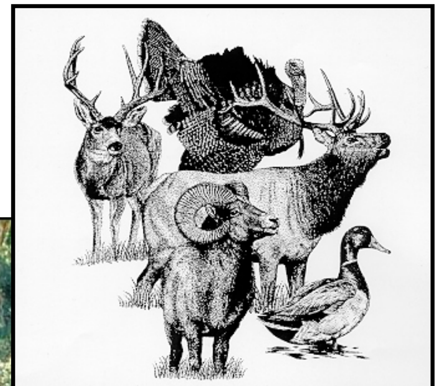
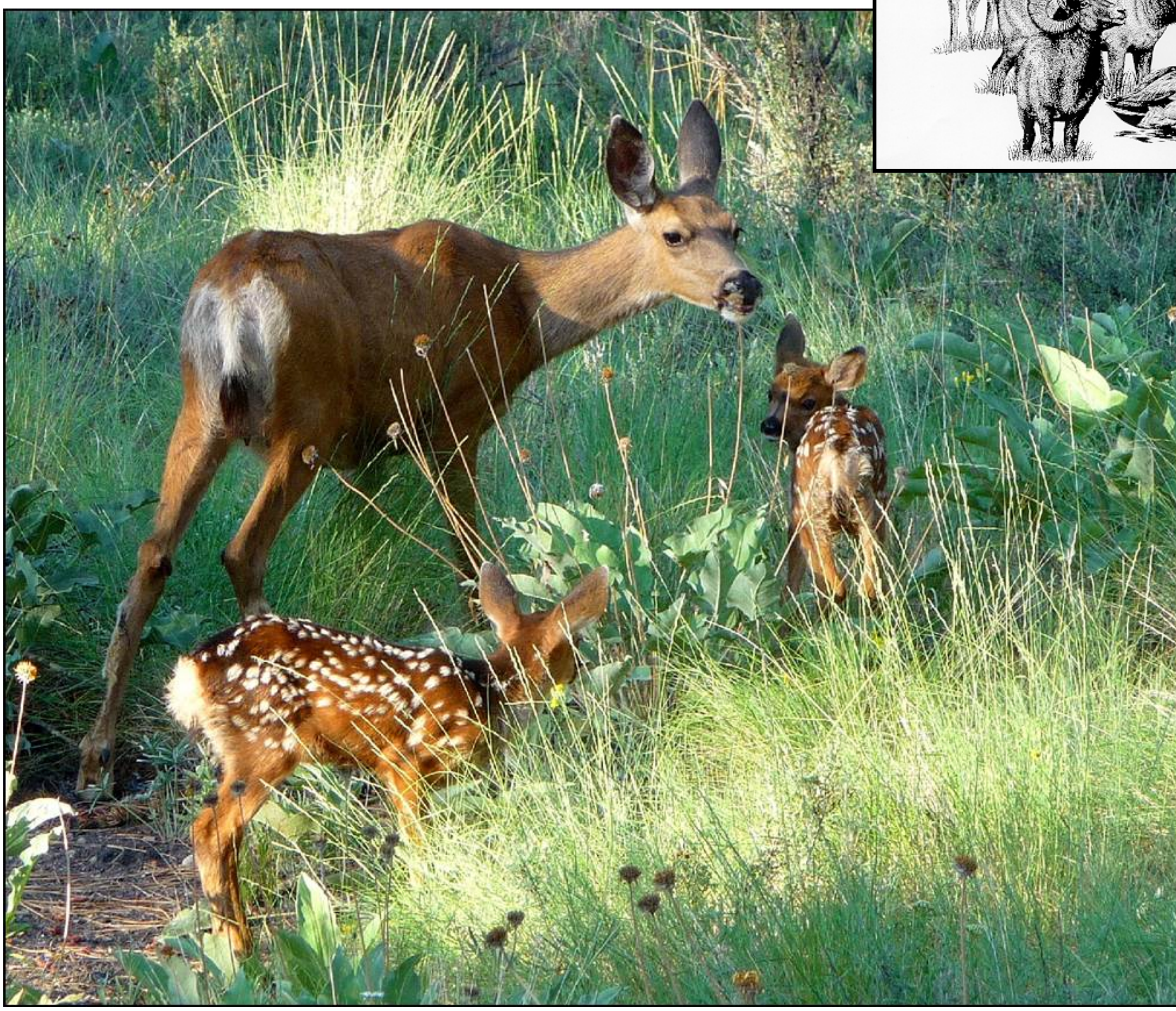
STATE OF WASHINGTON

2015 Game Status and Trend Report





Washington Department of FISH and WILDLIFE

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2015 GAME STATUS AND TREND REPORT

July 1, 2014 – June 30, 2015

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

This Program Receives Federal Aid in Wildlife Restoration, Project W-96-R, Statewide Wildlife Management.

