. There were 25 bulls and 58 calves per 100 cows. This compares with 22 bulls and 49 calves per 100 cows averaged over the 1987-97 time period. Since calf ratios have picked up this year we expect bull ratios to increase in the following years surveys if harvest ratios can be maintained.

Sample size done in September, by air, may be too small to accurately represent overall composition. In addition, calves are less observable than adult elk. Spike bulls are less visible than adult bulls due to smaller less polished antlers and satellite behavior of young bulls. We could increase sample size and accuracy of preseason elk surveys by allocating additional resources to this effort but with limited funding we will probably abandon helicopter surveys and conduct limited ground surveys in the Colockum. We believe post season surveys done in February provide more valuable information and we are not willing to decrease our February survey effort in order to improve September information.

Post season surveys were conducted in February 1998, by helicopter, in selected winter ranges for both the Colockum and Yakima elk areas. Areas surveyed were randomly selected, but were weighted toward high density winter ranges. We surveyed about 25% of the elk winter range within Region 3 and found a total of 6,516 elk on these surveys. In addition we ground surveyed feed lots in the Yakima area where another 3,233 elk

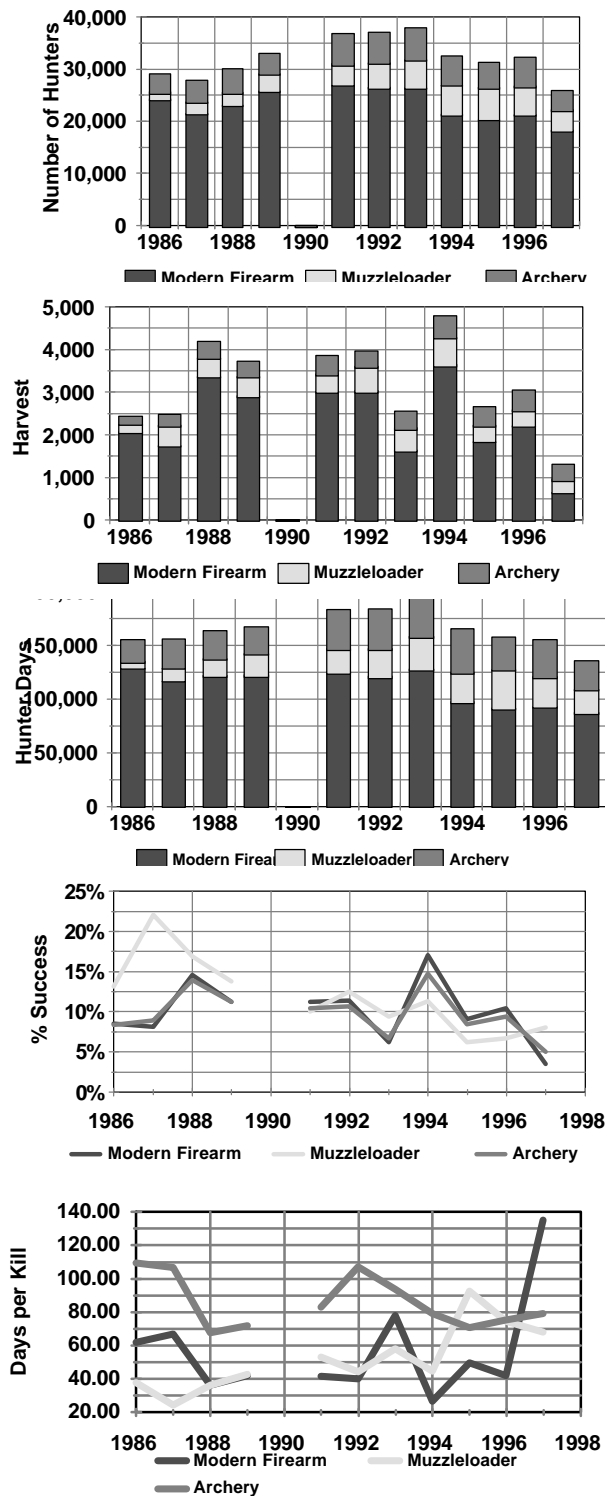


Figure 1. Number of hunters, harvest, percent success, number of hunter days and kills per day for each weapon type in Region 3.

were classified. This represents the highest count we have ever attained.

We found 3,809 elk in the Colockum compared to 2,200 elk in the 1996-97 winter. Our bulls and calves per 100 cows, on the Colockum, did not change much from 1996. Calves were at 30:100 both years and bulls were at 5.3 compared to 5.7 in 1996 (Table 1).

We found 2,707 elk in selected survey units compared to 948 elk in 1996 in the Yakima herd. In addition we surveyed 3,233 elk on the feedlots. These combined counts yielded 13.6 bulls :100 cows compared to 13.4 bulls :100 cows in 1996. Calf ratios were down from 43 calves per 100 cows to 33 calves per 100 cows in the Yakima area (Table 2).

Calf ratios are generally higher in the Yakima than the Colockum herd however, this winter they were nearly the same. We speculate that higher calf ratios in the Yakima area are generally higher because of supplemental winter feeding but that did not hold true for this year. This past winter calf ratios were among the lowest we have seen in the last 10 years for both the Colockum and Yakima herds. We have not yet identified why.

Population Status And Trend Analysis

Elk populations in both the Colockum and Yakima elk areas are strong and relatively stable due primarily to the large amount of elk winter range controlled by Washington Department of Fish and Wildlife (WDFW). Elk populations within Region 3 are controlled by the level of antlerless harvest which is generally driven by damage to agricultural crops. Spike only management has been in effect for four seasons. Bull ratios are now higher than we have seen in the past but are still below targets especially in the Colockum herd. We expect to reach bull escapement objectives (15 bulls :100 cows in February) for the Yakima herd within the next year. However, we are way below the target of 15 in the Colockum with only 5 bulls per 100 cows. Limited access may be the key to increasing the bull ratio since Colockum bulls are vulnerable throughout the season. We are seeing very few yearling bulls in the post season surveys and feel they are being over harvested.

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 has been a very dry period with no green up beginning before the winter sets in and will likely impact winter forage availability. Both Colockum and Yakima winter ranges are generally in excellent condition not withstanding the drought this past summer. Most of these areas are controlled by WDFW. We have some localized range degradations as the result of land management prior to acquisition, however habitat condition on these areas are improving.

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

Table 1. Colockum elk - winter Population composition counts for 1989-98. C:100:B is calves and bulls per 100 cows. Unid.(unidentified)

Year	Bull Antler Class			Total	Cows	Calves	Unid.	C:100:B
	Prime	Raghorn	Yearling					
1989								
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

Table 2. Yakima elk - winter population composition counts for 1989-98. C:100:B is calves and bulls per 100 cows. Unid.(unidentified)

Year	Bull Antler Class			Total	Cows	Calves	Unid.	C:100:B
	Prime	Raghorn	Yearling					
1989								
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

is generally shifting away from large clear cuts in favor of smaller clear cuts or selective cuts. Much of the Forest Service managed land is shifting toward late successional 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. We continue to meet and discuss these issues with the various agencies and expect to eventually look at allocation of range resources for each ungulate species.

Wildlife Damage

Elk damage to agricultural crops is a major problem throughout Region 3. Elk damage has a large influence on antlerless elk harvest, which determines population size in Region 3. Most of the serious problem areas within the Yakima elk area have been fenced. Continued construction of re-entry gates in elk fences are improving the effectiveness of the fence program by directing elk back to public land after they wandered around or gone through drift fences that protect private crop land.

Most of the serious problem areas within the Colockum elk

area have not been fenced. Unfenced areas require extensive use of manpower to herd and harass elk back toward public lands. WDFW has recently began hiring temporary personnel to repair fences damaged by elk and to apply preventative strategies. The addition of temporary staff has improved effectiveness of preventative measures but agency revenue shortages could effect this program also.

WDFW is working with cooperators to improve range for elk on public lands through the use of fertilizer, providing supplemental salt and water developments. In addition to elk herding and range improvements, elk damage is managed more through the use of hunting pressure on both general hunts and Hot Spot hunts within the Colockum.

Management Conclusions

Region 3's elk population is relatively stable. Elk herd composition is shifting to include more total bulls and an increasing proportion of adult bulls. We should achieve bull escapement goals in the Yakima herd within two years but Colockum bull escapement goals will take longer. We need to continue to focus attention on management of elk damage and look at road management scenarios, especially on the Colockum herd. Winter elk habitat, which is mostly managed by WDFW, is generally good and improving.

Species	Region	PMUs	GMUs
Elk	4	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. Reduce the number of elk currently occupying lowland agricultural habitats.
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 implementing a conservation closure, road management programs, 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 implementing a conservation closure in GMU 437, maintaining hunting pressure on elk utilizing agricultural lands in order to encourage depredated 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 5% 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), increasing forage enhancement projects on public and private lands adjacent to damage areas, and encouraging development of motorcycle, ATV, horse and hiking trail systems in elk range areas peripheral to damage areas.

Hunting Seasons 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.

Surveys

Post-season herd composition surveys were completed on

8/22/97 and 8/29/97. Aerial surveys were conducted using a Hughs 500-D helicopter (total flight time = 6 hrs). Survey results indicated a bull:cow:calf ratio of 31.7 bulls and 37.8 calves per 100 cows in a relatively small sample size of 112 classified animals. Older age class bulls (greater than 3 pts) represented 17.6 of the 31.7 bulls per 100 cows reflecting the typically high numbers of older age class bulls in the Nooksack herd resulting from limited harvest over the last five years. Animals observed were widely dispersed throughout the entire range in small fragmented groups. Post-season herd composition surveys were not conducted in 1997.

Population Status And Trend Analysis

Formulated population estimates and trend analysis do not exist for the Nooksack elk herd. The Nooksack Elk Herd Plan (Draft 1997) identifies the development of a statistically valid population model as the highest research priority. Population estimates for the Nooksack herd based upon field observations place the current numbers of elk at between 350 and 400 animals. Approximately 150 - 200 elk occupy lands outside of the designated primary range in areas considered agricultural depredation zones.

Habitat Condition And Trend

No recent habitat analysis has been completed in the Nooksack area since 1991 when a Lansat (GIS) analysis of the entire elk range indicated that cover/forage ratios, thermal cover, hiding cover, and travel corridors were all below prescribed levels on both winter and summer range. The most relevant problems affecting habitat use include road densities in un-gated systems and human disturbance. Road closures on both private and public lands have mitigated human disturbance in critical summer and winter ranges and in severely impacted habitats. Cumulative impacts of numerous recreational, administrative, and development activities in managed forests continues to limit habitat productivity for elk. Trail development on public lands and use of off road vehicles (ORVs) are accelerating and probably represent the most significant threat to elk habitat today.

Augmentation/habitat Enhancement

Planning for two enhancement projects began in 1997 and are projected for implementation in late 1998 or early 1999. Both projects are cooperative WDFW/Rocky Mountain Elk Foundation efforts involving elk forage enhancements on winter range.

Management Conclusions

Management recommendations for the Nooksack elk herd include:

1. Continuation of the Conservation Closures in both GMUs 418 & 437.
2. Maintain increased harvest pressure on animals utilizing agricultural lands.
3. Increase habitat enhancement projects in primary elk range

-
- (summer and winter range).
4. Evaluate the potential for transplanting elk into newly designated elk range in GMU 437.
 5. Continue increased herd composition surveys. Data to be used in population reconstruction models. WDFW is currently working cooperatively with local tribes to complete modified herd composition surveys. Tribal funding is available for 12 helicopter flight hours (\$6,500) for each of the next three years (1998 - 2000).

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 to 1991. The current late spring/early winter population estimate is 227 elk (range 177 to 277).

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 1998, 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 none will be issued 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.

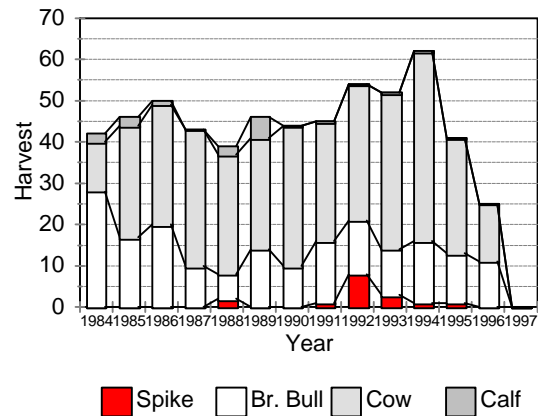


Figure 1. Harvest of Elk in GMU 485.

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.

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).

The Muckleshoot Tribe collects age and reproductive data during their established hunt. The tribe also contributes by

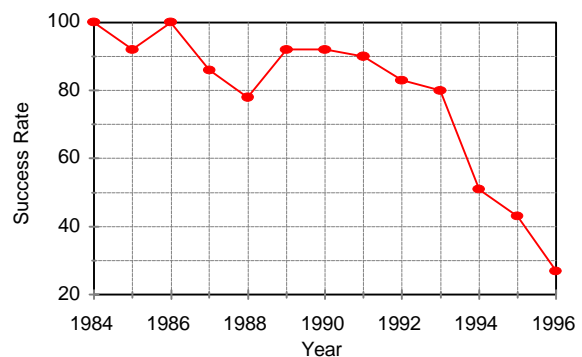


Figure 2. Hunter success for elk in GMU 485.

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 - 1997 are presented in Table 1. One notable point for discussion are the extremely low calf survival rates. The pre-season 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.

Table 1. GMU 485 Pre-season Elk Herd Composition 1984-1997 (all ratios per 100 cows)

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

Our pre-season 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.

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. 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 1984-1996 (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

* flight and data provided by D. Vales, Muckleshoot Indian Tribe Biologist

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 1997. 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 seral 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

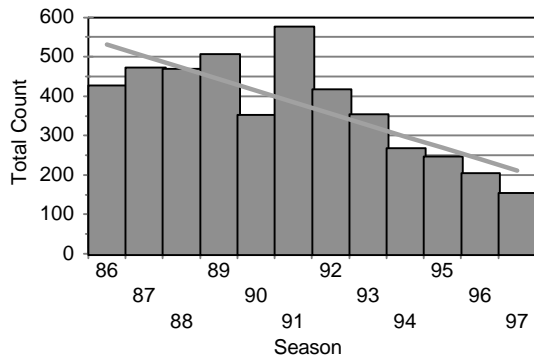


Figure 3. Total counts of elk during helicopter census in GMU 485.

densities. 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.

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 1997 was 154 elk, again suggesting a decline in the population (Figure 3).

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

None at this time

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 appear to be incompatible. Our 1997 paintball mark-recapture population estimate documented a 42% decline in this population.

The low post season spike ratios from 1993 through 1997 are a concern and may now be affecting 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.

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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), 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 eight 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.

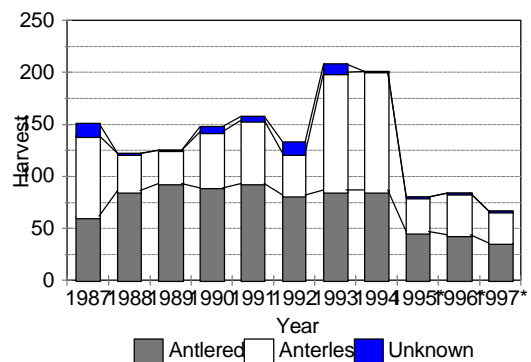
This management approach was reviewed and analyzed during 1996. The 1997 hunting season was made permit only for all hunters. This allows more accurate determination of hunting mortality by state authorized hunters.

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.

Actual harvest is higher, but currently not all tribes have reported their harvest for the 1997-98 season. We suspect harvest numbers will fall between 95-120 animals, similar to and within the range for the 1990-1995 period (Fig. 1).



*does not include unknown harvest by native american tribes

Figure 1. Harvest of Elk in GMU 472.

Hunter pressure continues to decline because of the permit-only hunting status and lower elk population levels. The number of state authorized hunters for years 1984 to 1997 is presented in figure 2. Hunter 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 has been

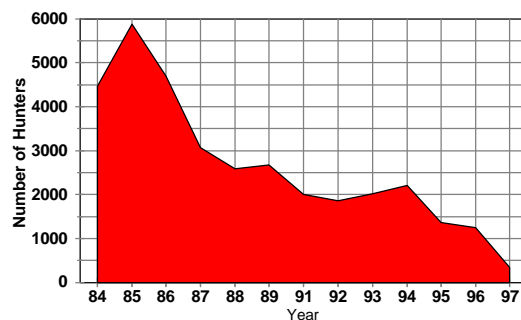


Figure 2. Number of hunters 1984-1997

effective in increasing the percentage of branched bulls in the population based on data collected from pre-season composition counts.

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.

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 1988-1996.

Year	Branched		Total	
	Spikes	Bull	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

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. 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.

Table 2. GMU 472 Post Season Composition 1988-1996.

Year	Branched		Total	
	Spikes	Bull	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

*flight by Muckleshoot Indian Tribe

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 antlerless harvest, primarily adult cows, is artificially inflating post season calf counts. This year the calf:cow ratio dropped to 27:100 which may reflect difficult winter conditions. This is the lowest calf:cow ratio since 1988.

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 and 1998 count was 255 and 286 elk respectively, an increase of over 30 percent. This is despite low recruitment. This increase may have been an artifact of an early and prolonged snowfall that blocked access to many roads used to hunt elk during the winter in 1996 and 1997, and reduced tribal harvest, thereby reducing hunting mortality.

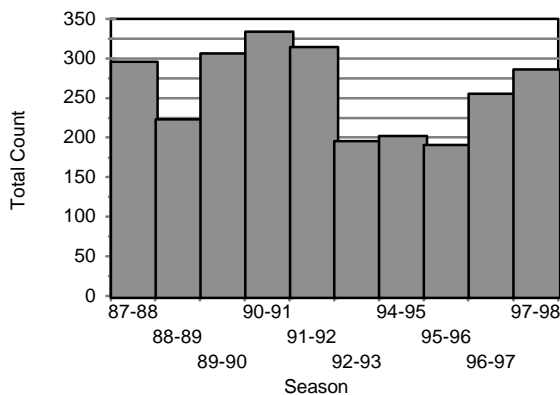


Figure 3. Total helicopter counts for GMU 472.

Figure 4 shows FPI results and trend data for the period 1985-1996. Fall 1996 FPI results are 966 elk. These data indicate a general decline in the elk population from historic levels. This decline is most apparent from 1985-1989 followed

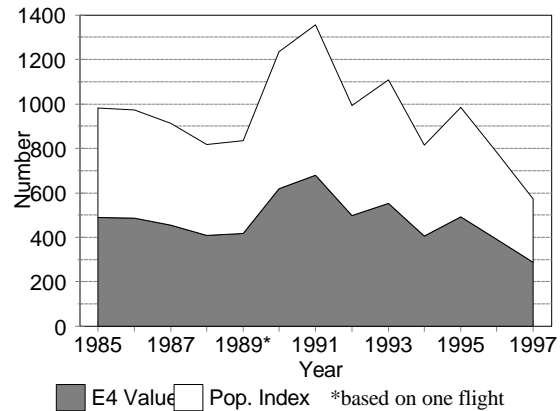


Figure 4. E4 and population index values for GMU 472.

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 25 percent in 1997. This is still 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. Likely both these factors play a contributing role in the population dynamics of this elk herd. However, we believe antlerless harvest is 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. The 1997 ratio is the highest in four years (Table 2).

No population estimate is available for 1997-98. However, the winter trend data for 1996 and 1997 indicates a slight increase in the population.

We suspect the population will continue to fluctuate and likely decline without antlerless harvest regulation.

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 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. This is vital to proper herd management and population evaluation.

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Species	Region	PMUs	GMUs
Elk	5	All	All

**Prepared by: Min T. Huang, Wildlife Biologist
Pat Miller, District Wildlife Biologist
David Anderson, 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 (WDFW 1996). 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 5-year's mean, unless productivity was below maintenance levels during that period (WDFW 1996).

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. In 1997 additional to field checks, a check station was operated in Region 5 to evaluate hunting conditions and hunter satisfaction. Field contacts are not used to evaluate hunting pressure or success.

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 3-year hunting packages, the latest of which was the 1997-1999 package.

In 1997 elk were managed under four principal harvest strategies in Region 5. During the modern firearm season these were: any-elk GMUs (501, 564, 568, 574, 578, 582, and 588), spike-only GMUs (504, 505, 510, 516, 520, 550, and 560), 3-pt GMUs (506, 513, 530, 558, and 572), and permit only GMUs (524 and 556). Apart from the any-elk GMUs, antlerless harvest was allowed during archery seasons and by permit during general firearms and muzzleloader seasons. Those units identified in the text as spike-only were managed with an any antlered bull regulation in the past.

The advent of spike-only regulations in 1997 was new to southwest Washington. The change was designed to increase overall bull survivorship in GMUs where bull escapement was below management goals. Additionally, the goal of the regulation change was to increase the number of prime-aged bulls in these units. General public reaction to the regulation was decidedly against. Another change in 1997 was the reduction in season length of the modern firearm season from 12 to 9 days. Season length reduction was implemented to determine whether this alone would allow certain units to meet previously unmet bull escapement goals.

Since 1991, hunter pressure in Region 5 has been stable $r = 0.39$, $P = 0.38$, with a mean \pm SE of 24,566 \pm 732. Days spent

afield has also remained stable over this period $r = 0.38$, $P = 0.4$, with a mean \pm SE of 149,717 \pm 6026.

Current regulations have resulted in stable elk populations. Elk populations in 'spike-only' and 3-PT GMUs, however, are not meeting WDFW escapement goals of 12 bulls per 100 cows. A change in regulations from any bull to 'spike-only' and a reduction in the length of the general season were designed to determine whether bull escapement could be improved.

Warm, dry conditions prevailed through much of the 1997 elk season. This resulted in uniform hunter distribution in both high and low-elevation GMU's. Early archery hunters were most likely influenced by the dry conditions, as stalking becomes more difficult with increasing moisture loss in ground cover.

A total of 22,871 elk hunters spent 138,533 days afield in 1997. Region 5 harvest was 2,141 elk. Overall hunter success during the general season was 7%. Permit hunt success continued to be high, with reported success rates of 47% for the 37 permit hunts that were offered in the Region.

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. Overall harvest in 1997, however, was likely reduced by the regulation change from any bull to 'spike-only'.

Surveys

Previous to fiscal year 1997-98, spring and fall elk composition counts were used to determine the sex and age structure of the Region 5 elk population. In 1997-98 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.

Counts were conducted from a helicopter and on ground throughout the Region. Sampled GMUs were selected by optimal allocation based on elk population levels and harvest regime. 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 1997, surveys were conducted from 18 September to 7 October.

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.

Sampled GMUs were pooled based on their harvest strategy for any-elk, spike-only, and 3-pt units. Permit-only units were analyzed individually. Data were used to generate calf:cow and bull:cow ratios, expressed as the number of bulls/calves per 100 cows. Ninety percent confidence intervals were constructed about the ratios following Czaplewski et al. (1983).

A total of 1,504 elk were classified during the fall 1997 composition flights (Table 1). Weather conditions were abysmal throughout the sampling period, however, total coverage was better than in previous years.

Table 1. Region 5 fall elk composition counts, September 1997.

Unit	Per 100 Cows	
	Bulls	Calves
Spike-only	24±5	46±7
3-pt	27±5	44±8
GMU 524	48±5	48±5
GMU 556	35±7	49±10

Demographic ratios have not differed significantly within a harvest strategy (Table 2). Lack of precision (e.g. large 90% confidence intervals), however, make valid comparisons and inferences difficult. Improved precision would result in greater power to detect differences in ratios between harvesting strategies.

Sample sizes were also small in the analysis of bull age structure (Table 3). Bull age-structure pooled by harvest strategy indicate mortality rates of 0.66 in 'spike-only' GMUs, 0.56 in 3-PT GMUs, 0.35 in GMU 524 (Margaret), and 0.39 in GMU 556 (Toutle). If elk management is to use age-structure as a harvest guide, it is imperative that precision of data allow for analysis of the impact of various harvest regimes. At present, large confidence intervals only allow for detection of gross differences in pertinent demographic parameters.

In age-stable, stationary populations, where recruitment is defined as occurring at age 1.5, age-structure can be used as an unbiased estimate of total mortality (Bender 1997). In these populations, the percentage of yearlings comprising the harvest equals the overall mortality rate of the adult segment of the population. Age data (Table 4) indicate long-term bull elk mortality rates of 0.70 in 'spike-only' (formerly 1-PT) GMUs, 0.53 in 3-PT GMUs, 0.35 in GMU 524 (Margaret), and 0.40 in

GMU 556 (Toutle).

Table 2. Historic results of Region 5 fall elk composition surveys by harvesting regime, following standardization of survey methodology in 1993.

Unit	1993	1994	1995	1996	1997
Bull: Cow Ratios					
1-pt*	20±6	19±6	24±6	24±7	24±5
3-pt*	26±5	22±6	38±9	26±7	27±5
GMU 524	**	66±22	57±10	54±6	48±5
GMU 556	**	42±14	44±11	44±9	35±7
Calf: Cow Ratios					
1-pt*	38±11	41±10	54±11	41±11	46±7
3-pt*	35±9	37±9	42±9	46±9	44±8
GMU 524	**	43±12	55±10	45±5	48±5
GMU 556	**	63±16	51±13	49±9	49±10

*In 1997, historic 1-pt or better units were 'spike-only', 3-pt units remained 3-pt in 1997.

**Data missing.

Table 3. Preseason 1997 Region 5 bull age-structure based on harvest regime. Prime bulls are defined as ≥5x5, immature as 3 or 4 point bulls, and spikes as 1 point bulls.

Unit	Spike	Immature	Prime	Branch	n
Spike-only	66%	25%	9%	34%	65
3-pt	56%	35%	9%	44%	62
GMU 524	35%	39%	26%	65%	100
GMU 556	39%	37%	24%	61%	46

* Prior to 1997 these units were 1-pt or better.

Table 4. Long-term (1993-1997) preseason bull age-structure (%age in each category) in Region 5, by harvest regime.

Unit	Spike	Immature	Prime	Branch	n
Spike-only	70	20	10	30	199
3-pt	53	38	9	47	359
GMU 524	35	44	21	65	417
GMU 556	40	38	22	60	212

*Prior to 1997 these units were 1-pt or better.

Approximately 80% of total bull elk mortality is assumed to be attributable to hunter harvest (L. Bender, WDFW, unpub. data). Therefore, mean bull elk removal rates due to hunting were approximately 56% in spike-only GMUs, 42% in 3-PT GMUs, 28% in Margaret, and 32% in Toutle. A Region 5-specific re-evaluation (L. Bender, WDFW, unpub. data) of the data from the WDFW elk mortality study (Smith et al. 1994) indicated a pooled mean harvest rate of 36% for the greater Mt. St. Helens herd.

Budget cuts in 1998 resulted in a reduction of Region 5 survey monies. Due to the reduction in allotted flight time, we concentrated our survey efforts in Margaret, Toutle, Winston, and Ryderwood. A total of 998 elk was classified (Table 5). Because sample size in the open entry units was small (<2 GMU's per harvesting strategy), comparison with past survey effort is not provided here.

Table 5. 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. Demographic parameters are presented in Table 6. Both units showed higher bull mortality in 1998 than in 1997 and lower productivity (Tables 1 and 6). In anticipation of higher mortality in these units, permit levels were reduced for 1998. Should mortality continue to increase in these units, further permit reduction and/or alternative harvest strategies will have to be considered.

Table 6. Fall demographic parameters for elk in 524 and 556, September 1998.

GMU	B:C Ratio	C:C Ratio	Bull Mortality
524	49±6	36±5	40%
556	35±7	33±7	52%

Habitat Condition And Trend

Climate tends to have a negligible effect on Regional elk populations west of the Cascade crest. 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.

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 1997-98 was relatively mild, although high elevation sites received substantial snowfall. A small fraction of Region 5 elk occur 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 had already resulted in loss of significant amounts of historic winter range.

Loss of elk habitat due to LSR establishment is expected to approach 41% 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 St. Helens Wildlife Area. 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.

Augmentation/habitat Enhancement

Steps are being taken to enhance forage quality on the Toutle mud flow through fertilization. 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. New seeding projects in Lewis County are being pursued. Due to controversy over lack of access the initial project in the Boistfort Valley was less successful than initially hoped.

Management Conclusions

Bull escapement is still below the WDFW guideline of 12 bulls per 100 cows in both 'spike-only' and 3-PT GMUs. Permit-only GMUs continue, however, to meet escapement goals. Since 1993, bull elk mortality rates in 'spike-only' and 3-PT GMUs have averaged 0.70 and 0.53 respectively. This has resulted in neither harvesting strategy meeting WDFW bull elk survivorship goals. Long-term mean prime bull (>4.5 years old) percentages in 'spike-only' (10%) and 3-PT (9%) GMUs are poor, compared with permit-only GMUs. The long-term means in Margaret and Toutle are 21% and 22% respectively.

Regulation changes designed to test the three-year effects of harvest strategy on population parameters have been shelved for 1998. All westside GMUs that were 'spike-only' in 1997 will be 3-PT in 1998. This will likely result in higher recruitment into the branched bull age-classes, but lower overall recruitment of prime age bulls in these units. Because of the short duration of the regulation, it will be difficult to assess the effects that 'spike-only' management had on demographic parameters of elk. Harvest levels in 1997 were down in some of the 'spike-only' units (e.g. GMU 520, 550, and 560). Much of this can be attributed to less hunter pressure. However, an older bull age-structure in Lewis River, for example, likely resulted in depressed overall harvest numbers.

Antlerless permit levels have been allocated based on subjective perceptions of elk damage to agriculture and tree farms. Use of the elk population reconstruction model will

allow for objective permit allocation, based on population size and observed productivity.

The current level of population surveying in Region 5 is inadequate to determine the impacts of various harvest regimes on elk populations. Confidence intervals about vital population parameters are too imprecise to detect differences between harvest strategies and different GMU's within harvest strategies. In order to better understand elk population responses to various harvesting strategies, 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

This is done through conservative harvest strategies. 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 treaty tribes.

Hunting Seasons and Harvest Trends

The 1997 hunting season was the first season of the 1997-99 three-year hunting season package. There were significant changes over the 1996 season. Specifically, Game Management Units (GMUs) in Population Management Units (PMUs) P61 and P62 went to a spike bull only harvest strategy (except GMU 681). At the same time PMUs P63, P65 and P66 were managed as 3 point minimum units. In addition these three PMUs were closed to the harvest of antlerless elk during state seasons. Hunting conditions were typical for the area and season with no unusual dry or inclement weather recorded during the actual seasons.

Due to the changes in available elk hunting opportunities and the more conservative seasons, elk harvest as well as hunter numbers and hunter days declined over the previous year. These estimates are based on the statewide hunter survey: Numbers of elk hunters hunting in Region 6 declined by 53 percent over the 1996 season estimate. For the same period hunter days declined by 62 percent. Total antlered elk harvest declined by 53 percent while total antlerless harvest declined by 77 percent (Table 1).

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

PMU	Antlered Harvest	Percent Change from 1996
61	107	-54
62	18	-18
63	23	-69
64	0	0
65	72	-36
66	11	-77

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

During the 1997-98 reporting period meetings between regional personnel and representatives of Olympic Peninsula Tribes continued for the purpose of managing the elk resource of the Peninsula cooperatively. Periodic technical and policy meetings have taken place with representatives of the Point No Point Treaty Council, the Quinalt, the Hoh, the Quileute and Makah tribes.

Surveys

During the period of September 16 through October 6, 1997 pre-season helicopter elk surveys were done in the following GMUs: #602 (Dickey), #615 (Clearwater) and #673 (Williams Creek) (Table 2).

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

Unit	Bull Antler Class			Per 100 Cows		
	Branch	Spike	Cows Calves	Branch	Spike	Calves
602	15	13	106 45	14	12	42
615	10	17	120 54	8	14	45
673	9	13	89 38	10	15	43

Post-season (early spring) surveys were conducted during the period from March 25 through April 8, 1998 in the following GMUs: #615 (Clearwater), #658 (North River), #673 (Williams Creek) and #681 (Bear River) (Table 3).

Table 3. Results of post-season surveys in 1998.

Unit	Bull Antler Class			Per 100 Cows		
	Branch	Spike	Cows Calves	Branch	Spike	Calves
615	2	14	191 61	1	7	32
658	6	4	203 69	3	2	34
673	8	8	202 60	4	4	30
681	3	6	47 27	6	13	57

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 pertains particularly to the forested areas of coastal Washington. However, using the pre-season composition data and an estimated total antlered mortality rate of about 60 percent it is clear that stated goals of 12 bulls per 100 cows in post-season surveys is not being met. This does not seem to impact calf ratios however.

Population Status And Trend Analysis

No likely change since the 1997 report (1996 season). Harvest trends can be important indicators of population trends. However, the change in management strategies for the 1997 season reduced harvest greatly and thus harvest data for this year cannot be compared with prior years. 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 efforts need to be spent on surveys.

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 eliminated all cow seasons on the Olympic Peninsula for the 1997 seasons. Recommendations as a guide to tribal harvest planners are shown in Table 4.

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.

Table 4. Maximum cow harvest levels recommended to tribal policy planners in 1997.

GMU	Maximum Cow Harvest
601	6
602	22
603	2
607	15
612	7

Management Conclusions

The 1997 seasons marks the first year of elk hunting season strategies designed to reverse the population decline particularly on the Olympic Peninsula. The 1998 elk seasons in Region 6 retain some of the conservative elements of the 1997 seasons, such as no antlerless harvest on the Olympic Peninsula, while at the same time becoming more "user friendly" in switching to a 3 point minimum strategy for all of Region 6.

Species

Mountain Goat

Statewide

Prepared by: Steve Pozzanghera, Carnivore, Furbearer and Permit Species Section Manager

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-one permits were available in 16 different goat management units for 1997 and a total of 2,502 applicants entered the drawing. The 1997 mountain goat season provided 49 days of mountain goat hunting (September 13 to October 31), and was different from the 1996 season only by calendar date adjustments (i.e., 1996 season had 48 days of hunting, September 14 to October 31). One significant change was made during 1997 for specific weapon designations within goat units. Prior to 1997 several units specifically allowed hunters to use archery, or muzzleloader gear only. In 1997 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.

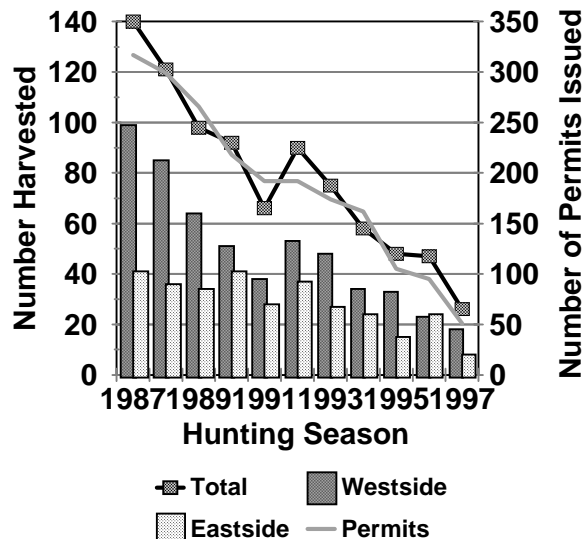


Figure 1. Statewide mountain goat harvest.

Mountain goat hunting conditions in 1997 were generally

favorable with mild conditions and no excessive snowfall hampering hunter effort. Of the 51 permits available in 1997, 41 individuals actually reported that they hunted goats. A total of 26 goats were killed for a hunter success rate of 63%. Compared to 1996, individual hunter success rates increased from 59%, but there were 44 fewer permits available to hunters in 1997. Therefore, the harvest decreased when compared to the 1996 harvest of 47 goats. Overall, the 1997 goat harvest decreased approximately 309% when compared to the 10 year average harvest of 84 goats/year (1987 to 1996) (Figure 1.).

Surveys

Ten of 16 mountain goat units open to hunting in 1997 were surveyed. Additional surveys of non-hunted populations occurred in 13 areas throughout the state including regions 1, 2, and 4. 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, their 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** **Population**
Mountain Goat **1** **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.

At least 3 of these 11 new goats, 2 billies and 1 nanny, were subsequently found at Linton Mountain.

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.

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

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 powerline 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.

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.

Four surveys were conducted in October and November of 1997 with the highest count of 9 adult goats obtained on November 5th. In addition a hunter reported seeing one kid in a group of mountain goats at Linton Mountain on October 5, 1997. On June 3, 1998 five mountain goats were tallied; all 5 were adults.

Population Status And Trend Analysis

In this century, Linton Mountain did not become 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.

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 in the field.

The mountain goat population at Linton Mountain appears perilously low and unproductive. 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 thus far not implemented it.

Augmentation

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

Management Recommendations

The Linton Mountain Goat Herd is a nationally recognized

wildlife resource. The Department needs to do everything within its means to help maintain a viable population there. The following recommendations are given to address the depressed condition of the Linton Mountain Goat Herd:

- * 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 Mountain 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	N/A	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 percent of minimum known population) as objective levels are reached. Overall, Chelan County's mountain goat population is 39 percent below objective. Individual units range from 12 to 84 percent below objective (Table 1).

Table 1. Chelan County mountain goat population objectives by management unit.

Area	1997 Survey	1998 Survey	Population Objective	% from Objective
N. Chelan	42	80	100	20
S. Chelan	33	44	50	12
Stehekin	4		25	76
Chiwawa	14	15	30	50
N. Wenatchee	18	6	30	80
East Stevens	12	14	30	53
Total	123	163	265	39

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 one survey per year. 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 densities, mountain goats are expensive to monitor. Budget constraints preclude regular monitoring of most un hunted populations. However, we will not recommend hunting in any units without current survey data that verifies objective population 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 increasing toward the high levels seen between 1988 and 1992 (Table 2).

Habitat Condition And Trend

Table 2. Population composition counts from Lake Chelan. K:100 is 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

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. Fire suppression policies are changing, however changes in habitat 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, harvested mountain goat populations are being managed for conservative, sustainable yield, with the goal of increasing herd size and distribution where possible. This is particularly true of herds with high productivity, indicating forage resources are available to support expansion.

The Methow Goat Unit is the most productive in Region 2 and is managed to provide a sustainable harvest, while providing for range expansion. In comparison, the less productive Chopaka Goat Unit is limited in size and is managed more conservatively to minimize impacts to a small goat herd that provides excellent viewing opportunities for the general public.

Hunting Seasons And Harvest Trends

Goat season ran from September 14 - October 31 in 1996. 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.

Hunter pressure, harvest success, and goat numbers in the Methow Unit had remained fairly steady for several years through 1996 (Table 1). WDFW reduced the permit level to five for the 1997 season to mitigate anticipated excessive mortality from the 1996-97 winter. Winter mortality turned out to be less than expected, but the permit level remains at five to promote herd expansion into adjacent sparsely inhabited habitat. Goats are being seen farther east in the northern portion of the unit than in previous years, and it is hoped this trend will continue.

WDFW reduced hunter pressure in the Mt. Chopaka Unit from two permits to one in 1994 (Table 2). Even so, productivity in this herd is low, and the population appears to be in decline.

Table 1. Summary of harvest information for mountain goats in the Methow Unit.

Year	Permits	Hunters	Harvest	Success	Seen/Hunter	Goats
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	

A hunting closure in this unit needs to be considered.

Five permits were issued in the Methow Unit. Four of five

Table 2. Summary of harvest information for mountain goats in the Mt. Chopaka Unit.

Year	Permits	Hunters	Harvest	Success	Seen/Hunter	Goats
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	

hunters successfully filled their tags, while hunting an average of 3 days. One permit was issued for the Mt. Chopaka Unit. The lone hunter in the Mt. Chopaka Unit hunted for 20 days, and successfully filled his tag.

Surveys

As a result of a budget shortfall, no aerial surveys were conducted in the spring of 1998. An attempted ground survey of a portion of the Gardner Mountain area in the Methow Unit yielded no goats, despite an earlier forest service report of 27 adults and 7 kids from the same area. No other goat surveys were conducted.

Population Status And Trend Analysis

Several years of survey data suggest that the Chopaka Mountain herd is in decline (Table 3). 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.

In general, inferences about population levels and trends in

Table 3. Population composition counts from the Methow Unit. K:100 is kids per 100 adults.

Year	Population			K:100
	Kids	Adults	Estimate	
1994	6	25	--	24:100
1995	--	--	--	--
1996	16	41	--	39:100
1997	20	49	--	41:100
1998	--	--	--	--

the Methow Unit are rather speculative. Existing survey data suggests mountain goat numbers are fairly stable, or perhaps slowly increasing, and productivity is at healthy levels (Table 4). 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

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	--	--	--	--

Okanogan District outside of the established goat units. Little survey work has been done in these areas due to lack of resources. Population size or trend is unknown for these animals.

Habitat Condition And Trend

The mild winter in the Okanogan District likely had little affect on goat habitat or populations.

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 reduction in Methow Unit harvest implemented as a precautionary measure in response to severe winter weather, should be retained for the purpose of fostering emigration into surrounding habitat. 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 be suspended until reliable survey data over successive years indicates a minimum population of 25 goats that is stable or on the increase. 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

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

Our Mountain Goat season is open only to hunters drawing a special permit for one of the units open for hunting. In 1997 there was only one permit allowed for each of the five goat units open to hunting. Harsh winter conditions in the previous winter combined with season setting dates prior to survey efforts resulted in conservative permit allotments. Severe winter has been shown to drastically affect survival of goats and thus a conservative approach was taken to minimize impacts when data was lacking.

All five permit holders in the five open units were successful (Tables 1-5). The number of goats seen per hunter varied depending on the amount of time each hunter spent hunting. Some units showed higher number of goats than other units but late season surveys showed goat populations better than hunter reports with the exception of Kachess Pass. Bad weather prevented efforts to survey Kachess Pass adequately and we are targeting that unit for surveys in the fall of 1998 to determine it's status.

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

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. 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 pre

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

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

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

season composition counts are conducted. Our estimation is that the September surveys tend to yield the best results in total

Table 5. Summary of harvest information for goat Unit 3-11 Kachess Ridge.

Year	Permits	Hunters	Harvest	Goats	
				Success	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

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 1997-98 was a normal snowfall year with milder temperatures at lower elevations. Even though heavy snowfall occurred in some high elevation areas indications are that it did not impact the goat population and did provide abundant forage production. Higher than normal 1998 summer temperatures may affect late season forage production but cooling trends generally occur in September.

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	Region	Goat Unit(s)	Population
Mountain Goat	4	4-15 through 4-24	Darrington Ranger District

Prepared by : Ruth Milner, District Wildlife Biologist

Population Objectives/guidelines

Long term objectives for managing mountain goats in units 4-15 through 4-24 are to establish a stable population which is large enough to sustain a recreational harvest.

Hunting Seasons And Harvest Trends

All units have been closed to hunting since 1995.

Surveys

Methods: No surveys were conducted in 1998 due to lack of funding for aerial surveys.

Population Status And Trend Analysis

Data collected between 1995 and 1997 were not sufficient to show any meaningful trends. Future surveys should concentrate on repeatable techniques which enable us to analyze these populations for long range trends.

Habitat Condition And Trend

Recreational use of the high country occupied by goats

appear to be increasing and this should result in negative impact to goats. No studies have been conducted to confirm this hypothesis.

Augmentation/habitat Enhancement

No attempts to supplement the goat population or enhance habitat were made in 1998.

Management Conclusions

A mountain goat population study is needed in the Darrington Ranger District. The study should concentrate on developing repeatable techniques for assessing population (e.g., a mark-recapture study). We have suggested a marking study done from helicopter and using paint balls to the U. S. Forest Service, but have not pursued surmounting the potential obstacles inherent in working in the Glacier Peak Wilderness Area.

Species	Region	Goat Unit(s)	Population
Mountain Goat	4	4-8 & 4-9	East Ross Lake & Jack Mountain

Prepared by: Mike Davison, District Wildlife Biologist

Population Objectives/guidelines

Mountain goats (*Oreamnus americanus*) were historically abundant throughout the Cascade Mountain range prior to 1950. During the 1997 hunting season only two goat management units remained open to recreational harvest. Excessive logging throughout critical winter and summer range areas, and increased human disturbance resulting from extensive road and hiking trail development in sensitive alpine habitats continue to negatively impact goats in this area. Management guidelines for this species are based upon harvest criteria as described by Hebert and Turnbull (1) for coastal habitats. Harvest within Washington's mountain goat units is managed so as not to exceed four percent of the total estimated goat population. This harvest rate is designed to minimize impact on older age class females in the population. Although the management strategy is biologically valid, the current survey information regarding the status of individual herds is inadequate to allow for appropriate use of the four percent harvest formula.

Management objectives for mountain goats in Region 4 remain unchanged from the 1996 season:

1. Return population levels and distribution to or near historic levels (pre-1980).
2. Re-establish hunting in goat management units currently closed.
3. Increase permit numbers and harvest to pre-1980 levels.
4. Manage site specific goat herds for public viewing in areas where road access allows.

Hunting Seasons And Harvest Trends

Goat hunting season opportunity in Region 4 remained the same in 1997 with season dates for hunters that successfully drew a permit running from Sept. 13 - Oct. 31. Only two goat management units out of a total 14 units in Skagit and Whatcom counties were open to hunting in 1997 with permit levels in the East Ross Lake Unit (Unit 4-8) reduced from 10 to 4 and the Jack Mountain unit remaining at 2 permits. Harvest reports indicate that only two of the four permitted hunters in the East Ross Lake unit 4-8 hunted the area. Hunter effort in this unit totaled 14 days with no goats observed. Harvest success in the Jack Mountain unit (4-9) was better with 50 percent of the two permits successfully filled. Hunter effort in the Jack Mountain unit during the 1997 season totaled 12 days with a total of 42 animals observed. Twelve of the 42 goats observed (28.6 percent) were kids. Based upon past experience, it is likely that a significant number of animals observed were repeat sightings making the total number of individual goats observed considerably lower.

Hunting conditions during the 1997 mountain goat hunting season were fair with higher snowfall levels above 4,200 feet elevation. Lower than average snow levels below 4,200 feet

and excellent trail conditions afforded hunters good access to mid-elevation hunting areas.

Surveys

No field surveys were conducted during 1997 in any north Region 4 goat management units.

Population Status And Trend Analysis

There are no statistically valid population estimates for mountain goats in north Region 4 units. The most recent aerial surveys completed in 1996 goat management units 4-2 through 4-7 documented a total of 61 animals (an average of 8.7 goats per unit). Juvenile recruitment in the region was high with 22 kids per 18 adult female (1.22 kids per adult female). All of these units were closed to hunting during the 1997 season. Based upon the 4 percent harvest strategy (Hebert and Turnbull, 1977) a minimum of 20 goats per unit would be required for one harvest permit to be issued in each unit. It will be necessary to complete a mark/re-sight population model to accurately determine total populations in individual units.

Habitat Condition And Trend

GIS (Landsat) analysis of habitat status in north Region 4 mountain goat management units was completed in 1987 indicating severe habitat degradation on both winter and summer range areas. However, the intensive logging activities credited as the cause of habitat loss has continued without monitoring since the earlier research. No current day information regarding the status of mountain goat habitat is available but it is generally speculated that conditions have steadily deteriorated since 1987. Human disturbance of fragmented goat populations utilizing impacted habitat poses the highest management concern for WDFW (Washington Department of Fish and Wildlife). The majority of mountain goat habitat (90 %) exists on U.S. Forest Service and National Parks lands. Both agencies have accelerated road and hiking trail development over the last ten years resulting in significantly increased public access to previously remote alpine areas. Future management challenges for mountain goat conservation efforts will necessitate mitigation for existing roads and trails as well as for new trail proposals which may threaten critical niche habitats currently used by goats.

Augmentation/habitat Enhancement

There have been no re-introduction efforts of mountain goats in the north Cascades since the early 1980s when both goat releases and habitat enhancement projects were implemented.

Management Conclusions

Recommendation for enhancing management capability for mountain goats in north Region 4 units are:

1. Population modeling of western Washington mountain goat units is the highest priority for managing this species.
2. Harvest report cards, telephone surveys, and mail harvest

questionnaires have served as the primary source of mountain goat data. However, these sources of information have diminished as hunting opportunity has declined. Additionally, none of these techniques provided reliable population estimates. 3. A sightability index survey based upon radio telemetry marking and paint marking would be desirable. 4. Continue aerial herd composition surveys in all goat management units. Surveys should be conducted for a minimum of three consecutive years in each GMU. Age and sex composition, herd size, sub-herd distribution, and seasonal habitat use are important data needs associated with resolving the hiking trail/roading issues. WDFW efforts to mitigate the

disturbance impacts of recreational trail use on USFS and NPS lands will require aerial survey monitoring on a pre and post mitigation level.

5. Update existing GIS(Landsat) habitat maps for mountain goat units in north Region 4.

6. Identify and evaluate potential re-introduction sites in historical goat use areas currently unoccupied.

Literature Cited

Hebert, D.M., and Turnbull, W.G. 1977. A description of southern interior and coastal mountain ecotypes in British Columbia, 1st Annul. Symp. Mt. Goats. 21pp.

Species	Region	Population
Mountain Goat	4	Kelly Butte, Goat Mountain/Rooster Comb Mountain

Prepared by: Rocky Spencer, District Wildlife Biologist

Surveys

We used a Bell 206B helicopter to locate and count mountain goats at three sites (Table 1).

Table 1. Helicopter survey results for Kelly Butte, Goat Mountain, and Rooster Comb Mountain

Population	Adults	Kids	Total
Kelly Butte	11	5	16
Kelly Butte	14	4	18
Kelly Butte Total	25	9	34
Rooster Comb Mountain	11	6	17
Goat Mountain	7	3	10

These small mountain goat populations are unique in that they can be monitored using both ground and aerial surveys. We are currently working with other cooperators to design and conduct a mark-recapture survey which will allow a population estimate. This may involve using paintballs filled

with bright dye fired by a paintball gun from a helicopter.

Kelly Butte is the proposed study area. This area offers safe terrain to mark the goats and to maneuver the helicopter. Historic flights indicate resight flights for marked goats would be effective and provide for a reliable population estimate.

Population Status And Trend Analysis

Kelly Butte holds a small, primarily resident population characterized by seasonal elevation migration. Until recently this herd has been relatively isolated. Current land exchange and timber management proposals could combine to impact this herd. Initial baseline population estimates and primary use areas need to be identified to discuss future management and mitigation activities.

At Goat Mountain/Rooster Comb Mountain, a small population likely migrates to adjacent ridges, rock outcrops and small peaks within 4 to 5 miles subject to weather and forage availability. As with Kelly Butte, recent timber management and land exchange proposals prompted the need to gather further baseline information on mountain goat numbers, productivity, and distribution.

Species	Region	Goat Units	Populations
Mountain Goat	5	5-2,5-3&5-4	Tatoosh, Smith Creek, Goat Rocks
Prepared by: Min T. Huang Wildlife Biologist Patrick J. Miller, District Wildlife Biologist			

Population Objectives/guidelines

Mountain goats (*Oreamnos americanus*) are prized in Washington states 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 2-25 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

Beginning in 1997, all three units in Region 5 are open to any legal weapon. Prior to 1997, Smith Creek was an archery-only Unit. Harvest quotas have been conservative in Region 5. In 1997, permit levels were: Smith Creek; Tatoosh, 5; and Goat Rocks, 10.

Hunting seasons in all three Units have traditionally been the last two weeks of September and the entire month of October. In 1997 the goat season was 13 September-31 October. The bag limit is one goat of either sex, with horns longer than 4 inches per permit.

Hunting pressure in all three Units is limited by conservative permit allocation.

Solely based upon hunter success, survey returns, and aerial surveys, mountain goat populations in Region 5 have not been negatively impacted by current season lengths or permit levels. Concern over declining hunter observations of kids in Goat Rocks, however, indicate a possible decline in productivity or high adult mortality in this Unit (see harvest recommendations below).

Weather conditions in 1997 were good for goat hunting. Harvests were spread throughout the season. Warm conditions, however, slowed migrations of goats into the Tatoosh Unit. This late migration resulted in difficult hunting conditions in the Tatoosh. Typically, however, goat hunting is less influenced by weather conditions than other big game seasons, due to the long duration of the season (6 weeks).

Hunter success in 1997 was slightly lower than in 1996. This constitutes a two-year downward trend in hunter success in Region 5 Goat Units (Table 1).

Historically, success levels in the Goat Rocks Unit have approached 100%. This was the case in 1997. The Goat Rocks Unit contains the most extensive goat habitat, has the highest goat numbers, and is composed of resident animals. Success rates in Goat Rocks are stable over time ($r=0.418$, $P=0.18$). The number of goats seen by hunters in this Unit is indicating a significant upward trend ($r=0.729$, $P=0.007$).

Table 1. Summary statistics for Region 5 mountain goat harvests, 1985-1997

Unit	Year	Permits	Harvest	Success	Goats % Seen/ Hunter	Mean Days per kill
Smith Creek	1997	3	1 (2)*	50	25.0	9.5
	1996	5	2	40	30.0	12.5
	1995	5	2 (4)	50	36.0	22.5
	1994	3	2	67	17.0	6.0
	1993	3	2	67	43.0	11.0
Goat Rocks	1997	10	9(9)	100	21.0	2.8
	1996	10	6(9)	67	50.0	5.8
	1995	10	10	100	38.0	2.2
	1994	10	10	100	45.0	2.3
	1993	10	10	100	39.0	1.9
Tatoosh	1997	5	1	20	11.0	8.0
	1996	5	1 (3)	33	9.0	35.0
	1995	5	3 (4)	75	9.0	6.0
	1994	5	2	40	3.0	15.0
	1993	5	2	40	3.0	12.5

*Numbers in ()'s indicate surveys returned, if less than permits issued.

Hunter success in the Tatoosh Unit is variable, often dependant on the timing of goat migration out of Rainier National Park. Early, heavy snowfall results in early migrations out of the Park, and better hunter success in Tatoosh. When snowfalls are limited, hunters become dependant on the small resident Tatoosh population. This results in lower goat sightings and lower harvests. Success in Tatoosh has been significantly declining ($r=-0.674$, $P=0.01$). Conversely, however, the number of goats seen in this unit is showing a significant upward trend ($r=0.571$, $P=0.05$).

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 of goat habitat. In 1993 hunting was limited to archery-only. Permit allocation was initially very conservative ($n=3$). Due to the patchy distribution of habitat in this unit, unlike either Goat Rocks or Tatoosh (which have extensive areas of high elevation goat habitat), goats have limited movement options, making them vulnerable to over-harvest. In 1997, this unit was open to any weapon. Hunter success was 50%. A non-significant downward trend in success ($r=-0.813$, $P=0.09$) exists in Smith Creek. No upward or downward trend is evident in the number of goats seen by hunters ($r=-.0364$, $P=0.55$).

Surveys

For the past five years survey intensity has been concentrated in the Smith Creek Unit. With the re-initiation of hunting in the unit, surveys were focused to assess the ability of the population to sustain limited harvest. A cooperative project between the Gifford-Pinchot National Forest-Packwood District and WDFW in this unit has facilitated the use of both ground and helicopter surveys in the Smith Creek Unit.

Goat group sizes and composition were determined by group observations. Areas within the Smith Creek Unit known to hold significant numbers of goats were subjectively chosen and surveyed by hiking and ground observations. Counts were taken during daylight hours. Surveyed areas were separated and all areas surveyed were completed within five days to minimize multiple count biases. All goats observed were classified as kid, billy, nanny, unknown adult, or unknown. In 1995 only the total number of goats was tallied. Surveying in 1994, 1996, and 1997 was done solely by helicopter. A kid-to-adult ratio was calculated from survey results. Ninety-percent confidence intervals around the ratios were determined following Czaplewski et al. (1983).

Because of increased budget in 1997, helicopter surveys in Smith Creek were conducted on 25 March 1997, 14 July 1997, and 6 October 1997. Previously, helicopter surveys had been single flights. For consistency, results of only the fall flight are presented here. A total of 33 goats were observed (Table 2). Observed productivity continues to be above the goal for Region 5 goat populations. Lower 90% C.I.'s however, are at lower limit of acceptable productivity levels for this population.

Table 2. Mountain goats classified during the Summer/Fall surveys of the Smith Creek Unit, 1993-1997

Year	Total	Adults	Kids	Kids: 100 Adult
1997	33	24	9	38+20:100
1996	51	39	12	31+11:100
1995	75	0	0	0
1994	54	43	11	26+10:100
1993	58	44	14	32+11:100

* Goats unclassified in 1995.

Survey results indicate that the present conservative permit allocations in the Smith Creek Unit have had no deleterious impacts on goat numbers in this Unit. 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. Results of the Cooperative Cispus AMA goat study indicate that this goat population is steadily increasing its range, effectively merging with the Goat Rocks population, particularly on wintering areas. This expansion of range and goat distribution

may be responsible for the current non-significant trends in hunter success and visibility in the Smith Creek Unit.

Population Status and Trends

As previously indicated, hunter success is significantly declining in Tatoosh ($r=0.674$, $P=0.01$). No significant trends are evident in Smith Creek ($r=-0.813$, $P=0.09$) or Goat Rocks ($r=0.418$, $P=0.18$). Using Catch per Effort (CPE) to model goat populations in Region 5, however, is impractical, due to small sample size. Hunter success and thus any inferences on population status, can be biased merely by sampling error, due to the small sample size ($n<20$) Caughley (1997).

A useful index of goat productivity in each unit may be the use of trends in hunter surveys cards. These observations indicate stable productivity in all goat units in the Region. A slight downward trend is evident in Goat Rocks. Quality and completeness of these report cards, however, is variable. Therefore, in the absence of a statistically viable population model, these trends must be viewed conservatively.

Habitat Condition and Trend

No known climatic influences are affecting mountain goat habitat in Region 5.

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	Acres of Meadow		Difference
	Historic (1959)	Recent (1990)	
Stonewall	348	259	-89
South Point	749	529	-220
Smith	248	195	-53
Castle Butte	599	557	-42
Total	1,944	1,540	-404

The documented loss of alpine meadow constitutes an overall decrease of 20.8% in the study area. Of the 1540 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 (Olmstead 1979). United States Forest Service (USFS) 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 Activities

The USFS is presently investigating the possibilities of starting a prescribed burn program in the Smith Creek Unit to create and maintain favorable goat habitat (T. Kogut, pers. Comm.). Biologists are in the process of writing proposals and hopefully this will result in an active burning program that will restore alpine meadow habitat to historic levels.

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. Quotas for the Goat Rocks Unit have been reduced to 7 permits due to declining kid numbers on the hunter reports. Non-harvest mortality of mountain goats can be high (P. Miller pers. comm.) Although the trend in observed productivity in Goat Rocks is non-significant, caution in permit allocation is advocated at this time. Despite the significant downward trend in hunter success in the Tatoosh Unit, quotas should also remain at 5 permits. Hunter success in Tatoosh seems to be largely tied to weather conditions. In 1997, due to warm weather, most goats were found inside the Park boundaries or in Carlton Creek. Subsequent low hunter success in 1997 resulted in the significant negative trend seen in the Tatoosh. Quota levels in Smith Creek should remain at the current number of three. The cooperative Cispus AMA study indicates that habitat loss may constitute a significant limiting factor to this population. The Smith Creek populations also has a history of over-exploitation. With the change from archery-only to any weapon hunting and until long-term habitat restoration in Smith Creek can be adequately addressed, permit allocation should remain very conservative.

Based upon the results of the cooperative Cispus AMA study, alpine meadow restoration is recommended. Restoration is contingent upon financial and environmental approval by the USFS for the implementation of a prescribed burning regime.

Research is needed to develop population estimates and models for the goat population in Region 5. Should funding

be available, marking of goats with highly visible, numbered ear tags, 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 our aerial 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 unsuitable 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**Bighorn Sheep****Region****Statewide**

Prepared by: Steve Pozzanghera, Carnivore, Furbearer, and Permit Species Section Manager

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.) Seven general season permits were available in 7 different sheep management units for 1997 and a total of 2,160 applicants entered the drawing. Two of the 7 areas available for hunting in 1997 were open for the first time (Selah Butte and Lincoln Cliffs), and one additional unit will be open to hunting in 1998. Two additional permits were available for bighorn sheep in 1997 (1 raffle, and 1 auction). The 1997 bighorn sheep general season provided 26 days of hunting (September 15 to October 10), and was different from the 1996 season only by calendar date adjustments (i.e., 1996 season had 27 days of hunting, September 15 to October 11). In 1997 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).

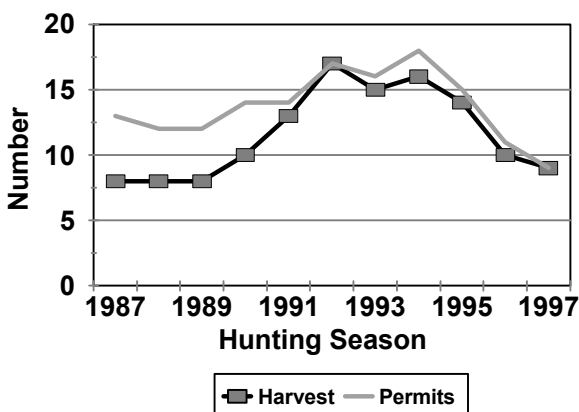


Figure 1. Number of sheep harvested and permits issued in Washington State.

Bighorn sheep hunting seasons in Washington occur relatively early in the year and weather is rarely a factor in

hunter success. Of the total 9 permits available in 1997, all 9 individuals actually reported that they hunted bighorn sheep. A total of 9 sheep were killed for a hunter success rate of 100%. Compared to 1996, individual hunter success rates increased from 91%, but there were 2 fewer permits available to hunters in 1997. Therefore, the harvest decreased by 1 when compared to the 1996 harvest of 10 bighorn sheep. Overall, the 1997 sheep harvest decreased 25% when compared to the 10 year average harvest of 12 sheep /year (1987 to 1996) (Figure 1.).

Surveys

All seven of 7 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 1997. Despite this, the total sheep population estimate for 1997 within the Blue Mountains has increased slightly (Table 2.) and it is hoped that 1998 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 1.). 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

Table 1. California bighorn sheep population trend.

Sheep Herd	Population				Comments
	1994	1995	1996	1997	
Tucannon	50	45	50	50	Continued poor lamb survival. Predation may be a limiting factor.
Vulcan	115	100	70	70	Fifty-seven percent decline in ewe:lamb number in 1997. Low lamb survival the last few years, and low number of adult ewes in the population.
Mt. Hull	--	55	60	65	Population stable although 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	Population continues to struggle. Range forage condition is poor due to noxious weed and livestock competition.
Swakane	30	38	25	30	Population is static yet contains a high number of adult rams. WDFW and Wenatchee NF have developed and MOU for bighorn management in this area.
Quilomene	50	70	90	135	Continues as the fastest growing herd in Washington since introduction in 1993. One permit will be available in 1998.
Umtanum	200	150	150	150	Population has maintained itself despite removal of 43 sheep for transplants to new areas.
Cleman	55	60	65	100	Second consecutive good lamb production year in spring 1998 with 26 lambs.
Lincoln	35	45	65	90	Excellent production continues as herd continues to grow.
Cliffs					
Total	535	563	620	730	

Table 2. Rocky Mountain bighorn sheep population trend.

Sheep Herd	Population				Comments
	1994	1995	1996	1997	
Hall Mountain	35	35	35	30	Low lamb survival. High predator populations are likely a contributing factor.
Asotin Creek	15	12	13	13	A supplemental release of 10 bighorns from BC occurred in January 1998. This herd escaped the pasteurilla die-off.
Joseph Creek	215	50	45	54	Lamb mortality remains high. Yellow-star thistle continues spreading despite aggressive herbicide programs.
Wenaha Tucannon	110	90	50	69	Lamb mortality continues to be high. Yellow-star thistle is serious range threat.
Cottonwood Creek	60	45	18	23	Lambs in 1997 appeared to have survived longer than in 1996 before succumbing to pneumonia.
Total	435	232	161	189	

North American Wild Sheep continues to be active in bighorn 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 an evaluation of reintroducing sheep onto the north shore of Lake Chelan should be completed.

The monitoring of the Blue Mountains herd also remains a priority as that area recovers from the 1995 pasteurilla die-off. Lastly, coordination and cooperation with the tribes will become of greater importance as tribal interest in sheep hunting increases.

Species **Region** **Population**
Bighorn Sheep **1** **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 use.

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. However, during this survey, few sheep were observed because portions of the herd had moved into areas they normally do not use, and another group was in the riparian zone (brush-trees). Also, surveying herds this small can easily result in low sightability levels if only 5-8 sheep move into the brush.

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 (Fig. 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 (Table 1). If lamb survival improves, this bighorn population should start to show an increasing trend over the next few years.

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 Asotin Creek herd range. The rams have ranged considerable distances and have been monitored in Wenatchee Creek, within the boundaries of the Mt. View herd range. The rams have returned to Asotin Creek and were observed at Pinkham Butte the week of June 14-20, 1998. This type of movement will expose the Asotin Creek herd to scabies and other diseases associated with the Mt. View 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.

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.

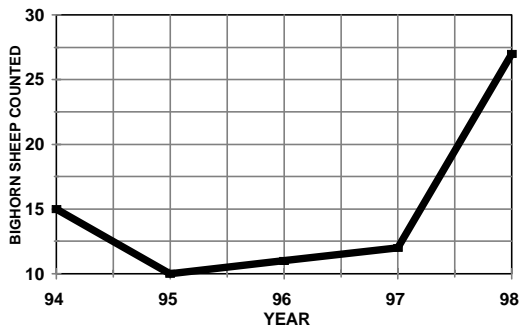


Figure 1. Bighorn Sheep Survey Trend, Asotin Creek Herd.

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 1998.

Year	Lambs	Ewes	Rams			Total	Count Total	Population Estimate	Per 100 Ewes L:100:R
			Y1	<3/4	>3/4				
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	12	13	67:100:33
1998*	7	13	3	2	2 (1)	7	27	30	54:100:54

Permit controlled hunting for rams will be implemented when the population meets specific criteria established in the Bighorn Sheep Plan.

Species**Region****Population****Bighorn Sheep****1****Black Butte Herd - Unit 9****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 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. Hunting will be initiated when this population meets the criteria for establishing permits as listed in the Bighorn Sheep 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 1998 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. Sightability was determined by the number of collared ewes counted, compared to the total number of collared ewes in the population. Observers counted 10 out of 11 collared ewes; 91%.

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 remained fairly static since the die-off of 1995-96. Surveys for 1995, 1996, and 1997 populations produced counts of 42, 36, and 49 bighorn sheep, respectively (Fig. 1).

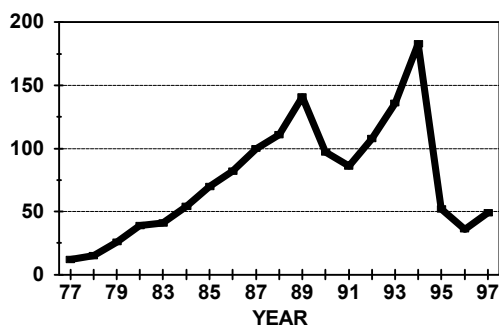


Figure 1. Bighorn Sheep Survey Trend, Black Butte Herd.

Lamb production and survival has been monitored closely since the die-off (Table 1). Lamb mortality due to pneumonia

has taken a high 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). To date, little mortality has occurred and 10 of 11 collared ewes still have lambs. However, lamb mortality in the Wenaha herds is heavy. Only two lambs have been lost in Black Butte to date (July 98). However, heavy lamb mortality could still occur.

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. Hopefully, lamb survival will improve in 1998.

To date, we have not been able to isolate the factor responsible for lamb mortality, whether it is a bacteria (*Pasteurella*) or a virus. We may change the protocol and attempt to capture any lambs that appear to be sick and transfer them to W.S.U. in an attempt to identify the pathogen.

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 levels appear to be holding at low levels based on analysis of fecal samples from radio-collared ewes and necropsied individuals, and is not a problem at this time.

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 reaches 30+ lambs/100 ewes.

Contact with domestic sheep is still considered a major problem for this herd. Several domestic sheep were reported running loose near the mouth of the Grande Ronde river in June, 1998, but the domestics were not located during aerial surveys. This problem will continue until the public understands the threat domestic sheep pose to bighorns.

The short term management objective for the Black Butte herd will be to increase numbers 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 (i.e., trap/transplant, or ewe seasons).

Table 2. Black Butte Herd Composition Data 1989-97, Blue Mtns. Washington. () indicates number of Class-4 rams in > 3/4.

Year	Lambs	Ewes	Rams				Count Total	Population Estimate	Per 100 Ewes L:100:R
			Y1	< 3/4	> 3/4	Total			
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	40:100:51
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

Species	Region	Population
Bighorn Sheep	1	Hall Mountain Herd
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 call for 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 1970s, ground surveys at the winter feeding station were used in late 1997 and early 1998 to estimate the total number of sheep, sex ratio, and lamb production. (Table 1). Similar efforts counting and classifying British Columbia bighorn sheep that occasionally mix with the Hall Mountain herd were also carried out in January of 1998. Count totals at a feeding station along Canada Highway 3 included 3 lambs, 9 rams, and 12 ewes for a lamb/ram/ewe ratio of 25 L : 100 E : 75 R. The U.S. Forest Service (Sullivan Lake Ranger District, Colville National Forest) has been monitoring a number of animals from the Hall Mountain herd by radio telemetry since 1995 (Aluzas 1997, Bertram 1996). Table 2 presents information on all sheep fitted with radio transmitters and their current status. As of June 1998, there are 4 rams and 5 ewes alive and actively transmitting.

Population Status And Trend Analysis

The Hall Mountain bighorn sheep herd appears to have declined incrementally at least since 1993, the last year that animals were transplanted out of the herd (Table 1). Of greatest concern has been a steady decrease in lamb production since 1993 which is the last year that the lamb to ewe ratio was at the targeted objective of 50:100. This last year was the lowest lamb ratio ever obtained with only three lambs accounted for, a ratio of 21 lambs per 100 ewes. The lamb to ewe ratio obtained on the counterpart herd in British Columbia was not appreciably higher at 25 L : 100 E. There are no clear indications as to why this trend exists. Predation by cougars could be significant as such is suspected to be a problem for recently translocated woodland caribou in the same general region. Much closer monitoring of radio-telemetered ewes during and subsequent to the spring lambing season may provide insight into the low lamb recruitment problem.

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 predation. At this time there are no firm plans to enhance existing bighorn sheep habitat.

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." The potential exists that without supplemental winter feeding, sheep could stray to human settlements for food.

Watchable Wildlife Area

The 1997-98 winter was mild compared to most winters in northeastern Washington. Hence the Hall Mountain bighorn sheep availed themselves of food at the Noisy Creek Feeding Station to a lesser degree than previous years. A substantial portion of the initial stockpile of 120 hay bales and 1,500 pounds of alfalfa pellets went unused. As usual, public visitation to the site peaked around the Christmas and New Years holidays. Sheep largely quit using the feeders by late February of 1998 and winter feeding was discontinued at that time.

The Washington Department of Fish and Wildlife has a "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. This permit expires in 1998 and the intent of both agencies is to renew the permit and continue with the winter feeding and public viewing program. Feeding the sheep will hopefully contribute to recovering herd productivity so that Hall Mountain animals 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 1997. The normally annual winter live-capture by Department personnel working with veterinary students and Prof. William J. Foreyt out of Washington State University, along with other project cooperators, did not take place in 1997.

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.

Year	Lambs	Ewes	Rams	Count Total	Population Estimate	Number Translocated	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	2L 5E 2R	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	4L 8E 3R	44 : 100 : 62
1983	13	22	13	48	55	7L 3E 1R	59 : 100 : 59
1984	17	27	17	61	65	-	63 : 100 : 63
1985	12	29	21	62	65	8L 15E 3R	41 : 100 : 72
1986	9	11	13	33	35	1R	82 : 100 : 118
1987	6	10	12	28	30	2L 1R	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	3L	55 : 100 : 95
1991	6	12	12	30	40	1L 3E 2R	50 : 100 : 100
1992	5	14	12	31	40	-	36 : 100 : 86
1993	9	18	13	40	45	3L 4E 4R	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

ND = Insufficient data available.

Management Recommendations

The Hall Mountain Bighorn Sheep may be in trouble as there appears to be an inadequate number of lambs being recruited to the herd. The following recommendations are given to address this problem:

- * Consider taking blood samples of ewes for pregnancy testing at the annual winter sheep capture.
- * Radio track ewes much more closely and regularly during and subsequent to spring lambing. Monitor ewes with lambs at least from late spring through fall as much as practicable.
- * Investigate the potential to carry out some controlled burning to enhance forage and predator escape terrain on Hall Mountain and other areas that are key to the herds range.
- * Seek funds and potential cooperators to help construct a fenced viewing area for the public which will provide for better crowd control and enhance wildlife viewing quality at the Noisy Creek winter bighorn sheep feeding station.

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Table 2. Radio telemetered Bighorn Sheep from Hall Mountain and their status as of June 1998.

Transmitter Frequency	Mo/Yr		Capture		Status
	Radio Tagged	Sex	Age	Ear Tag #	
148.878	12/95	M	10+	Orange 12	Mortality in July 1997
149.196	12/95	F	2.5	Yellow 28	Alive
149.218	12/95	F	2.5	Yellow 30	Mortality in April 1996
149.238	02/96	M	4+	Red 11	Alive
149.070	02/96	F	4+	Red 14	Alive
149.339	12/96	F	4+	Red 39	Mortality in August 1997
149.238 & # 149.442	12/96	M	4+	None	Alive
149.320	12/96	M	8.5	Yellow 29	Mortality in September 1997
149.301	12/96	F	2.5	None	Alive
149.180	12/96	F	4+	None	Alive - but poor transmitter signal
149.077	12/96	M	6+	None	Alive
# 149.162	12/96	M	2.5	Red 16	Unknown - due to poor transmitter
149.360	12/96	M	4+	None	Alive
149.320	12/96	F	2.5	Green 8	Alive - original frequency was 149.010

= Experimental radio transmitter attached to ear tag. All other sheep received radio-collars.

Species **Region** **Population/Herd**
California Bighorn Sheep **1** **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.

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.

The local interest in the bighorns has developed into an acute case of "local ownership" and combined with the nearly 100% private land ownership in the area it is in the best interests of the herd to limit ram permits to only one per year. 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 no 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.

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.

Management Conclusions

Population objectives of 60 plus bighorns have been met and the herd continues to increase. 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.

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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

Species**Region****Population****Bighorn Sheep****1****Mt. View Herd - Unit 8****Prepared by: Pat Fowler, District Wildlife Biologist****Population Objectives/guidelines**

The Mt. View herd suffered a major *Pasteurella* die-off during 1996, reducing the population 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 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 remained fairly static since the die-off of 1996. Surveys for 1996 and 1997

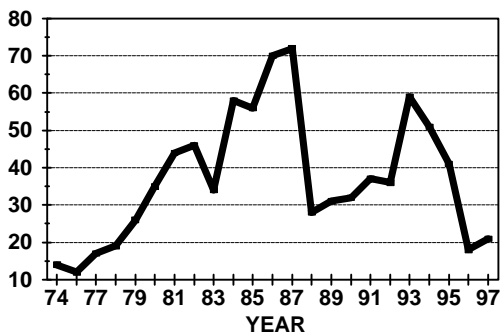


Figure 1. Bighorn Sheep Survey Trend, Mt. View Herd.

populations produced counts of 16 and 21 bighorn sheep, respectively (Fig. 1).

Lamb mortality was high in 1997 due to pneumonia.

Surveys conducted in June-July of 1998 produced a count 24 bighorn sheep; 3 rams, 13 ewes, 8 lambs (Table 1). Although survival of the 1998 lamb crop is high, it could still sustain heavy mortality from pneumonia.

The Mt. View bighorn sheep population increased slightly between 1997 and 1998, but it will take a major improvement in lamb survival for this herd to increase significantly over the

next five years.

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.

Scabies is a continuous problem, and appears to have a greater impact on this herd than others, with the exception of the Wenaha. 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+ lambs/100 ewes.

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 (i.e., trap and transplant, or establishing ewe seasons).

Table 1. Population Trend and Herd Composition, Mt. View Herd-Unit 8, Blue Mtns. () indicates number of Class-4 rams in > 3/4 segment.

Year	Lambs	Ewes	Rams			Count Total	Population Estimate	Per 100 Ewes L:100:R
			Y1	< 3/4	> 3/4			
1989	6	16	—	5	4 (2)	9	31	56:100:38
1990	7	18	—	5	2 (1)	7	32	39:100:39
1991	8	15	—	8	6 (4)	14	37	93:100:53
1992	5	16	—	6	8 (4)	14	35	88:100:31
1993	18	23	—	10	8 (4)	18	59	78:100:59
1994	10	24	—	10	7 (4)	17	51	71:100:42
1995	6	28	1	1	5 (2)	7	41	25:100:21
1996	1	14	1	0	0	1	16	7:100:7
1997	3	14	1	1	2 (1)	4	21	29:100:21

Species **Region** **Population**
Bighorn Sheep **1** **Tucannon Herd - Unit 3**
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 is to sustain a bighorn sheep population of 50-70 animals.

Hunting Seasons And Harvest Trends

One ram permit was issued in 1997. The hunter harvested a Class-4 ram that scored 169 7/8 B&C; horn length was 38 7/8 x 34 2/8, with 14 4/8 in bases. One permit will be recommended for 1998.

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. The survey this year produced a count of 47

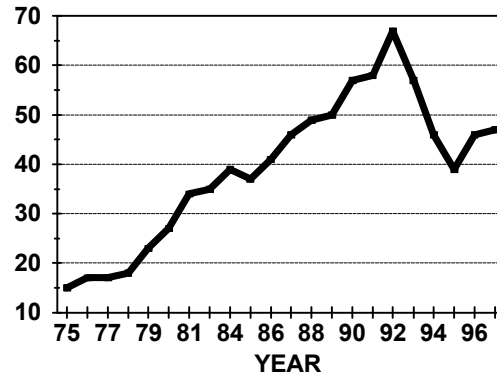


Figure 1. Bighorn Sheep Survey Trend, Tucannon Herd.

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.

Table 1. Population Trend and Herd Composition, Tucannon Bighorn Sheep, Blue Mtns. Washington. () indicates number of Class-4 rams in > 3/4 segment.

Year	Lambs	Ewes	Y1	Rams			Count Total	Population Estimate	Per 100 Ewes L:100:R
				<3/4	>3/4	Total			
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

bighorn sheep; 10 rams, 27 ewes, and 10 lambs (Table 1).

Lamb survival declined slightly in 1997 to 37 lambs\100 ewes, although the number of lambs surviving was identical to 1996; 10 lambs (Figure 1).

The ram population has declined from 18 to 10 over the last three years, probably due to a combination of low lamb survival and predation. Permit levels will remain conservative over the next five years.

Augmentation/habitat Enhancement

Weed control is the major habitat improvement project at the present time.

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 herds range. This could be a significant

danger to this bighorn population.

This herd remains scabies free, but will probably be infected by a wandering ram some time in the future.

Management Conclusions

The Tucannon herd is relatively stable at the present time. Population surveys will continue to be conducted annually.

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.

The management objective will be to maintain this bighorn sheep population at 50-70 animals. If the population increases significantly beyond 70 animals, an assessment will be conducted to determine if herd health is declining, and options are needed to reduce herd numbers (i.e., trap and transplant, or ewe seasons).

Species**Region****Population/Herd****Bighorn Sheep****1****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 now near or below the lower population objective for the herd. The immediate objective is to monitor herd characteristics to provide basic data for management recommendations. Hunting is one of the primary objectives of this herd and is co-managed with the Colville Confederated Tribes (CCT). The USFS and the BLM manage important portions of the range and take the lead on most habitat enhancement projects.

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 1997 was considered to be two rams so each manager recommended one permit be issued.

The state (WDFW) received 972 applications for the one permit offered for any ram from the Vulcan Herd in 1997. One ram was taken (Table 1). There was a dramatic increase in the interest from tribal members for the CCT permit (51 in 1996 vs 415 in 1997) this year because hunters could take sheep of either sex rather than ewes only. One tag was issued but no sheep was taken. (Murphy, 1998).

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		

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 this year the age of the ram taken was consistent with the maturity of the average rams taken over the years.

Wildlife Officer Ron Cram documented two road-killed adult ewes over the winter. He also investigated the death of a 7 year old ram that likely died from harassment from dogs.

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 should be run more than once as fog or snow are often factors affecting the results. Our sheep hunters are also requested to keep records of the sex and age of sheep observed while hunting. This contributes to the general knowledge of the herd.

Ground surveys are run on two days, duplicating the same route each day of the survey. The counts were coordinated and conducted by biologists from WDFW, USFS and CCT. Complete counts were made both days but the second day, November 18, 1997, was the most successful (27 sheep vs 52 sheep). Our best count was 30 rams, 19 ewes, and 3 lambs for a ratio of 158 rams and 16 lambs per 100 ewes (Table 2).

The count records provided by the permittee in early fall support the fall composition numbers and ratios. The permittee related that he did not see many ewes but did see 17 ewes with 6 lambs in one group on a scouting trip. After several days in the field he estimated there were about 24 rams, 18 being in the 3/4 curl or better range, 4 with heavily broomed horns. His total sightings, including duplicates, was 40 rams, 25 ewes, and 6 lambs (160R:100E:24L).

There has been no statistical modeling to develop a population estimate of the herd. Using the best knowledge I have of the herd at this time I would suggest a total of 75 sheep.

Population Status And Trend Analysis

The Vulcan herd has apparently declined quite dramatically in the last few years. The ram numbers have held up well but the low number of lambs in the last two years is alarming. Our fall count in 1994 produced a total of 51 ewes and lambs vs 22 for 1997, a decline of 57 percent (Figure 1). There is certainly cause for concern given the low number of ewes noted (less 2 lost to road-kill over the winter), and only a few female lambs, at best, to supplement the population in the near future.

Table 2. Fall population composition counts from Vulcan Mountain. Y1 = 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).

Year	Lambs	Ewes	Rams			Total	Count Total	Population Estimate	L:100:R
			Y1	<3/4	>3/4				
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	

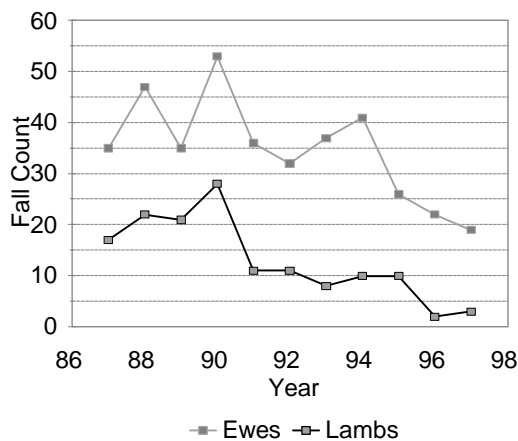


Figure 1. Vulcan ewe and lamb fall counts, 1987-97.

Habitat Condition And Trend

The 1997/98 winter was very mild and there has been good moisture for forage production during the spring. Survival over winter and spring lamb production should be near biological potential. This sheep area is relatively small though and is experiencing continued encroachment by rural home development.

Wildlife Damage

Damage to crops has been solved with a fence being built around the alfalfa field. Sheep using private rangeland is not a significant issue with the present lower population of sheep. Ranchers do appreciate sheep as long as populations don't build to levels experienced in the early 1990s. Local

residents seem slightly alarmed at the low population at this time so I think our objective of 80-110 sheep is still reasonable and one the ranchers find acceptable.

Habitat Enhancement

There were no habitat activities in 1997. The USFS helicopter logging and prescribed fire enhancement project implementation has been held up by appeals.

Management Conclusions

The good number of rams in the population allowed us to continue hunting even though the ewes and lambs have declined alarmingly. We will have to work closely with the tribal biologists this year though and be certain we can document enough current and replacement rams to warrant a hunt. The low number of ewes and lambs will certainly result in a reduced number of rams at some point.

Efforts to coordinate forage improvement projects such as fertilizing Moran Meadow and working with the Ferry County Weed Board for knapweed control should be elevated to a higher priority.

If lamb numbers don't improve during the fall count we should implement a series of surveys in the late spring to attempt to determine if lambs are being produced.

I would like to pursue efforts to increase the awareness and opportunities for this herd to provide a Watchable Wildlife experience. Coordinated efforts by the agencies, (i.e., WDFW, BLM, USFS, and CCT) and support by Ferry County, could result in media coverage, brochures, road signs, viewing locations identified, or biologist guided viewing days from the Curlew Conservation Corp compound.

Literature Cited

Murphy, M. 1998. 1997 North Half Colville Tribal Harvest. Fish and Wildlife Dept., Colville Confederated Tribes.

Species**Region****Population****Bighorn Sheep****1****Wenaha Herd - Unit 11****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 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. Observers counted 9 out of 10 collared ewes during the survey; 90%.

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 remained fairly stable since the die-off of 1996 (Fig. 1). Surveys in 1995, 1996, and 1997 produced counts of 76, 49, and 62 bighorn

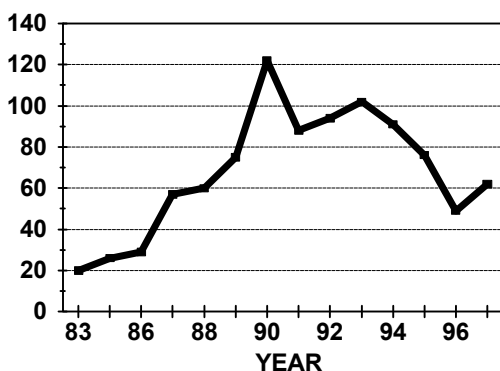


Figure 1. Bighorn Sheep Survey Trend, Wenaha Herd.

sheep, respectively.

Lamb production and survival have 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, Table 1). Counts conducted in early July produced a count of 30 ewes with 8 lambs (27 lambs\100 ewes). Lamb mortality due to pneumonia has been fairly constant since early June, and is taking a heavy toll of lambs.

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 was poor in 1996, 1997, and 1998. Hopefully, lamb survival will improve in 1999.

To date, we have not been able to isolate the factor responsible for lamb mortality, whether it is a bacteria (*Pasteurella*) or a virus. We may change the protocol and attempt to capture any lambs that appear to be sick and transfer them to W.S.U. in an attempt to identify the pathogen.

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 levels appear to be holding at low levels 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+ lambs\100 ewes.

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 (i.e., trap and transplant, or establish ewe seasons).

Table 2. Wenaha Herd Population Trend and Composition Counts, Blue Mtns. Washington. () indicates number of Class-4 rams in > 3/4 segment.

Year	Lambs	Ewes	Rams			Count Total	Population Estimate	Per 100 Ewes L:100:R	
			Y1	<3/4	>3/4				Total
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	0	49	50	9:100:4
1997	4	50	1	7	0	0	62	69	16:100:8

Species	Region	Population
Bighorn Sheep	2	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.

No harvest occurs if the population is undergoing a significant decline, or if the herd does not contain at least eight mature rams > ½ curl, and at least 2 rams > ¾ curl. In addition, harvest is further limited to the following:

1. 20% of mature rams when ram:ewe ratio is > 50:100.
2. 15% of mature rams when ram:ewe ratio is = 25-50:100.
3. 10% of mature rams when ram:ewe ratio is < 25:100.

Hunting Seasons And Harvest Trends

Hunting Seasons, Regulations, and Hunter Pressure: The season for sheep was September 15 - October 10, and hunting conditions were generally favorable. For the Mt. Hull Unit, WDFW issued one ram permit and the Colville Confederated Tribes issued one ewe permit. No permits were issued in the Sinlahekin area.

Effectiveness of Regulations: WDFW permit numbers have been limited to one in the Mt. Hull Unit to insure adequate numbers of mature rams. The ram component of this herd seems to be doing well. A minimum of six rams of ¾ curl or better were present in June of 1996. As the precision of our survey methodology improves, an additional permit for this herd could be considered, assuming population levels remain healthy.

No permits are issued in the Sinlahekin area to insure that mature ram numbers remain adequate. Even so, both the total population and mature ram component appear to be in decline. This is likely a function of habitat quality and quantity.

Harvest Success, Effort, and Tribal Input: One ram was harvested under the WDFW permit, but the tribal ewe permit was not filled (Table 1). Interest in the tribal ewe permit has been low, and the Tribes have announced their desire to convert this permit to any sex. This will generate much more interest in this permit and likely result in the annual harvest of an additional ram in the Mt. Hull Unit.

Surveys

A severe, agency-wide budget shortfall eliminated survey flight money. As a result, no surveys were conducted last year.

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. Since then,

Table 1. Summary of harvest information for bighorn sheep in the Mt. Hull Unit.

Year	Permits	Harvest	CCT Permits	CCT Harvest
1989	--	--	--	--
1990	--	--	--	--
1991	--	--	--	--
1992	2	2	--	--
1993	1	1	--	--
1994	1	1	--	--
1995	1	0	1	--
1996	1	1	1	0
1997	1	1	1	0

the population has declined slightly, particularly following the severe winter of 1992-93. If winter weather moderates, numbers should climb back to historic highs. Much expansion beyond that level is unlikely, given the existing resource base.

The Sinlahekin herd grew rapidly following reintroduction in 1957. High productivity and continued expansion allowed for translocation of sheep to other ranges in Washington. Within the last ten years, the population has shown signs of decline, and incurred heavy losses during the winter of 1992-93 when 5 mature rams succumbed to severe winter weather and another 4 ½ year old ram was poached.

Five-year: Since the winter of 1992-93, the Mt. Hull herd appears to be relatively stable, although a definitive statement cannot be made without more data. Expected population growth has been hampered by harsh winters. Lamb:ewe ratios have been highly variable, primarily an artifact of varying levels of success locating animals during survey efforts. What data we do have suggests that productivity is at least adequate to sustain the current population, estimated at 55-65 animals (Table 2).

The Sinlahekin herd is more problematic. There has been little recovery since the severe winter of 1992-93 (Table 3). The population is likely still in decline, and suffering from range degradation. Rams appear especially vulnerable to winter starvation, and appear to be in rather poor health overall. Individuals may not reach a ¾ curl until they are seven or eight years old. Lamb:ewe ratios are low.

Although resources were not available to survey the Sinlahekin this year, incidental observations of animals suggest the population is still struggling, despite the mild winter of 1997-98. This herd could be in danger of local extirpation in the foreseeable future. The Sinlahekin herd probably numbers between 25-40 animals.

Table 2. Population composition counts from the Mt Hull area. Y1 = 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).

Year	Lambs	Ewes	Rams			Count Total	Population Estimate	L:100:R
			<3/4	>3/4	Total			
1989	--	--	--	--	--	--	80	--
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	--	--	--	--	--	--	--	--

Table 3. Population composition counts from the Sinlahekin area. Y1 = 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).

Year	Lambs	Ewes	Rams			Count Total	Population Estimate	L:100:R
			<3/4	>3/4	Total			
1989	--	--	--	--	--	--	--	--
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	--	--	--	--	--	--	--	--

Habitat Condition And Trend

Over-winter survivorship for all sheep in the Okanogan District was likely high during the mild winter of 1997-98. Sheep in the Sinlahekin did not disperse widely from traditional range, as they did during the severe winter the year before.

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.

The majority of 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. Existing nutritional stress on the bighorns enhances vulnerability to pathogens, and the potential for disease transmission is high. Such a stochastic event could effectively eliminate the Sinlahekin herd.

Generally, the Mt. Hull range appears to be in good shape and the amount of available habitat is stable. Livestock competition and knapweed invasion are much less of a problem in this area.

Public Land Manager's Assessment of Habitat Conditions and Trends: 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. WDFW supports this

effort.

Management Conclusions

Mt. Hull Herd: The Mt. Hull herd appears to be doing fairly well and the current level of one state permit plus one tribal ewe permit is not likely to adversely affect the population. Further expansion of the herd is likely if winter weather moderates. This would allow for the conversion of the tribal permit to an either sex hunt.

Such a conversion should be used as a catalyst for the pooling of state and tribal resources to support a joint survey effort for this herd. This would improve the accuracy of surveys and allow us to refine our survey technique. Paint ball marking as a monitoring tool looks promising, and it is recommended that this technique be explored further on Mt. Hull.

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.

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	Swakane Canyon and other Chelan County potential areas

Prepared by: John Musser, District Wildlife Biologist

Population Objectives/guidelines

Management objectives for Chelan County bighorn sheep are to: increase size and range of existing population; and reestablish bighorn on the north shore of Lake Chelan.

Most bighorn in Chelan County are found near Swakane Canyon. There are about 30 sheep in the Swakane. Our population objective for Swakane is 50.

Colockum-Quilomene bighorn, which number approximately 125, range into Chelan County. About 6 Colockum sheep are currently in Chelan County on Jumpoff Ridge.

Bighorn were native to the Lake Chelan area but disappeared in the late 1800s. We would like to reestablish bighorn along the north shore of Lake Chelan. The area between Safety Harbor Creek and Mitchell Creek could support at least 100 bighorn 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 1997 through July 1998, 12 reports of Swakane bighorn were received. The most useful information from these reports include:

- A full curl ram reported by USFS in Tillicum Creek.
- A total of 24 sheep between the house and 97A.
- Nine rams between the office and Ohme Garden.
- Eleven rams in rattlesnake acres canyon.

On July 11, 8 routes were surveyed by two WDFW biologists and 14 volunteers. Only 4 adult rams were seen.

Population Status And Trend Analysis

The Swakane bighorn population is static and numbers about

30.

Habitat Condition And Trend

Most of the area used by this herd was burned in the Dinkelman Fire (1989). As a result of the fire, tree and shrub habitat components have decreased while grass has increased. Habitat shifts have been positive for bighorn and negative for mule deer, the only other wild ungulate that shares the habitat with Swakane 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 continues or increases.

Augmentation/habitat Enhancement

This population has not been augmented since it was reestablished with 9 bighorn from the Colockum in 1969.

Management Conclusions

The Swakane bighorn may be affected by disease from domestic sheep which overlap the bighorn range on national forest. Wenatchee National Forest is currently evaluating their sheep allotment in the area. WDFW and Wenatchee National Forest are currently developing an 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. We hope bighorn can be obtained from British Columbia and Quilomene in the next year for Swakane.

Although the Swakane bighorn population is relatively static, it contains at least 11 adult rams. We will consider one permit for Swakane in 1999.

Table 1. Population composition counts from Swakane. 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).

Year	Lambs	Ewes	Rams			Total	Count Total	Population Estimate	L:100:R
			YI	<3/4	>3/4				
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	
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

Species **Region** **Populations/Herds**
Bighorn Sheep **3** **Clemon Mountain, Tieton, Umtanum, Selah Butte, Quilomene**

Prepared by: 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. They are Tieton, Clemon Mountain, Umtanum, Selah Butte, and Colockum-Quilomene. The original Umtanum herd was split into two harvest units, Selah Butte and Umtanum. The Tieton herd was established in 1998 and does not have a hunting season yet. During the 1960s the Colockum herd was hunted until a die-off in the herd occurred during the winter of 1971-72. Sixteen animals were present in 1973 and then declined to nine in 1974. By the early 1990s only one to two animals were left in the Colockum. A reintroduction in the Quilomene area was initiated in 1993. The new herd was south of the Colockum, but now the Quilomene herd has expanded their range into the former Colockum herd area.

The Clemon Mt. herd was established in 1967 and hunting was allowed in the 1970s and early 80s until a decline in total numbers and production resulted in the season being closed in 1984. The season was reopened in 1997, after supplementation of the population allowed for an increase in production. One permit was issued for this herd and a ram was taken under this permit. However, the state raffle tag holder chose to hunt this herd resulting in an additional ram being harvested (Table 1). This herd is continuing to increase and two permits were issued for the 1998 season.

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

The Umtanum herd was established in the early 1970s and continued to grow at a rapid rate. The season has been open for a number of years and had a total of three permits per year from 1991-1996. The harvest has been 100% for permit holders for each of those years. Fifty three (53) animals were removed from this herd over a three year period to supplement herds in other areas. This, coupled with a heavy winter mortality during the 1996-97 winter, resulted in only one permit being issued for the 1997 season. However, with mild winter conditions during the winter of 1997-98, sheep survival was good and one permit was issued for this unit. However, the state auction tag holder chose to hunt this unit as well and

one more ram was harvested (Table2).

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

Selah Butte was a new unit for 1997. This unit has been a part of the Umtanum herd but hunting was not allowed in this area. Bighorn sheep moved into this area, by crossing the Yakima River, sometime in the early 1990s and we began documenting the population in 1994. One permit was issued for 1997 and one ram was harvested (Table 3).

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

The Quilomene herd has been expanding rapidly since its re-establishment and for the first time one permit was issued for the 1998 hunting season.

A new herd in the Tieton River was established in 1998. We expect it to take 5 years before hunting will be considered.

Hunting conditions in 1997 consisted of mild dry weather and access was fairly easy to all units. All permit holders filled their tags.

Surveys

Historically surveys have been conducted using ground survey techniques. With the availability of funding provided by auction and raffle revenue, much of the work was converted to helicopter surveys which allowed for efficient use of personnel and coverage of the terrain in all the units. Surveys are flown at contour line levels for each drainage within the herd unit when using the helicopter. Hiking routes are laid out following ridge lines from the top to the bottom in the units surveyed. Helicopter surveys, which provide the most consistent data, have been used since 1993.

Winter elk surveys provide opportunity to classify sheep inhabiting the same areas. This provides survivability information while summer production surveys (Tables 4-7) allow for recruitment information. This past Spring (1998) we were able to fly in March prior to capture operations in some of our units and have found this may be the best time frame for total population assessment. June surveys are still necessary for recruitment information.

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 this Region in the 1960s on the Colockum and Clemon Mt. areas.

Table 4. Population composition counts (June) from Clemon Mt. Y1 = 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).

Year	Lambs	Ewes	Rams			Total	Count Total	Population Estimate	L:100:R
			Y1	<3/4	>3/4				
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

Table 5. Population composition counts (June) from Umtanum. Y1 = 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).

Year	Lambs	Ewes	Rams			Total	Count Total	Population Estimate	L:100:R
			Y1	<3/4	>3/4				
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

Table 6. Population composition counts (June) from Selah Butte. Y1 = 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).

Year	Lambs	Ewes	Rams			Total	Count Total	Population Estimate	L:100:R
			Y1	<3/4	>3/4				
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

Table 7. Population composition counts (June) from Quilomene. Y1 = 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).

Year	Lambs	Ewes	Rams			Total	Count Total	Population Estimate	L:100:R
			Y1	<3/4	>3/4				
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

The Colockum was the first and most successful reintroduction effort with the population quickly building to well over 100 animals. However, after several years of limited hunting and animals being trapped for other reintroduction efforts, the population crashed. The cause of this was not totally understood, but the crash in the early 1970s presumably occurred as either a result of *Pasteurella H. pneumonia* or winter mortality. Bighorns were at very low numbers in the 1980s and an augmentation effort was initiated in 1980 and 1987. Very small numbers of sheep were released in those two years but did not sustain the population. After the old herd of animals from the Colockum were reportedly gone another reintroduction effort was started on the Quilomene unit in 1993. That year 11 bighorn sheep were transplanted from Vulcan Mountain in Ferry County to the Quilomene drainage. Subsequently, in 1994 twenty bighorn sheep were transplanted from the Umtanum herd into the Quilomene and in 1996 ten more sheep were brought in from Kamloops, B.C. The

treated with antibiotics in 1990, then released. In September of 1989 four bighorns were obtained from Northwest Trek and released on the range and in January of 1990 four sheep were obtained from Oregon and released as well. These efforts helped the population to grow at a moderate rate going from about 30 animals in the late 1980s to nearly 50 in 1993. Lamb production was still not very high and appeared to be keeping even with natural mortality. In 1996 ten bighorns from Umtanum and nine bighorns from Kamloops, B.C. were released in the Clemon herd. Positive results were documented with at least 17 lambs born in the spring of 1997 and 26 lambs in 1998. We have now documented about 117 animals in the population (Table 8).

The Umtanum herd was established in 1970 with the release of eight animals taken from the original Colockum herd. Within 15 years this population grew to more than 200 animals. By 1993 bighorns began to disperse crossing the Yakima River onto private property as a result of the population increase. This allowed for a nucleus in providing

Table 8. 1998 Population computations based on March composition counts and extrapolated with June productions counts.

	March 1998 Survey			June 1998 Survey			Estimated Population			
	Ewes	Lambs	Rams	Ewes	Lambs	Rams	Ewes	Lambs	Rams	Total
Quilomene	59	16	40	46	21	19	64	30	49	143
Umtanum	55	19	23	27	23	18	65	55	34	154
Selah Butte	19	9	0	14	7	19	16	8	19	43
Clemon	45	19	23	42	20	36	55	26	36	117
Tieton	0	0	0	6	5	1	6	5	1	12

Quilomene population is now known to have more than 143 animals (Table 8).

The Clemon Mountain unit was the next population established in 1967 when eight animals were introduced. This population grew rapidly to over 100 animals (Ellis Bowhay, Pers. Comm. 1998) and then apparently crashed and eventually stagnated in the late 1980s when we suspected an undetected disease may have caused a die off in the population. Lamb production and survival were both at extremely low levels as well. A portion of the population was captured, tested, and

sheep for augmentation of other sheep units where needed. In 1994, 20 sheep were moved from the Umtanum to the Quilomene and in 1996 ten were moved from the Umtanum to the Clemon herd. In 1998 thirteen sheep were captured and moved to the Tieton River in Yakima County and Dead Canyon in Klickitat County. With the removal of 43 animals the population dropped but production has maintained the growth of the population. The winter of 1996-97 was an extremely harsh winter affecting the survival of animals in this population. The population dropped to about 60% of its 1993 level but 1998 data shows the population rebounding. The

current known population is at 154 animals (Table 8).

Selah Butte is an offshoot of the Umtanum herd. Sheep in the Umtanum occasionally wandered, particularly the rams, but always seemed to return to their range. However, about 6 years ago several ewes crossed the Yakima River and formed a nucleus of a herd that has since grown and extended its range. This past spring 9 animals were captured from this unit and transplanted to other areas. In 1996 twenty four sheep were also captured and transplanted to supplement other herds. This population could be larger and will continue to increase but there is limited range to provide a large population. The herd now numbers 43 bighorn sheep (Table 8). These animals can interact with the Umtanum herd providing some genetic diversity.

The Tieton River is our newest herd. It began this spring (1998) with the release of 12 bighorn sheep (3 rams, 9 ewes). We have been radio tracking 5 of these sheep, of which 3 are ewes. All these ewes have been observed with a lamb. Eight of the nine ewes tested positive for pregnancy when captured and we expect there to be a possible 8 lambs produced. However, 3 ewes and a young ram were observed outside the unit shortly after release. These animals do not have radio collars and their whereabouts is unknown at this time. Another ram with a radio collar also made his way outside the unit and was headed for urban areas. The threat for interaction with domestic sheep and his determination to access Clemon sheep resulted in our opening the feedlot gate to Clemon Mt. and letting him in with that herd. Our projected population estimate is 12 sheep (Table 8) since we are unsure of the wandering sheep.

Habitat Condition And Trend

Forage resources are excellent in all areas as a result good winter moisture and spring rains during 1997 and 1998, providing excellent growing conditions for native grasses on all the ranges. 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 had both negative and positive effects. Two fires occurred in the primary lambing area of the Umtanum unit in the summer of 1996. These fires forced animals to move across the Yakima River to the Selah unit and up the Umtanum Creek drainage. The major impact was to shrubs that provide shade and escape cover. The positive aspect is that regeneration of grasses are providing abundant food.

Augmentation/habitat Enhancement

Three animals that were released on the Clemon Mountain unit from Kamloops, B.C. in 1996 have radios attached and we have continued to monitor them. Of note is that two ewes with radios attached have not strayed from the general herd but the

ram with radio attached moved west about 10 miles into the Rock Creek area. Rock Creek is a fairly timbered area, however, this ram stayed there for nearly a year. This past September the ram moved back to the main herd on Clemon Mountain. We have noticed similar patterns of sheep in the Roza area of the Umtanum unit. Fourteen animals were moved into this area from the east side of the Yakima River near Umtanum Creek in the spring of 1996. We noticed some winter mortality on two rams, three deaths to a train (a ewe & two lambs), and the apparent movement of two animals (1 ewe & 1 ram) out of the area back to the point of capture. Recent surveys in June 1998 showed we have five bighorn sheep still in the area.

Management Conclusions

Augmentation efforts have boosted the Clemon Mt. and Quilomene herds during the past few years. The Quilomene unit had 40 animals released over a four year period which provided a substantial core for the population to build from. This herd now has approximately 143 animals (Table 7) in the population and we expect it to continue increasing. A permit for hunting was issued in 1998 for the first time since the herd was established.

The Clemon Mt. herd had remained stagnant until animals released in 1989, 1990, and 1996 provided reproductive animals that were able to overcome natural mortality. This last augmentation has proved to be the impetus the herd needed. Production went up over 100% in 1997, from eight lambs to 17 lambs, and increased another 53% above this in 1998 when 26 lambs were produced. The population is now at its highest level since animals were released in 1967 (Table 4). We are at a critical level of insuring this herd remains disease free. Monitoring the health of this herd is very critical since a domestic grazing allotment 10 miles to the west of the main herd is still in effect. We have documented bighorn sheep movements across this allotment numerous times in the past and as recently as this summer. It is of concern to us and we are continuing to have discussions with the USFS on this issue.

It is our desire to continue with the re-establishment of bighorn sheep to historical locations in the region. We released 12 bighorn sheep in the Tieton River in April 1998. This was the first year of a proposed 3-5 year program aimed at providing a herd nucleus in developing a permanent population here. This herd may eventually interact with the Clemon herd since the main barrier separating the two is an elk fence. We have also initiated discussions and conducted tours with the Yakama Indian Nation looking at potential for re-introduction efforts there. A herd in this area would be isolated from potential contact with domestic sheep and allows the range extension to be increased.

Species
Moose

Region
Statewide

Prepared by: Steve Pozzanghera, Carnivore, Furbearer and Permit Species Section Manager

Population Objectives/guidelines

Moose population management objectives in Washington are to maintain a healthy population which is capable of providing limited entry recreational opportunity. As moose populations increase in Washington, greater emphasis may need to be placed on minimizing moose damage and nuisance activity near urban human populations.

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.) Thirty-two permits were available in 5 different moose management units for 1997 and a total of 2,584 applicants entered the general permit drawing. One additional moose permit was available by raffle. General permit season dates were identical to those hunted in 1996. All moose units were open for the use of any legal weapon, this provides eligibility to all hunters for all units and maintains hunter weapon choice. Moose hunters are allowed to take one moose of either sex.

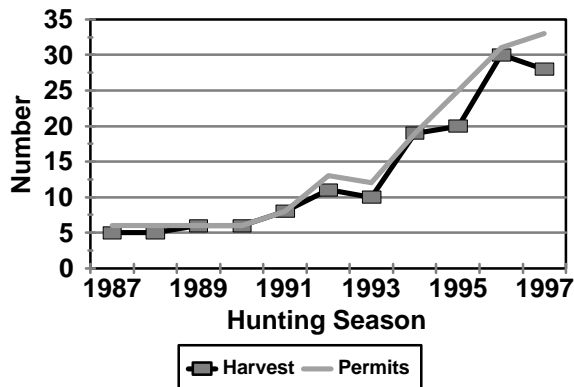


Figure 1. Statewide moose harvest.

Moose hunting conditions in 1997 were fair. Snow was absent for most of the season which may have decreased hunter success in some areas. Of the 33 permits available in 1997 (includes raffle permit), 32 individuals actually reported that they moose hunted. A total of 28 moose were killed for a hunter success rate of 88%. Compared to 1996, individual hunter

success rates decreased slightly from 97% , and the total harvest declined from the 30 moose that hunters took in 1996. Despite these slight decreases, overall, the 1997 moose harvest increased approximately 133% when compared to the 10 year average harvest of 12 moose /year (1987 to 1996) (Figure 1.).

Surveys

Moose are currently surveyed within Region 1 using both helicopter surveys and pellet transects. It appears as though late December is an optimal time for flying aerial surveys and classifying bulls, cow, and calves. The initiation of a moose raffle has enhanced our aerial survey abilities by providing dedicated moose management funds. Given these funds, pellet transects in the Mount Spokane and Hangman moose units may be converted to aerial surveys and aerial surveys will be enhanced in the more northern moose units.

Population Status And Trend Analysis

Moose populations within northeast Washington continue to prosper from the logging activity of the 1980's and early 1990's. This logging has created large mosaics of early successional forest that include a heavy regeneration of deciduous species (i.e., favored moose browse). Based on limited aerial survey data, the population is conservatively estimated to number at least 250 animals. Increased survey activity should allow us to improve on our total moose population estimate.

Habitat Condition And Trend

Habitat conditions in northeast Washington should continue to favor increases in moose numbers and expansion of moose range even into the Okanogan Valley and the Pasayten Wilderness. Current early successional forests should maintain good moose habitat characteristics for at least the next decade.

Management Conclusions

Dedicated funds from the creation of a moose raffle should allow us to expand our survey effort for this species and enhance our ability to estimate the population. At a time when recreational hunting opportunity is becoming more restricted for more species, moose hunting opportunities in Washington are on the rise. A management plan which clearly outlines priorities for this species is needed, specifically so that total harvest guidelines can be applied to individual moose units.

Species	Region	Moose Units	GMUs
Moose	1	1, 3, 5	GMUs 109, 113, 117

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

Population Objectives/guidelines

Maintain sustainable moose populations within habitat limitations and provide quality recreational hunting opportunity with limited entry permits.

Hunting Seasons And Harvest Trends

Hunters drawing a limited entry permit can hunt moose of either sex throughout the months of October and November. If drawn, it is a once in a lifetime opportunity. There is a mandatory hunter report to be returned to WDFW.

There were 22 (includes Raffle Permit) total permits offered in 1997 (Selkirk Mountains -10, 49 Degrees North - 8, Threeforks - 3). One additional permit was offered on the Raffle Permit process and that hunter chose to hunt in 49 Degrees North. Permits were reduced 9% due to concern for calf losses in the severe 1996/97 winter and expected poor recruitment in 1997.

The either-sex limited entry permits continue to be effective hunting regulations. There may be some concern for the potential for too many cows to be taken but that has not proven to be a problem at the level of permits being issued. In 1997 only 1 of 19 moose taken was a cow. Since 1992 only 15% of the harvest has been cows (75 Bulls, 11 Cows). Timing of the hunt continues to work out well. Hunters have a long season which includes the rut and easy access during October, and usually plenty of snow and good tracking conditions in November.

Hunter success was relatively low for deer and elk in 1997, somewhat because of losses of animals in the 1996/97 winter but more so because of lack of snow, which provides optimum hunting conditions. The same factors affected moose hunters. Hunter success was still very good at 86% but the days per kill at 13.8 was higher than usual (Table 1).

Table 1. Moose harvest and hunter effort for Units 1, 3, and 5.

Year	Permits	% Success		Hunter			Days per kill
		Bull	Cow	Total	Days	per kill	
1997	21	86%	17	1	18	248	13.8
1996	23	96%	19	3	22	115	5.2
1995	20	85%	10	5	15	152	8.9
1994	15	100%	14	1	15	98	6.5
1993	9	78%	6	1	7	113	16.1
1992	9	78%	7	0	7	65	9.3

Surveys

The primary moose survey effort is an annual helicopter

survey in late December. Our budget for 1997 was \$4,000, not enough to do all moose units so we select different units each year. This year we surveyed 49 Degrees North and Threeforks. We select the best areas to survey rather than attempt to survey on transects or every square mile. Total flight time, including ferry time, was 12.7 hours at a cost of \$300/hour for a total of \$3,800. A total of 144 moose were classified (Table 2). At this time of year moose are generally found above 3,000 feet elevation and in clearcuts with snow, on east and north exposures. The technique is to search out logged over areas or brush fields, then search for moose or tracks in or adjacent to the cut. Timbered areas are not searched unless tracks are noted as we pass over.

The 49 Degrees North unit is heavily cut over and provides excellent early winter moose foraging habitat. Most of the large cuts are clearcuts so sightability with the fresh snow was excellent. The majority of the moose are seen on the Pend Oreille drainage (east slope) side of the mountain range. A total of 144 moose were classified (of 146 seen), with a ratio of 82B:100C:27Ca (Table 2). The calf ratio is low but ratios tend to run low in northeastern Washington (29-33 from 1994-96). The ratio was expected to be low this year as the cows were coming off a severe winter.

The Threeforks Unit has not been surveyed before so we were inexperienced in this area. Much more of this unit is USFS or DNR and has timber or selective cuts that provide much poorer sightability. This survey yielded only 27 moose (133B:100C:67Ca). Moose are not as concentrated in this unit as in 49 Degrees North and would be more difficult to hunt. The higher calf ratio may be related to the high ratio of cover.

Moose hunters provide their observations with the mandatory report. Hunter classification ratios were generally quite similar to WDFW flight survey results (Table 3). Selkirk was the only unit where hunters failed to take a moose and this did have the highest days hunted per kill and lowest moose seen per day. Hunters were able to see the most moose in 49 Degrees North, similar to our results with aerial surveys. The calf ratios were also consistent with WDFW surveys.

Population Status And Trend Analysis

Early winter composition survey flights have been accomplished each year for 4 years. The areas surveyed changes each year but the Bull:Cow:Calf ratios do not show any obvious trends (Figure 1). Bull ratios are high so we do not anticipate harvest has had any appreciable effect on the population composition.

We monitor age and antler spread of harvested bulls in hopes of detecting any trends in the age structure of the bull population (Figure 2). The mean antler spread appears consistent at 34-36 inches. The mean age of bulls is also relatively consistent and averages 4.1 from 1984 to 1997. Over the long-term harvest, 1984-97, the prime bulls (>5 years) made

up 27 % of the harvest. In 1997 prime bulls accounted for 30% of the take.

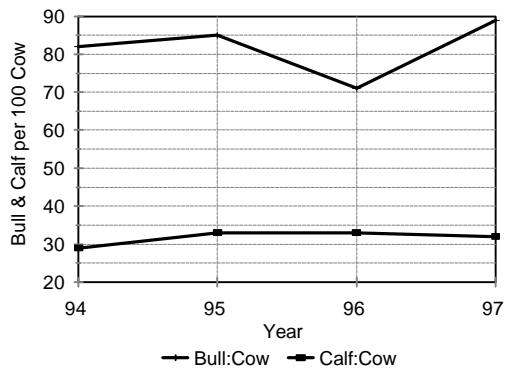


Figure 1. Moose composition flight results, Units 1, 3, 5. Areas surveyed varies each year.

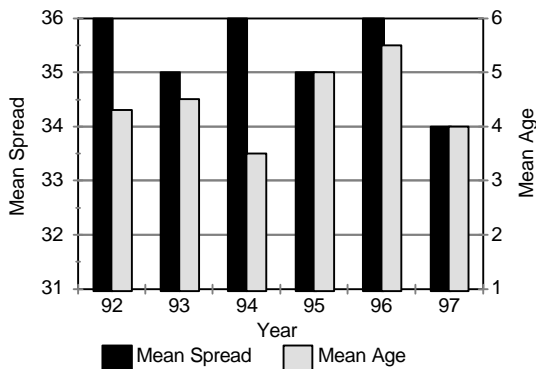


Figure 2. Age and antler spread of harvested moose, Units 1,3,5.

Condition And Trend

This past winter was very mild so moose survival and recruitment should be good for the 1998 fall. Abundant spring precipitation has produced exceptionally good forage growth.

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.

Poaching

Moose seem to be poached at a higher rate than most species. Wildlife Officers have emphasized efforts to reduce the loss of so many moose in recent years. We may be seeing the results of those efforts as there were only 6 moose known to be poached in the Colville District in 1997.

Management Conclusions

There is tremendous interest in moose hunting in Washington. Populations appear to be expanding their range and increasing in numbers. 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. One goal for moose management in Washington should be the development of a Moose Plan, similar to our other ungulate plans.

Early winter helicopter surveys have proven effective in identifying moose distribution and sex/age composition. These surveys should be given high priority. It is not necessary to fly all units each year but it would be valuable if we could fly one traditional area and one area new to us each year.

Moose are becoming relatively common in GMU 105 and Ferry County (GMU 101). No permits have been issued there because there has not been a survey yet. These areas are within the North Half of the Colville Indian Reservation so survey efforts and possible hunting will be coordinated with Tribal biologists. If sufficient funds are available to survey this area next winter there may be an opportunity to establish a new moose unit.

Table 2. Population composition counts by area surveyed in 1997.

Area	Moose							Total	B:100C:Ca	Hours	Moose per hour
	Unit	Date	Bull	Cow	Calf	Uncl.					
Flowery Trail S	3	12/22	25	33	8	2	68	76:100:24	2.5	27	
Flowery Trail N	3	12/22	21	23	7	0	51	91:100:30	2.0	26	
E of Aladdin	5	12/24	6	5	4	0	15	120:100:80	2.0	8	
W of Aladdin	5	12/24	6	4	2	0	12	150:100:50	1.7	7	
							146				

Species	Region	Moose Unit	Unit Name	GMUs
Moose	1	2	Mt. Spokane	124
		6	Hangman	127, 130

Prepared by: G. J. Hickman, District Wildlife Biologist

Population Objectives/guidelines

Maintain a healthy moose population and provide quality recreational hunting opportunities and aesthetic appreciation of this species by Washington state residents. Aesthetic appreciation of moose near Spokane is becoming increasingly important because of the proximity of moose habitat to the metropolitan area.

Hunting Seasons And Harvest Trends

Hunting in these twomoose units occurs in parts of three Game Management Units (124, 127, and 130) and is by limited permit only. In 1997, ten bull moose were harvested in GMU 124 by ten permittees for 100 percent hunter success. Because of past hunter success and continued increases in animal observations in this unit we will offer ten either sex permits for 1998 but, also, include 4 antlerless only permits for youth hunters. One permit was available for the Hangman unit and no moose was taken. One permit will be offered for this unit in 1998. Moose are present in this unit but at a lower density than the population in the Mt. Spokane unit in GMU 124.

Surveys

Pellet transects are conducted when time and personnel are available. Many contacts are made with the moose hunter permittees by phone and field contacts during the season. (refer to tables 1 and 2).

Table 1. Moose harvest and hunter effort for GMU 124

Year	%		Hunter Days				
	Permits	Success	Bull	Cow	Total	Days	per kill
1997	10	100	10	0	10	44	4.4
1996	8	100	6	2	8	37	4.6
1995	5	100	5	0	5	19	3.8
1994	4	100	3	1	4	44	11.0
1993	3	100	3	0	3	16	5.3
1992	4	100	3	1	4	17	4.3
1991	3	100	3	0	3	21	7.0

Population Status And Trend Analysis

The moose population is stable or increasing in all suitable habitat in Spokane county. The number of urban problem animals handled by WDFW personnel is not a reflection of population trends. Changes in problem moose numbers from

Table 2. Urban problem moose by year. *

Year	
1998	5
1997	6
1996	7
1995	6
1994	5
1990	15

*these are the years with estimates of relocated animals

Table 3. Moose pellet transect results, Mt. Spokane.

Year	Pellet Groups
1998	29
1997	no survey
1996	42
1995	28
1994	21
1993	22
1992	18
1991	15
1990	12

year to year reflect the annual weather and habitat changes.(refer to table 3).

Habitat Condition And Trend

Shrub fields and second growth forest habitats are providing abundant summer range for moose in Spokane county. Reduction in pellet groups in 1998 is a reflection of habitat maturation and a resulting change in moose utilization of the area where the transects were surveyed(see table 2).

Management Conclusions

Moose are successfully occupying available habitat in Spokane county. The limited permit hunt and the aesthetic appreciation of the animals by the public is well received. The public is very concerned about moose which wander into urban areas when searching for additional home range. It is in the best interest of the resource if WDFW can balance the moose population within the needs of the hunting and the wildlife viewing public.

Species

Black Bear

Statewide

Prepared by: Steve Pozzanghera, Carnivore, Furbearer, and Permit Species Section Manager

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. 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).

Hunting Seasons And Harvest Trends

Black bear seasons have changed significantly over the last two 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. Despite these efforts, the 1997 black bear harvest declined 36% from 1996, (844 versus 1,310) and declined 37% when compared to the previous 6 year average harvest (Table 1.) Hunter success dropped to a 7 year low and thus the number of days that it took a hunter to harvest a bear rose to a 7 year high (Figure 1. and Table 1.) Given that individuals using bait or hounds were the most efficient of black bear hunters (they accounted for 50% of the total bear harvest prior to the initiative), these reductions in harvest, hunter success and days per kill were not unexpected. In other states where similar initiatives have banned bear hunting methods, we can expect that with the additional opportunities provided for bear hunting, that our bear harvest will return to pre-initiative levels in the next several years. Western

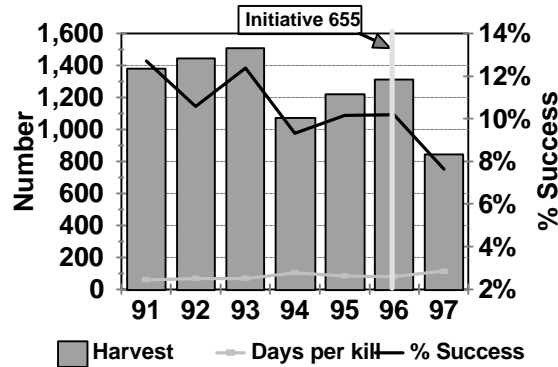


Figure 1. Harvest, days per kill, and percent success for black bears harvested in Washington State.

Washington’s dense forest cover will make it more difficult to keep up with the increasing bear population.

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 bear population as a whole is not being negatively impacted by our harvest (Figure 2.).

Black bear bait station surveys which yielded disappointing results in 1996 (5% visitation in western Washington BBMUs, and 15% visitation in eastern Washington BBMUs), were run again in 1997. Visitation rates were again lower than needed to use the method as a means of monitoring populations within individual bear management units. Additional work is needed to determine if

Table 1. Statewide black bear harvest, hunter effort and median age information, 1990 - 1997.

Year	Male	Female	Total # of hunters	% Success	Hunter Days	Days per kill	Median Age			
							Males	Females	% females	
1990	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%

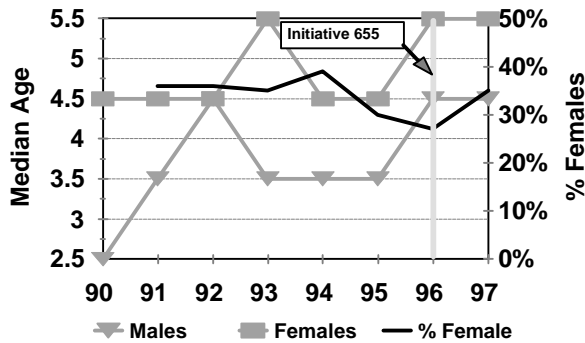


Figure 2. Median age and percent females in black bear harvest in Washington State.

an alternate bait (e.g., other than sardines), or a longer duration between the time that a bait is hung and the time that it is checked can improve visitation rates. 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 2.) The 1997 field reports indicate that the total number of black bear/human complaints reported by the public decreased slightly between 1996 and 1997 from 556 to 541, respectively. Black bear nuisance and damage activity may not be a good indicator of the status of the population, but more

Table 2. Statewide black bear/human complaint summary, 1995-1997.

Year	Total Complaints	# Relocated	# Killed		
			By WDFW	Other	Human Attacks
1995*	208	36	6	4	1
1996	556	70	16	4	0
1997	541	37	16	26	0

*10 months of data

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. Conversely, complaint reports in 1997 were moderated by an early spring green-up and a good fall huckleberry crop.

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

BBMU

Black Bear Management Unit

Black Bear

1

Coastal

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

Population Objectives/guidelines

Objectives for coastal black bear populations include the control of a population likely to increase because of the implementation of Initiative 655.

Hunting Seasons And Harvest Trends

The estimated total black bear harvest for the coastal region in 1997 was 158 (Table 1). This was approximately 41 percent below the 1996 harvest. Sixty-five percent of the harvest in 1997 were males and 35 percent females.

Table 1. Region 6 bear harvest summary 1993-97.

Year	Male	Female	Total	Days/Kill	Hunter Success%
1997	102	56	158	92	9
1996	222	44	266	103	10
1995	212	93	305	82	12
1994	168	110	278	94	10
1993	168	110	278	70	12

The sharp decline of bear harvest in 1997 (41 percent) reflects the implementation of Initiative 655 which, starting with the 1997 season, prohibits the taking, attracting or hunting of black bear with the aid of "bait" and prohibits the use of hounds to hunt or pursue black bear, cougar, and bobcat. The observed harvest decline comes close to that predicted in an assessment of Initiative 655 (Pozzanghera, 1996).

Hunting season length for 1997 was extended to November 13 and a special bear damage season was initiated to increase bear harvest post I-655. The bear damage season gives a hunter, who purchases a damage season bear tag and a general season bear tag, the potential to harvest two bears.

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 1997 was determined from black bear tooth samples submitted by successful hunters. Thirty-nine teeth

from male bears and 19 from female bears were examined. The median ages for male and females were 4.5 and 8.5 years respectively.

Table 2. Age distribution of male and female black bear harvested in the Coastal BBMU from 1993-97 (N=number of tooth samples).

Year	Male			Female				
	N	Min.	Max	Med. Age	N	Min.	Max	Med. Age
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
1993	65	1.5	27.5	4.5	37	1.5	20.5	4.5

Nuisance and Damage Activity

Early wildlife damage seasons in Region 6 for 1997 were set for PLWMA 600 and in GMUs 601, 603, 615, 627, 642, 648 and 667.

Management Conclusions

The decline in bear harvest for 1997 season illustrates the impact of Initiative 655 on the recreational harvest of bears. Black bear numbers can be expected to increase over the next few years in the coastal region until a new equilibrium is achieved. Higher bear numbers are likely to bring about increases in nuisance bears as well as damage to timber plantations.

Literature Cited

Pozzanghera, S. 1996. A biological, recreational, and economic assessment of Initiative 655. Unpublished report. WDFW.

Species

BBMU

Black Bear Management Unit

Black Bear

3

North Cascades

Prepared by: Mike Davison, District Wildlife Biologist

Population Objectives/guidelines

Black bear are estimated to occupy a minimum 30,000 square miles of forested habitat in Washington State. With the exception of urban development centers in the Puget Sound basin, the habitat base for black bear has changed comparatively little from historic levels. The primary management objectives and strategies for black bear in Washington State as described by the Black Bear Management Plan (1997) are:

1. Maintain the population size and distribution of black bear in Washington.
2. Manage the bear population more intensively.
3. Protect remaining black bear habitat in Washington.
4. Provide recreational use of black bear consistent with sound biology.
5. Minimize the number of problem black bear, protect private property, and ensure public safety.
6. Educate the public on black bear issues.
7. Enforce regulations pertaining to black bear use and issue penalties for violations that occur.

Hunting Seasons And Harvest Trends

The hunting season format and regulations in Black Bear Management Unit #3 (North Cascades) are identical to the general statewide regulations. BBMU #3 (North Cascades) includes Game Management Units 418 - 460. Hunting access throughout BBMU #3 was excellent during the 1997 season with above normal snowfall at higher elevations (above 4,200 feet) and significantly lower snow accumulation below 4,200 foot elevation. However, increased road closures in Region 4 continue to limit hunter access in specific drainages. Harvest success and hunter effort data for BBMU #3 (1994-1997) is presented in Table 1. No significant changes in total hunters, total harvest, hunter success, or hunter days occurred in 1997 as compared to the 1994-1996 data.

Table 1. Black bear harvest and hunter effort summary for BBMU #3 (1994-1997)*

Year	# of hunters	Harvest	Success	Hunter Days
1994	866	45	5.2%	6318
1995	871	69	8.0%	6344
1996	724	84	12.0%	6585
1997	1227	116	9.0%	5848**

*Data Source- Washington State Game Harvest Report (1997).

**Includes harvest data for GMUs 450 & 460

Population Status And Trend Analysis

Black bear population size in Washington State was

estimated using two different methods: (1) extrapolation of black bear density to habitat availability (N=25,000 black bear statewide) and (2) population reconstruction through an analysis of harvest age data (N=30,000 black bear statewide)-"Washington State Management Plan for Black Bear" (1997). The harvest age data analysis indicated a trend toward an increasing population.

Black bear harvest guidelines are based upon hunting vulnerability criterion associated with different age class and sex cohorts. More restrictive hunting regulations are required in BBMUs when the percentage of females is > (greater than or equal to) 39%, when the median age of males is less than or equal to 2 years, or when the median age of females is less than or equal to 5 years (Washington State Management Plan for Black Bears-1997). Table 2 compares age and sex class data for black bears harvested in BBMU #3 (North Cascades) during the 1996 and 1997 season with management criteria.

Table 2. Comparison of age and sex data in BBMU #3 (North Cascades) for 1996 & 1997 with management guidelines.

Criteria	Over harvest	1996	1997
% Females	>39%	28.6%	32.7%
Male Median Age	<2	5.1	6
Female Median Age	>5	3.9*	4.2*

*Below median age criteria for females (less than or equal to 5 yrs)

Harvest data presented in Table 3 indicates that the percent of females in the harvest remains below the 39% level that defines overharvest but also shows that the percentage of females has increased from 1996 to 1997. Median age for males remains well above the 2 year or less level defining overharvest and look good from a management perspective. However, the median age for females in the harvest remains below the minimum level established in the Black Bear Management Plan, 1997 (less than or equal to 5 years).

Nuisance and Damage Activity

Black bear damage and nuisance complaints are handled by the Enforcement Division. Complaints received in 1997 totaled 17 (9 in Skagit County, 8 in Whatcom County). No animals were relocated or killed.

Habitat Condition And Trend

Statewide habitat analysis indicates that black bear in Washington State reside on approximately 30,000 sq. miles of forested range with the highest densities occurring in western Washington's coastal habitat and in eastern Washington's Selkirks and Blue Mountains. Although black bear range in Washington has changed little in comparison to historical

times, these animals no longer occupy urban centers in Puget Sound (Status Report-6th Western Black Bear Workshop, 1997). Perhaps the single most significant habitat change in western Washington relates to extensive road closures on both public and private forested lands. Restricted access to large portions of black bear habitat has inadvertently enhanced black bear populations by further reducing harvest while also allowing for increased black bear use of impacted range via reduced human disturbance.

Management Conclusions

Management recommendations for the 1998 season remain unchanged from 1997. Significant changes in hunting season

format resulting from the passage of Initiative 655 will have unpredictable impacts upon harvest success rates, harvest distribution and hunter effort. It is recommended that no significant changes in seasons be effected for a period of 2-3 years until the influences of I-655 are fully understood. It should also be noted that it appears that legislative proposals amending I-655 will be submitted by legislators during the upcoming January, 1999 legislative session.

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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, median male harvest age of >4. Bear harvest is also managed in an attempt to minimize timber damage, property damage, and black bear/human interactions.

Hunting Seasons And Harvest Trends

General black bear seasons and damage seasons in SC BBMU remained similar to past years. The passage of Initiative 655 in November of 1996, however, prohibited the use of bait and hounds. Despite increased hunter pressure, this regulation change led to a significant harvest reduction in the SC BBMU in 1997 (Table 1). The 1997 black bear harvest in the SC BBMU was the lowest since 1991 (Table 1). Historically, bait and hound hunters have much greater success than boot hunters. Lower black bear harvest in the SC BBMU might be expected to continue as a result of the bear baiting and hound hunting prohibition. Some evidence from other states indicates that harvest by "boot" hunters will increase in time, as greater numbers of hunters choose to hunt bear and learn new methods of hunting them.

Table 1. Black bear harvest in the South Cascades Black Bear Management Unit, 1991-1997.

Year	Male	Female	Total	% Success	Hunters	Days Hunted	Days/Kill
1997	36	30	66	0.02	2707	17778	269
1996	127	70	197	0.08	2447	13629	69
1995	70	26	96	0.04	2368	16307	170
1994	97	44	141	0.05	2710	19503	138
1993	97	44	141	0.06	2405	16663	118
1992	84	46	130	0.05	2407	15698	121
1991	92	53	145	0.07	2070	13055	90

Population Status And Trend Analysis

Based upon harvest data, black bear are not being over-exploited in the SC BBMU. Median age of harvested black bear are within acceptable management levels (Table 2). Although the percentage of females in the harvest in 1997 was high (45%), historically female percentages is well within

management goals for black bear in the SC BBMU (Table 1). A greater percentage of females was expected in the harvest due to the prohibition on hounds and bait. Hound and bait hunters tend to be selective (i.e., by size or by observed sex of animal) toward male bears, while hunters that opportunistically or incidentally harvest a bear while hunting other species are not.

Surveys

Table 2. Median age of black bear harvested in South Cascades BMU, 1991-1997

Year	Male	Female	Sexes Combined
1997	2.5	5.0	3.5
1996	3.5	7.0	5.5
1995	3.5	5.5	4.0
1994	5.5	6.5	5.5
1993	4.5	3.5	4.5
1992	4.5	3.5	3.5
1991	3.5	8.5	3.5

Due to budgetary constraints, no surveys were conducted in the SC BBMU in 1998.

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 consistent. 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. Increasing development will reduce suitable habitat and lead to an increase in bear-human encounters and conflicts.

Management Conclusions

The passage of I-655 will probably result in an increase in black bear population levels in the SC BBMU. In 1997, the first year of the bait and hound ban, despite increased hunter pressure, bear harvest was considerably reduced. Increasing bear populations, coupled with an increasing human population will invariably lead to an increase in bear-human conflicts. Public education about bear behaviour and ways to avoid attracting bears into potentially dangerous situations must be increased. Dangerous animal-human conflicts attract intense public scrutiny, WDFW will have to be ready to handle an increase in these types of situations.

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 is female. 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 lengthened 1997 black bear season in Okanogan BBMU ran from August 1 - November 6. 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 for 1997.

Despite the lengthened season, hunter numbers reached a six-year low in 1997, but dropped only slightly from 1996, the first year without bait and hound hunting in BBMU 5 (Table 1). Part of this decline is likely a function of lower license sales in general, since many bear hunters buy tags with expectation of taking a bear incidentally while hunting other species. It is hoped that hunting conditions in general are on the rebound, and thus both license and bear tag sales may have bottomed out in the short-term.

Although hunter numbers have been down, harvest, success,

and effort have varied significantly the last two years under stricter regulations (Figure1). This suggests these parameters may respond more to habitat conditions, rather than regulations, in the Okanogan BBMU. This is not completely unexpected since much of BBMU 5 is rugged and roadless, and traditionally received little pressure from baiting and hound hunting. For instance, success was high in 1996, a year with a poor berry crop and early snow. These conditions concentrate more bears in accessible lower elevation habitats in the late summer and fall, increasing susceptibility to harvest. Conversely, in 1997 when berries were plentiful and snows came late, bears remained dispersed across a wide elevation gradient, and harvest success was cut almost in half.

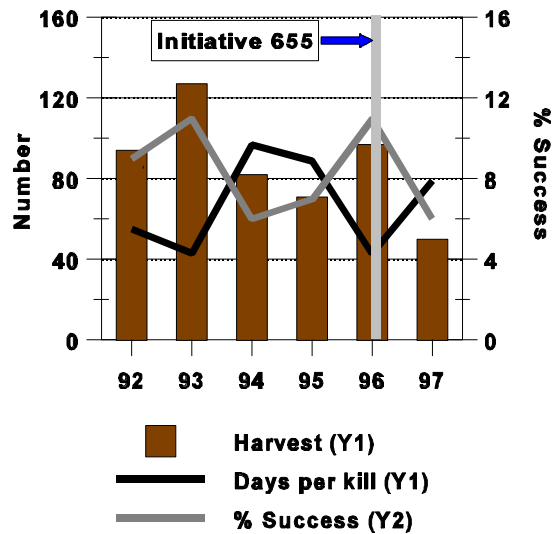


Figure 1. Harvest, number of hunters, days per kill, and percent success for black bears harvested in BBMU 5.

Table 1. Black bear harvest, hunter effort and median age for BBMU 5.

Year	Male	Female	Total # of hunters	% Success	Hunter Days	Days per kill	Median Age		
							Males	Females	% females
1990	--	--	--	--	--	--	2.5	4.5	36%
1991	--	--	--	--	--	--	3.5	3.0	36%
1992	54	40	94	9%	5,124	55	3.5	3.5	43%
1993	85	42	127	11%	5,448	43	3.5	3.5	33%
1994	53	29	82	6%	7,979	97	3.5	2.5	36%
1995	59	12	71	7%	6,343	89	5.5	8.0	23%
1996	73	24	97	11%	4,181	43	2.5	4.5	36%
1997	30	20	50	6%	3,967	79	6.5	6.5	38%

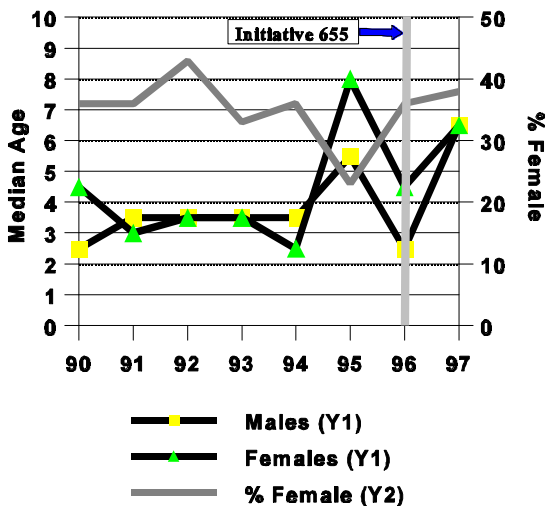


Figure 2. Median age and percent females in black bear harvest in BBMU.

Bear population parameters for the Okanogan BBMU have dipped below acceptable levels in several instances in recent years (Figure 2). The low median age of harvested females has been of particular concern. In 1997, the median age of both sexes increased noticeably, suggesting harvest pressure on the population may be easing; however, the sample sizes are small and one year of data does not constitute a trend. Even so, if hunter numbers remain depressed, and success is comparable to recent averages, some expansion in the bear population is likely, and the median age of harvested individuals may rise.

Population Status And Trend Analysis

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 1-2 years. At present, no population estimate exists for the BBMU 5.

Fairly dramatic statewide reductions in harvest, combined with the relatively young age structure of the current population, suggest black bear numbers have declined significantly since the middle part of the century. To what extent this is a function of harvest pressure versus habitat loss is unclear. These statewide trends probably also apply to the Okanogan BBMU.

Harvest and age structure have remained fairly constant, and population monitoring parameters have hovered near acceptable minimums, suggesting bears have been harvested at maximum sustained yield, and that the population is relatively stable. If hunter numbers do not rebound from their current low, bear numbers in this unit may increase, but for now, the future trend is difficult to predict without several years of data

under the new harvest regulations.

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. Complaint numbers were average or below last year. A good berry crop, a long growing season, and mild weather, produces an abundance of natural foods, reducing the need for bears to forage near human development.

Habitat Condition And Trend

Last year's excellent growing season and mild winter should have enhanced cub production and yearling survival. Berry production was favorable at all elevations.

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. Related mortality, associated with defense of property, occurs on domestic sheep leases, even in designated wilderness areas. 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.

Management Conclusions

In the short-term, it appears that the net effect of a liberal hunting season, but stricter hunting technique regulations, will be to reduce hunter numbers and corresponding annual harvest. As a result, the median age and size of the BBMU 5 population may be increasing. If so, this would ease pressure on a population hovering near minimum population characteristic thresholds. This trend could be reversed; however, if license sales rebound, and as hunters become more comfortable operating under the current bear hunting restrictions. Current inferences are speculative at best. No other significant changes in harvest strategy are recommended until the effects of the recent changes can be more clearly discerned.

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 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 1997 was comparable to 1996 and the 10 year average (Table 2). Hunter numbers and effort were 50% above average. Median age and percent females in the harvest were within the desirable category. Hunter success was well below statewide average.

Boot hunters may have better success in years of good mast production. Mast is not surveyed in the region, but casual observations and reports indicate 1997 was a good year for huckleberries. There was also a light tracking snow for the first weekend of deer season. Low success rates can be expected because of the ban on hounds and bait.

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 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 has been > average in recent years. Plant growth and production has 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 orchards. The orchards provide abundant soft mast, but create

Table 2. Black bear harvest, hunter effort and median age for BBMU 6.

Year	Male	Female	Total	# of hunters	% Success	Hunter Days	Median Age		
							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	5.0	4.5	30

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 1997, the increase in hunters negated reduced success rates, and harvest was near the 10 year average. Harvest may actually increase in BBMU 6 with longer seasons, reduced tag fees, and an increased limit. The

age and sex ratio in the harvest must be monitored closely.

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

1

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 6 eastern Washington season. The bag limit was one bear. Hound hunting and baiting were closed statewide. There were no special damage hunts in this BBMU.

Hunter numbers did not seem to be effected in this BBMU as much as expected (down 5% from 1996), (Table 1).

The extended bear season was established to compensate for the loss of hound hunting and baiting. The 1997 harvest was down 24% from 1996 and 31% from the 1991-96 average (Table 1). The price of the tag remained at \$18 for 1997 but will drop to \$15 for 1998. We expect harvest to increase as more hunters take advantage of the lower costs and possible bear population increases resulting from reduced harvest.

The addition of the August black bear season did result in concern for potential grizzly bear mortality. 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.

Patrols in the recovery zone in August of 1997 alerted us to the potential for greater risk to grizzlies than anticipated, as there was relatively more hunter effort and success in the recovery zone than in other areas of the Northeast BBMU. The black bear harvest in GMU 113 in 1997 was 72% higher than 1996 (74 vs 43). Observations of hunter numbers in the recovery area in August and the success rate (15% in 1997, highest in the BBMU vs 9% in 1996) lead WDFW to conclude the increased opportunity in August would only escalate and did pose an inappropriate risk for grizzlies at this time. Hound hunting and baiting had not been allowed in the recovery area in the past so this opportunity was not lost to traditional hunters of this area. Recommendations for 1998 to delay the black bear opener in the northern portion of GMU 113 to early September in 1998 were approved by the Commission.

Hunter success in 1997 was 9%, down from 11% in 1996. The average days of hunting per bear kill was up from 1996 and it appears that there has been a general trend in lower success rates and increased days per kill for several years (Figure 1). Hound hunting and baiting were both relatively efficient means of hunting though so it is reasonable to expect success to be lower with the loss of those hunting techniques.

The Colville Confederated Tribes offered a boot hunt and

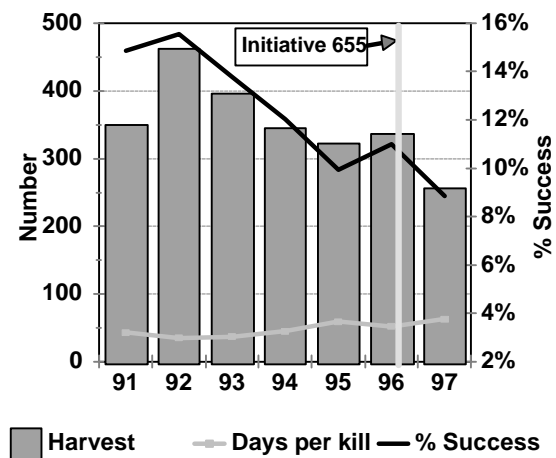


Figure 1. Harvest, days per kill, and percent success for black bears harvested in Northeastern BMU.

a hound hunt on the North Half (GMUs 101, 105, and 204). The Tribal Fish and Wildlife Department issued 22 tags but no bear were reported taken (Colville Confederated Tribes, 1998).

Population Status And Trend Analysis

The median age of harvested female bears in BBMU 1 was below the acceptable harvest guidelines, the second year in a row it has been 4 (guideline is >.5). Males are within acceptable levels (2-3) but relatively young at 3, and slightly below desired levels (>.4). The percentage of females in the harvest was well within guidelines and right at the desired level of 35% (Table 1 and Figure 2). It appears that a reduction in harvest was appropriate for BBMU 1 in 1997. While there is a considerable amount of anecdotal concern for high bear populations and lack of harvest without hounds and bait, the data appears to suggest harvest levels are quite appropriate for 1997 and the near future.

Table 1. Black bear harvest, hunter effort and median age for BBMU Northeastern.

Year	Male	Female	Total # of hunters	% Success	Hunter Days	Days per kill	Median Age		RCards	
							Males	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	2870	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

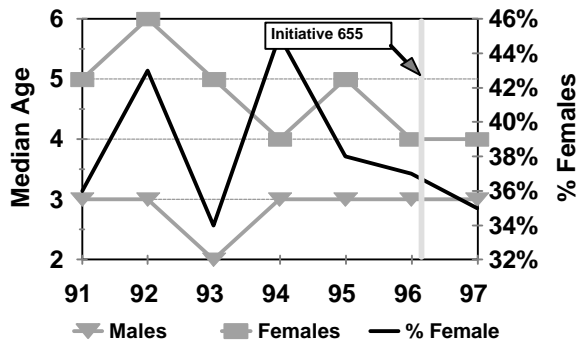


Figure 2. Median age and percent females in black bear harvest in Northeastern BBMU.

Nuisance and Damage Activity

Fish and Wildlife Officers responded to 74 complaints involving bear in the Colville District (Ferry, Stevens, Pend Oreille Counties). Bear are second only to cougar in complaints regarding problem wildlife in northeastern Washington. While our acceptable harvest guidelines have been partially exceeded overall, there still remains the concern for human health and property protection that justifies heavy harvest in populated areas.

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 dependent on berry production, especially huckleberries. The huckleberry crop was below average in 1997 and appears very poor in 1998. This could mean two years of poor recruitment and subsequent reduced bear populations as these age classes are depended on more for harvest and production.

Management Conclusions

While there is considerable public interest or demand for increased bear harvest due to the loss of hound hunting, baiting, and the frequency of sightings; the data gathered from one year of hunting with the August through November season suggests this has been fairly effective in meeting bear management and hunter opportunity objectives. Increased harvests may not be appropriate given the low median ages and the possibility of poor recruitment in the near future.

Tracking ages of harvested bear is critical so I hope the sample of teeth collected can be increased as we move toward mandatory reporting by all bear tag holders. Our age data analysis should include data and charts depicting each age class, this will help biologists identify good or poor recruitment years and predict population changes.

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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

Hunting seasons have 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 achieve an adequate bear harvest. The 1997 bear hunting season ran for 98 days, from August 1 to November 6. Hunters harvested a total of 28 bear in the Blue Mountains in 1997 (Figure 1). Even with the expanded hunting season the bear harvest declined 54% compared to 1996, and 65% compared to the 1992-96 average of 81 bear/year (Table 1). The number of days per kill also increased substantially in 1998, from an average of 70 days/kill for 1992-96 to 413 days/kill in 1997, an increase of 490%. The decline in harvest and increase in days/kill was expected due to the loss of hounds and baiting as an effective hunting technique.

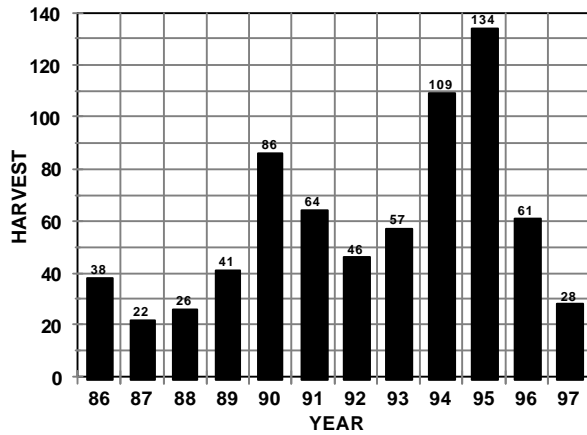


Figure 1. Bear Harvest 1986-97, Blue Mtns. WA.

Much of the bear harvest occurred on the westside of the Blue Mountains in GMU 154-Blue Creek. The Blue Creek unit produced 64% (18) of the total harvest. This is a direct result of bear concentrating in the fall to feed in natural foraging areas such as blackberry patches, old orchards, and Hawthorne thickets. 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 low harvest.

The composition of the 1997 bear harvest was split evenly between males and females; 14 males, 14 females. This is probably a reflection of hunters not being selective and taking the first bear they observed. The mean age of bears harvested was 5.5 years for females, and 11.8 years for males.

Population Status And Trend Analysis

Based on field observations and sightings, bear populations in the Blue Mountains are still at fairly high levels. Bear density trend transects have been discontinued due to budget limitations.

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 are becoming more frequent.

Nuisance and Damage

The number of bear complaints registered are comparable between 1997 and 1998, with 3 and 2, respectively. The number of bear complaints appears to have declined over the last two years.

Habitat Condition And Trend

Although habitat conditions have changed due to fire suppression, the bear population appears to be at high level. The implementation of controlled burning will improve habitat by increasing the forage base, such as huckleberry fields.

Management Conclusions

Black bear population growth in the Blue Mountains probably stabilized in 1994 and 1995 in GMUs 154, 162, 166, 172, and 175 due to increased harvest levels. However, our ability to adequately harvest bear by GMU has been 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. This will probably result in a resurgence of growth in the bear population. Bear populations should continue to increase unless a better strategy for harvesting bear is developed. Combining the current bear season with a permit controlled spring bear season would increase our ability to provide a well balanced harvest by game management unit.

Table 1. Black Bear Harvest Summary 1992-97, Blue Mtns., Washington

Year	Bear Harvest				Hunter Days	Days per kill	Median Age		
	Male	Female	Total # of hunters	% Success			Males	Female	
1992	30	16	46	494	9%	2,740	69	--	--
1993	25	32	57	491	12%	1,988	35	—	--
1994	71	38	109	903	6%	5,450	50	3.0	5.0
1995	88	46	134	1,024	13%	7,363	55	3.0	3.5
1996	43	18	61	1,325	5%	8,543	140	3.0	4.0
1997	14	14	28	1,486	2%	11,567	413	10.5	5.5

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.

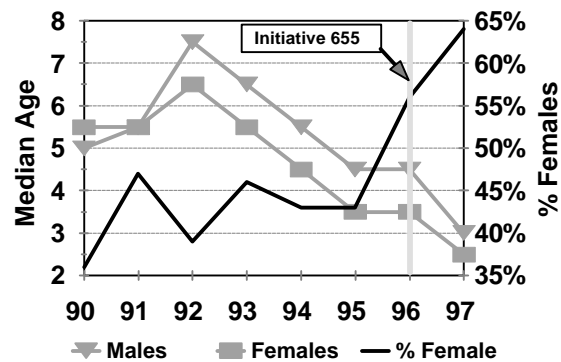


Figure 1. Median age and percent females in cougar harvest in Washington State.

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 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

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 Limited Areas	66	62%
1996*	Permit Only. Hound Use Shortened by Initiative 655	112	53%
1997	General Season. No Hounds Allowed	132	64%

*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.

cougar nuisance and damage activity in the state (Table 2.) The 1997 field reports indicate that the total number of confirmed cougar/human complaints reported by the public increased 14% between 1996 and 1997 from 495 to 563, respectively. Unlike with black bear, nuisance and damage activity by cougar is likely a good indicator of the status of the cougar population.

Table 2. Statewide cougar/human complaint summary, 1995-1997.

Year	Total Complaints	# Relocated	# Killed		Human Attacks
			WDFW	Other	
1995*	247	14	6	4	0
1996	495	11	27	16	1
1997	563	2	21	26	0

*10 months of data

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.

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 CMU **Cougar Management Unit**
Cougar 1 **Coastal**
Prepared by: Greg Schirato, District Wildlife Biologist
 Bryan Murphie, Wildlife Biologist

Population Objectives/guidelines

The goal for cougar management in the Coastal Unit is to reduce the population through harvest to 1993 population levels to reduce damage complaints and elk predation.

Hunting Seasons And Harvest Trends

The 1997 cougar hunting season extended from August 1, 1997 through March 15, 1998. There were no permit only or pursuit only season. The use of hounds was not permitted.

A total of 12 cougars were taken during the 1997 season. Of these 33% were females (Table 1). The median age of males and females harvested were 4.0 and 2.5 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 1997 for the Coastal Unit.

Table 1. Cougar harvest and percent females in harvest for 1997.

Year(s)	Hunt Type	Harvest	% Females
1991-1995 Average	Permit Hunts	18	39
1996	Permit Hunts	10	50
1996	General Season	6	17
1997	General Season	12	33

Tribal harvest for 1997 was approximately 5 cougars. Several tribes have tried to target cougar harvest due to concerns about elk predation in declining herd areas.

Population Status And Trend Analysis

The 1997 Status and Trend Report calculated that the population had been increasing since 1987. The population

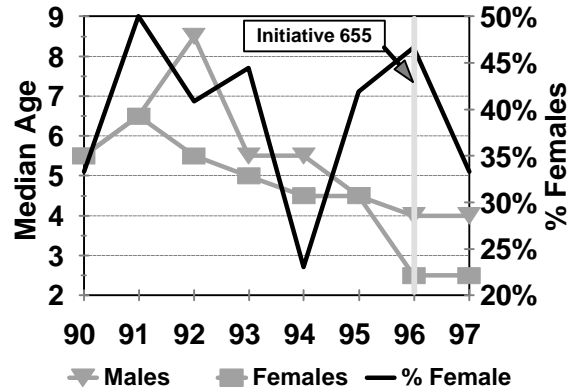


Figure 1. Median age and percent females in cougar harvest in 1997.

had been increasing even before the hound hunting restriction.

Habitat Condition And Trend

We currently do not monitor changes in habitat specifically affecting cougars.

Management Conclusions

Harvest has not been able to increase with the increasing cougar levels. Increasingly cougars are being killed by Fish and Wildlife Officers or by landowners in damage scenarios. 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.

Species

CMU

Cougar Management Unit

Cougar

2

Puget Sound

Prepared by: Rocky Spencer, District Wildlife Biologist

Population Objectives/guidelines

Attempt to reach a harvest level of about 5-9 lion per year in the Puget Sound CMU. This, in theory will provide recreational viewing opportunity and control the population which may reduce 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 CMU are presented below in figure 1.

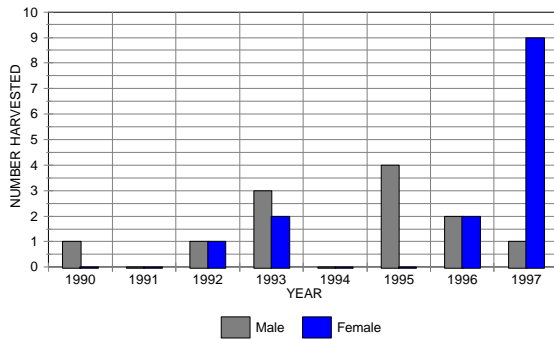


Figure 1. Mountain Lion Harvest Puget Sound CMU 1990-97

The general lion hunting season runs from August 1, 1997- March 15, 1998. A hunting licence and a cougar tag are required to hunt. Hunter pressure has dropped with passage of Initiative 655.

The passage of Initiative 655 in 1996 restricted the use of hounds to hunt lions. Subsequently, we should 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 the Puget Sound CMU ten (10) lions were killed during the 1997 season, an increase of 125% from 1996 (4 lions). This is notable increase from the 1990-1996 average of 2.3 lions. This season was characterized by an unusually high (90%) female harvest; however 5 of the 9 females (55%) were subadult. In this CMU the average percent female lions in the

harvest for the 7 year 1990-96 period is 38%. Excessive harvest levels are characterized by a high proportion of females in the harvest (WDFW Draft Cougar Mgmt Plan 1997 p. 49).

Population Status And Trend Analysis

Statewide population status and trend analysis are projected from 2 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 2). Projections at the CMU level are difficult and less precise, but The Puget Sound CMU likely has between 130-250 lions.

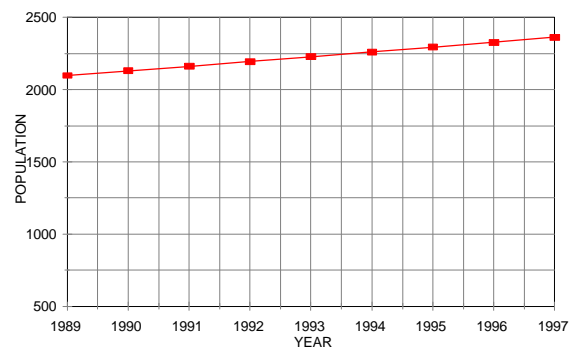


Figure 2. Estimated Lion Population Growth Based on Reconstruction (after Bender 1997 unpub. rep.)

The 1997 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 and by utilizing suburban vacant and other marginal habitats.

Nuisance and Damage Activity

Lion damage to private property primarily involves killing and injury 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 significantly effect lion habitat availability 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; the Puget Sound cougar management unit (CMU) covers about 12% of this range, or about 1,052,410 ha (acres). Much of this lion habitat occurs adjacent to major metropolitan areas such as, Seattle, Tacoma, Everett etc. 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) potentially more frequent human-lion encounters, 3) an increase in intra-specific cougar interactions and possibly mortality, and 4) an increase 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's 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 affect on the population dynamics of all wide ranging carnivores, including mountain lions.

Literature Cited

Pozzanghera, Steve. 1998. Per comm.

Spencer, R.D. et.al. 1996. An Analysis of Mountain Lion Home Range, Dispersal, Mortality and Survival in the Central Western Cascade Mountains of Washington. Washington State Management Plan for Cougar- Draft Environmental Impact Statement. 1997.

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

Cougar hunting season was from 1 August to 15 March. The passage in November 1996 of initiative I-655, prohibiting the use of hounds for hunting cougar, will have drastic impacts on cougar harvest numbers in the coming years. The suspected reduction in cougar harvest and success rates due to hound hunting prohibition, however, was not evident in 1997 (Table 1).

Table 1. Cougar harvest in the South Cascades Cougar Management Unit (CMU), 1992-1997

Year	Male	Female	Total
1997	5	8	13
1996	1	5	6
1995	9	7	16
1994	6	2	8

Data from 1992-1996 include harvest, if any, from GMU 478 (Puyallup). Data format does not allow for extraction of this GMU.

Population Status And Trend

No surveys for cougar are conducted in the SC CMU. The prey base and habitat in the SC CMU is well distributed and cougar are probably utilizing most if not all available habitat. Based upon harvest and complaint data, the cougar population is stable to increasing.

Habitat Condition And Trend

The major problem facing cougar in the SC CMU is the encroachment of human civilization.

Management Conclusions

The prohibition of hound hunting will have impacts on cougar harvest and the amount of cougar complaints. Despite an increase in the harvest in 1997, prohibition of hound hunting will likely lead to long-term decreases in cougar harvest and increases in cougar complaints. Without adequate means of maintaining cougar harvest, the department will likely need to expend more money and personnel to deal with an increasing cougar population in the SC CMU.

Species **Cougar Unit Number(s)** **Cougar Management Unit Name**
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

In recent years, about 70 percent of the cougar harvested in Washington have been taken by hunters using hounds. Approximately 70 percent of Washington’s cougar harvest has come 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 (limited numbers of) tags. On December 5, 1996 the use of hounds to hunt for cougar was banned by public initiative.

Cougar tags are not limited currently. Hunters are limited to one cougar per year. Hunting season begins on August 1 and extends to March 15.

Since 1991, cougar harvest in units 5 and 6, which cover Okanogan, Chelan, and northern Kittitas counties has averaged 37 animals, 22 percent of the average statewide harvest. The combined 1997 harvest for these units totaled 34 (Table 1). Four of these cougar were killed as a result of depredation complaints.

Population Status And Trend Analysis

We have no population estimates for cougar. Based on the number of reports received from hunters and landowners,

Table 1. Cougar harvest and median age for units 5, East Cascades North and 6, Columbia Basin.

Year	Harvest Unit 5		Harvest Unit 6		Age Unit 5		Age Unit 6	
	Male	Female	Male	Female	Male	Female	Male	Female
1991	4	9	4	9	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

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

Cougar hunting season is open nearly statewide from August 1 - March 15. Although the yearly bag limit is one, cougar tags are not limited. We currently have no harvest objectives established for management units because of the lack of harvest that occurs without the use of hounds. Given the current harvest levels, cougar management units may be unnecessary. Cougar management units could be replaced by Game Management Units, Population Monitoring Units, or Regional boundaries to track cougar harvest and population.

Washington’s human population continues to grow and displace wildlife. Reduced hunting efficiency, more people, and rural home-sites result in an increasing trend in cougar encounters, and depredation. Responding to complaints and human safety situations is costly and time consuming. WDFW needs to secure general fund revenue to fund these activities.

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

Three cougar were taken during the 1997-98 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 3 year average harvest is now 3.7 cougar.

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	0
1996	General Season	0	NA
1997	General Season	3	100

Population Status And Trend Analysis

Prior to the 1970s cougar were rare in Yakima County and no cats were reported in Klickitat County until recently. 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

CMU
8

Cougar Management Unit
Northeastern

Prepared by: Steve Zender, District Wildlife Biologist

Population Objectives/guidelines

Long-term objectives are to maintain healthy cougar populations within each 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. Currently cougar populations and depredation complaints are high, so increasing harvest opportunity has been the short-term goal.

Hunting Seasons And Harvest Trends

Hound hunting is no longer allowed in Washington so the permit system was dropped and any license holder could purchase a cougar tag in 1997. The season was extended to include August 1-March 15, 1998. One cougar was allowed per hunter. The price of the tag remained high (\$24) because legislative action is needed to change tag prices. However, the legislature has provided the Fish and Wildlife Commission the authority to establish the cost of black bear and cougar transport tags. The Commission has responded by reducing the cost of 1998 cougar transport tags to \$5.

The primary objective of the much longer season and dropping the requirement for a permit was to provide hunter participation and effort sufficient to mitigate the loss of the use of hounds. The harvest was higher than I would have expected without the use of hounds but still fell far below our objective. Cougar populations appear to have been stable or increasing since 1995 yet our harvest has declined 26% from 1996, when hounds were legal for a short time, and 49% from 1995 when hounds were legal all season (Table 1).

The cougar harvest has declined since the loss of hound

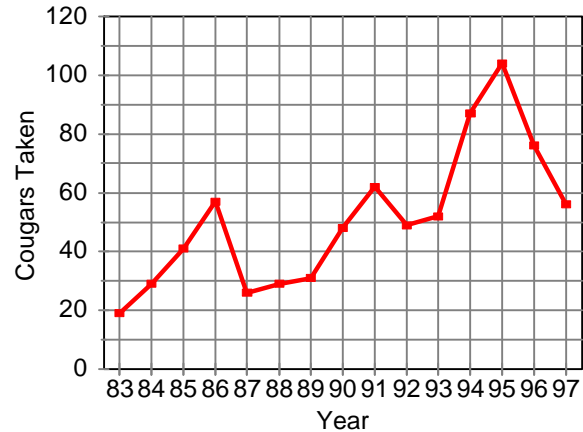


Figure 1. Cougars taken by hunters, depredation or other means in the Northeastern Cougar Unit (GMU's 101-133 and 204).

in Unit 8 increased from 8 in 1996 to 14 in 1997 (Table 1). Complaints regarding dangerous cougar registered in the Colville District (includes most of Unit 8) were higher (154 total from 7/1/97-6/30/98) than any other problem wildlife complaint.

Population Status And Trend Analysis

The mean age of harvested cougars continues to drop in the Northeastern Unit (Figure 2). It would seem reasonable

Table 1. Cougar hunter harvest, other kills, and percent females for Northeastern Unit 8.

Year	Female		Male			Combined Harvest		Total Harvest	Percent Female	
	Hunter Harvest	Other Take	Female Total	Hunter Harvest	Other Take	Male Total	Other Take			
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%

hunting but is still above most of the harvests in the 1980s (Figure 1).

Human Safety and Wildlife Damage

Hunting has not been effective in reducing concerns for human safety or protection of livestock and pets. Cougars killed by WDFW or citizens involving damage or public safety

that this would be an indication of a very productive population with high harvest levels. Younger cats may be 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 animals) cougar.

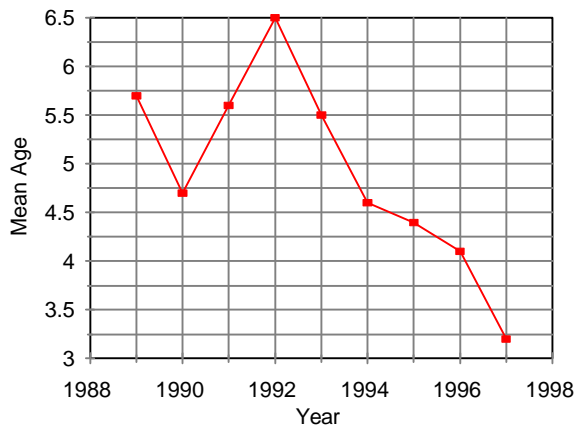


Figure 2. Mean ages of all cougars harvested (N range 30-92) from Northeastern Cougar Unit 8.

No specific field surveys have been effective in monitoring cougar trends. However, cougar sightings by the public are unusually high and broadly distributed throughout the Northeast Unit. This anecdotal information, along with the high number of complaints involving cougar, suggests population levels near humans remain high or have increased.

Habitat Condition And Trend

Deer populations were at a high in 1992 but declined significantly after the severe winter of 1992/93. They

recovered fairly well until 1996/97, another very severe winter. Mule deer populations are at record lows in much of the Unit. The current prey base for cougar in the Northeast Cougar Management Unit is about as low as we would expect to get. This past winter was very mild though and at least white-tailed deer are showing signs of increasing.

Management Conclusions

Cougar numbers appear to be high. The very young mean age of harvested cats may be an indication that high harvests have impacted the population. 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. Subadult cougar likely 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. The reduced cost of the cougar tag to \$5 should provide the means to increase harvests.

Much of our management is shifting from setting harvest levels and collecting data to informing and educating the public on cougar behavior and working with human/cougar conflict issues. At the present time it appears that human/cougar conflict will be the driving force behind cougar management for some time. The Wildlife Management Program and the Enforcement Program may need to do a better job of integrating data collection and analysis, at the district and statewide level. At the District levels the biologists and officers can serve the public better by becoming partners in addressing human/cougar conflicts, as well as providing hunting opportunity.

Species **Cougar Unit Number** **Cougar Management Unit Name**
Cougar **9** **Blue Mountains**

Prepared by: Pat Fowler, District Wildlife Biologist

Population Objectives\Guidelines

Managing the cougar population will be extremely difficult after implementation of Initiative 655. We will attempt to manage cougar populations at a level that provides optimum recreational opportunity for consumptive and non-consumptive users, while minimizing conflicts with other management objectives.

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 1997 cougar season started on August 1 and closed on March 15, 1998 and was open to any hunter possessing a valid 1997 cougar tag.

The cougar harvest in 1997 was higher than anticipated (13), with most of the harvest occurring in September and October during the fall bear and deer seasons (Figure 1). The composition of the harvest consisted of 69% females, which indicates hunters are not being selective, taking the first cougar they see (Table 1).

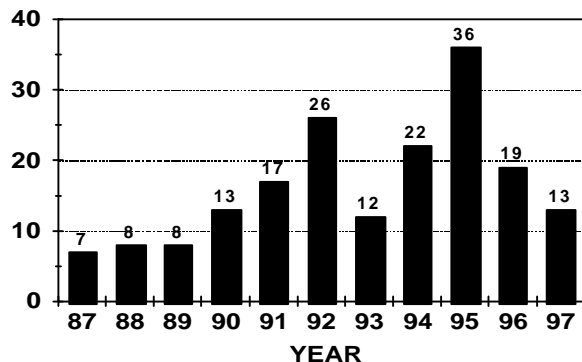


Figure 1. Cougar Harvest, Blue Mtns. Wash.

Table 1. Cougar Harvest Trend 1992-97, Blue Mtns. Wash.

Year	Hunt Type	Males	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	6	9	15	69%

The distribution of the harvest was interesting with 46% (6) of the harvest occurring in Unit-154 Blue Creek. This particular unit has a high density of cougar, and heavy hunter activity during the fall, which may have combined to produce the resulting cougar harvest. Unit-162 Dayton came in second with a harvest of three (3) cougar, 23% of the harvest. Unit-181 Couse produced a harvest of two cougar, while Unit-169 Wenaha, and Unit-178-Peola produced a harvest of one cougar each. Unit-154 Blue Creek and 162-Dayton produced 69% of the overall cougar harvest.

The reduction of the cougar tag fee to \$5.00 may result in an increase in the harvest in 1998.

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, the 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, and in the agricultural areas to the north near the Snake River, and in or near towns.

Nuisance and Damage Complaints

Cougar nuisance and damage complaints declined from 34 complaints in 1997 (entire calendar year) , to 8 complaints in 1998 (as of July 31). Although there is a significant decline in overall complaints between 1997 and 1998, 10-15 years ago cougar complaints were very rare.

Complaints registered in 1997 consisted of six that involved the killing of domestic livestock or attacks on dogs. Two hunters reported attacks on their bird dogs while hunting. In 1998, only one complaint has involved a cougar killing domestic cats at a rural residence.

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.

Annual elk calf mortality is high, mostly due to predation, and cougar are the primary predator, as indicated by calf mortality study data. If the cougar population continues to increase, the annual survival rate of elk calves may not improve.

Mule deer populations in the mountains are at a 25 year low, and may not increase significantly until the cougar population declines.

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

WDFW coordinates 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 1997 and mourning dove surveys completed in the late spring of 1998.

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 logistic 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.

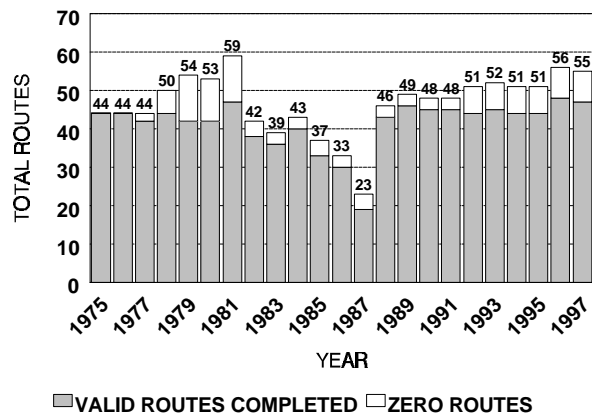


Figure 1. Washington band-tailed pigeon call-count survey. Valid routes completed and zero routes

The band-tailed pigeon mineral site survey was initiated in

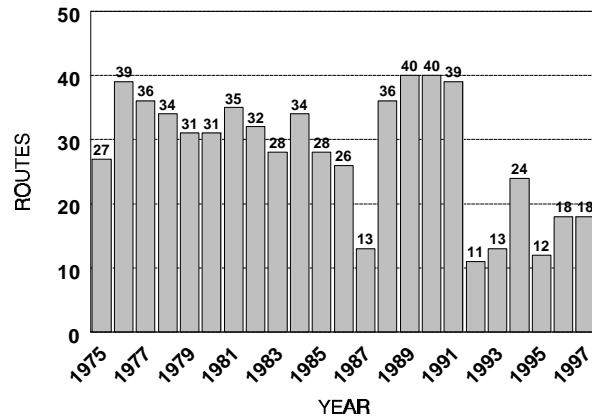


Figure 2. Washington band-tailed pigeon call-count survey. Number of routes contributing to index

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 (Potlatch, 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.

The mourning dove survey was completed between May 20-31, following methods in Dolton and Smith (1998). 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.

The Washington call-count survey results are presented in Table 1 and Figures 1-3.

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.

Results from the mineral site survey are presented in Table 2 and Figure 3.

The mourning dove analysis and report were completed by Dolton and Smith (1998, Fig.4).

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

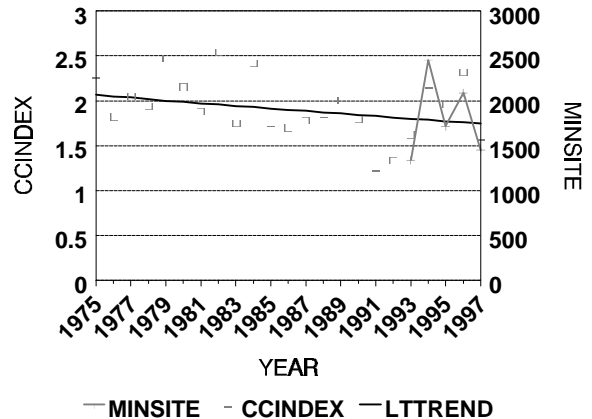


Figure 3. Washington band-tailed pigeon call-count index vs. mineral site survey.

Table 2: Results of 1993-97 Band-tailed Pigeon Mineral Site Survey

Region	Site	Mineral Site Index				
		1993	1994	1995	1996	1997
4	Red Salmon Creek	89	88	89 ^a	109	95 ^a
5	Cedar Creek	112	361	121	285	150
5	Newaukum	86	42	108	104	0
5	Upper Kalama	388	399	379	463	403
5	Altoona	120	297	141	168	10
5	St Martin Hot Springs	228	371	151	275	332
6	Potlatch	107	382	217	228	175
6	Mud Bay	150	271	245	271	215
6	Lilliwaup	58	243	265	183	71
		1338	2454	1716	2086	1451

^anot surveyed - average from past counts

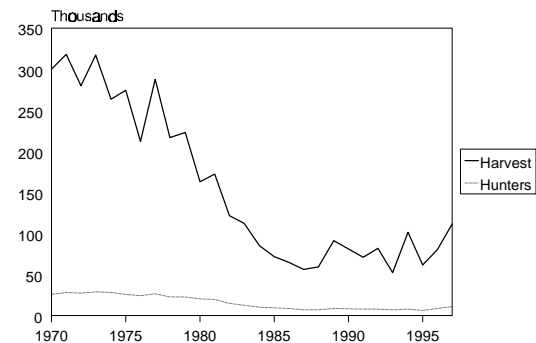


Figure 4. Mourning dove harvest and hunter trends

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 1.60 was below the 1980-84 population objective index (this index varies each year because of route-regression analysis methods, but was 2.15 for the 1997 analysis).

The call-count survey did not show a significant correlation ($p < 0.05$) with the mineral site survey for the period 1993-97 using Pearson, Spearman, and Kendall tests. These surveys are being evaluated by U.S. Geological Survey - Biological Resources Division, along with other methods, to develop a range-wide survey for the Pacific Coast population.

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 1998 for breeding waterfowl populations, duck broods, pond index, 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)

The 1998 breeding duck population surveys were conducted between April 28 and June 28. 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 conducted by ground counts, except helicopter counts are used for 1/4-sections in the Columbia Basin Irrigated strata. We tested the use of fixed-wing aircraft for surveying Union Flat Creek and the Palouse River.

In 1997 breeding duck surveys were initiated in western Washington using a quadrate design, for eventual analysis using bellweather sampling techniques. Survey plots in most cases were defined by section lines, or square mile areas. Survey areas were selected based on knowledge of breeding duck densities and surveyed using helicopter. Survey strata and sampling design continue to be refined, based on preliminary results of 1997-98 surveys.

Methods for estimating total number of breeding ducks follow the Standard Operating Procedures of Aerial Waterfowl Breeding Ground Population and Habitat Surveys in North

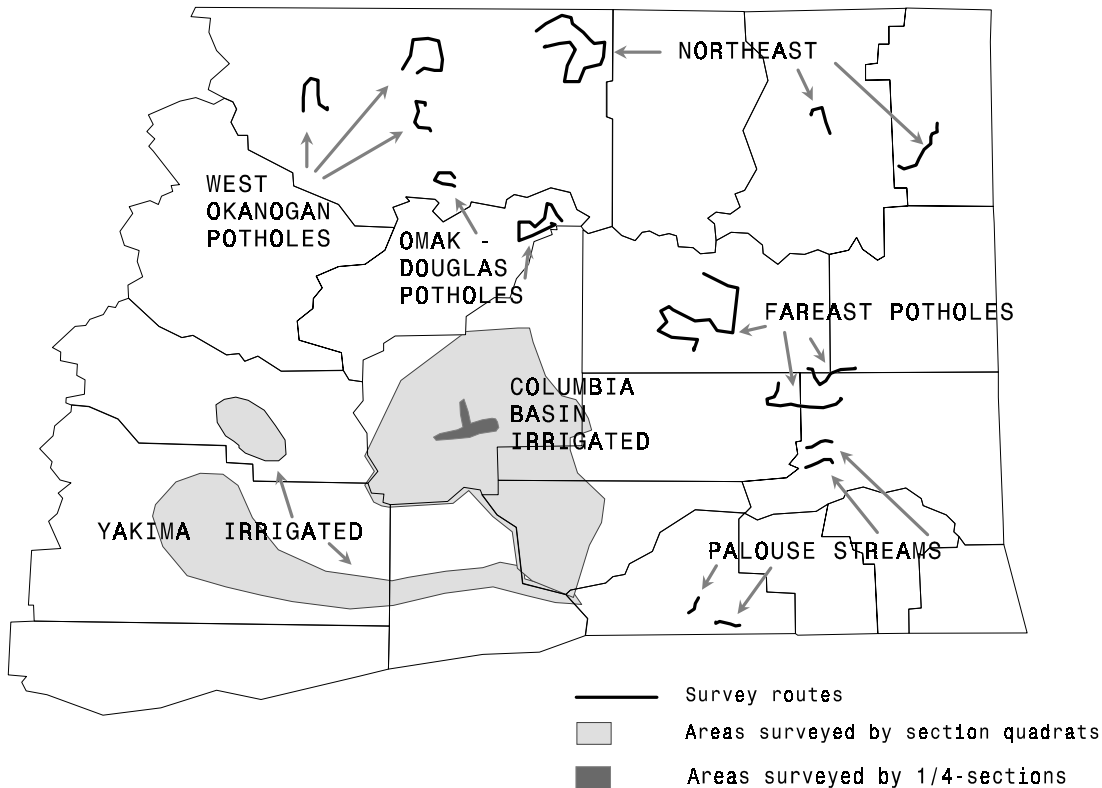


Figure 1. Breeding duck surveys in eastern Washington.

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

^aSurveyed by helicopter beginning in 1994.

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 1998 and 1997, and between 1998 and the long-term average for mallards and total ducks. This analysis is provided to USFWS for the annual season setting and Population Status Report.

The index of breeding duck population in eastern Washington was up 7% from 1997 ($p = 0.78$) and up 16% from the long term average ($p = 0.78$) (Fig. 2, Table 2). Mallard numbers were up 18% from 1997 ($p = 0.85$) and 50% from the long-term average ($p = 0.95$) (Fig. 3, Table 2). Statistical analysis is included in Appendix A. Our statistical analysis is not sensitive when strata vary independently. This year there was a large increase in the Potholes strata, but declines in the Irrigated, and Northeast strata (Fig. 4., Table 3).

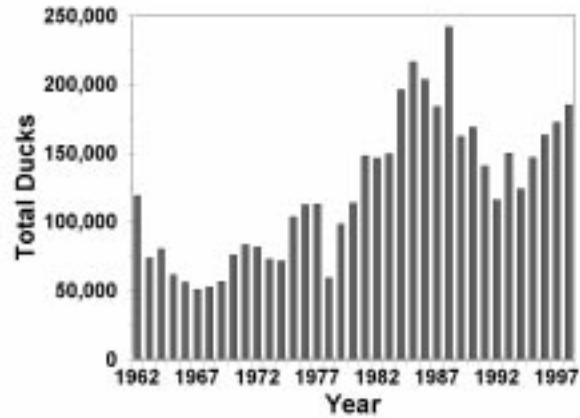


Figure 2. Breeding duck population in eastern Washington.

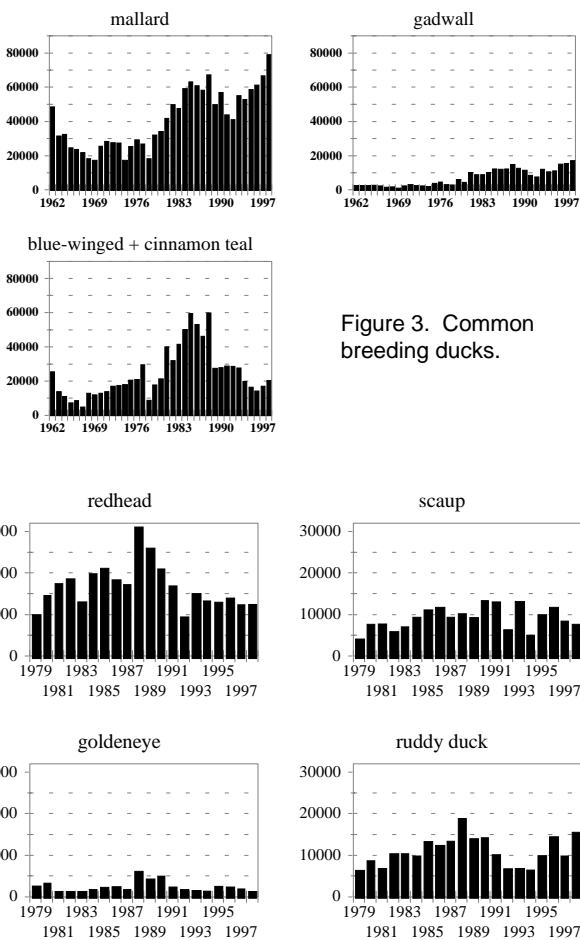


Figure 3. Common breeding ducks.

Table 2. Weighted breeding duck population indices by species for Washington, 1990-1998.

Species	1991								% change		% change	
	1992	1993	1994	1995	1996	1997	1998	96 AVG	from 1996	from AVG		
mallard	43,748	41,009	54,988	52,675	58,908	61,615	66,666	78,962	52,618	18	50	
gadwall	8,323	7,594	12,021	10,520	11,028	14,996	15,306	17,077	10,715	12	59	
wigeon	5,770	2,710	5,095	4,477	3,761	6,010	8,392	7,039	6,295	-16	12	
green-winged teal	2,175	1,195	1,783	1,607	2,987	3,953	7,040	3,983	3,154	-43	26	
blue-w.+cinn. teal	28,823	28,690	27,686	19,768	16,362	14,080	16,903	20,228	33,084	20	-39	
northern shoveler	3,581	3,462	4,409	3,921	5,194	6,092	11,770	12,580	6,018	7	109	
northern pintail	379	243	1,990	931	1,164	1,849	2,802	2,110	2,139	-25	-1	
woodduck	1,994	3,634	2,018	2,342	1,256	2,056	1,584	1,836	1,641	16	12	
redhead	16,938	9,434	15,059	13,323	12,943	14,042	12,363	12,399	16,967	0	-27	
canvasback	222	274	728	121	677	640	1,362	619	736	-55	-16	
scaup	13,092	6,321	13,106	5,010	9,942	11,762	8,433	7,674	9,189	-9	-16	
ring-necked duck	1,729	2,031	1,346	1,059	5,938	3,815	2,490	2,490	2,731	0	-9	
goldeneye	2,351	1,784	1,502	1,383	2,459	2,358	1,877	1,308	2,469	-30	-47	
bufflehead	1,002	666	1,169	77	2,462	4,886	5,355	805	1,280	-85	-37	
ruddy duck	10,104	6,755	6,887	6,476	9,956	14,511	9,837	15,474	10,689	57	45	
merganser	563	181	51	224	2,277	593	270	668	397	148	68	
Total Ducks	140,793	116,264	149,836	123,912	147,312	163,259	172,776	185,251	160,139	7	16	
coot	20,322	12,568	19,219	20,079	27,737	34,797	62,074	49,629	32,764	-20	51	
Canada goose	8,483	9,483	9,190	9,396	15,017	12,758	13,019	11,199	7,379	-16	52	

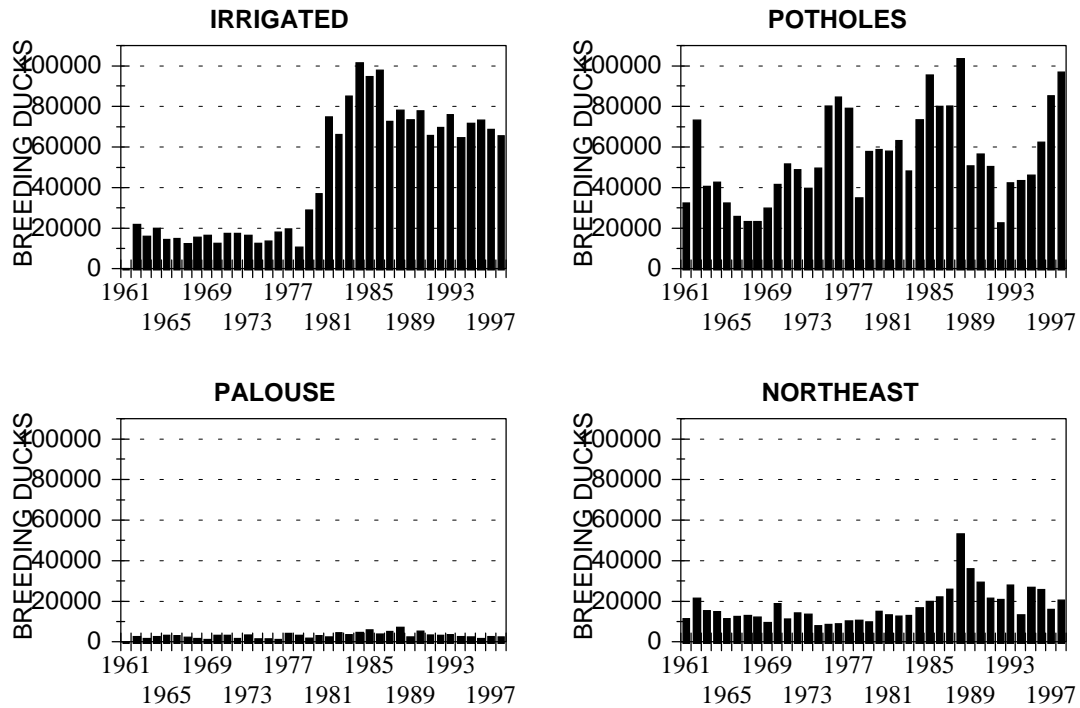


Figure 4. Breeding ducks by stratum.

Table 3. Weighted breeding duck population indices by areas for Washington, 1979-1997.

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
1979-97					
AVG	72,122	63,720	3,574	21,978	161,395
% change from last year	-4%	14%	-12%	27%	7%
from AVG	-10%	57%	-36%	-7%	16%

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 52% of the breeding ducks in all strata were found in the Potholes strata. Duck numbers in this strata were up 14% over 1997 and 57% 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.

The irrigated strata have been relatively stable since 1987 but were down 4% from last year and down 10% 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 Phragmites, 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 (Fig. 5), has come a large and steady increase in the number of nonbreeding scaup. Scaup broods are uncommon but scaup

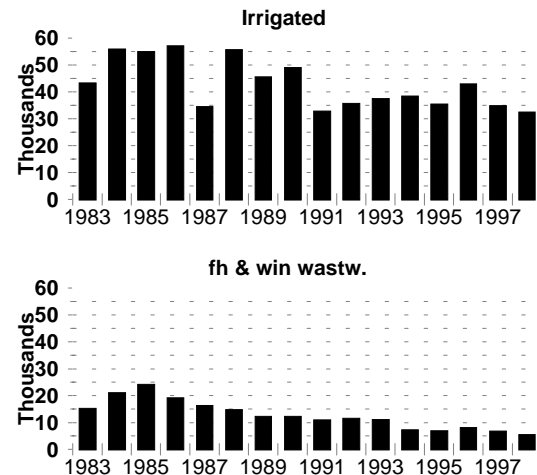


Figure 5. Columbia Basin breeding ducks..

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 27% from 1997 and down 7% from the long-term average (Fig. 4, Table 3). The District Biologist suggests that a low count in 1997 resulted from high water levels and flooding during the breeding season. Palouse strata were up 14% from 1997, and 57% 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 strata 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 39% from the long-term average, but are up 20% 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.

Pond Index

Ponds are counted on 8 transects within the Potholes Area (Fig. 1), during the breeding-duck survey to index water conditions (Fig. 6, Table 4). The 1997 index was the highest ever recorded. The index was down 41% over last year, but still 51% above the long-term average. Pond numbers have been building since 1994. Transects in all areas showed increasing

pond numbers.

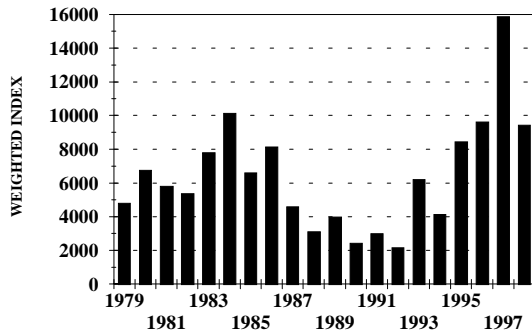


Figure 6. Index to pond numbers in the Potholes strata in eastern Washington.

Table 4. Weighted pond index from transects within the Potholes Area of Washington, 1979-1997.

Year	Douglas Omak			W. Lincoln		Total
	Co.	Lake Fareast	Okanogan	Co.		
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
1979-1997						
Average	900	583	320	3396	1055	6254
% change from 1st yr	-23	-20	-52	-46	-38	-41
% change from Avg.	66	54	32	46	58	51
from Avg.	130	103	203	201	179	177

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 strata should be exceptionally high in 1998, as predicted. However, pond numbers decreased this year and next years breeding ducks should decrease (Fig. 7).

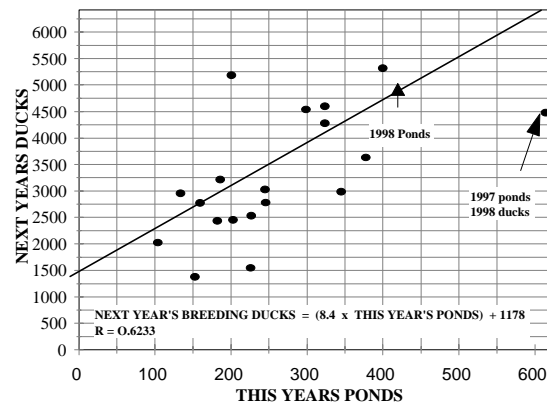


Figure 7. Regression of next-year's ducks on this year's ponds.

Duck Production (Brood Surveys)

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 brood 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.

The 1998 duck production survey data indicated a 6% decrease in total number of broods seen over 1997 (Table 5, Fig. 8). This year's count was up 7% from the long-term average. Changes were inconsistent among species, most common diving duck species increased and diving ducks decreased. The index

Table 5. Weighted duck brood indices by species for the Potholes, Palouse, and Northeast areas of Washington, 1990-1997.

	1992	1993	1994	1995	1996	1997	1998 AVG	%98-97	%98-AVG	
mallard	1,153	1,514	1,954	1,189	2,054	2,316	2,978	1,810	29	65
gadwall	0	261	331	107	277	433	842	445	95	89
wigeon	45	86	162	45	305	96	93	345	-4	-73
green-winged teal	0	5	61	15	474	104	641	136	514	371
blue-winged teal	280	190	185	76	251	340	466	771	37	-40
cinnamon teal	0	10	675	14	252	131	699	104	435	570
northern shoveler	0	82	0	0	350	41	406	181	896	124
northern pintail	48	143	114	0	199	77	342	141	344	143
woodduck	14	0	65	26	77	128	70	41	-45	70
redhead	140	207	407	143	726	227	684	547	201	25
canvasback	26	0	26	51	51	0	26	24	ERR	5
scaup	26	54	52	0	5	228	127	60	-44	112
ring-necked duck	82	79	48	19	16	26	31	58	20	-48
goldeneye	128	77	127	70	97	192	282	132	47	114
ruddy duck	223	119	109	189	500	530	411	279	-22	47
merganser	0	0	0	0	15	29	14	50	-52	-72
Total Broods	2,163	2,825	4,316	1,943	5,649	5,334	8,112	5,124	52	58

Table 6. Weighted duck brood indices by areas for Washington, 1979-1997.

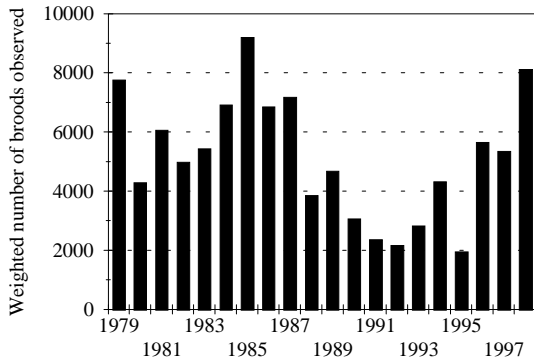


Figure 8. Duck brood index.

increased in the Okanogan and Northeast, and decreased in the Scablands and Palouse (Table 6). The index in the Columbia Basin was down 18% from last year.

Canada Goose Breeding Population Index

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 areas 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

	Scablands	Okanongan	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	
1979-96 AVG	2885	916	939	250	5124	186
% change last year	205	16	-51	-12	52	-18%
% change AVG	80	101	-2	-35	58	-4%

Table 7. Goose nest surveys conducted in Washington.

Survey Area	Year Initiated	Agency Conducting Survey	Frequency of Survey	Annual Rate of Change		
				1984-88	1989-93	1994-98
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%
Snake River	1975	Army Corps	Annual			
Snake River Cliff	1979	Army Corps	Periodic			
Lower Columbia				21%	4%	-1%
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%
Moses Lake	1981	WDFW	Biennial			
Potholes Res.	1981	WDFW	Biennial			
Lenore, Alkali and Park	1981	WDFW	Biennial			

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. Our index from goose nest surveys decreased 8% from last year and 14% from the long-term average (Table 8, Fig. 9). This is the lowest index since 1986. Declines occurred in all survey areas, except the Snake River that remained unchanged. This index increased between 1982 and 1987, and remained relatively unchanged (Fig. 9, Table 8). This years declines are likely related to the initiation of a state-wide September Canada goose hunting season that was started in 1997.

Surveys in the Upper Columbia have increased over the past 20 years, with numbers being more stable in recent years. Results from 3 surveys are noteworthy: Rocky Reach, Rock Island, and Hanford. Two game reserves were removed from Rocky Reach and Rock Island pools in 1997, partly because urban goose problems were occurring in the area. Nest number on these 2 pools grew 8.1% per year between 1975 and 1997. Goose nest numbers decreased on these pools from last year by 33%. Increased harvest of these geese likely caused the decline. The Hanford survey increased at a rate of 5.5% per year from

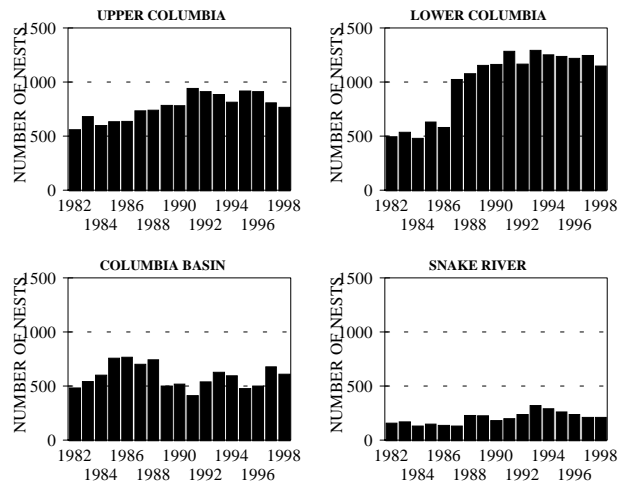


Figure 9. Canada goose nest surveys.

1974 to 1991 where numbers peaked at 325. Since 1991 the number has decreased at a rate of 8% per year to this year's value of 196. Reasons for these declines are uncertain. The

Table 8. Canada goose nest survey results in important areas of Washington, (1974-1997) and weighted number of geese observed during breeding duck population surveys (1979-1997).

Year	Number of Nests				Total	Weighted number observed
	Upper Columbia	Snake River	Lower Columbia	Columbia Basin		
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	2,570
1980	393	112	339	0	844	1,925
1981	534	145	332	249	1,260	4,053
1982	557	160	495	484	1,696	1,203
1983	680	171	535	541	1,926	3,225
1984	598	132	481	601	1,811	2,305
1985	633	150	631	757	2,171	6,674
1986	637	136	580	765	2,118	5,225
1987	735	130	1,024	702	2,591	7,938
1988	741	229	1,076	742	2,787	5,426
1989	783	227	1,154	500	2,664	5,605
1990	780	180	1,161	518	2,639	16,695
1991	941	199	1,282	414	2,836	8,483
1992	909	236	1,164	538	2,847	9,483
1993	883	319	1,293	628	3,123	9,190
1994	811	290	1,251	595	2,947	9,396
1995	917	261	1,302	477	2,957	15,017
1996	910	236	1,271	501	2,918	12,758
1997	807	210	1,245	676	2,938	13,019
1998	764	210	1,147	610	2,521	11,199
85-97 avg	807	216	1,110	601	2,733	9,608
% Change						
Frm Avg	-5	-3	3	1	-8	17
Frm L-Yr	-5	0	-8	-10	-14	-14

^aHelicopter surveys were conducted by U.S. Army Corps of Engineers to count cliff nesting Canada geese on the Snake River.

increase in daily bag-limit in 1993 from 3 to 4 birds may have contributed to the decline in locale 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 1997 and 1998 the index fell 25%. 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. 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 survey (Fig. 9, Fig. 11). The 1998 index declined 14% from last year.

Potential Improvements to Breeding Waterfowl Surveys

1. Breeding Duck Survey
 - a. Expand databases to include older data.
 - b. Explore the possibilities of including data from National Wildlife Refuges and National Forests.
 - c. Clearly delineate strata and check accuracy of

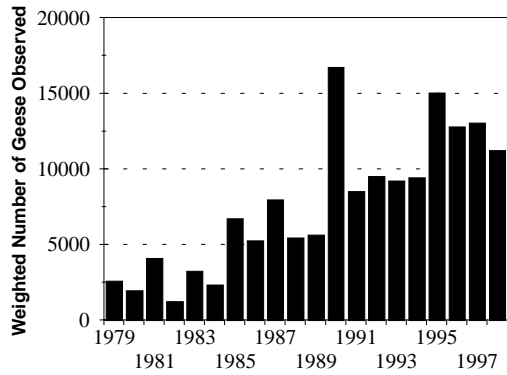


Figure 10. Geese observed during duck surveys.

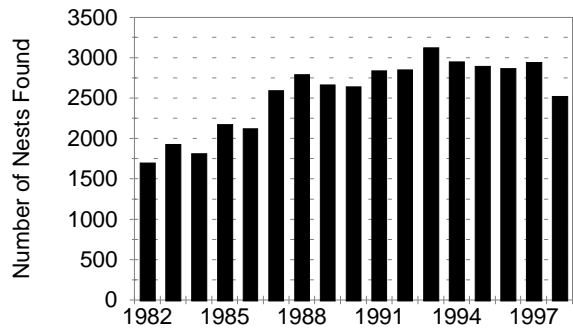


Fig. 11. Total number of nests observed during Canada goose nest surveys.

- d. weighting factors and sample size.
- d. Calculate a "Lone Drake Index" from past data to determine the chronological timing of past surveys.
- 2. Pond Index
 - a. Include pond counts that are made during production surveys in future reports.
- 3. Duck Production
 - a. Standardize brood surveys in the Yakima Irrigation areas and continue to modify where necessary.
 - b. 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.
- 4. Goose Surveys
 - a. Increase survey efforts in other areas particularly northeastern Washington. Explore the possibilities of including data from National Wildlife Refuges.
 - b. Expand the database to include goose data from breeding duck surveys prior to 1979.
 - c. Change annual surveys to biennial and use time savings to expand survey coverage.

APPENDIX A. Wilcoxon signed rank test of Washington breeding duck survey.

mallards ROUTES	19 year			1998-			20 yr.		
	1997	1998	Avg.	1997	RANK	RANK^2	Avg.	RANK	RANK^2
Colville #5	204	1072	960	868	9	81	112	3	9
Cusick #4	1634	3574	1255	1940	15	225	2319	15	225
Moulson-Sidley-									
Muskrat Lake	1430	1021	2273	-408	-7	49	1252	-14	196
Union Flat Creek	650	650	959	0	0	0	-309	-8	64
Palouse River	520	455	587	-65	-1	1	-131	-4	16
Tochet River	0	260	290	260	6	36	-30	-2	4
Walla Walla									
River	0	130	376	130	3	9	-246	-7	49
DOUGLAS CO.	1831	2777	2312	946	11	121	465	10	100
Methow Valley	675	787	637	112	2	4	150	6	36
Salmon Creek	689	1603	956	914	10	100	647	11	121
Sinlahekin	872	1040	1015	169	5	25	25	1	1
OMAK LAKE	1416	1573	1439	157	4	16	134	5	25
LINCOLN CO.	13040	20702	5348	7662	17	289	15354	18	324
Ewan-Revere	1906	5308	1637	3402	16	256	3671	16	256
Sprague-Lamont-									
Downs	2916	1719	1398	-1196	-14	196	322	9	81
CB Irrigated	16763	15645	14399	-1118	-13	169	1246	13	169
fh & win wastw.	1729	1296	1968	-432	-8	64	-671	-12	144
Yak. Irrigated	20392	19347	14810	-1045	-12	144	4537	17	289
			1 9 9 7 -						
			1996	T+	98		18 year	124	
				T-	55		average	47	
				N	17			18	
				SUM RANKS	43			77	
				SUM RANKS^2	1785			2109	
				T	1.018			1.677	
				P	0.85			0.95	

TOTAL DUCKS ROUTE	1997	1998	19 year average	1998-1997	RANK	RANK^2	19 year average	RANK	RANK^2
colville #5	1532	3651	3331	2119	14	196	320	4	16
cusick	5157	9293	3555	4136	16	256	5738	13	169
moulson-sid	9370	7480	15174	-1889	-12	144	-7693	-15	225
union flat	1496	1236	1945	-260	-2.5	6.25	-710	-10	100
palouse riv	1171	715	870	-455	-4	16	-155	-2	4
touchet riv	0	260	308	260	2.5	6.25	-47	-1	1
walla walla riv	0	130	516	130	1	1	-386	-6.5	42.25
douglas co	9736	15901	11965	6165	18	324	3936	11	121
methow v	1476	2193	1651	717	5	25	542	8	64
salmon creek	2264	3501	2897	1237	8	64	604	9	81
sinlahekin	2503	3684	3365	1181	7	49	319	3	9
omak lk	7323	8680	8294	1357	9	81	386	6.5	42.25
lincoln co	46210	44259	23277	-1951	-13	169	20982	18	324
ewan-revere	8018	12821	4208	4803	17	289	8613	17	289
sprag-lamont	7607	5943	6312	-1663	-11	121	-369	-5	25
columbia bas	34903	32445	40532	-2459	-15	225	-8087	-16	256
wasteways	6794	5427	10442	-1367	-10	100	-5015	-12	144
yakima	26892	27631	21496	739	6	36	6135	14	196
			1997 - 1996	T+	103.5		18 year average		103.5
				T-	67.5				67.5
				N	18				18
				S U M RANKS	36				36
				S U M RANK					
				S^2	2108.5				2108.5
				T	0.78409				0.784
				P	0.78				0.78

Species **Region**
Waterfowl **Statewide** **Washington Waterfowl Regulations, Winter Populations, and Harvest**
Prepared by: **Matthew J. Monda, State Waterfowl Biologist**

Introduction

This report summarizes the 1997-98 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 program. Several of the data sets extend back to the late 1940's.

Hunting Season Regulations

The 1997-98 waterfowl harvest was conducted under Washington State regulations (Table 1). Flyway waterfowl populations have increased over the last 4 years, which has allowed for longer seasons and larger bag limits (Table 2). The season length was 107 days statewide. One day was added for

Table 1. Waterfowl hunting season regulation summary 1997-98.

Ducks	Youth Hunters Only	Statewide	Sept. 27th only
	Western Washington	Oct. 4-Jan. 17	(106 days)
	Eastern Washington	Oct. 4-Jan. 17	(106 days)
	<u>Bag Limit</u> --7d(day)/14p (possession) ducks -- not more than 2d/4p hen mallard, not more than 3d/6p pintail, not more than 2d/4p redheads, and 1d/2p canvasbacks.		

Geese (See Map 1 for goose management areas)

Western Washington

EARLY CANADA GOOSE Bag Limit 3d/6p

Sept. 6-12. Statewide

WESTERN GOOSE MANAGEMENT AREA 1. Bag Limit 3d/6p.

Oct. 11-Jan. 4. 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. 22 - Jan. 18

Bag Limit 4d/8p not more than 3d/6p Canada geese, 3d/6p snow geese, not more than 1/season dusky Canada, and not more than 2d/4p cackling Canadas. 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. 11 - Jan. 11, Sat., Sun., & Wed., and Holidays; and everyday Jan. 15-21.

EASTERN GOOSE MANAGEMENT AREA 2.

Oct. 11-Jan. 11, Everyday

Snow Geese Bag Limit 3d/6p included in the above limits.

Brant Open in Pacific County, Jan. 3,4,10,17,18

Skagit Counties: Jan. 10, 11, 14, 17, 18

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	Season Length		Bag Limit		Special Limits		Stamp Fees		Hunting License	Steel shot Regulations
	East	West	East	West	Mallards	Pintail	State	Federal		
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	" "
89-90	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

¹Non-toxic shot zones were established at Barney Lake, Skagit Bay, and the Columbia River flood plain.

²Only Barney Lake was retained as a non-toxic shot zone.

³Steel shot in progressively larger zones from 86-87 through 91-92 when steel shot was required statewide.

the Youth Hunt. The bag-limit was 7 ducks with additional species restrictions. 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 1997-98 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 remained at 5 for 1997-98 (Fig. 1). Analysis of harvest data for the old goose management zone 2 in eastern Washington, which allowed hunting Saturday, Sunday, Tuesday, and Wednesday, revealed that harvest or recreation did not benefit from this zone. It was eliminated to help simplify regulations.

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 1997-98 midwinter waterfowl inventory was completed by WDFW and U.S. Fish and Wildlife Service (USFWS) personnel. Washington's data are comparable with previous years (Table 3).

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 5,473,691 in 1996-97 to 6,607,263 in 1997-98. 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. Northern pintails have contributed most to the long-term decline

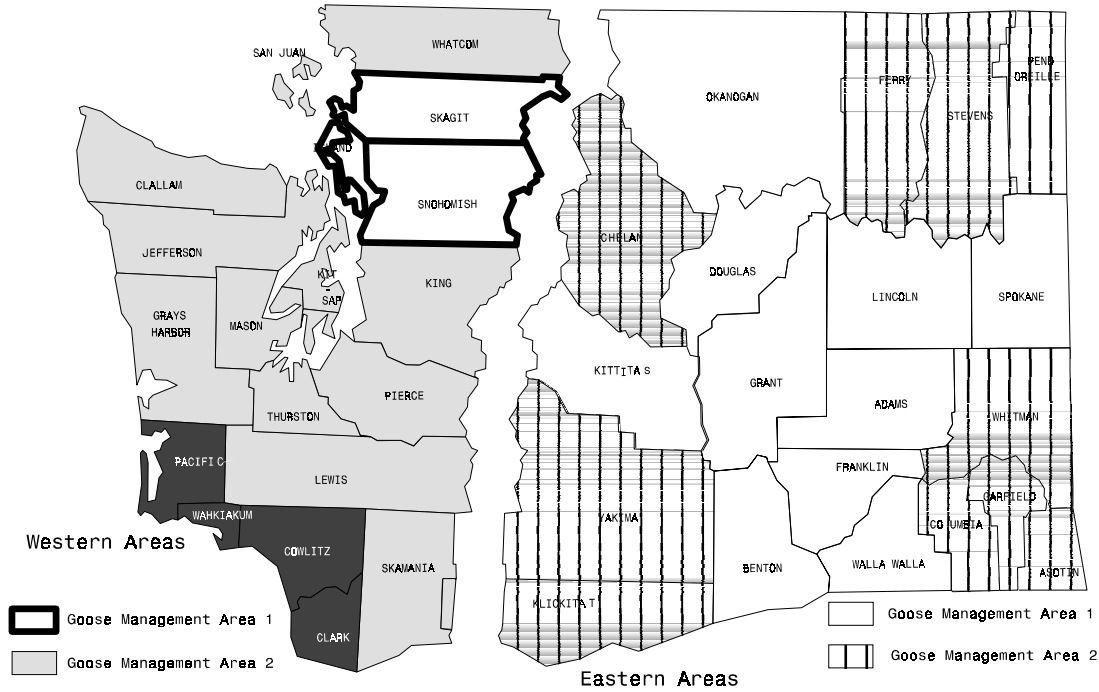


Fig. 1. Washington goose management zones.

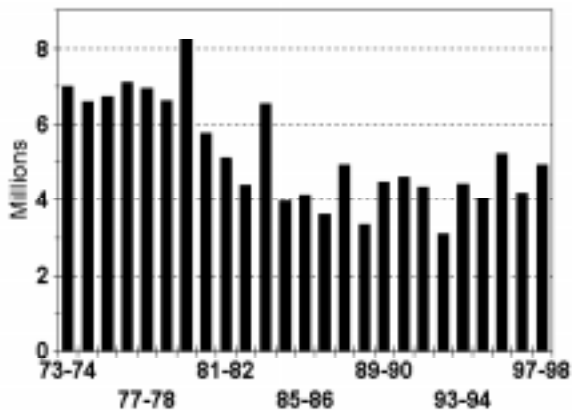


Fig. 2. Pacific flyway midwinter survey

(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 1.2 million pintails and 1.6 million mallards. Midwinter surveys are not accurate estimates of annual population numbers, due to survey inconsistencies and changes in weather patterns. However, these surveys give us information on long term trends and relative distribution of waterfowl within the Pacific Flyway in any one 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 1997-98 survey was higher than the previous 5 years (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 the average at 29% and 16.9% respectively (Fig. 4, Table 3).

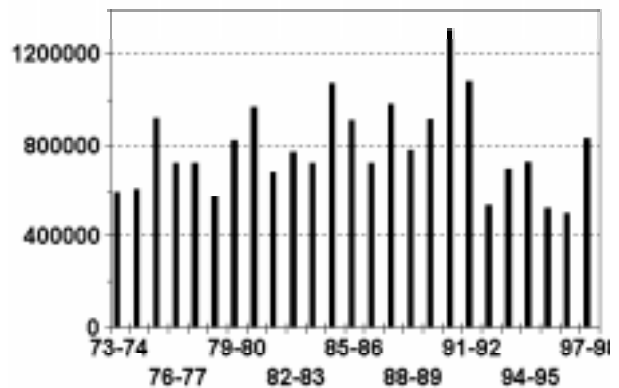


Fig. 3. Wash. midwinter duck survey.

Table 3. Washington Department of Fish and Wildlife annual waterfowl inventory - January 1998.

SPECIES	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	98 VS 97	89-97 Av.	98 to Av
Mallard	485948	594709	861433	764514	211497	421864	419005	310724	240838	547134	127%	478948	14%
Gadwall	5674	5232	5908	4528	2218	4556	2565	3165	6304	7482	19%	4461	68%
Wigeon	96074	116486	175887	101733	81998	95801	116748	73771	68478	117536	72%	102997	14%
GW Teal	15355	14857	8361	11466	8612	11834	18247	10993	7121	6729	-6%	11872	-43%
Bw/Cn Teal	0	45	0	100	19	54	425	0	0	0	ERR	71	-100%
Shoveler	1236	1151	1149	1681	571	1060	1305	2310	1313	3100	136%	1308	137%
Pintail	78612	74837	141149	62813	38361	35896	56808	48227	39156	43763	12%	63984	-32%
Wood Duck	240	24	90	105	48	381	454	162	30	72	140%	170	-58%
Redhead	1354	5036	5077	4014	4673	3744	6779	1517	6782	2495	-63%	4331	-42%
Canvasback	4041	3517	4352	2423	3439	1401	2941	4673	6115	6261	2%	3656	71%
Scaup	15943	20743	43477	25685	39719	26590	40644	32261	36545	28684	-22%	31290	-8%
Ringneck	6553	3780	4188	3709	6526	1419	5456	4314	3782	3327	-12%	4414	-25%
Goldeneye	13430	9365	16572	15730	19277	16910	22360	19663	16951	12894	-24%	16695	-23%
Bufflehead	7313	13611	12421	24750	51571	21317	26724	19441	20818	14780	-29%	21996	-33%
Ruddy Duck	2558	2516	1865	2039	1918	3588	3372	4248	3417	2712	-21%	2836	-4%
Eider	2	0	0	0	0	0	0	0	0	0	ERR	0	-100%
Scoter	34285	40060	27326	42356	30165	23952	35437	26059	26939	21386	-21%	31842	-33%
Oldsquaw	121	166	467	162	464	356	1550	636	1046	575	-45%	552	4%
Harlequin	170	8	91	164	507	750	884	1077	909	791	-13%	507	56%
Merganser	9256	7346	5757	9099	10282	11212	10971	9830	7039	5750	-18%	8977	-36%
Unidentified Ducks	836	1210	2289	4496	19468	16336	8338	8064	4304	7364	71%	7260	1%
Snow Goose*	36084	15062	32054	21855	30912	34867	36681	32340	44441	42666	-4%	31588	35%
White-fronted Goose	2	0	2	0	0	2	2	25	20	1	-95%	6	-83%
Canada Goose	82549	79527	86658	113333	65248	90780	67383	76884	47901	95444	99%	78918	21%
Black Brant	18538	13756	16221	13505	13054	13595	20308	7082	9753	10881	12%	13979	-22%
Tundra Swan**	2101	939	2248	3209	883	2616	1332	4118	3211	3424	7%	2295	49%
Trumpeter Swan**	962	183	1263	308	55	171	75	3017	2817	2352	-17%	983	139%
Unknown Swan**	0	626	124	113	575	129	251	85	103	371	260%	223	66%
Coot	33549	19478	28152	43690	36341	33378	52746	59652	64956	58199	-10%	41327	41%
TOTAL	952549	1044277	1484585	1277581	642060	841181	959791	764338	671089	1046173	56%	959717	9%
10 YEAR AVERAGE	956149	964390	1002966	1076387	1049413	1050720	1021192	1004344	863745	863745			
*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	-3%	38797	14%

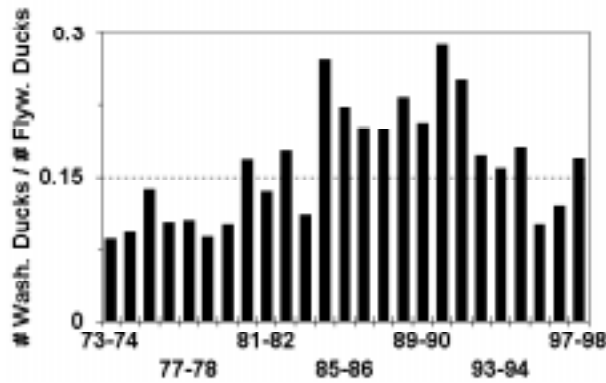


Fig. 4. Proportion of Pacific Flyway ducks during midwinter survey

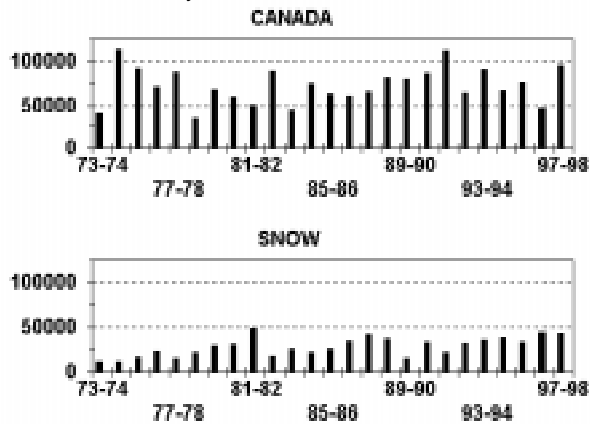


Fig. 5. Geese in Wash. In midwinter.

*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.

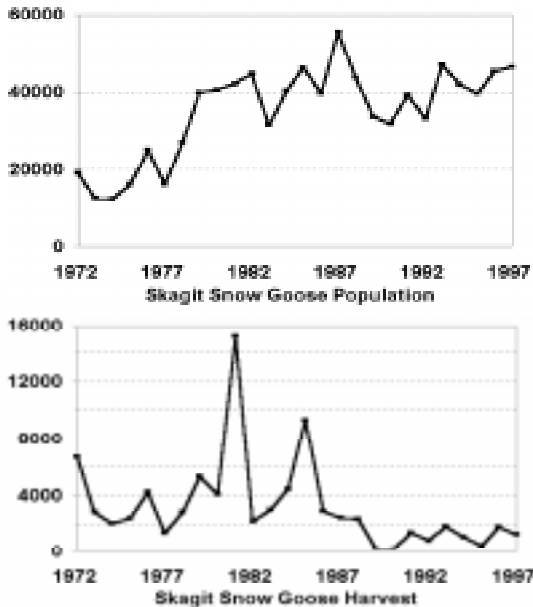


Fig. 6. Skagit snow goose population and harvest.

Canada geese are not well represented in midwinter surveys because geese feeding in fields are not easily surveyed. 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 461,790 was the second highest on record. The 1997-98 count was the highest on record at 484,175. 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, 6) have been dynamic with no discernable trend. Washington's snow geese have increased slightly during 5 of the last 6 years (Figs. 5, 6). This years count at 46,364 was the highest since 1993-94. Washington's brant survey was below the long-term average at 10,881 but higher than the previous two years (Fig. 7).

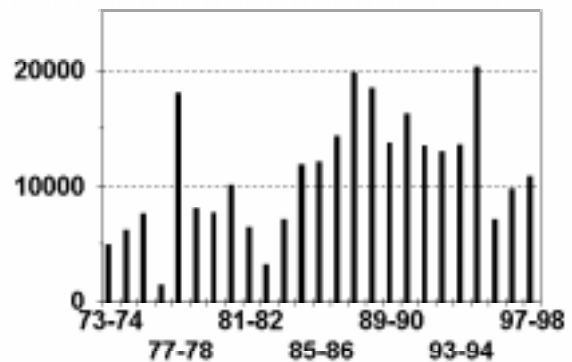


Fig. 7. Brant in Wash. in midwinter.

Traditional Aerial Surveys

Aerial waterfowl surveys in northern Puget Sound were accomplished by WDFW (Table 4). Surveys in the Columbia Basin were conducted cooperatively between USFWS and WDFW. The highest count in the Columbia Basin occurred during the December with 378,485 waterfowl. The highest count in Northeastern Puget Sound occurred during the December survey with 234,565 dabbling ducks.

Snow goose number from photo counts was 47,686 (Table 5). Prior to the hunting season 19.2% 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

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 Basin¹				
	Oct. 22	Nov. 20	Dec. 9	Jan. 5
Mallard	22,739	256,124	286,215	320,060
Total Ducks	86,625	301,524	363,932	356,610
Total Geese	22,731	9,815	14,352	27,716
Total Swans	23	182	201	99
Total Waterfowl	109,402	311,521	378,485	384,425
Northeastern Puget Sound²				
	Oct. 16	Nov. 6	Dec. 1	Jan. 6
Mallard	54,694	92,205	97,055	90,259
Northern pintail	48,356	34,390	44,140	26,413
American wigeon	18,771	44,355	88,540	70,984
Green-winged teal	6,649	5,710	4,830	1,209
Dabbling Ducks	128,470	176,660	234,565	188,865
Brant		22	12	760
Snow Goose Photo Counts				
	Skagit/Snohomish	Fraser	TOTAL	
Nov. 11	16,180	31,506	47,686	
Dec. 3	22,295	24,688	46,983	
Jan. 21	42,666	1,418	44,084	
Feb. 2	2,396	43,964	46,360	

¹Includes Northern Columbia Basin only, not Tricities or Yakima area.

²Includes coastal areas from northern Port Susan Bay to the Canadian border.

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 a mandatory hunter report cards. Dusky Canada goose harvest is counted at mandatory hunter check stations.

The waterfowl harvest was separated by WDFW regions (Table 7, Fig. 8). The largest harvest was in Region 2 (38%), followed by Region 3 (20%), and Region 4 (16%).

Table 7. Waterfowl harvest by regions.

Region	Ducks & Geese	
	Harvested	% of State Total
Region 1	88,735	13.1
Region 2	255,519	37.7
Region 3	138,414	20.4
Region 4	106,736	15.8
Region 5	55,683	8.2
Region 6	31,789	4.7
Total	676,976	100.0

The old WDFW Region with the highest harvest has traditionally been old Region 2. With the new regional boundaries, the new Region 3 will have the higher harvest in years with more severe winter weather. The previous winter, which was exceptionally cold, produced a larger harvest in

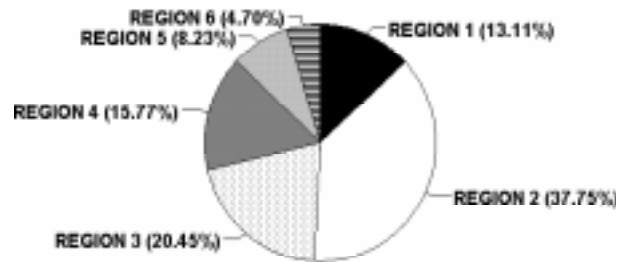


Fig. 8. Waterfowl harvest by regions.

Region 3.

The 1997-98 duck harvest of 676,976 was higher than in 1996-97, which was 427,732 (Fig. 9). The harvest in Washington has declined steadily from over 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. Mallards made up 53.3% of the harvest and wigeon are a distant second at 13.0% (Table 6).

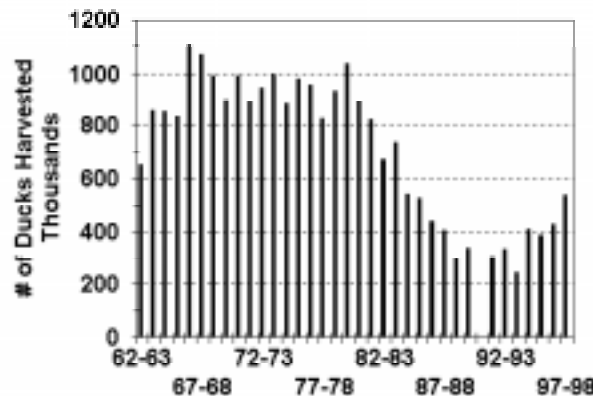


Fig. 9. Washington duck harvest.

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 contributed to the increased large goose harvest. The harvest of large Canada geese has been on an increasing trend since the early 1960's and reached its peak this year at 37,799 in 1997-98; this year it was 32,932. However, the harvest of small Canada geese has declined from 47,270 in 1979-80 to 14,284 in 1995-96. Small goose harvest increased from the previous year to 24,649. Reasons for the decline in small goose harvest are 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.

Table 5. Snow goose population and harvest summary.

Year	% Young			Estimated Population	Harvest				
	Preseason	Postseason	Harvest		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				

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 6. Waterfowl harvest by species in Washington (1996-97).

Species	# Harvested	% of Total
Mallard	327,684	53.3
Northern pintail	34,853	5.7
American wigeon	79,701	13.0
Green-winged teal	61,553	10.0
Other ducks	111,118	18.1
Total Ducks	614,909	100.0
Large Canada	32,932	53.1
Small Canada	24,649	39.8
White-fronted	432	0.7
Snow	785	1.3
Total Geese	61,967	100.0
TOTAL WATERFOWL	676,876	

¹The 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
Permits Issued	490	654	747	1194	1069	1207	1445	1331
Hunters	338	330	319	496	287	343	254	197
Days (Successful)	763	647	709	765	484	552	549	326
Harvest								
Skagit	808	790	950	1347	825	918	1493	597
Whatcom	0	3	9	7	0	0	0	0
Pacific	73	52	18	53	23	44	41	59
Total	881	845	977	1407	848	962	1534	656

Snow goose harvest report summary.

Permits Issued	2298	2588	2313	2363	2795
Hunters	572	433	221	427	424
Days (Successful)	1096	664	373	996	812
Harvest					
Island	58	60	57	39	38
Skagit	677	496	99	381	545
Snohomish	1124	522	331	1400	749
Total	1859	1078	487	1820	1332

These figures are based on analysis of mandatory harvest report returns, corrected for nonresponse bias.

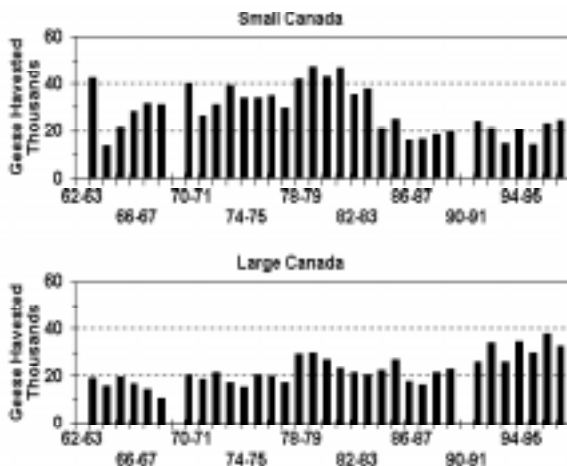


Fig. 10. Wash. Canada goose harvest.

The snow goose harvest in Washington is highly variable (Fig. 6). Harvest of snow geese in Washington has been on a negative trend since the mid-1980's and related to limited recruitment. There was a slight drop in harvest this year, to 1,332 (mandatory punch 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 (Fig. 6) does not follow the number of geese counted in Washington during the midwinter count (Fig. 6).

The brant harvest in Washington steadily increased from 1986-87 (Fig. 11). Harvest dropped this year to 656. The number of brant counted during the Washington midwinter

survey was 10,881 which is down from the long-term average (Table 3). It is uncertain whether the long-term decline represents a population decline or a shift in wintering areas.

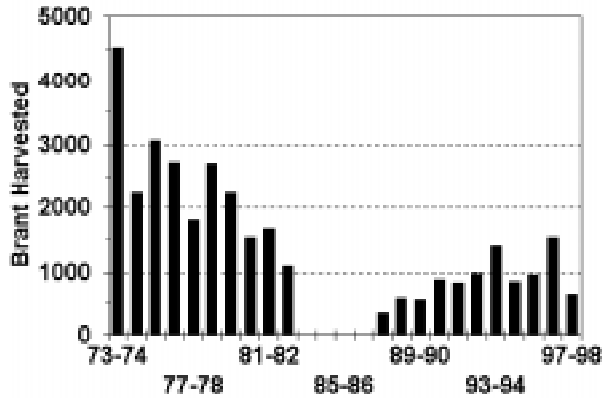


Fig. 11. Washington brant harvest.

The Washington hunter survey estimates the number of waterfowl hunters (Fig. 12). During the 1997-98 season an estimated 41,686 hunters participated in the waterfowl season,

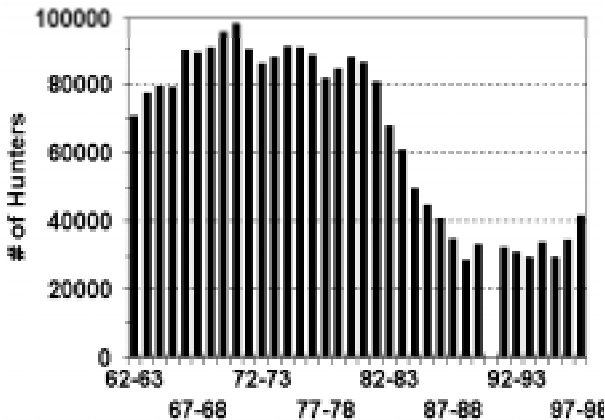


Fig. 12. Washington waterfowl hunters.

which was up 21% from last year. There was a steady decline in hunters through the 1980's. Hunter numbers have been increasing over the last 3 years (Fig. 12). The average number of ducks harvested per hunter in 1997-98 was 12.90, which was above the long-term average. The average number of waterfowl harvested per hunter per year has not decreased over the last 20 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.

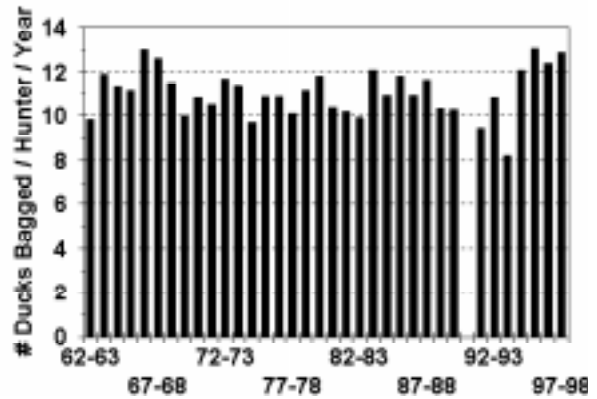


Fig. 13. Duck hunter success rate.

Members of the hunting public often believe the decline in hunter numbers is a result of the restrictive regulations that 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 were obtained from field observations in Northern Puget Sound are shown in Table 8.

Table 8. Age ratios from northern Puget Sound.

Species	Date	Sample size	% Juveniles
Brant	Preseason	1849	10.2%
Brant	Post-season	496	7.7%
Snow Geese	Pre/during season	4000	19.2%
Snow Geese	Post-season	6000	16.2%
Tundra Swan	1/28-2/5/98	1816	10.9%
Trumpeter Swan	1/28-2/5/98	298	15.5%

Species

Wild Turkey

Statewide

Prepared by: **Dave Ware, Upland Game Section Manager**
Clifford G. Rice, Game Surveys Coordinator

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 30 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.

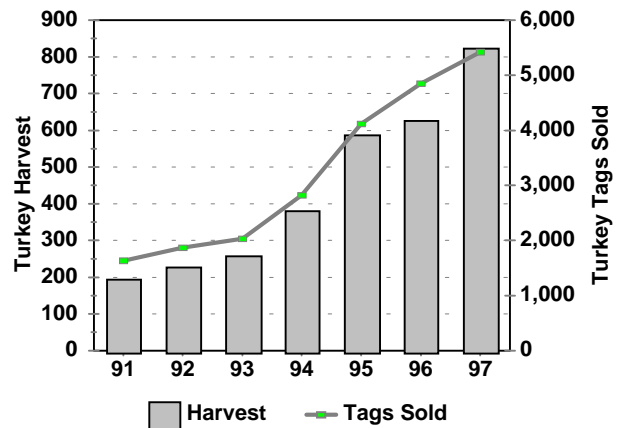
Beginning in 1995, hunters could kill one bearded turkey per day from each of three subspecies for a total of three per year. Subspecies are defined by county of kill. Multiple tags could only be purchased prior to the spring hunting season. After the spring season starts, only one turkey tag may be 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.

Harvest has increased each year as hunter numbers increase (Figure 1). An average of about 700 turkeys have been harvested for the past two spring seasons and there were over 5,400 turkey hunters in 1997. 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). From 1992 to 1996, harvest has averaged over 400 turkeys per year.



Population Status And Trend Analysis

In the Blue Mountains,, 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.

Table 1. Turkey harvest by county in the Blue Mountains..

County	1992	1993	1994	1995	1996	1997
Asotin	9	8	22	25	16	16
Columbia	31	23	50	62	67	74
Garfield	22	22	23	21	10	9
Walla Walla	3	12	13	42	17	26
Whitman				1	3	7
Total	65	65	108	151	113	125

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 2). 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

Table 2. Turkey harvest by county in northeastern Washington.

County	1992	1993	1994	1995	1996	1997
Ferry	12	12	29	36	33	62
Pend Oreille	0	1	3	4	18	7
Spokane		1	0	3	9	16
Stevens	22	36	61	130	150	277
Total	34	50	93	173	210	346

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. Eight turkeys were released in Douglas County 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.

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 3).

Table 3. Turkey harvest by county in central Washington.

County	1992	1993	1994	1995	1996	1997
Grant	0	4	0	0	0	1
Lincoln	31	40	57	104	101	157
Total	31	44	57	104	101	158

This turkey population also continues to expand and should provide high harvests depending on weather. These birds have greater access to wheat stubble during winter and may not be as dependant on pine seed production and winter conditions as parts of northeastern Washington appear to be.

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, 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 4).

Table 4. Turkey harvest in Okanogan County.

County	1992	1993	1994	1995	1996	1997
Okanogan	10	12	17	12	22	10

This appears to be a small, but stable population. The lack of grain farming in the area may be limiting population growth.

On the east slope of the Cascades there were several unsuccessful early attempts to establish wild populations of turkeys in Yakima County between 1913 and 1931. In all, 94 turkeys were released according to early records. It is important

to remember that most of 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 still no population was established.

In the mid-1960s Merriam's turkeys were trapped from Stevens and Spokane counties and released on the Colockum Wildlife Area in Kittitas County and on the Swakane Wildlife Area in Chelan County. Only 4 birds were released on the Colockum and 12 on the Swakane Wildlife Area. These releases also proved to be unsuccessful.

More recent releases occurred in this east-slope Cascade area beginning in 1984. Thirty eight Rio Grande turkeys were released in Yakima County in 1984 and 1985 and 28 in Chelan County in 1985. Only 2 turkeys have been harvested in the last 4 years in this area (Table 5), indicating that it has not seen the same success as turkey introductions in other areas of Washington.

Table 5. Turkey harvest by county on the east slope of the Cascades.

County	1989	1990	1991	1992	1993	1994	1995	1996	1997
Chelan	0	0	0	3	1	0	0	0	0
Kittitas			0	1	0	0	0	0	0
Yakima			3	3	3	0	1	0	1
Total	0	0	3	7	4	0	1	0	1

Although pockets of Rio Grande habitat occur throughout this area, the habitat may be better suited for the Merriam's subspecies overall. A more thorough evaluation of the suitability of this area for Merriam's turkeys will be conducted in 1999.

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 1960s, 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 records indicate that this has been a successful strategy (Table 6).

Table 6. Turkey harvest by county in south-central Washington.

County	1989	1990	1991	1992	1993	1994	1995	1996	1997
Klickitat			73	62	66	83	109	140	121
Skamania			3	5	0	3	3	5	2
Total	39	78	76	67	66	84	112	145	123

The south-central turkey population appears to be very stable. Recent increases in harvest may be tied to improved weather conditions in combination with additional brood stock released in the late 1980s.

From 1925 to 1931 several documented turkey releases were made throughout western Washington. Most releases were small except releases in San Juan County of over 35 birds in three different releases over six years and Clark County with 50 birds released in two different years. In the early 1960s, turkeys were also released on Protection Island in Jefferson County, and then Orcas Island in San Juan County. These Protection Island birds were most likely of the Rio Grande subspecies because they came from game farm stock that originated in Texas.

The Department of Game trapped Merriam's 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. Exceptions include San Juan Island and a few reported turkey sightings continue on Bangor and Orcas Island.

In 1987 the Department of Wildlife began releasing Eastern wild turkeys in Lewis County and in 1988 in Pacific County. A total of 17 birds were released in Lewis County and 13 in Pacific County. Additional Easterns were released from 1989 to 1992. Nineteen were released in Thurston County; 18 in Pacific County; 15 in Grays Harbor County; 31 in Lewis County; and 39 in Cowlitz County. Subsequently, in 1993 and 1994 a few additional (>10) turkeys were trapped in Pacific County and released in Cowlitz and Grays Harbor counties. In 1996, 10 birds were trapped in Pacific County and moved to Grays Harbor (5), and Thurston (5) counties. In 1997, an additional 12 turkeys were brought in from Iowa and eight were trapped in Pacific and Cowlitz counties and released in Wahkiakum County. One hundred Iowa turkeys were released in 1998; at a new site in Snohomish County, to augment 2 populations in Wahkiakum County; and at other sites in Thurston and Pacific counties.

Turkey harvest in western Washington has increased over the past 7 years (Table 7) as a result in of the recent releases and increasing hunter effort.

Table 7. Turkey harvest by county in western Washington.

County	1992	1993	1994	1995	1996	1997
Cowlitz	0	0	7	9	12	12
Grays Harbor	1	0	0	1	0	1
Lewis	7	5	5	7	4	7
Pacific	1	1	0	7	3	3
San Juan	0	5	0	1	0	1
Snohomish	0	0	0	1	0	0
Thurston	3	5	7	5	7	13
Total	12	16	19	31	26	37

The western Washington turkey harvest continues to increase. However, population expansion has been slower than in other parts of Washington due in part to the difficulty of obtaining a large number of this subspecies for release.

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.

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.

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.

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

Region 1

Wild Turkey

Northeast, Southeast and Central Districts

Prepared by: G J Hickman, District Wildlife Biologist

Population Objectives/guidelines

The purposes of turkey management in Region 1 are to provide a population for aesthetic appreciation and for recreational harvest. Wild turkey are not native to Washington State. The current expanding population is being maintained by an aggressive WDFW trapping and transplanting program by the Upland Restoration program.

Hunting Seasons And Harvest Trends

Hunting seasons for wild turkey are currently a 31 day spring season. The statewide spring season, April 15 through May 15, was established in 1994. Beginning in 1995, hunters could kill one bearded turkey per day from each of two subspecies for a total of two per year in Region 1. Multiple tags may be purchased prior to the spring season, but after the spring season begins, only one turkey tag may be purchased. There is a limited fall season in the Blue Mountains for Advanced Hunter Education graduates.

Harvest has increased each year as hunter numbers increase. In 1997, 526 wild turkeys were harvested in the two northern districts of Region 1, this up from 314 taken in 1996 (Tables 1 and 2).

Table 1. Turkey tag sales.

Year	1989	1990	1991	1992	1993	1994	1995	1996	1997
Tags	791	1,247	1,632	1,868	2,029	2,820	4,119	4,852	5,423

Table 2. Turkey harvest by county 1997.

County	Spring	Fall	Total
	season	season	
Asotin	16	0	16
Columbia	65	9	74
Ferry	62	0	62
Garfield	9	0	9
Lincoln	157	0	157
Pend Oreille	7	0	7
Spokane	16	0	16
Stevens	277	0	277
Walla Walla	26	0	26
Whitman	7	0	7
total	642	9	651

Some hunting areas are becoming so popular that hunter crowding and safety are becoming a concern on opening day and weekends.

Population Status And Trend Analysis

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 3). 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. Although Spokane County is not identified as a major turkey transfer management area because of urbanization in this county, surveys for elk have regularly encountered turkey in the Mica Peak area. Pend Oreille County has become not only a major area for transfer of trapped Merriams subspecies but, also an important area for spring gobbler hunting (Tables 2 and 3).

Table 3. Turkey trap and transfer records.

Year	Sub-Species	Source	#	Release
		County		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 Oreille
97/98	Merriam's	Spokane	32	California
97/98	Merriam's	Stevens	70	Ferry
97/98	Merriam's	Stevens	68	Pend Oreille
97/98	Merriam's	Stevens	13	Klickitat

Augmentation/Habitat Enhancement

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 (Table 3) and to trade with other states in cooperative conservation projects.

The Upland Wildlife Habitat Restoration program continues 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.

Management Conclusions

The populations of wild turkey in Region 1 continue to increase with management efforts by WDFW. Hunter interest and harvest have increased each of the past ten years. The release of wild turkeys in Pend Oreille 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.

Species

Wild Turkey

Okanogan County

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

Population Objectives/guidelines

The goal of the turkey introduction program is to provide additional hunting opportunities, by establishing self sustaining populations that support a sustainable harvest, particularly on WDFW lands. Seasons are designed for conservative harvest in an effort to encourage population expansion.

Hunting Seasons And Harvest Trends

Hunters pursued turkeys in Okanogan County during the statewide spring season from April 15 to May 15. Most harvest occurs on or near the WDFW Chiliwist Wildlife Area. Spring weather was cool and moist, and hunting conditions were generally favorable. The winter of 1996-97 was particularly hard on a variety of other game birds, and probably reduced turkey numbers as well. Harvest in 1997 dropped to a six year low (Fig. 1).

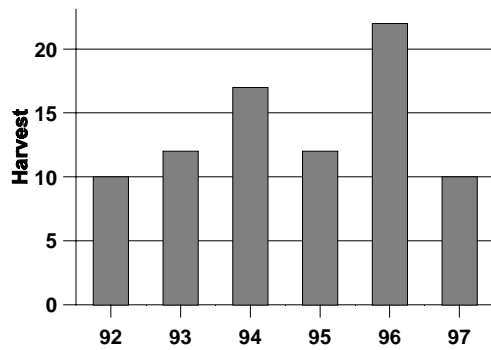


Figure 1. Wild turkey harvest in Okanogan County

Population Status And Trend Analysis

Earlier releases of Merriams turkeys in the Okanogan County in the 1960s and 1980s apparently failed. Releases of Rio Grande turkeys on the Chiliwist Wildlife Area have been more successful. Until recently, sustained harvest in this area indicated that the population was probably stable or increasing slowly. The population likely declined as a result of the 1996-97 winter; however the mild winter of 1997-98, and the favorable spring conditions that followed, should help foster a population rebound. No population estimate has been calculated for the Okanogan County turkey population.

Habitat Condition And Trend

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.

Management Conclusions

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.

Species

Wild Turkey

Southwest Washington

Prepared by: **Frederick C. Dobler, Regional Wildlife Program Manager**

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 12 years, an aggressive release project has been conducted by the Department of Fish and Wildlife. Three subspecies of turkeys were introduced throughout Washington.

In the Southwest Region (Region 5), Merriam's turkey were released in Klickitat and the eastern subspecies were introduced in Cowlitz and Lewis counties.

Current operations are focused on translocation of turkeys as a landowner incentive to enhance wildlife habitat and to provide additional hunting opportunities on public lands (i.e. Wildlife Areas). This activity is being implemented through the Upland Wildlife Restoration Program, and by using volunteers. 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 with date, location, sex, and age of harvested birds. The reporting rate is estimated at 70% so harvest is projected by expanding reported harvest by 30 %.

Hunting seasons for wild turkeys have varied from a two day, fall season in 1965 to the current 31 day spring season statewide and four days 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 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 to be 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.

Harvest has increased each year as hunter numbers increase (Tables 1 and 2). It is estimated that over 800 turkeys were harvested from Washington in 1997. The exact number of turkey hunters is not known since some hunters purchase more

Table 1. Turkey harvest by county.

Year	Klickitat	Skamania.	Total
1997	121	2	123
1996	140	5	145
1995	109	3	112
1994	83	3	86
1993	66	0	66
1992	62	5	67
1991	73	3	76
1990			78
1989			39
1988			40

Table 2. Turkey harvest by county.

County	1992	1993	1994	1995	1996	1997
Cowlitz	0	0	7	9	12	12
Lewis	7	5	5	7	4	7
Total	7	5	12	16	16	19

than one tag, but the 5,423 tags sold in 1997 certainly reflect an increase in both hunter effort and numbers (Table 3). In 1987, just prior to full implementation of the turkey augmentation activity of the late 1980s, hunter numbers were down to a low of 428, and turkey harvest averaged 65 birds per year (from 1983-1987).

Table 3. Statewide turkey tag sales.

Year	1993	1994	1995	1996	1997
Tags	2029*	2820	4119	4652	5423

Population Status And Trend Analysis

Klickitat county was one of the first areas in Washington where several early attempts were made to establish a population. These releases 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 three years (1995-1997) is above 120 birds.

The south-central turkey population appears to be stable. Recent increases in harvest may be tied to improved weather conditions in combination with the additional brood stock released in the late 1980s.

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-on 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 4.

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 4. Eastern wild turkey trap and transfer records 1992-1998

Year*	No. Males	No. Females	Release County	Release T/R/S
1992-T	2	5	Cowlitz	T10-R2-S2
1992-T	1	0	Cowlitz	T7-R1-S31
1994-P	0	1	Cowlitz	T10-R1-S14
1997-I	2	0	Wahk.	T8-R5-S13
1997-I	3	7	Wahk,	T8-R6-S2
1997-P	1	4	Wahk,	T8-R5-S13
1997-C	1	2	Wahk.	T8-R5-S13
1998-I	2	8	Wahk,	T8-R5-S12

* The letter following the year refers to county origin:

T-Thurston, P-Pacific, C-Cowlitz, I-Iowa (Shipped from state of Iowa by the Wild Turkey Federation).

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.

Habitat Condition And Trend

Winter conditions in the eastern portion of Klickitat County 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.

Management Conclusions

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.

Species**Region****Wild Turkey****6****Prepared by: H. M. Zahn, District 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 12 years, an aggressive release project has been conducted by the Department of Fish and Wildlife. Three subspecies of turkeys were introduced throughout Washington.

In the Coastal Region (Region 6) turkeys of the eastern subspecies have been introduced into portions of Grays Harbor, Pacific and Thurston counties.

Current operations are focused on translocation of turkeys as a landowner incentive to enhance wildlife habitat and to provide additional hunting opportunities on public lands (i.e. Wildlife Areas). This activity is being implemented through the Upland Wildlife Restoration Program, and by using volunteers.

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 with date, location, sex, and age of harvested birds. The reporting rate is estimated at 70% so harvest is projected by expanding reported harvest by 30%.

The current statewide spring season (April 15 to May 15) is the only turkey season in Region 6.

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 to be 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.

Regional turkey harvests have gradually increased in recent years reflecting positive recruitment rates as well as additional releases (Table 1).

Table 1. Turkey harvest by county.

Year	Grays Harbor	Pacific	Thurston
1997	1	5	13
1996	1	4	7
1995	1	7	5
1994	0	0	7
1993	0	1	5
1992	1	1	3

Population Status and Trend Analysis

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. Following the initial release of 13 birds additional birds were released in Pacific as well as Grays Harbor and Thurston counties. Gradually increasing harvest as well as observation of birds suggests that the birds are adjusting well to their new environments.

Habitat Condition And Trend

Winter conditions in the coastal area are generally mild and no winter mortality has been documented. No adverse habitat trends relative to turkeys are anticipated.

Management Conclusions

Turkeys are still a minor species on the palette of game species available to the hunters in the coastal region. However, the gradual increase in harvest observed in recent years suggests that this need not always be so. To this and additional releases of birds are planned for the 1998/99 period.

Species

Pheasant

Statewide

**Prepared by: Dave Ware, Upland Game Section Manager
Clifford G. Rice, Game Surveys Coordinator**

Population Objectives/guidelines

Pheasants were introduced around the turn of the century and took advantage of the newly developing agricultural landscape. They are most numerous in the irrigated Columbia and Yakima river basins and in wheat farming areas along the Snake River and its tributaries where annual rainfall exceeds 15 inches per year.

The primary objective for all pheasants is to maintain healthy well distributed populations and to provide appropriate levels of hunting recreation.

Hunting Seasons And Harvest Trends

The hunting season structure for pheasants has not changed since 1984 when a split season structure was eliminated. The daily bag limit has never changed significantly except when one hen pheasant was allowed in the daily bag. The last hen season was in 1965.

Pheasant harvest and hunter numbers hit an all time low in 1995, but increased over the last 2 years (Fig. 1) while harvest per day has fluctuated between 0.5 and 0.6 in recent years.

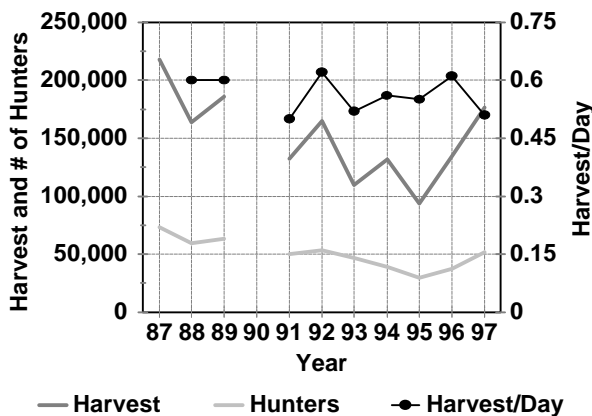


Figure 1. Pheasant harvest, number of hunters, and harvest per day for Washington State.

Surveys

Three survey techniques have been used recently to monitor population trends in pheasants. They are sex ratio counts, crowing (call) counts, and brood counts. All counts are conducted on long term, established routes.

Call count surveys show annual fluctuations that are influenced by winter mortality and previous year's production. Brood surveys also fluctuate each year mostly dependant on weather during the peak of hatch in late May and early June. Neither survey indicates much of a trend in the 1990s.

Long term call and production surveys show significant declines from the late 1970s and early 1980s into the 1990s. While long term declines are attributed to loss of habitat through changing farming practices, some of the decline in this time period is also due to a combination of severe winters and poor production. Severe winters occur periodically even during population increases, but can be mitigated by good production. However, from 1987 to 1994 the state was in a drought and production was poor most of the time. Recent increases in the number of pheasant seen per day in Regions 1 and 2 (Fig. 2) may be a consequence of the drought ending.

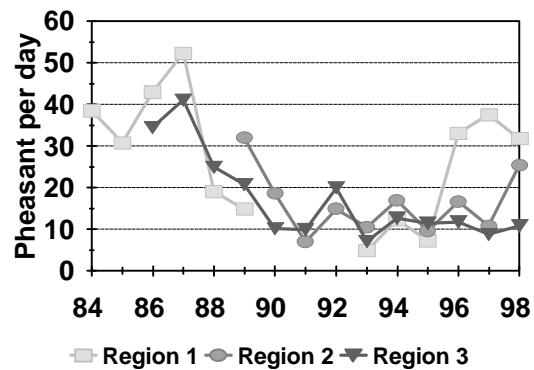


Figure 2. Mean number of pheasants seen per day during brood surveys in each Region of eastern Washington.

Population Status And Trend Analysis

While calls per station continues to fluctuate, production in the Snake River Basin has been excellent for the past two years. This basin escaped most of the severe winter that was experienced in the remainder of eastern Washington, so broodstock levels were relatively high. Good broodstock levels combined with good production has resulted in the one of the highest pheasant populations for many years.

The pheasant population in the Columbia Basin appears to be stable, but at a lower level than occurred here historically. The maturity of the Columbia Basin irrigation project and technological and cultural improvements in farming have resulted in reduced habitat quality than occurred in the Basin in the 1960s and 1970s.

Production was down significantly in the Yakima River Basin in 1997. This area has habitat problems associated with a change from row crops such as wheat and corn to orchards, vineyards, and hops, which do not provide good pheasant habitat. The long term prospects for pheasants are not good in the Yakima Basin due to plans for irrigation system improvements which will result in reduction of habitat along

canals and drains.

Habitat Condition And Trend

Habitat conditions in southeast Washington have improved recently with the U.S. Department of Agriculture's Conservation Reserve Program. Thousands of acres of farmland have been "set aside" from production. Most of this land was seeded to grass. This improved habitat along with the end of the drought allowed populations in this area to improve dramatically since 1994. The new farm bill has changed the requirements for CRP, but lands in this part of Washington continue to qualify.

The most significant habitat impacts in southeast Washington occurred earlier in the century. This may help explain why the harvest decline is not as great in this part of the state as in the Columbia and Yakima basins. In addition, call count surveys indicate that pheasant breeding population levels have also been more constant in southeast Washington. The prognosis for southeast Washington may be better at this point than other parts of the state's primary pheasant habitat.

Habitat conditions in the Yakima basin have changed significantly in the past several years as a result of changes from row crops to orchards, vineyards, and hops. This is in addition to habitat changes throughout irrigated agriculture (including the Columbia Basin) in terms of farm machinery, irrigation systems, cultural techniques, and pest control. The small grain fields divided by weedy fence lines, irrigation ditches, and field borders are generally gone. Farm machinery improvements and advances in crop genetics have allowed faster, more frequent harvesting of hay crops and more efficient growing and harvesting of grains. Pesticide use has become more effective at eliminating vegetative and insect pests. The result of all these farming improvements for pheasants is extensive loss of habitat and important food sources.

Augmentation/habitat Enhancement

Habitat enhancement and landowner relations activities are being conducted through WDFW's Upland Wildlife Restoration

Program. This program is largely financed by federal funds including mitigation funding for habitat lost by Snake River dam construction and impoundment. Over 5000 acres of habitat in southeast Washington have been enhanced through the Restoration program.

A significant amount of the better pheasant habitat in the Yakima basin occurs on Yakima tribal lands. WDFW's Upland Wildlife Restoration Program concentrates on habitat enhancements outside of tribal lands in the Yakima River basin. Most Restoration activities occur on private land adjacent to cropland or lands set aside for agricultural conservation programs. In addition, key habitat along the Yakima River has been acquired with plans being developed for additional land acquisition in the future.

Habitat acquisition has been the main focus of the Restoration Program in the Columbia Basin. Over 2,000 acres of habitat have been enhanced and are providing benefits for pheasants. Future efforts will continue to emphasize habitat purchase, protection, and enhancement.

Management Conclusions

The number of upland bird hunters has plummeted in recent years. The main thing that would encourage more hunters is better upland game populations. The greatest draw for upland bird hunting continues to be pheasants. It is very likely that pheasant hunter participation also drives the number of other upland game hunters. There have been several recent proposals seeking to fund additional habitat acquisition, habitat enhancement, and the release of game farm pheasants to improve hunting success and pheasant populations. It will take the concerted effort of several such proposals to maintain pheasant hunting recreation over time.

WDFW's Upland Bird Management Plan is now ten years old. This plan is scheduled to be updated. Several of the issues discussed in this status report will be addressed during the development of the new plan.

Species

Pheasant

Region 1

Prepared by: Pat Fowler, District Wildlife Biologist

Population Objectives/guidelines

The long term objective is to increase pheasant populations to historic levels that occurred in the 1960s through habitat development and enhancement.

Hunting Seasons And Harvest Trends

The eastern Washington general pheasant season started at noon on October 11 and closed December 31, 1997, for a total of 81.5 days of hunting opportunity. In addition, a juvenile season ran for two days; September 27-28. The bag limit was 3 cocks per day.

The pheasant harvest in Region 1 peaked in the 1960s with an average of 121,422 pheasants harvested per year. The harvest has continued on a downward trend for the last 25 years. Compared to the 1960s, the ten year average harvest in the 1970s declined 15% to 103,359 pheasants/year, 30% in the 1980s to 84,540 pheasants/year, and 66% to 41,728 pheasants/year during the 1990s (Figure 1.). The Regional pheasant harvest in 1997 increased 31% over 1996, and 70% over the 1990-96 average. The significant increase in the 1997 harvest may be a result of increased pheasant production and hunter participation.

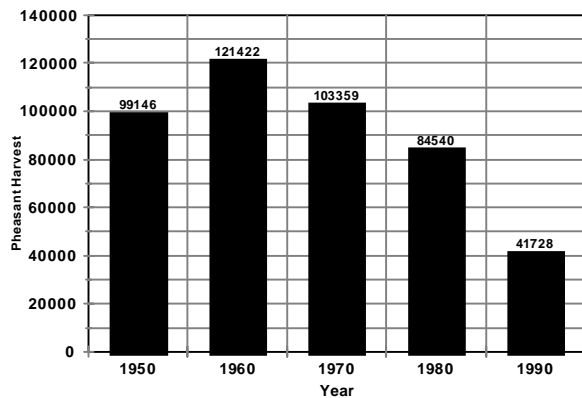


Figure 1. Region 1 Pheasant Harvest-Decade Average

Although hunter trend information is limited, over the last twelve years (1986-1997) the number of pheasant hunters in Region 1 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 (Fig. 2). What generated the sudden interest in pheasant hunting in 1997 is unknown, unless the re-implementation of the pheasant release program stimulated hunter interest.

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, lack of personnel, and weather have reduced the number of surveys done in Region 1. 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.

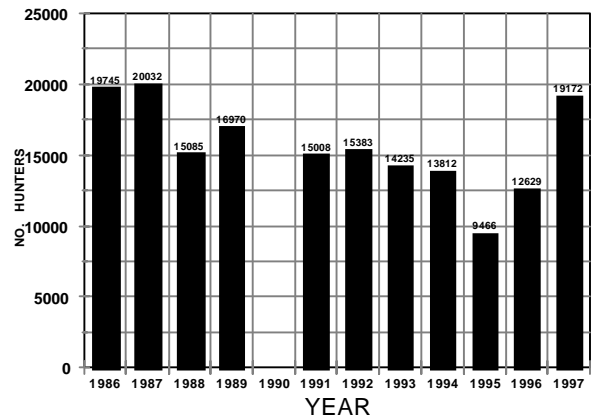


Figure 2. Pheasant Hunter Trend -Region 1

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 good information on the number of pheasants observed per survey (obs.-day), and the level of production for the year. However, these surveys

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

should probably be conducted after the wheat harvest (mid August) in order to survey pheasants when sightability conditions are optimal. Otherwise, data may not reflect the true population and level of production because fluctuations in sightability will occur due to the variability in timing of the wheat harvest from year to year.

Population Status And Trend Analysis

Based on surveys and harvest, pheasant populations have declined significantly over the last 25 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.

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 can result in very high mortality of young pheasants, decimating annual production.

Mild winters and fair nesting conditions in 1997 allowed the pheasant population in Region 1 to increase slightly.

Nesting conditions in 1998 were cool and wet, which definitely had a negative impact on nesting success and survival of young. In southeast Washington, 56 hens were counted with 36 broods indicating poor nesting success (64%). In good years, the number of hens with broods will reach 85-90%. Brood size was average at 4.5 young/brood.

For the Region, the number of pheasants observed per day on established routes declined 15% compared to 1997 (Table 2). Although production routes in southeast Washington show a decline of 18% in birds/observer day in 1998, two out of the three routes actually showed an increase of 82% in birds/observer day. The variability in pheasants observed per day between routes in southeast Washington is probably a

In Whitman County pheasant populations appear to have stabilized over the last three years.

Habitat Condition And Trend

Habitat conditions over the last 25 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 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 amount of acreage being accepted into the program. In the major pheasant areas of the southeast and central districts of Region 1, a total of 191,370 acres of CRP were enrolled under the current program. This program will provide large acreages of suitable habitat near agricultural crop lands, enhancing habitat conditions for pheasant over the next 8-9 years.

Augmentation/habitat Enhancement

The Upland Habitat Restoration Program has developed 5,501 acres of upland bird habitat in the southeast and central districts. The southeast district has developed 4,701 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.

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 1 are affected by numerous factors which hold the population below management objectives. Land development, changing agricultural practices, pesticides, and conflicts with other species may prevent significant increases in the pheasant population in the foreseeable future.

Acknowledgments

Personnel assisting in the collection of survey and habitat

Table 2. Pheasants per Observer day for Production Routes, Region 1

Survey Route	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Walla Walla	33.5	43.5	57.0	62.0	45.0	27.8	ns	ns	ns	23.0	12.7	12.3	83.3	102.5	42.0
Touchet	7.5	14.0	8.3		7.0	7.3	ns	ns	ns	4.5	6.3	6.3	12.0	18.5	23.0
Lambie Grade				29.8	16.0	14.8	ns	ns	ns	4.0	4.0	1.0	14.7	23.5	48.5
Hay	74.5	ns	67.5	65.3	8.3	5.0	ns	ns	ns	nd	26.7	nd	22.5	5.5	13.5
Average	38.5	30.8	43.0	52.3	19.1	14.9	ns	ns	ns	4.9	12.4	7.3	33.1	37.5	31.8

reflection of differences in nesting success and production in different areas. Production can be down in one area and up considerably in another area due to variations in weather patterns during the nesting season.

restoration data are Ted Johnson, Mark Grabski, Scott Rasley, Joey McCanna, Susan Nostrant, Steve Henry, and Bob Dice. Their assistance is greatly appreciated.

Species**Pheasant****Ephrata District****Prepared by: Jim Tabor, District Wildlife Biologist****Population Objectives/guidelines**

Population objectives for pheasants in the Columbia Basin include:

1. Maintain a viable population that will provide hunting opportunity and harvest.
2. Increase the population size above that of the past six years.

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 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 38% in the 10-year period from 1987 to 1996, but increased to slightly above 1987 numbers in 1997 (Table 1.) The number of hunters increased 67% from 1996 to 1997. The trend in hunter numbers is very similar for both counties.

Table 1. Number of pheasant hunters in Grant and Adams counties, 1987-1997.

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

Current season structure and bag limits are conservative. Even with the restriction of cock only harvest, sex ratios in the basin have averaged 2.7 hens/rooster in the past nine 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 189 cooperators with a total of 202,435 acres of hunting access in 1997. The Habitat Development Program had 41 parcels totaling 1,691 acres available to hunters.

Harvest estimates for pheasants in Grant and Adams counties were examined from 1984 through 1997. During this 14-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). Harvest trends have been similar in both counties.

Table 2. Number of pheasants harvested in Grant and Adams counties, 1984-1997.

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

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 0.70 in 1996 to a low of 0.40 in 1991. The 1997 success (0.47) was the second lowest since 1986.

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.

Table 3. Pheasant hunter success rate (number of pheasants harvested/hunter day) in Grant and Adams Counties, 1986-1997.

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

Six permanently established crowing count routes along farm roads and highways in Grant and Adams counties' irrigated farmland are normally surveyed twice annually (at least one week between surveys) during the period from April 25 to May 15. Only one route was surveyed in 1997. Surveys begin 50 minutes before sunrise and are completed within two hours. Routes are 19 miles long with listening stops at the starting point, end point, and one-mile intervals between. At each of the 20 stops the observer listens for two minutes and records the number of pheasant crows heard. Routes are not surveyed on mornings with rain or wind in excess of 6-8 mph. Stops with unavoidable excessive noise are omitted on specific surveys during which this condition occurs. The highest count of the two runs for each route is used for the index. 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.

Pheasant sex ratio surveys (counts) are made in farmland areas adjacent to the established crowing routes annually between March 15 and May 15. Counting effort is focused in April. Surveys are made the first 1.5 hours after dawn and the last hour before sunset. All pheasants observed during survey sessions are classified and recorded. Most observations are made from a distance of greater than 100 yards with the aid of binoculars and spotting scopes. Each flock is observed for several minutes if possible to increase the probability of seeing the less conspicuous hens. 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. This area was adjacent to the Warden crowing route.

The hen population index (broodstock index) is calculated by multiplying the number of hens/rooster by the mean number of rooster crows/stop.

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. Routes are

approximately 30 miles in length and follow established roads. Each route is surveyed once per week for three weeks beginning the fourth week of July and ending the second week of August. Surveys are conducted in either early morning (start at sunrise) or late afternoon (start 1.5 hours before sunset). Routes are driven at 25-30 mph or slower and observers stop when pheasants are seen. Observers record all pheasants seen including adult roosters, adult hens without broods, adult hens with broods, and chicks. When a brood is seen an attempt is made to count all chicks (flushing the brood if necessary and if possible) and estimate age in weeks. Data are summarized by observation day (i.e., 1 route surveyed 1 day) for each route and all routes combined and includes number of adult males, number of adult hens without broods, number of adult hens with broods, number of broods, number of chicks, and total number of pheasants. Mean brood size and percent hens with broods are calculated. The production index is the number of broods or chicks seen per observation day.

This report contains results of 1998 surveys for breeding population size (one area only) and production.

The 1998 index to the breeding population size (limited to the Warden area of the Basin) shows a 64% decrease in the number of roosters and a 36% decrease in the number of hens compared to that of 1997 (Table 4). This decrease can be explained in part by the poor production observed in 1997 and the reduced number of pheasants entering the winter. The winter of 1997-98 was abnormally mild and should have been Table 4. Pheasant breeding population indices for the Warden area of the Columbia Basin Irrigation Project, 1994-1998. (Data are from only 1 crowing route and 1 sex ratio sampling area).

		1994	1995	1996	1997	1998
Crows/Stop	Rooster Index	8.7	12.9	6.2	13.9	8.5
Hens/Rooster	Sex Ratio	2	2.7	1.8	3.1	3
Broodstock Index	Hen Index	17.3	34.8	11.3	40.5	25.8

conducive to good over-winter survival.

The pheasant production index for 1998 as measured by the number of chicks seen per observation day on six brood routes increased 167% from that of 1997 (Table 5). The increase occurred despite the fact that there was 36% fewer breeding hens in 1998 than in 1997. The increased production of chicks was clearly due to excellent nesting success and/or Table 5. Pheasant production index for the Columbia Basin Irrigation Project, 1989-1998.

Year	Broods/ Obs. Day	Chicks/ Obs. Day	Tot. Pheas./ Obs. Day	Percent Juveniles	Percent 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	1.6	8.2	10.8	76	59
1998	3.8	21.8	25.4	86	95

chick survival. Pheasant production in 1998 was 90% above the 1986-1997 average.

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. 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 8/section in 1997.

Habitat Condition And Trend

The winter of 1997-98 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 warm and dry compared to 1997 and provided good conditions for chick survival. Ninety-five percent of hens observed during summer brood counts in 1998 were accompanied by chicks compared to the mean of 76% of hens with broods seen 1989-1997. In 1997 only 59% of hens were accompanied by broods.

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. 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.

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.

Species

Pheasant

Region 3

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 increased for the third year and were 8% above the 10-year average in Region 3 (Figure 1). Effort was 100,594 recreation days, 14% below the goal. Harvest reportedly increased 40% (21,959 total), but was 78% below the goal of 100,000. Surveys (birds per day) in 1997 suggested harvest would decrease. The winter of 1996-97 combined with poor nesting conditions had a negative impact on pheasant populations. The increase in harvest was because of stocked pheasant.

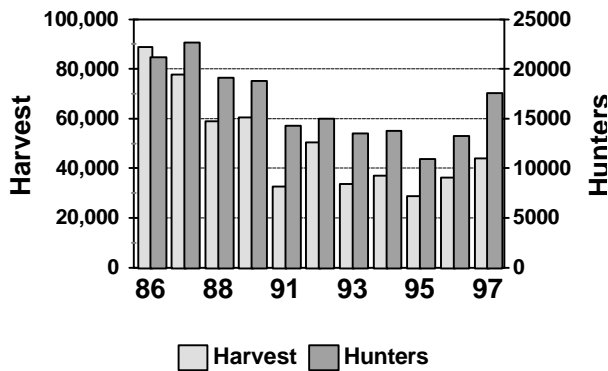


Figure 1. Pheasant harvest and number of hunters for Region 3.

Surveys

Brood count survey routes are driven by a lone observer at <20 mph along 20 miles of low-moderate traffic roads. Surveys are started one half hour before sunrise or 2 hours before sunset and must be concluded within 2 hours. Attempts are made to run each transect three times between July 20 and August 20. In 1998, each route was completed twice. All birds encountered are tallied by sex and age. Attempts are made to flush birds in or near cover to obtain complete brood counts. On broods with incomplete counts, the average brood size from all surveys

during the year is used. 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). The 1998 index may have been biased low by an early hatch. Some broods had broken up and may not have been as visible. 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.

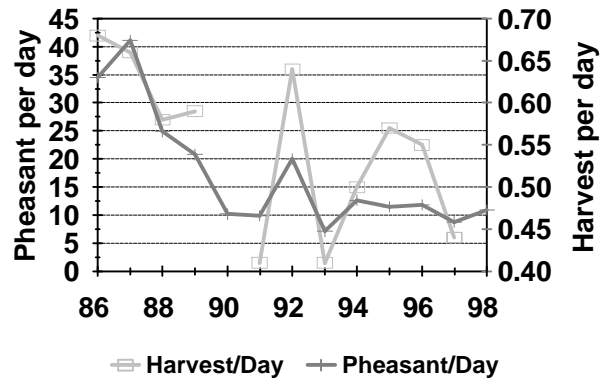


Figure 2. Pheasant seen per day of driving surveys vs hunter success for Region 3.

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 39,311) for 1984-88 vs 1993-97. The five-year average hunter success has dropped 15% (0.58 vs 0.49). 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 1997 with the stocking of 5,000 farm raised roosters. While the

stocking did not enhance the wild population, it apparently increased the number of hunters and total harvest.

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, did increase the harvest, hunters, and recreation days. Pheasant stocking is popular with a segment of the hunting population and will continue. 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

Statewide

**Prepared by: Dave Ware, Upland Game Section Manager
Clifford G. Rice, Game Surveys Coordinator**

Population Objectives/guidelines

Chukars and gray partridge were first introduced into Washington by the Department of Game in the 1930s, primarily to provide hunting opportunity. Chukars occupy the steep, arid canyons of eastern Washington. They are generally confined to the Snake, Yakima, and Columbia river canyons and associated tributaries. Chukars quickly adapted to these areas in large part because of the invasion of cheat grass brought about by extensive livestock grazing.

The primary objective for chukar is to maintain healthy well distributed populations and to provide appropriate levels of hunting recreation.

Hunting Seasons And Harvest Trends

The chukar and gray partridge season and bag limit was changed several times during the 1980s, but has remained stable since 1988. In central Washington, the season changed from Sept. 12 - Jan. 10 with a bag limit of six per day in 1981 to Oct. 12 - Dec. 31 with a bag limit of four per day in 1983. Regulations changed in southeast Washington from a 10 partridge bag limit to four and then back to six a few years later. Most of these changes were in response to lower chukar populations and a hope that hunting season restrictions would increase the population.

Chukar harvest has declined over the past ten years along with hunter numbers. Recent improvements in populations as indicated by harvest per day should result in future hunter and harvest increases (Fig. 1).

Surveys

Chukar surveys were initiated in southeast Washington (Region 1) in 1987. They were expanded to other major chukar population centers in 1991. Because the surveys were new in these areas, the area searched and technique changed from year to year as the survey was refined. The results during these years are not directly comparable. Comparable information is available beginning in 1993 in Region 2 and 1995 in Region 3. Surveys were not flown in Regions 1 and 2 in 1998 due to a budget shortfall.

Population Status And Trend Analysis

While chukar numbers decreased significantly in 1997

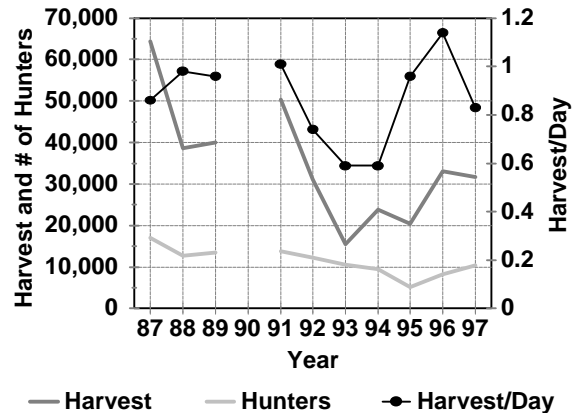


Figure 1. Chukar harvest, number of hunters, and harvest per day for Washington State.

throughout the state, this was not sustained in 1988 in Region 3 and incidental observations suggest this was true in Regions 1 and 2 as well. Overall, the chukar population has been steadily increasing since the hard winter of 1992-93. Chukars in central Washington had shown dramatic increases since 1993, then the winter of 1996-97 caused a major reduction.

Habitat Condition And Trend

Although chukar habitat is relatively stable in Region 2 and 3, Region 1 has seen a deterioration in habitat conditions due to the invasion of noxious weeds.

Augmentation

Nevada provided over 150 chukar that were released in the Yakima River Canyon in August of 1997.

Management Conclusions

Survey techniques that incorporate data provided by volunteers need to be developed. It is unlikely that future budgets will provide funding for helicopter surveys conducted over the past five years.

Species

Chukar

Snake River Basin

Prepared by: Pat Fowler, District Wildlife Biologist

Population Objectives/guidelines

The long term objective will be to increase chukar populations within the Snake River Basin to historic levels that occurred in the late 1970's.

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 usually 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 of 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 has declined dramatically over the last 16 years. The chukar harvest in the Snake River Basin peaked in the 1970's at 60,790 birds/year. Since 1980, the chukar harvest has dropped dramatically. The average chukar harvest in the 1980's declined 42% compared to the 1970's. During the 1990's, the chukar harvest took another plunge, declining 84% compared to the 1970's (Figure 1).

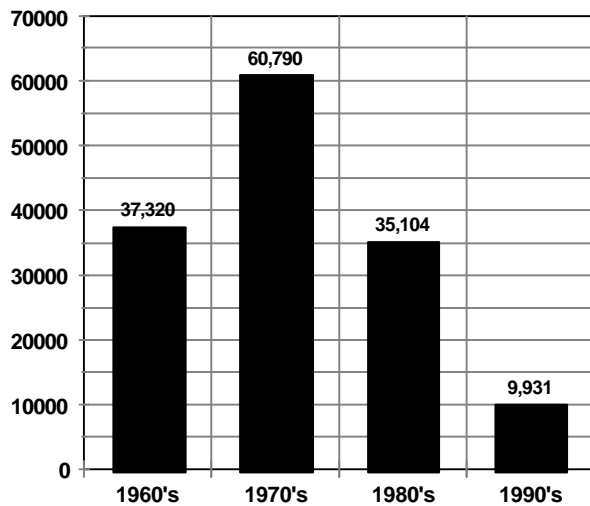


Figure 1. Ten-year average chukar Harvest - Region 1. Asotin, Columbia, Walla Walla, Garfield, Whitman counties

Hunter participation in chukar hunting also peaked in the late 1970's. After the population crash in 1982, hunter participation started a steady downward trend.

Surveys

Chukar populations in southeast Washington are surveyed from the air. A linear transect is flown using a Hiller 12-E helicopter. Chukars are quite sensitive to the helicopter and readily flush as the helicopter approaches and passes nearby. Chukars flushed within 300 feet on each side of the helicopter are counted. The first leg of the transect is flown at high elevation contouring along the breaks of the Snake and Grande Ronde Rivers, while the return leg is flown within 300-800 feet of the river. The transect is flown in this manner in order to neutralize year to year fluctuations in chukar distribution due to weather, water availability, and forage conditions.

Aerial surveys were started in 1987 and conducted annually through 1997 (Figure 2). However, surveys were not conducted in 1998 due to budget cuts.

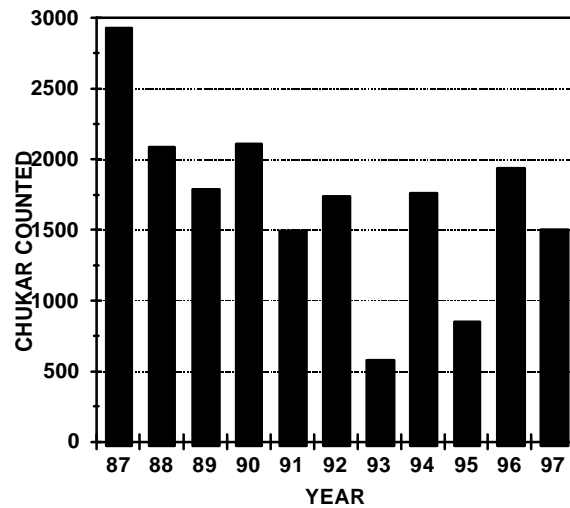


Figure 2. Aerial Chukar Surveys - Asotin Co.

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. Chukar population levels are highly dependent on the success of annual production.

Although the aerial survey were not conducted in 1998, observations from the ground indicate chukar production was better than anticipated. Broods have been observed that contain as many as 18 young. Determining the level of population

increase will be impossible without conducting the aerial survey.

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.

Based on aerial surveys, it appears chukar distribution is changing. 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 the areas being infested with large acreages of yellow-star thistle.

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. Habitat deterioration and poor nesting conditions have prevented the chukar population from increasing to historical levels.

The future outlook for chukar populations 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

Region 2

Prepared by: John Musser, 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

Chukar season was open from October 1 through January 11 in eastern Washington. Bag and possession limit for chukar was 6 and 18. These season and limit regulations allow more recreation for chukar hunters than has been available recently.

Region 2 chukar harvest has varied from about 5,000 to 17,000 birds per year since 1991. Chukar harvest in 1997 was 14,500 birds (Figure 1).

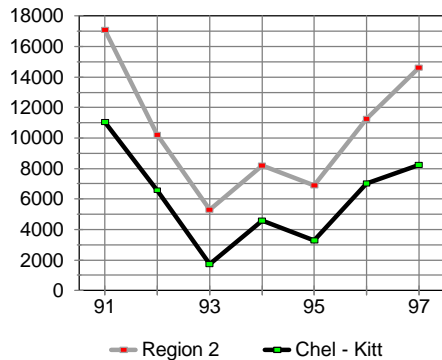


Figure 1. Chukar harvest in Region 2 compared to chukar harvest for Chelan and Kittitas Counties

Since 1991, the number of chukar hunters using Region 2 has varied from about 2,200 to 5,000. 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).

Surveys

Helicopter surveys were used to monitor chukar populations between 1991 and 1997. Results of helicopter surveys were poorly correlated with chukar harvest.

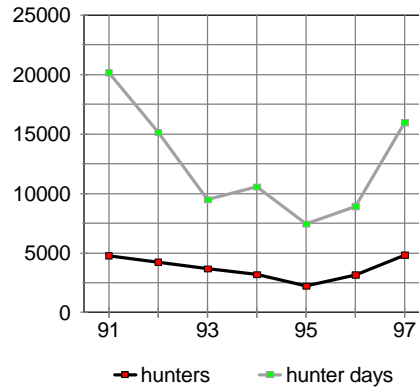


Figure 2. Chukar hunters and hunter days in Region 2.

Aerial chukar surveys were canceled this year due to budget shortfall. This year we counted chukar along three routes driven slowly in a vehicle. These routes were established in 1975. Driving routes were correlated (R squared = .7) with harvest when they were used in the 70s and 80s in Chelan and Kittitas counties. The harvest for these counties is closely correlated (R squared = .94) with Region 2 chukar harvest.

During July and August 1998, three routes (Colockum - Tarpiscan, Swakane - Nahahum, and Chelan Butte) were driven twice to monitor chukar population. An average of 10.8 chukar were seen on each route driven.

Population Status And Trend Analysis

The number of chukar seen this year indicates that Region 2 chukar population is continuing to rebound from the low point seen in 1993. This year's harvest is expected to total nearly 20,000 chukar. We also expect hunters and hunter days to increase.

Habitat Condition And Trend

Chukar habitat is relatively stable in Region 2.

Management Conclusions

We need to conduct aerial and road surveys for chukar for several years and evaluate which method provides the most useful and cost effective method of monitoring chukar populations in Region 2.

Species

Chukar

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

Hunter numbers increased for the third year and were 9% above the 10 year average in Region 3 (Figure 1). Antidotal information (calls to the Region) suggests pheasant hunters are looking for alternate opportunities. Many hunters are unaware of how and where to hunt chukars.

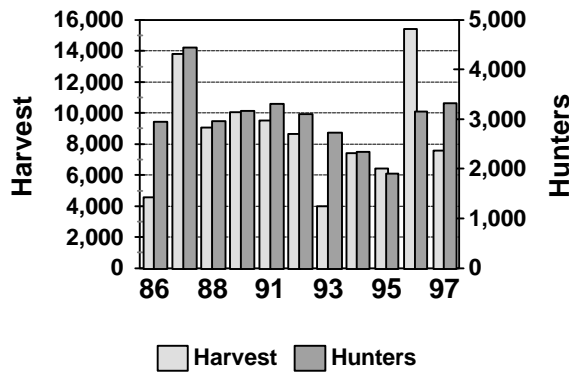


Figure 1. Chukar harvest and number of hunters for Region 3.

Total harvest has been cyclic and was 15% below the 10 year average in 1997. Chukar populations declined after the winter of 1996-97. Harvest is not believed to effect chukar populations. The steep rocky terrian chukar inhabit make it unlikely populations will be over harvested, especially with the relatively low hunting pressure.

There is a concern that the October 1st opening may result in over harvest of local populations if the birds are concentrated near water sources. In 1997, rains fell early and often. The birds were not concentrated and hunting success (Figure 2) may have been lower than anticipated because of the early moisture.

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. Historically, surveys have been conducted between August 19th and September 15th, preferably after a period of hot dry weather. In 1997, the survey was flown

on August 15th. 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). The density may have been slightly underestimated in 1998. Volunteers were used for surveys and the birds were not as concentrated near water sources. The weather had been hot and dry for an extended period, but birds may have been getting moisture from abundant grasshoppers.

Population Status And Trend Analysis

Prior to 1991, the only indicator of population was harvest.

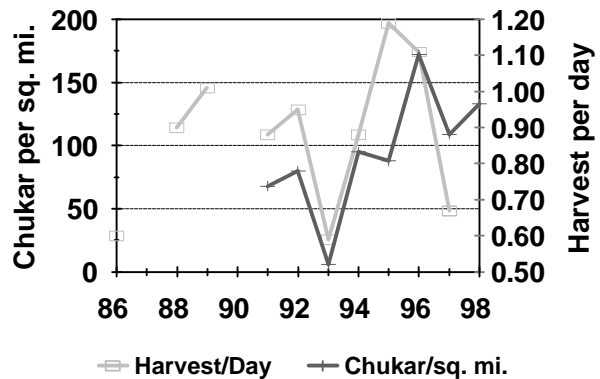


Figure 2. Chukar seen per square mile of helicopter surveys .vs hunter success for Region 3.

Annual harvest in Region 3 indicate the chukar population peaked in 1980 and crashed in 1983. Harvest continued to decline from until in 1986. In 1986, hunter success estimates became available and the population was probably at a low with hunter success only 0.64 birds/day. The chukar population increased from 1986 to 1989 with hunter success rising to 1.01 birds/day (Figure 1) . Harvest (Figure 1), hunter success and aerial surveys (Figure 2) indicate the chukar population crashed again as a result of the winter of 1992-93. The population built rapidly from 1993 through 1996, but declined after the winter of 1996-97 (Figure 2). The most severe loss from 1996-97 was in the Yakima Canyon where surveys indicated an 80% decline. Surveys in 1998 show the population rebounding (Figure 2).

Chukar populations cycles are related to weather. Consistent snow cover during the winters of 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 (WDF&W) and Department of Defense lands (DOD) own the majority of chukar habitat. WDF&W lands have not changed significantly in the last decade. In recent years the DOD has excluded cattle grazing. Sections of both WDF&W and DOD lands have burned in the last few years. The fires did not appear to significantly impact chukar habitat.

Moisture effects vegetation and insect production in the short term. The trend in recent years has been for excellent growth from average to above average precipitation.

Augmentation/habitat Enhancement

An experimental release of 150 wild chukar from Nevada was made in the Yakima Canyon in August 1997. All birds were banded and voluntary hunter registration boxes installed. Hunter and survey information indicated approximately 30-40% of the birds survived until January.

Management Conclusions

The chukar population in Region 3 is healthy. There is little information on how to enhance habitat or populations. The current challenge is to increase the hunter base. Increasing season length or bag limits will probably not attract new hunters. Upland bird hunters are interested in chukar, but lack information on where and how to hunt. Providing information through a pamphlet and emphasizing chukar at sporting shows is suggested.

Species

California Quail

Statewide

**Prepared by: Dave Ware, Upland Game Section Manager
Clifford G. Rice, Game Surveys Coordinator**

Population Objectives/guidelines

California quail were introduced by settlers early in Washington's history. They were released throughout Washington, similar to other introduced game birds, and are currently most numerous along the brushy streams and hillsides of eastern Washington. There are also limited populations in western Washington associated with brushy areas adjacent to pastures and suburban areas.

The primary objective for quail is to maintain healthy well distributed populations and to provide appropriate levels of hunting recreation.

Hunting Seasons And Harvest Trends

California quail seasons and bag limits have remained stable in recent years.

Quail harvest and harvest per day has not declined at the same rate as pheasant and chukar harvest. Although the total number of quail hunters has remained stable for the past four years, even though harvest per day has been high (Fig. 1).

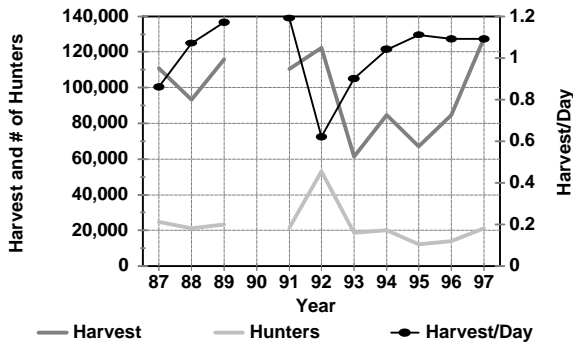


Figure 1. Quail harvest, number of hunters, and harvest per day for Washington State.

Surveys

California quail production surveys have been periodically used in Regions 1 and 3 and more consistently in Region 2.

Population Status And Trend Analysis

While the number of quail seen per day has fluctuated considerably, surveys from Regions 2 and 3 during the last four years show levels at or above earlier surveys.

Consistent use of these surveys will enable managers to monitor quail populations independently from harvest. This survey directly monitors quail population levels and helps improve the accuracy of management decisions.

Habitat Condition And Trend

Increasingly intensive agricultural land use has reduced quail habitat in eastern Washington. In addition, this is often accompanied by greater application of pesticides which probably reduces food available for quail. These influences may be partially offset by enrollment of farmland in the Conservation Reserve Program. (CRP).

Augmentation/habitat Enhancement

The expansion or augmentation of California quail populations has proven quite successful through trapping wild birds and relocating them to suitable areas. Generally the birds are trapped in suburban settings or state facilities (fish hatcheries) and released on private lands that are under agency agreements or on public land. Successful establishment should result in expanded California quail distribution and future hunting opportunity.

Management Recommendations

Agricultural practices conducive to quail should be encouraged, especially through CRP enrollment. In addition, quail populations in state Wildlife Areas should be augmented to establish new populations or after severe winters. Quail survey techniques that rely on volunteers need to be developed. Budget reductions result in the need to find less expensive population monitoring techniques for upland birds.

Species

Region

Quail

1

Prepared by: Pat Fowler, District Wildlife Biologist

Population Objectives/guidelines

The long term objective will be to increase California and Mountain quail populations to historic levels that occurred in the 1960's through habitat development and enhancement.

Hunting Seasons And Harvest Trends

The hunting season for California quail runs from mid October to mid-January, 103 days. In addition, a juvenile-senior season was established in 1997 on September 27-28.

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 quail harvest has declined dramatically compared to the 1960's and 1970's. 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).

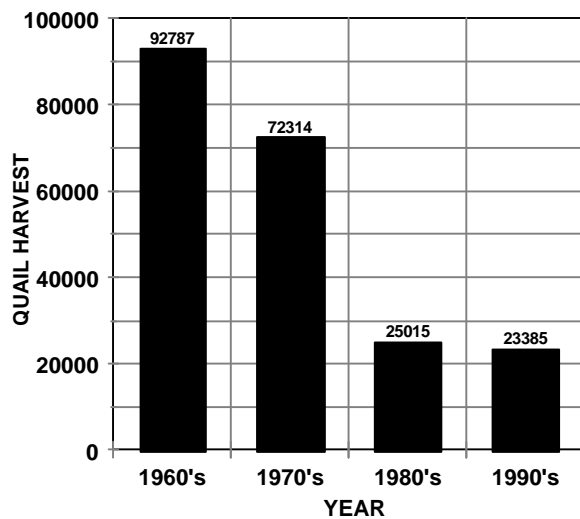


Figure 1. Quail Harvest History - Region 1 by decade

Surveys

A quail survey route was established in southeast Washington in 1998. It will take several years to accumulate sufficient data base for comparison.

Survey routes established for quail would probably produce the best results if they were run in mid-late August, if the primary goal is to measure birds observed per day. Quail often re-nest or nest late producing young broods in late July and August. However, early broods will be difficult to separate from adults. Also, the wheat harvest is normally completed by the second week in August, which would reduce traffic along routes and increase sightability. The re-implementation of sight frequency data collection would also expand the sample size for

comparing the percentage of young in the population, and brood size.

Population Status And Trend Analysis

California quail populations have declined significantly based on harvest data.

Quail production data has not been tabulated for approximately ten years, due to the exclusion of sight frequency data, and limited personnel to establish new survey routes. However, one quail production route was established in the southern district in 1998. This data was incorporated into a table (Table 1) with data from 1983-88 in order to compare the percentage of young in the population and brood size. From 1983-88, the percentage of young in the annual population averaged 73%, compared to 58% in 1998. This indicates quail production was down in 1998 compared to the average. Brood size averaged 7.8 young/brood between 1983-88, compared to 8.9 young/brood in 1998, which is probably not a significant difference.

Table 1. Quail production data, Blue Mtns.

Year	Adults	Broods	Young	% Young	Young/Brood
1983	35.0	30.0	148.0	81%	4.9
1984	135.0	29.0	240.0	64%	8.3
1985	203.0	63.0	554.0	73%	8.8
1986	197.0	72.0	676.0	77%	9.4
1987	228.0	113.0	686.0	75%	6.1
1988	237.0	49.0	444.0	65%	9.1
1998	125.0	20.0	170.0	58%	8.5

Quail nesting success and production was probably impacted by the cool, wet weather that occurred during May and early June.

Habitat Condition And Trend

Quail habitat has suffered 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 amount of acreage being accepted into the program. In the major pheasant areas of the southeast and central districts of Region 1, a total of 191,370 acres of CRP were enrolled under the current program. This program will provide large acreages of suitable habitat near agricultural crop lands, enhancing habitat conditions for pheasant over the next 8-9 years.

Augmentation/habitat Enhancement

The Upland Habitat Restoration Program has developed 5,501 acres of upland bird habitat in the southeast and central districts. The southeast district has developed 4,701 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.

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

California quail populations will not increase significantly unless the loss of habitat is reversed.

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.

Acknowledgments

Personnel assisting in the collection of survey and habitat restoration data are Ted Johnson, Mark Grabski, Scott Rasley, Joey McCanna, Susan Nostrant, Steve Henry, and Bob Dice. Their assistance is greatly appreciated.

Species**Region****California Quail****2****Prepared by: Jim Tabor, District Wildlife Biologist****Population Objectives/guidelines**

The population objective for California quail in Region 2 is to maintain viable populations that will provide hunting opportunity and harvest.

Hunting Seasons And Harvest Trends

Quail hunting seasons and bag limits in Region 2 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 last 5 years, 32% of Washington's quail hunters hunted in Region 2. In 1997, 7271 hunters hunted quail in Region 2, this was a 69 percent increase from 1996 and a 58 percent increase from the 1992-1996 average of 4613 (Table 1). The number of quail hunters in the region declined each year from 1992 to 1995, but increased slightly in 1996 and dramatically in 1997 (Table 1).

Table 1. Number of quail hunters in Region 2, 1992-1997.

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
Mean	668	1048	1075	1510	1003	5056

During the past 5 years, 31% of the statewide quail harvest occurred in Region 2. Harvest estimates for quail in the region were examined from 1992 through 1997. The number of quail harvested during this 6-year period ranged from a high of 41,706 in 1997 to a low of 14,292 in 1993 (Table 2). The 1997 harvest of 41,706 quail increased 46 percent from that of 1996 and was 69% above the 1992-1996 average of 24,734 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, 1992-1997.

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
Mean	2066	5954	7164	4519	7860	27563

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 1998 were derived from surveys of 11 permanently established brood routes in representative quail habitat of Adams (2 routes), Douglas (3 routes), and Okanogan (6 routes) Counties. The number of routes in Okanogan County was reduced from 7 surveyed in 1995 and one additional route was used in Douglas County.

Routes are approximately 30 miles long and follow established roads. Each route was surveyed once per week for 2 weeks beginning the last week of July and ending the second week of August. In 1996 routes were surveyed 2 times. Surveys are conducted in either early morning (start at sunrise) or late afternoon (start 1.5 hours before sunset). Routes are driven at 25-30 mph or slower and observers stop when quail are seen. Observers record all quail seen including adults without broods, adults with broods, and chicks. When a brood is seen an attempt is made to count all chicks (flushing brood if necessary or possible). Data are summarized by observation day (1 route surveyed 1 day) for each route and all routes combined.

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 1998 brood route surveys.

The 1998 index to the adult summer population size indicated a 35 percent increase compared to that of 1997 and a 46 percent increase compared to the 1989-1997 average (Table 3).

The production index for 1998 as measured by the number of chicks seen /observation day on the 11 brood routes was 73% above that of 1997 and 63% above the 1989-1997 average (Table 3). The number of chicks produced in Region 2 was much higher than that of 1997. The increased production was due to both an increase in number of breeding pairs and excellent nesting success and/or chick survival. Production was only 9% below that of the exceptional high of 1994.

Population Status And Trend Analysis

No long-term population trend in Region 2 are apparent from existing data of adult quail seen on summer routes. What

Table 3. California quail summer adult population index and production index for Region 2, 1989-1998.

Year	Broods/		Total	Percent	Adults/ Obs. Day
	Obs. Day	Chicks/ Obs. Day	Quail/ Obs. Day	Adults/ with Brood	
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
Mean	3.8	32.3	44.0	57	12.0

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 1997-98 was abnormally mild in Region 2. The mild temperature and lack of snow cover were conducive to excellent over-winter survival. The adult population index in summer of 1998 showed a major increase over that of 1997.

Most hunted populations of quail in the region occur in shrub steppe and riparian habitats. Additionally, a significant percentage of the quail in Region 2 occur 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 1997-98, 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 1997-98, the UWR program conducted habitat enhancement on 41 WDFW properties with 1691 acres and had 278 private landowner cooperators with agreements to provide some form of habitat development on their private land.

During the mild winter of 1998-97, 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 California quail is a major upland game bird species in Region 2 and is also a species of major interest to non-consumptive users. 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

Region

Quail

3

Prepared by: Jeff Bernatowicz, Wildlife Biologist

Population Objectives/guidelines

The objective of California quail (hereafter referred to as quail) 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 recent trend of increased effort and harvest continued in 1997 (Figure 1). Effort was at a 10-year high and harvest was 25% above average. Hunter success was 8% below the 10 year average.

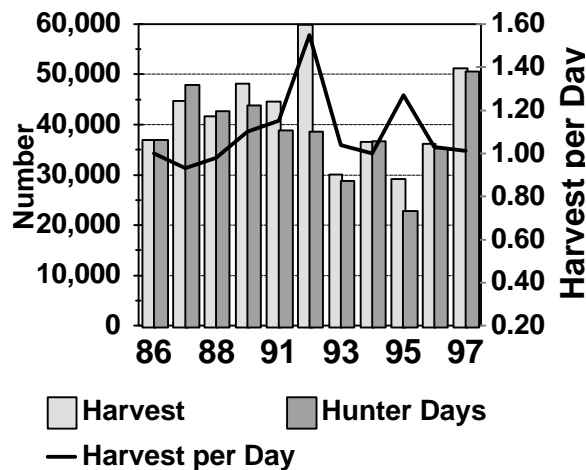


Figure 1. Quail harvest, hunter days, and harvest per hunter day for Region 3.

Quail are probably hunted secondarily to pheasant. In 1997, the number of reported pheasant hunters also increased for the third year. However, field observations did not match the reported increase. Pheasant populations were near an all time low and a new \$10 pheasant enhancement stamp requirement in 1997. Pheasant were stocked and release areas had fairly heavy pressure. However, few hunters were noted in other areas, especially after opening weekend. Some hunters may have pursued quail and other upland birds rather than pay the new fee. Other hunters may have pursued quail after hunting pheasant at release sites. Overall, the survey indicating more effort is questionable.

Surveys

Brood count survey routes are driven by a lone observer at <20 mph along 20 miles of low-moderate traffic roads. Surveys are started one half hour before sunrise or two hours before sunset and must be concluded within two hours. Attempts are made to run each transect three times between July 20 and

August 20. In 1998, each route was completed twice. All birds encountered are tallied by sex and age. Attempts are made to flush birds in or near cover to obtain complete brood counts. On broods with incomplete counts, the average brood size from all surveys during the year is used. 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 1997 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.

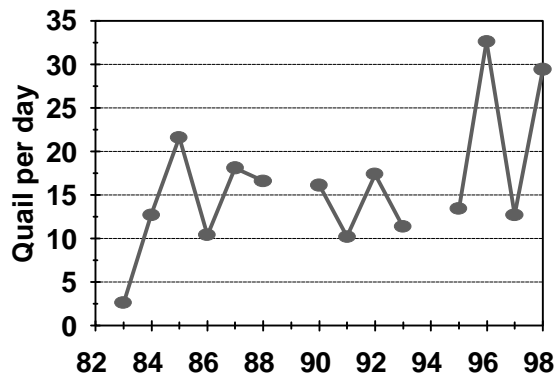


Figure 2. Quail seen per day of surveys for Region 3

Population Status And Trend Analysis

Quail population 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 harvest indicates the population has been stable the last 10 years (Figure 1) while brood counts (Figure 2) have shown wide variances. Historical brood count surveys are questionable because of a lack of emphasis on quail and variation in the number and location of routes. There is also a wide variance between the number of birds seen on an individual survey because of the flocking nature of quail. It is not unusual for the number of birds to vary 60-70 birds from between repetitions on an individual survey route. The statistical result is a high variance and low confidence in the index. Overall, the quail population has undoubtedly declined since the 40s and 50s. In the last 10 years the population has probably been stable with a high proportion of birds in urban areas.

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**

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 and confidence levels for estimating statewide harvest are high.

The current Sept. 1 to Dec. 31 hunting season structure has been in place since 1987. The daily bag limit has not changed since 1952. Hunter numbers have remained fairly stable over the past ten years (Table 1).

Table 1. Forest grouse hunter numbers in Washington.

Year	Ruffed	Blue	Spruc	Total*
1987	59,512	37,235	5,488	102,235
1988	38,215	23,329	3,320	64,864
1989	45,654	30,545	4,343	80,542
1991	42,425	28,556	4,098	75,079
1992	47,005	29,935	4,200	81,140
1993	41,849	28,169	3,944	73,962
1994	41,236	25,609	3,676	70,521
1995	43,450	27,694	4,482	75,626
1996	37,620	23,169	2,928	63,717
1997	36,532	22,041	3,034	61,607

*This total does not accurately represent the number of grouse hunters because many grouse hunters pursue more than one species of grouse, therefore grouse hunters may be double counted.

Forest grouse harvest over the past ten years has been stable, although it fluctuates annually depending on production (Table 2). The fluctuations appear to be similar for all three species.

Long term harvest projections 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.

Surveys

No surveys for forest grouse were conducted in 1996. In earlier 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.

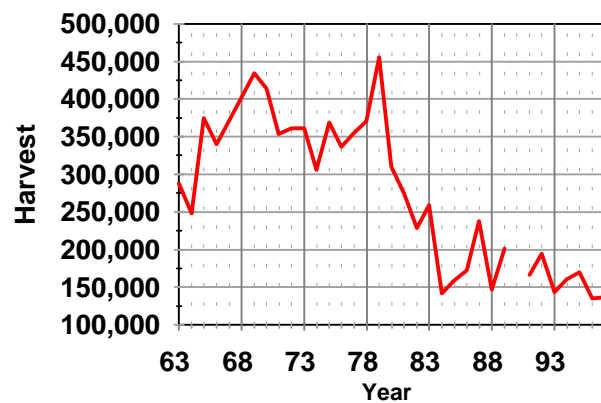


Figure 1. Number of hunters and harvest of forest grouse in Region One from 1991 through 1997.

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

Table 2. Forest grouse harvest in Washington.

Year	Ruffed	Blue	Spruce
1987	164,198	68,812	5,205
1988	98,413	44,533	4,596
1989	133,395	63,272	5,158
1991	110,631	51,932	3,744
1992	132,438	58,037	3,743
1993	96,564	43,763	2,935
1994	110,574	47,771	2,452
1995	114,152	52,139	3,338
1996	94,238	39,023	1,344
1997	94,153	39,689	3,220

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.

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.

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.

Species

Region

Forest Grouse

1

Prepared by: Dana L. Base, Wildlife Biologist

Population Objectives/Guidelines

Forest Grouse in Region 1 of Washington State include Ruffed, Blue, and Spruce Grouse. Management objectives are to sustain well-distributed populations and provide appropriate levels of hunter harvest. Harvest levels of forest grouse are generally assumed to be closely aligned with annual grouse reproduction and weather conditions. Current population levels are considered satisfactory 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 is believed to provide an adequate sample of Ruffed and Blue Grouse hunters on a statewide scale and confidence levels for estimating statewide harvest are high.

The current September 1st through December 31st hunting season on forest grouse has been in place since 1987. The daily bag limit of 3 of any of the three species with 6 in possession has not changed since 1952.

Figure 1 depicts the number of hunters and harvest of forest grouse in Region 1 from 1991 through 1997. The number of hunters pursuing forest grouse has remained fairly stable at around 20,000 since 1991. Harvest of forest grouse within Region 1 has varied between approximately 40,000 and 60,000 since 1991. The last three years (1995-97) have had almost a constant harvest of about 44,000 of all three species combined. Generally the Hunter Questionnaire has reported the Ruffed Grouse harvest to be roughly three to four times higher than Blue Grouse each year. Spruce Grouse harvest is consistently low as this species is the least common and range restricted forest grouse in the region.

Table 1 presents the number of hunters and 1997 harvest of forest grouse for each of the three districts comprising Region 1. District 1 (Pend Oreille, Stevens, and Ferry counties) has by far both the highest number of forest grouse hunters and birds harvested.

Staff at the Little Pend Oreille National Wildlife Refuge collected 69 grouse wings from hunters in 1997. These wings

Table 1. Number of hunters and harvest of forest grouse by District within Region 1 in 1997.

	Hunters	Harvest
District 1	14,559	30,483
District 2	3,340	6,359
District 3	4,864	7,336
Region 1 Total	22,763	44,178

came from 62 Ruffed Grouse, 6 Blue Grouse, and 1 Spruce Grouse. Although the sample size is small, harvested Ruffed Grouse were overwhelmingly juveniles whereas adult and juvenile Blue Grouse were evenly divided. The one Spruce

Grouse was a juvenile which was apparently taken near Cliff Ridge, an area of higher elevation within the Refuge.

Population Status and Trend Analysis

Based on harvest trends it appears that forest grouse populations have remained mostly stable within Region 1 since

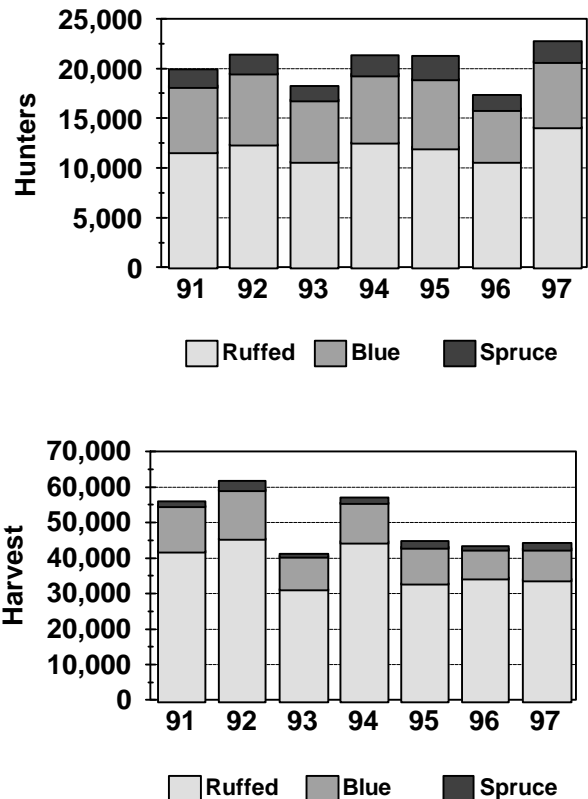


Figure 1. Number of hunters and harvest of forest grouse in Region 1 from 1991 through 1997.

1991.

Habitat Condition and Trend

In forested landscapes such as existing throughout much of Region 1, silviculture is the most significant human activity influencing forest grouse habitat conditions and population trends. Spruce Grouse may be especially vulnerable to clear-cut timber harvest. Forest regeneration techniques that include extensive broad-leaf tree and shrub reduction along with lower seedling/sapling stocking rates and reduced woody plant cover can negatively impact carrying capacity for forest grouse. More selective, uneven-aged timber harvest prescriptions can maintain better forest grouse habitat. Such forest practices include leaving numerous and well-distributed large down logs for

Ruffed Grouse drumming sites, and limiting the control of broad-leaf trees and shrubs for grouse forage.

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 Region 1 in 1997. 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.

Management Conclusions

The trend in hunter harvest suggests that population levels of forest grouse appear to be fairly stable. Hunter harvest strategies appear to be continuing to function appropriately at this time. The main questions or concerns regarding forest grouse are:

1. Long-term population monitoring for each of the three species of forest grouse;
2. Monitoring harvest of each species in as accurate of a way that is practical;
3. The impacts of widespread timber harvest upon both Spruce and Blue Grouse;
4. Hunter harvest rates on public lands.

Until monitoring of hunter harvest can be refined and a better determination of the proportion of the population that is harvested can be developed, no change in recreation opportunity is prudent.

Species

Region

Forest Grouse

3

Prepared by: Jeff Bernatowicz, Wildlife Biologist

Population Objectives/Guidelines

Forest grouse in Region 3 include blue, ruffed and spruce grouse. Management objectives are to sustain well distributed populations and provide appropriate levels of harvest. Current population levels are considered sufficient to meet hunter demands.

Hunting Seasons and Harvest Trends

The number of grouse hunters has remained stable at around 6,600 hunters since 1994 (Figure 1). The 10 year average is 7,600 hunters. Harvest has cycled over the last 10 years (Figure 1). In 1997 the total grouse harvest was 8% (total harvest of 8,977 grouse) above the ten year average and species composition has remained stable.

Little data is available in Region 3 on the effect of hunting

on grouse populations. However, the grouse and hunter populations appears stable.

Harvest success for forest grouse in Region 3 is the lowest of any upland bird. Long term averages are 0.28, 0.28 and 0.13 birds per day for ruffed and blue grouse. Success in 1997 was average for ruffed and blue, but below average for spruce grouse. The blue and spruce grouse success may be higher as many hunter apparently mis-identify juvenile and female blue grouse as ruffed.

Population Status and Trend Analysis

Data on grouse populations is limited to harvest statistics. Grouse populations are known to fluctuate, presumably with weather patterns. Harvest success indicates the grouse populations in the region are fairly low. Total harvest in Region 3 indicates we may be reaching the peak of the cycle.

Habitat Condition and Trend

Timber harvest on U.S. Forest Service land has decreased in the past decade and a large portion of the high elevation land is in wilderness designation. However, no timber type/age analysis has been done to evaluate current vs. future grouse habitat. The long-term impact of more mature timber is likely to be lower overall grouse populations.

Ruffed grouse in the region seem to be dependent on aspen riparian areas. Aspen riparian areas have changed little in recent decades. The listing of Pacific salmon and steelhead as threatened and endangered will likely increase the protection and management of stream corridors and possibly benefit ruffed grouse.

Management Conclusions

Little emphasis has been placed on forest grouse management in the region. Based on harvest data, the current season does not seem to be impacting overall grouse populations.

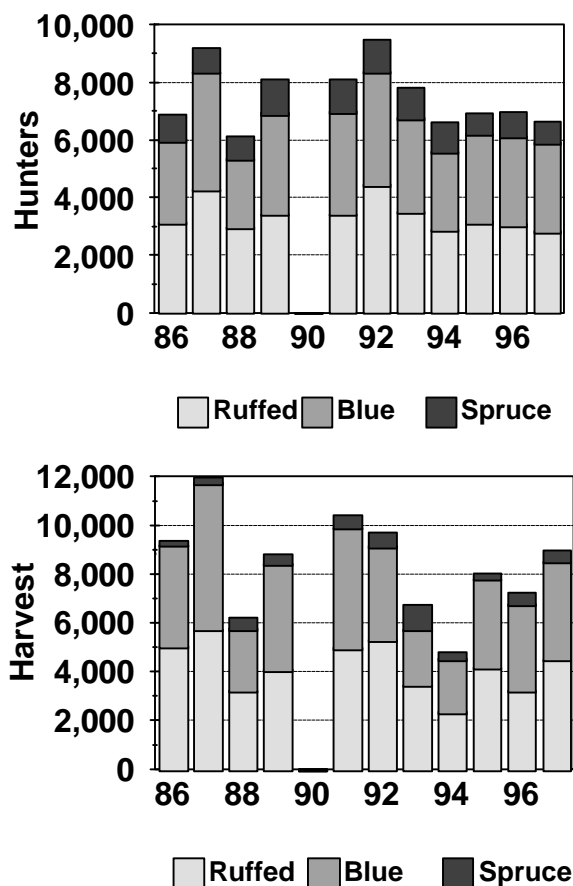


Figure 1. Number of hunters and harvest ruffed grouse, blue grouse, and spruce grouse.

Species**Forest Grouse****Prepared by: Mike Davison, District Wildlife Biologist****Region****4, Skagit & Whatcom Counties****Population Objectives/guidelines**

Management objectives for forest grouse (Ruffed, *Bonasa umbellus* & Blue, *Dendragapus obscurus*) are:

1. maintain maximum sustainable population levels in available habitat; and
2. maximize harvest levels and recreational opportunity.

Hunting Seasons And Harvest Trends

The 1997 hunting season for forest grouse in Washington State was Sept. 1 - Dec. 31 with a daily bag limit of 3 birds and a possession limit of 9 birds. 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 about 12% for ruffed grouse and 19% for blue grouse.

The number of grouse hunters has declined significantly for the last two seasons (1996 and 1997) as compared to the periods 1984-88 & 1993-95 combined. Blue grouse hunters have declined by 40% with ruffed grouse hunter numbers averaging 33% below historical levels. 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.

Habitat Condition And Trend

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. An estimated 706,000 acres (6.2 percent) occurs in the combined Whatcom/Skagit county area (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

Management Conclusions

Management recommendations for northern Region 4 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.

Literature Cited

Brewer, L. 1980. The ruffed grouse in Western Washington. Biological Bulletin No. 16 -Washington Dept. Of Game-Olympia, Wa.

Species**Forest Grouse****Region****5**

**Prepared by: Frederick C. Dobler, Regional Wildlife Program Manager
Patrick J. Miller, District Wildlife Biologist
David P. Anderson, District Wildlife Biologist**

Population Objectives/Guidelines

In Region 5, ruffed and blue grouse are the most common forest grouse, although spruce grouse do occur in small numbers in the Mt. Adams Wilderness. The Department's management objectives for these grouse are the same statewide; to maintain well-distributed, healthy grouse populations and provide hunting recreation. Brewer (1980) stated that ruffed grouse could sustain harvest of up to 50% of the fall population without threat of decline and our objective would be to avoid a take that exceeds that number. Our present harvest is thought to be well below 50% although neither the exact population nor harvest level is known. Weather is thought to be the most important factor governing both annual reproduction and hunter take. Current population levels are considered healthy and sufficient to meet hunter demand.

Hunting Seasons and Harvest Trends

The statewide harvest questionnaire is the sole technique currently used in Region 5 to monitor the population. The questionnaire provides a statewide sample of ruffed and blue grouse hunters and confidence levels for estimating harvest are broad. The harvest estimates are distributed by region based upon projections.

The current September 1st through December 31st hunting season on forest grouse has been in place since 1987. The daily bag limit of 3 with 9 in possession has not changed since 1952.

The number of forest grouse harvested in Region 5 from 1988 through 1997 has remained fairly stable (Figure 1). Ruffed grouse harvest has ranged between 15,601 and 23,704 with a mean of 18,489. Blue grouse harvest has ranged between

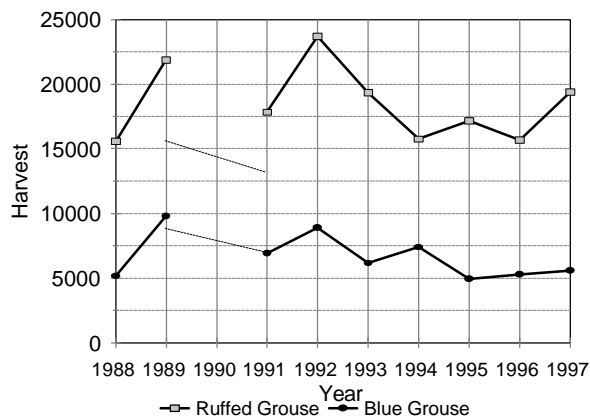


Figure 1. Forest grouse harvest in Region 5 from harvest questionnaire data. Dotted line represents missing data for 1990.

4,958 and 9,797, with a mean of 6,686. Grouse harvested per unit effort is another measure of population trend and that has been even more stable. Harvest per day for ruffed grouse is 0.31 birds (SD =0.05) and for blue grouse 0.19 (SD =0.04).

Population Status and Trend Analysis

Based on harvest trends it appears that forest grouse populations have remained stable within Region 5 since 1988.

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.

Habitat Condition and Trend

Timber harvest is the most significant factor influencing forest grouse habitat condition and population trends. In general, timber harvest activities benefit most species of forest grouse, although choice of treatments made during forest regeneration play a significant role in determining the degree to which timber harvest may provide habitat. The current trend toward intensively managed tree farms in favor of wood production will reduce benefits of timber harvest to grouse because it often removes deciduous plants valued by wildlife.

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 now with a peak in ruffed grouse populations over the next ten to twenty years.

The rate of timber harvest in Region 5 has slowed in the 1990's and should result in somewhat lower, but stable forest grouse populations over the longer term in parts of the region.

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, as will the Late Successional Reserves in the Gifford Pinchot National Forest. At the same time, a trend in reducing the length of timber stand rotation in matrix lands and private timber holdings may benefit grouse populations.

Augmentation/Habitat Enhancement

Supplementation of forest grouse populations is generally considered unnecessary in Washington State. No augmentation and no habitat enhancement was carried out in Region 5 for forest grouse in 1997. WDFW Habitat Program Staff however, frequently respond to Forest Practice Applications with recommendations which help to mitigate forest practice impacts

on grouse.

Management Conclusions

The hunter harvest questionnaire results suggest that population levels of forest grouse in Region 5 appear to be fairly stable, and harvest goals appear to still be valid at this time. However the main questions and concerns regarding forest grouse management revolve around the support of these conclusions:

1. Do harvest questionnaire results accurately reflect long-term population trends for grouse in Region Five?
2. Are harvest rates an acceptably low proportion of the fall

population as generally believed?

Until monitoring of hunter harvest can be refined and a better determination of the proportion of the population that is harvested can be developed, no increase in recreation opportunity is recommended.

Literature Cited

Brewer, Larry W. 1980, The ruffed grouse in Western Washington. Biol. Bul. No 16. Washington State Department of Game. pp. 102

Species**Region****Forest Grouse****6****Prepared by: H. M. Zahn, District Wildlife Biologist****Population Objectives/guidelines**

Management objectives for forest grouse (Ruffed, *Bonasa umbellus* & Blue, *Dendragapus obscurus*) are:

1. maintain maximum sustainable population levels in available habitat; and
2. maximize harvest levels and recreational opportunity.

Hunting Seasons And Harvest Trends

The 1997 hunting season for forest grouse in Washington State was Sept 1 - Dec. 31 with a daily bag limit of 3 birds and a possession limit of 9 birds.

The combined 1997 Region 6 grouse harvest for ruffed and blue grouse was estimated as 20,875 and 6,453 respectively. These estimates are based on an analysis of the returns from the annual hunter questionnaire survey. The harvest results for the 1997 season indicates a decline in numbers of grouse of both species taken when compared to the previous 5-year averages (1992-96). These declines correspond to declines in numbers of grouse hunters for the same periods (Table 1).

Habitat Condition And Trend

Much of the ruffed grouse habitat in the coastal region occurs in lower elevations (below 2,000 ft.) especially where there is a significant deciduous timber component. Due to

intensive forestry practices on commercial forest lands good ruffed grouse (often called "native" grouse by local hunters/habitat has declined. Increased stream side protection buffers ,however, are likely to benefit grouse. Blue grouse utilize higher elevations and do well on managed forest lands.

Table 1. Grouse Harvest and Percent Changes Region 6.

Species	1997 Harvest	% Change (1992-96)	1997 Hunters	% Change (1992-96)
Ruffed	20,875	-24	6,770	-36
Blue	6,453	-48	3,234	-44

Management Conclusions

Grouse recruitment and subsequent harvest is inversely correlated to the amount of rainfall during the period following hatching of chicks. This is particularly so in the often wet coastal area. We continue to consider grouse an underutilized resource whose number can fluctuate significantly on an annual basis due to good or poor recruitment rates. Blue grouse in particular are under utilized in Region 6.

Species

Prairie Grouse

Sage and Sharp-tailed Grouse

Statewide

**Prepared by: Dave Ware, Upland Game Section Manager
Clifford G. Rice, Game Surveys Coordinator**

Population Objectives/guidelines

The population objectives for sage and sharp-tailed grouse were defined in their respective management plans (Washington Department of Fish and Wildlife 1995a, 1995b). The statewide goal for sharp-tailed grouse is 2,000. The goal for sage grouse is 1,500. Both goals are for breeding populations as estimated from lek counts. Due to continued concern for sage and sharp-tailed grouse, both species are listed as Threatened by the State of Washington and as federal Species of Concern.

Surveys

Sage and sharp-tailed grouse populations are estimated using breeding ground counts and surveys for new breeding grounds (called leks). Leks are areas where the males display to attract females for breeding. Known, active leks are visited each year and grouse are counted. In addition, historic sites are visited and new areas are surveyed for leks.

The objectives for the sage grouse population are to maintain a population of 500 grouse (291 males counted at leks) in the Douglas county area and in the area of the Yakima Training Center (YTC). In addition, the objectives seek to establish additional breeding populations outside these two zones of at least 250 birds. The population goals are considered met if the estimate exceeds the goal for 10 consecutive years.

Goals for sharptails also include sub goals by zone. The goal for the zone in Region 1 is 800 birds (400 males counted at leks) and the three zones in Region 2 have a combined goal of 1,200 birds (600 males counted at leks).

Population Status And Trend Analysis

Counts from the zone centered in Douglas County (Region 2) indicate an increasing population of sage grouse that has exceeded the population goals for the past 4 years. The earlier decreasing trend in the zone centered on YTC has reversed for the last 2 years, but remains below the goal for that population (Fig. 1).

Population estimates are more difficult to obtain for sharptails than sage grouse because the lek sites are more obscure. In 1996 the difficulty in estimating population levels was further compromised because landowners refused access for counts. These estimates while not precise, still demonstrate that population levels of sharp-tailed grouse are far below goals (Fig. 2).

Habitat Condition And Trend

Several environmental and habitat changes appear to have led to improving sage grouse populations in Douglas county. The long term drought ended in 1994 and the USDA's Conservation Reserve Program is beginning to show some benefits for both sage and sharp-tailed grouse as indicated by research.

Although the YTC sage grouse population did not show a

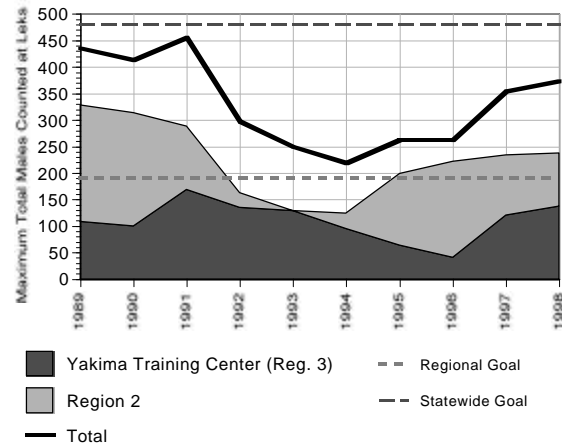


Figure 1. Maximum total male sage grouse counted at leks in Regions 2 and 3.

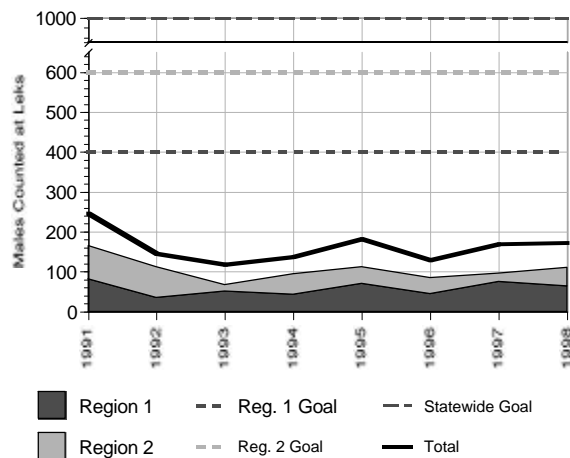


Figure 2. The number of male sharp-tailed grouse counted at leks in Regions 1 and 2.

similar response to the end of the drought in 1994, recent increases in the count could lead to achievement of the population goal in the near future and may indicate the requirements of sage grouse and training activities are being more successfully integrated.

Augmentation/habitat Enhancement

Sagebrush and other native vegetation has invaded many of the CRP fields improving their benefits to sage and sharp-tailed grouse. Aggressive habitat enhancements continue on recently acquired lands in Okanogan and Lincoln counties for sharptails. Military staff are replanting sage brush and other

vegetation in areas damaged by recent training and fires on YTC.

Management Conclusions

While habitat enhancements often take time to mature and result in population improvements, the population levels for sharptails and that portion of the sage grouse population on the Yakima Training Center require aggressive protection and enhancement activities. Some populations in these areas may be on the edge of viability and are likely to become extirpated pending additional environmental events or habitat degradation. A Region 1 plan for addressing sage grouse recovery/enhancement efforts is being developed by several agencies and the Yakima Tribe for south-central Washington.

For sharp-tailed grouse, more aggressive habitat protection

is needed by working with the agricultural community; population augmentation needs to be continued; additional core habitat needs to be purchased or brought under long term management for grouse; and additional enhancements need to be completed on recent acquisitions.

Literature Cited

- Washington Department of Fish and Wildlife. 1995a. Washington State management plan for Columbian sharp-tailed grouse. Game Div., Wash. Dept. Fish and Wildl., Olympia. 99 pp.
- Washington Department of Fish and Wildlife. 1995b. Washington State management plan for sage grouse. Game Div., Wash. Dept. Fish and Wildl., Olympia. 101 pp.

Species**Prairie Grouse****Sharp-tailed Grouse****Region****1****Prepared by: G J Hickman, District Wildlife Biologist****Population Objectives/guidelines**

The high number of leks in Lincoln county makes searches for leks that have moved a lower priority than counting active leks. The use of aerial surveys was attempted in the past. To locate birds on a lek the helicopter had to hover over the center of the lek and created disturbance. Hunting dogs seem to be the greatest help in locating "new leks".

Hunting Seasons And Harvest

Hunting season is closed. There is no apparent mortality from human beings this year.

Surveys

A standard lek survey is used at most active and historical leks. Survey results for 1996, 1997, and 1998 are in Table 1.

Management Conclusions

Habitat acquisition by WDFW and BLM has only recently occurred. The value of these lands to the grouse is increasing noticeably as habitat rehabilitation proceeds. The research efforts on the Swanson Lakes WA showed satisfactory breeding success. Habitat is much improved over previous ownership of the site. Overall, conditions and breeding potential of this population and adjacent populations on BLM lands in Lincoln County bode well for the future.

Table 1. Lincoln County Columbian Sharp-tailed Grouse lek surveys by year.

Active Leks	1998	1997	1996
Anderson	9	13	1
BLM	5	10	ukn
Phantom	8	11	14
Powerline	0	2	2
Roseman	7	7	6
Swanson	5	6	8
Seven Springs	8	10	13
Sinking Creek	19	10	ukn
Tracy Rock	2	5	0
Inactive Leks			
Drager			
Hatton			
Sterrett			
Hoffman			

Species**Prairie Grouse****Sharp-tailed Grouse****Region****2****Prepared by: Scott Fitkin, Okanogan District Wildlife Biologist****Population Objectives/guidelines**

The management objective for sharp-tailed grouse is to increase the population size and distribution of birds in Washington. Statewide, the target population is ≥ 2000 birds distributed across four management zones. The population target for the three management zones lying mostly or wholly within Region 2 is 1200 birds. A portion of zone 4 lies in Region 2; however, it contains no known active leks, and will not be discussed further in this report. Parts of the management zones include sharp-tail range managed by the Colville Confederated Tribes (CCT). CCT lands contain some of the highest quality habitat and the healthiest populations of birds. Each year lek counts are conducted to determine population levels in the three management zones in Region 2 in order to monitor long-term trends, and evaluate progress in achieving the overall population goals.

Surveys

Sharp-tailed grouse leks have been monitored in Washington state since 1954. Techniques have been gradually improved and standardized to produce more reliable results. Currently, the survey protocol requires that all known active leks be visited at least once during the breeding season. Additional historical leks and/or areas of potential lek activity are visited as staff time allows. During each visit, all birds observed are recorded and classified as male, female or unidentifiable. Additional factors, such as heavy snow cover also can influence the timing of counts. Leks are revisited if the weather conditions are marginal, disturbance is likely, the count is dramatically lower than the previous year, or the lek is newly discovered.

During April and May of 1998, field personnel visited 23 leks outside of CCT land in Region 2. Fifteen of the leks visited were active, yielding 110 total birds (Table 1). Additionally, 16 active and 1 inactive leks were visited on the CCT reservation, and a total of 202 sharp-tailed grouse were observed. This effort produced a total of 40 visited leks, 31 active leks and 312 birds tallied for management zones 1-3.

Population Status And Trend Analysis

Incorporating the observation of 312 birds into the formula from the Washington State Management Plan, the Region 2 breeding population of sharp-tail grouse is estimated at 624 birds in 1998. This represents 31% of the state-wide management objective and 52% of the 1200-bird population goal for management zones 1 - 3.

Sharp-tail grouse survey efforts were inconsistent from 1970 to 1990, and some leks had not yet been identified. As a result, interpreting long term trend is difficult. Even so, historical data indicate the total number of birds per lek decreased over time (WDFW, 1995).

More consistent data collection on leks since 1990 indicates a 60% decline in sharp-tail numbers between 1991 and

1993. From 1993 to 1995, overall numbers increased to previous levels and have remained relatively stable, but the majority of birds are now found on CCT lands.

Interpreting population trends from lek count totals alone is difficult, because the survey effort has varied significantly over time; however, trends in the mean number of grouse per lek, and the number of leks visited mirror the population trends from 1991 to 1997. This suggests lek count totals do reflect actual changes in the population.

Habitat Condition And Trend

Historically, the quantity and quality of sharp-tailed grouse habitat declined significantly through the early and middle parts of this century as an increasingly larger portion of the birds range was cultivated, grazed, and developed. In recent years, range conversion has slowed and the situation has become more stable, but the same pressures continue to slowly encroach on remaining habitat.

Currently, sharp-tailed grouse habitat is very fragmented and exists as relatively small parcels scattered throughout historical range. Much of this habitat is of poor to moderate quality. Eighty percent of current sharp-tail range in Washington occurs on private land. Less than 3% of the range occurs on WDFW land managed for sharp-tails. Recently, little headway has been made in acquiring more sharp-tail range, or generating cooperative habitat enhancement programs with private landowners, outside of the federal Conservation Reserve Program (CRP). This is largely due to a lack of funding for such an initiative. The acquisition program should get a funding boost in the next biennium.

The current condition of habitat on private land is variable. Significant portions of existing range are intensively grazed, or are being converted to cultivation, reducing the suitability of land for sharp-tails. Conversely, much of the land enrolled in the CRP is being restored to conditions more favorable for sharp-tail grouse.

In the short-term, the condition of habitat on private land will hinge on the effectiveness of the CRP program. Land that is dropped from CRP will likely be grazed or plowed, and the value of the land for sharp-tails will be diminished. The result will be a reduction, and further fragmentation and isolation of remaining suitable habitat. This is likely to adversely affect the overall sharp-tail population.

Augmentation/habitat Enhancement

Twenty-five sharp-tailed grouse were captured and radio-marked near Rockland, Idaho, and moved to the Scotch Creek Wildlife Area in Okanogan County. Mortality during the first four months following the release has been high (55%), but may be partially attributable to an unavoidable delay in releasing the birds following capture.

Table 1. Sharp-tailed grouse lek counts in Region 2.

Lek Name	1991	1992	1993	1994	1995	1996	1997	1998
Alameda Flat	--	--	--	0	0	--	0	--
Alameda Flat South	--	--	--	1	1	--	1	--
Barnes Butte	0	0	0	0	0	0	0	--
Barker Mtn	5	2	2	1	1	2	1	0
Barker Mtn NW	--	--	1	0	--	--	0	4
Beehive Mtn	1	0	0	0	5	2	4	1
Brown's Lake	0	0	--	0	0	--	0	--
Brown's Lake NW	4	0	--	0	0	--	0	--
Cayuse Mtn	3	--	2	4	4	--	4	2
Central Ferry Canyon	19	9	5	5	0	6	3	4
Central Ferry Canyon Lower	0	0	0	0	0	0	0	--
Central Ferry Canyon Upper	0	0	0	0	0	0	0	0
Chesaw	8	1	10	3	3	1	6	5
Cold Springs Basin	13	15	3	6	1	0	0	0
Coleman Hill	2	--	1	2	1	1	4	2
Dry Creek	--	--	--	--	7	2	2	0
Dyer Hill	22	22	12	10	17	13	7	13
Dyer Hill East	--	2	0	0	0	0	0	--
Dyer Hill West	0	0	0	0	0	0	0	--
Fields	--	--	--	11	2	1	0	0
Fye Draw Lower	7	--	3	9	7	3	5	2
Fye Draw Upper	4	4	4	1	0	0	0	--
Happy Hill NW	3	2	0	0	0	0	0	--
Happy Hill SE	9	5	1	1	1	0	0	0
Horse Springs Coulee N	3	--	0	0	0	--	0	--
Horse Springs Coulee S	7	5	--	1	--	--	0	--
Moses Creek	--	--	--	0	0	0	0	--
Packwood Cemetery	1	0	--	0	0	0	0	--
Peaceful Valley	17	10	2	8	12	18	13	--
Reeves Butte	6	3	3	1	0	0	0	--
Sanderson Creek	--	--	--	0	0	0	0	--
Sanderson Creek N	--	7	--	11	12	7	9	9
School Creek	--	4	--	--	--	--	0	--
Scotch Creek	7	2	1	1	8	5	3	2
Siwash Creek	6	4	6	5	2	4	6	3
Synarep N	12	11	11	13	28	20	18	19
Synarep SW	--	--	--	--	--	--	--	7
Tunk Creek S	6	2	0	0	0	--	9	24
Withrow	--	1	0	0	0	0	0	--
West Foster Creek	--	--	--	--	--	--	--	13
Total	165	111	67	94	112	85	95	110

Immediately, following release, birds initially moved substantially, but most eventually settled in areas with existing populations of sharp-tails. Females nested near active leks, most on the Scotch Creek Wildlife Area. Nesting success was 57%, but only two chicks were known to be alive at the end of the breeding season. It is hoped that the relocation effort can be repeated again with more Idaho birds, or perhaps with birds from CCT populations.

WDFW will likely be receiving about \$4.5 million to secure approximately 10,000 acres of sharp-tail habitat in the 2000-01 biennium. These acquisitions will be pivotal in providing for the long-term security of sharp-tailed grouse in Washington.

In the mean time, work continues on WDFW lands to enhance habitat for sharp-tailed grouse within their current range. Efforts focus on restoring native grasses and shrubs to shrub/meadow steppe communities, and regenerating deciduous tree and shrub cover in adjacent riparian corridors.

Management Conclusions

Lek count data indicates that the current population is relatively stable or in slight decline, and a larger percentage of the population now resides on CCT lands than in years past. Survey efforts have been somewhat variable and this is likely to continue based on fluctuating budget levels. For the purpose of monitoring trend, a minimum number of active leks could be

identified that could be consistently visited every year with baseline funding. As resources allow, additional lek counts and survey work would be conducted to further refine population estimates.

Concerns about the population status of sharp-tailed grouse have prompted recommendations to further protect this declining species. The State recently listed the sharp-tailed grouse as a threatened species.

In short, the future of sharp-tailed grouse in Region 2 hinges on the quality and quantity of available habitat. Currently, the bulk of existing habitat occurs on private land. The remainder is scattered across lands managed by various state and federal agencies. As a result, ongoing efforts to pursue cooperative management and implement conservation plans with the public and private landowners are vital.

On private land, financial incentives and public education programs will be necessary for success. Despite these efforts, conditions on private lands are likely to fluctuate significantly, as evidenced by the recent turmoil with the CRP. As a result, it is important to make the most of available habitat on public land.

Conservation agreements with BLM, DNR and other public agencies are a priority objective in the WDFW Management Plan. More emphasis should be placed on conservation agreements with public agencies that manage shrub-steppe meadow habitat. Focusing attention on specific, public owned parcels, would make habitat enhancement more cost efficient.

Unfortunately, the public land base is small, and in many cases, wildlife management must compete with other land use mandates. This underscores the need for WDFW to vigorously pursue land acquisition as resources allow. Land acquisition will ultimately decrease publicly funded management and

recovery costs, reduce fragmentation of sharp-tail habitat, and shift the economic burden of management and recovery of sharp-tailed grouse away from the private landholder.

In the future, WDFW managed lands may have to serve as the refuge for sharp-tails, with the expectation that birds from these areas will be used to enhance or restock populations on other public and privately managed suitable habitat. The current quantity and quality of existing WDFW habitat is not adequate for this task. It is important to continue to maximize habitat values for sharp-tails on these parcels. Even as WDFW holdings are enlarged and habitat quality improved, the fragmented nature of these lands leaves them vulnerable to stochastic events, and corresponding local population declines or extinctions. Consequently, intensive "hands on" management will likely be needed to perpetuate the species in Region 2. This may mean periodic augmentation.

The current WDFW augmentation should be continued. This presents an opportunity to stock vacant or sparsely populated habitat. Augmentation will also be useful in determining the response of the birds to relocation, identifying sources of mortality, and determining dispersion patterns and other associated behaviors. The ability of existing habitat to support additional birds long-term is currently limited. Sharp-tail survivorship and habitat enhancement will need to be closely monitored, and the location and number of birds released adjusted accordingly.

Literature Cited

WDFW. 1995. Washington State management plan for the sharp-tailed grouse. Game. Div., Wash. Dept. Fish and Wildl., Olympia.

Species**Region****Prairie Grouse****Sage Grouse****2****Prepared by: John Musser, District Wildlife Biologist****Population Objectives/guidelines**

Sage Grouse are a threatened species in Washington and are a federal species of concern. Douglas county supports about 60 percent of Washington's current sage grouse population. Our objective for Douglas County sage grouse is to maintain at least 500 breeding adults.

Surveys

Number of males at known lek sights are used to monitor sage grouse population levels. Although survey protocol suggests that 4 counts of each active lek be made, we were only able to complete 3 counts this year. Counts were conducted between March 4 and April 17. Counts were conducted from ½ hour before sunrise to 1½ hours after sunrise. Depending on distance, binoculars or spotting scopes were used to count birds.

Eleven Douglas County leks were active in 1998. The maximum number of displaying males at individual leks ranged from 6 to 41 and totaled 237.

Breeding females are estimated by multiplying maximum

observed males by 1.6. Lek surveys indicate the 1998 Douglas County sage grouse breeding population was about 600 (237 males +379 females = 616 total).

Population Status And Trend Analysis

Since 1984, number of males counted on leks in Douglas County has ranged from 75 to 335 (Table 1). Douglas county sage grouse population has been steadily increasing for the last 5 years. Currently the population is slightly above the previous 10 year mean (230 males) and exceeds minimum objective by about 20 percent. Number of active leks has varied from 8 to 13 since 1984. The number of active leks in 1998 (11) is equal to the 1984 - 1998 mean.

Habitat Condition And Trend

About 85 percent of Douglas County is privately owned. Most of this private land is used for some type of agricultural production. Remaining sage brush habitat is very important to wintering sage grouse. The Conservation Reserve Program is creating habitat that is heavily used for nesting and brooding.

Table 1. Sage Grouse lek counts in Region 2 (nc = not counted).

Lek Site	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Alstown	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	9	6	7	8
Armstrong	5	1	1	7	0	3	1	0	1	1	0	0	0	0	0
Barnes Butte	14	0	0	0	0	0	0	2	0	0	0	0	0	0	0
Coyote Canyon	2	0	1	0	3	0	nc	0	13	7	10	14	23	26	20
Davis	nc	16	14	24	57	63	64	69	13	29	33	34	60	58	47
Del Rio	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	9	11	8
Foster Coulee	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	21	14	11
Glessner	31	9	11	10	13	11	14	5	6	4	5	6	6	2	0
Jameson Lake	15	5	5	5	14	14	6	4	2	0	0	0	0	0	nc
Long S.B.F.	Nc	nc	nc	nc	nc	nc	nc	6	1	0	0	0	0	0	nc
Mansfield	23	12	61	71	90	91	88	71	36	11	18	25	22	22	28
Mansfield W.	Nc	nc	nc	nc	nc	nc	nc	nc	0	0	4	1	0	0	nc
Mary Jane Hill	nc	nc	nc	nc	nc	nc	nc	2	nc	1	0	0	0	1	0
Mattheisen North	17	2	3	15	45	46	55	45	26	14	4	4	1	0	6
Mattheisen South	43	22	19	37	52	63	57	53	24	26	19	20	21	26	41
Mold	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	2	0	0	0	nc
Pegg Canyon	nc	nc	nc	nc	nc	nc	3	0	0	0	0	0	0	0	nc
Reeves Butte	15	8	5	19	22	25	16	19	16	13	11	11	14	23	21
Sagebrush Flat	5	0	9	9	14	6	1	8	14	11	13	11	5	4	0
Saint Andrews	0	0	0	0	2	1	0	0	2	0	0	0	0	0	nc
Sulfer Canyon	nc	nc	nc	nc	23	5	nc	nc	9	4	1	21	20	7	6
Touhey	nc	nc	nc	nc	nc	nc	9	4	0	4	4	22	21	36	41
Total	170	75	129	197	335	328	314	288	163	121	124	199	222	234	237

Augmentation/habitat Enhancement

Sage Brush Flats, a 3000 acre parcel of shrub steppe habitat dominated by big sagebrush, was purchased by Washington Department of Fish and Wildlife (WDFW) in early 1998. Other shrub steppe acquisitions are pending. WDFW supported the current CRP in Douglas County which has been

beneficial to a variety of wildlife including sage grouse.

Management Conclusions

We need to continue to closely monitor this threatened population and work with Douglas County landowners to ensure that habitat is available for sage grouse.

Species**Region****Prairie Grouse****Sage Grouse****3****Prepared by: Leray Stream, District Wildlife Biologist****Population Objectives/guidelines**

Sage Grouse are native wildlife in the state of Washington. Historically they were used for subsistence when settlers moved into the state and were noted by many journalists. Subsequent to settlement, sage grouse were hunted until 1988 when a moratorium on hunting was implemented.

The Washington State Management Plan for Sage Grouse (Washington Department of Fish and Wildlife 1995) identifies population objectives for individual management zones. Present estimates of sage grouse in Washington is 900-1,000 statewide (Hays et al. 1998). Statewide objectives are aimed at increasing the population to greater than or equal to 1,500 birds averaged over a five-year period. Region 3 (Benton, Yakima, Kittitas, & Franklin counties) has four zones out of six identified in the State Management Plan. Specific population objectives for Region 3 is to reach 900 sage grouse distributed throughout these zones averaged over a five-year period

Once population levels attain the desired number and the habitat is protected well enough to sustain the population, then possibilities exist to again extend recreational activities to include a hunting program.

Surveys

The primary survey technique for monitoring and inventory work on sage grouse has been lek surveys. Males are vocal and visible while at leks which enables monitoring numbers fairly easy. Trends can then be viewed for population changes over time. Lek surveys are conducted in the early spring with the peak attendance occurring in March. Historical surveys (1970-1988) were conducted in March, once a week for a 3-week period. When sage grouse research was initiated at the Yakima Training Center in 1989 surveys were intensified to at least once a week from the 1st of February until the last of May. Future surveys are likely to be scaled back to the month of March but still with more effort than previous to 1989. Surveys start before dawn and extend to one to two hours after sunrise. All males are counted in the immediate vicinity of the lek.

Systematic Lek counts have been conducted on the Yakima Training Center (YTC) since 1970. Surveys were started that year at the Range Central Lek. In 1975 the Squaw Creek (Imumma) Lek was found. In 1983 birds were found at Range 15, which was a new lek. From 1970 through 1988 sage grouse were spread throughout the area in satellite leks as well as the main lek sites. Surveys from these sites were all lumped into the nearest major lek category for reporting purposes. When research was implemented on the Yakima Training Center in 1989 by Battelle Northwest Laboratories satellite leks were split from the main leks and given names of their own. In addition, new leks were found and monitoring of these continue by the U.S. Army, YTC wildlife biologists, to present.

Lek counts for 1998 were conducted once a week starting on March 3 and twice a week from April 1 to May 6. Surveys

followed established protocols. Male attendance at the leks on the YTC increased from 120 in 1997 to 137 (14% increase) in 1998 which making this the highest count since surveys were started (Table 1). Surveys were conducted only three times during March from 1970 -1988 and from 1989 to present once a week from February to May. Additional areas outside the traditional leks were surveyed in 1998, which increased the number of sage grouse in the sample.

Table. 1. YTC Sage Grouse counts from 1970 to 1996.

Year	Males	Females	Total	Estimated Population*
1970	18			
1971	18			
1972	12			
1973	8			
1974	5			
1975	22			
1976	31			
1977	44			
1978	53			
1979	49			
1980	102			
1981	120			
1982	125			
1983	111			
1984	118			
1985	117			
1986	74			
1987	73			
1988	84			
1989	108	30	138	278
1990	100	29	129	172
1991	168	56	224	263
1992	135	66	201	156
1993	129	66	195	192
1994	95	17	110	182
1995	64	16	80	109
1996	41	16	41	117
1997	120	19	139	312
1998	137	66	203	277

*Male:Female ratio =1:1.6(M+1.6M=TP)

The past 20 years trend shows a fluctuating level of males on leks (Table 1, Figure 1). The cause of the fluctuating trend have yet to be determined. Low levels occurred in both the mid-80s and mid- 90s with populations rebounding in the next few years. Recent high intensity survey effort should be accurately reflecting actual population trends.

Population Status And Trend Analysis

Based on the trends in the lek count surveys the population

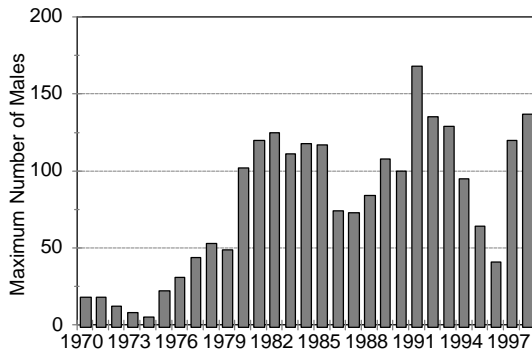


Figure 1. YTC Sage Grouse Lek Trends

is stabilized at a low level. The counts for 1998 are comparable to the numbers found in 1982, but the survey effort is much greater now than they were in that year. Starting in 1989 survey efforts were increased to finding all lek sites on the YTC with lek monitoring weekly from February through May and in some cases twice weekly during peak lek attendance in March and April. Previous surveys, before 1989, only monitored three known lek sites three times each during the month of March. Therefore, with a 10-year period of increased survey effort and with results still showing fluctuating trends in the number of birds found each year, the future remains uncertain.

Habitat Condition And Trend

The past winter provided ample moisture to promote vegetative production. Combined with early spring rains habitat provided for above average conditions for nesting and brood rearing. All upland game birds are improving with improved climatic conditions. However, there has been virtually no precipitation from June through October which could impact the vegetative growth this winter.

The YTC's primary mission is to provide an area for troop training activities. Impacts occur annually in the form of fires, trampling by vehicles, and encampments. Fire tends to be the most destructive as it eliminates large tracts of habitat very quickly.

The past few years YTC has had fires but nothing on a large scale, except 1996. Fires during the 1980s eliminated large tracts (25,000 acres) of habitat where sage grouse wintered diminishing potential use of the range. The 1996 fires burned over 55,000 acres of habitat. Many of the areas that burned were the same general areas which burned in the 1980s. Cascade Sage training maneuvers during 1995 caused substantial sagebrush mortality. The remaining sagebrush communities are crucial to maintaining the population.

The Department of Army, YTC staff, have developed a Western Sage Grouse Management Plan that is to take effect in October 1998 and run through 2003. Previous to this plan they have been operating under the Western Sage Grouse Conservation Agreement developed between the USFWS and

YTC. The old agreement is presently under review. These documents and the implementation of each will be crucial in maintaining sage grouse populations in Region 3.

Habitat found outside the confines of the YTC is either in poor condition or has already been converted to agricultural lands. The rate of sagebrush conversion is declining since most has already been converted. However, efforts are under way to identify key recovery areas outside the YTC boundaries which could help supplement the population and increase the current range of sage grouse.

Augmentation/habitat Enhancement

To date there has been no augmentation efforts to increase sage grouse populations. The issue is before The Western Sage Grouse Working Group, which is a group of biologists from various state and federal agencies organized to help direct efforts needed for maintenance and recovery of Washington's sage grouse populations.

No land acquisitions for sage grouse has occurred since 1994 when property in Benton County was purchased by WDFW that provides enhancement capabilities for the future. There are still acquisition plans on the agenda aimed specifically for sage grouse enhancement.

The promotion of the CRP program on private lands has the potential to increase sage grouse habitat if given time to develop. Many of the agreements under this project were terminated in 1997. Renewals were looked at with high priority on areas that could benefit sage grouse populations. However, in Region 3 there was not a high amount of CRP renewals.

The major impact to sage grouse population is the loss of shrub steppe habitat. The major cause of this loss is from agricultural conversion and fires. Since conversion to agricultural land has slowed, fires present the foremost threat to shrub steppe and Sage Grouse declines.

Management Conclusions

1. Habitat Enhancement Recommendations
 - a. Promote continuation of CRP programs in key areas for sage grouse management.
 - b. Participate in the Western Sage Grouse Working Group to promote management actions that will benefit sage grouse populations statewide.
2. Augmentation/Translocation Recommendations

Participate in the Western Sage Grouse Working Group to identify areas where augmentation actions may enhance sage grouse population expansion.

Literature Cited

- Hays, D.H., M.J. Tirhi, and D.W. Stinson. 1998. Washington State status report for the Sage Grouse. Wash. Dept. Fish and Wildl., Olympia. 62 pp.
- Washington Department of Fish and Wildlife. 1995. Washington State management plan for sage grouse. Game Div., Wash. Dept. Fish and Wildl., Olympia. 101 pp.

Species

Jackrabbits

Statewide

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Population Objectives/guidelines

Management objectives are to sustain well-distributed populations and provide appropriate levels of recreational harvest.

Hunting Seasons and Harvest Trends

This study was conducted during the September 1, 1997 to March 15, 1998 hunting seasons. Currently the daily bag limit is five rabbits with a 15-rabbit maximum possession. Previous years' limits were 10 daily and 30 possessions. The statewide jackrabbit harvest total for the 1997-98 season is reported as 691. This is a negative 80% change from the 1996 season with

will be entered into a department database for map development.

A literature search was conducted to generate a source of information on current research and to build a departmental guide for future recommendations. Items included in the jackrabbit literature search package are, scientific journal papers, graduate thesis research papers, and WDFW reports. A copy of these research papers will be made available to area biologists and managers.

For 1997, jackrabbit wanted poster responses, comprised 4 sighting report forms was returned for a total of 27 jackrabbits seen. All the returned reports were for WDFW Region's 3 and 5 (Table 1).

Table 1. Jackrabbit sighting information.

Obs	Spp	County	Map	Location	Date
1	WT	Kittitas	Wen S.	Bushy Creek-Quilomene	10/4/97
19	BT	Klickitat	Goldndale NE	South of Alder Creek	10/18/97- 1/10/98
2	Unk WT?	Klickitat	Goldendale SE	Hoggey Spring & Spring Canyon	10/18/97- 1/10/98
3	BT	Benton	Richlnd NE, SE	Benton City	3/97, 10/5 10/26/97
2	WT	Yakima	TopnshNE,NW	Toppenish	8/31/97
27	Total				

a confidence level of plus or minus 250%. This low confidence level is due to the fact that less than 10% of the people that purchase hunting licenses is surveyed and that rabbit hunters make up a very small proportion of hunters. Since this negative 80% is not reliable, it may take several years of study to develop an accurate picture of population trends.

Surveys

Jackrabbit sighting reports from hunters, hound owners and area biologists are the principal source of information used for this survey. Telephone calls were made to members of various hound hunter clubs in Washington state. Members who were contacted were asked to participate in the state wide jack rabbit survey. Arrangements were made to visit with hound owners at a dog trial competition in Castle Rock, Washington. A discussion of the objectives of the jackrabbit study was given at this meeting. The meeting produced interest with several hound hunters who would be pursuing rabbits in the Columbia basin shrub steppe regions. Maps and report forms were given out to these hound hunters.

A Jackrabbit wanted poster was made and published in the 1997-98 Migratory Waterfowl and Upland Game Seasons pamphlet. This poster asked for sighting information and gave hunters visual characteristics of the white-tailed and black-tailed jackrabbits.

Hunters who responded to WDFW as a result of the published wanted poster were sent report forms and maps. Completed forms from both the hunters and/or hound owners

Surveys were conducted by district biologists in WDFW Regions 1, 2, and 3 during 1996 and 1997 (Table 2).

Table 2. Biologist Survey Results.

	Region 1 1996	Region 2 1996 1997	Region 3 1996
Black-tailed	0	0	2 Live 1 Road Kill 4 Inc Live
White-tailed	1 Incidental	9 Live 2 Road Kill	2 Inc Live
Total Rabbits All Regions		18 Live	3 Road Kill

The latest survey for region 1 was conducted by G. J. Hickman in 1996. Mr. Hickman's report focuses on White-tailed jackrabbits. Dates of the survey are not known. Survey efforts were made in parts of Lincoln and Whitman counties. Methods used to survey jackrabbits were done by hiking selected roadside habitats along the survey routes and spotlighting after complete dark in areas east of Sprague. No jackrabbits were sighted (live or road-kills) during the survey efforts which covered a distance of 1025 miles and took 39 hours to complete. Mr. Hickman did however report seeing one jackrabbit during a deer survey on 8/1/96. In his report Mr. Hickman states that "he has never seen a Black-tailed jackrabbit

in the Lincoln or Whitman counties.” For more detailed information see the survey report.

The latest surveys for region 2 were conducted by Peggy Bartels in 1996 and 1997. Ms. Bartels’ report focused on White-tailed jackrabbits. Surveys in 1996 were conducted on December 17, 18, 20 and 23. The total number of miles driven was 528 in the four evenings. In 1997, the survey was conducted on August 15, 16, 17, 18, 24, 25, 26, and 28 with 1145 miles driven during the six evenings. Parts of Adams, Okanogan, Grant and Douglas Counties were surveyed. Methods used for the 1996 -97 jackrabbit surveys were done by spotlighting from a vehicle which included a driver and spotter. The duration of each nightly survey was from approximately 5:00 p.m. and continued until 1:00 a.m. the following morning.

A total of eleven white-tailed jackrabbits was observed during the 1996-1997 surveys. Two of the eleven sightings were road-kills. For more detailed information see the survey report.

The latest survey for region 3 was conducted by Rick Estes in 1996. Mr. Estes’ report focused on both species of jackrabbits. The survey was conducted on October 7, 8, 9, and 10 1996. Portions of four areas were searched: the Hanford nuclear reservation, the Yakima Training Center, the L.T. Murray Wildlife Area and the Horse heaven Hills. Methods used for the 1996 survey was to inventory suitable sagebrush habitats during daylight hours and to perform nighttime spotlighting in those areas that were found to be suitable for the jackrabbits during the daytime searches. Searches were conducted from a vehicle on roadsides and by walking cross country. Nearly 500 miles was traveled and 40 hours spent on the survey. At the Yakima Training Center, non specific surveys were conducted by a contract biologist named Dale Leatherwood. Mr. Leatherwood reported seeing black-tailed jackrabbits on the road between headquarters and range control. No survey methods and sighting numbers were given. In his report Mr. Estes also stated that WDFW biologist Del Peterson in 1996 reported seeing black-tailed jackrabbits at YTC and white-tailed jackrabbits in the Hanson Creek/MPRC area. Again survey methods and sighting numbers were not given. Mr. Estes also provided information on incidental sightings in 1996. One black-tailed jackrabbit was seen at each of the following sites: Status Creek/Plank Road, Rattlesnake Ridge/Zillah, and Sunnyside WA. Estes also included one other white-tailed jackrabbit sighting by Del Peterson at the Rattlesnake Mt./ Thornton WDFW management unit.

The jackrabbit sighting reports that were generated by hunters responding to the WDFW wanted poster and involvement of members of the Pacific Northwest Rabbit Hound Club showed limited distribution information. Of the 27 jackrabbits reported in the 1997-98 hunting season all were located within WDFW region 3 and 5. There were no responses from hunters in WDFW regions 1 or 2. All the reported sightings were located in areas where known populations exist. However, some new information on potential habitats was obtained from the reports of area biologists who conducted recent jackrabbit surveys. These areas such as the ones identified by Rick Estes, WDFW region 3 biologist in his jackrabbit survey report, identified significant sagebrush stands where potential jackrabbit habitats exist. Region 2 biologist,

Peggy Bartels wrote in her survey report that by request of area biologist Jim Tabor, Grant County was not surveyed in 1997. Region 1 biologist, Jerry Hickman stated in his survey report that Lincoln County could be surveyed in the winter due to past rabbit sign being detected in the snow. These areas could be checked for jackrabbits during the next hunting season by hound hunters who are asked to work these specific locations. During my visit to the rabbit hound club meeting in Castle Rock, WA I found that hunters were not as willing to go to locations outside of where they have known jackrabbits to be at. This sentiment is most likely due to the fact that the hunters have been reporting fewer jackrabbits over the past several years which are consistent with the declining harvest trends. Giving rabbit hunters better information on areas to hunt would stimulate enthusiasm and allow continued improvement of distribution information. Contacts with area land managers could be improved by the regional biologists and new agreements should be made with land owners in order to allow hound hunters better access to property.

Continued work is needed to find and gather new information on agricultural lands and shrub-steppe areas suitable for jackrabbit habitats. More emphasis is needed by the area biologist and volunteers to search out these areas and to look for jackrabbits. Protocol for conducting the jackrabbit surveys for both species needs to be emphasized. All surveys need to be scheduled and conducted at the same dates and time intervals. Region 2 biologist, Peggy Bartels reported using a good method for night spotlighting. Ms Bartels used a driver and a spotter and conducted surveys at consistent intervals when jack rabbits are most likely to be seen. Ms Bartels survey methods produced the best results as far as total jackrabbit numbers. However, only white-tailed jackrabbits were surveyed in regions 1 and 2. All regional surveys should include black-tailed jackrabbits as well. This is important because of the need to get as much information about how both species populations are declining.

Potential jack rabbit habitats should be located and included in the search area plan well ahead of the scheduled survey time. A method such as the daytime searches used by Area 3 biologist, Rick Estes should be incorporated into all WDFW area search protocol. The daytime searches will allow biologists to familiarize themselves with the area and will eliminate lost time spent looking for locations at night. Potential jackrabbit habitats can be noted during other species surveys and from historical data. This will allow for better species censuses and to determine habitat use. During potential habitat searches, location coordinates could be taken along routes. This will allow for easy map generation and could be used for successive searches.

The Jackrabbit wanted posters should again be published in the WDFW Hunting Regulations and Department news letters. Regional biologists should be asked to include any jackrabbit sightings in weekly reports and to query hunters or outdoor enthusiasts.

New contacts have been made with the Washington State Falconers Association and enthusiasm to work together with WDFW is high. With the help of hound owners, falconers, and area managers WDFW distribution information will continue to

improve.

Thanks to Paul McKinley, Secretary of the Pacific Northwest Rabbit Hound Club and members for letting me speak at their meeting and their participation in this study. Thanks also goes to hound owner Randy Connelly for his

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