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TABLE OF CONTENTS

Deer

DEER STATUS AND TREND REPORT: REGION 1

GMUs 101,105, 108, 111, 113, 117, 121

DANA L. BASE, District Wildlife Biologist

Population objectives and guidelines

The goal of deer population management in Washington State is to maintain relatively stable populations within the limitations of available habitat and landowner tolerance, accounting for extreme weather events such as summer and fall drought, catastrophic fire, and protracted winters with deep snow. An additional goal is to be responsive to landowner conflicts which sometimes involve recreational hunting seasons but other times require separate mitigation tools as spelled out in the wildlife conflict section (WDFW 2014).

In northeastern Washington white-tailed deer (*Odocoileus virginianus*) are the most abundant deer species. Mule deer (*O. hemionus*) are locally common, especially in the higher elevations and throughout Ferry County, but their overall numbers are lower compared to white-tailed deer on a district scale.

The white-tailed deer harvest management objective is to provide antlered and antlerless hunting opportunity for all hunting methods whenever feasible. The buck escapement goal is to maintain a ratio of at least 15 bucks per 100 does in the post-hunting season population (WDFW 2014).

Management goals for mule deer are to provide conservative hunting opportunity, maintain a range of at least 15 to 19 bucks per 100 does in the post-hunting season population, and allow population levels to increase by managing antlerless hunting opportunity (WDFW 2015).

Hunting seasons and harvest trends

In 2011, the Fish and Wildlife Commission changed the white-tailed buck hunting season structure in GMUs 117 and 121 from "any buck" to a "4-point minimum" antler restriction. Antlerless hunting opportunity was also reduced over the previous two years. Figure 1 depicts the trend in total estimated deer harvested by general season hunters within District One from 2008 through 2014. The overall deer harvest in District One steadily declined from 2008 through 2011, and then gradually began to increase from 2012 through 2014. Figure 2 shows the trend in total deer hunters within District One. Here the decline in hunters follows the same pattern as the deer harvest for 2008-2011. Then from 2012 through 2014 there was a very slight increase in the number of hunters. The number of days hunted per deer harvested ranged from 17 to 25 days between 2008 and 2014 (Figure 3). The peak in days hunted per harvested deer was in 2011 at 25 days and the lowest number was 17 days in 2014.

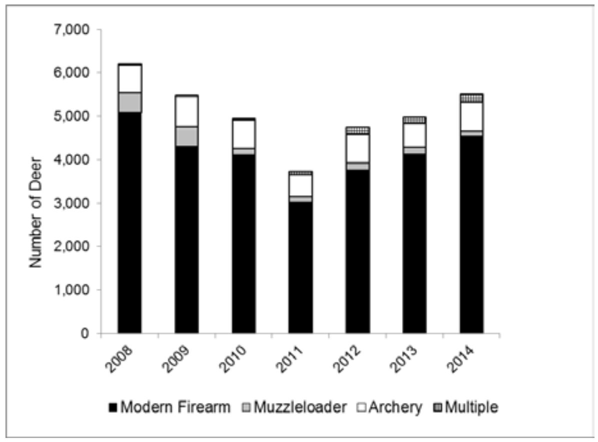

Figure 1. General season deer harvest by weapon type in District One (GMUs 101-121), 2008 – 2014.

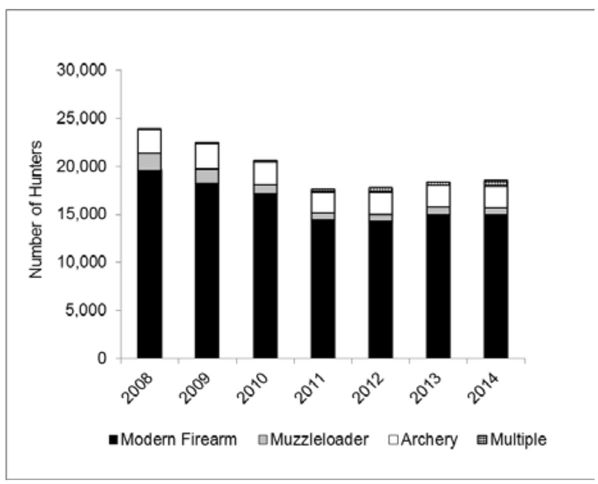

Figure 2. General season deer hunters by weapon type in District One (GMUs 101-121,) 2008 – 2014.

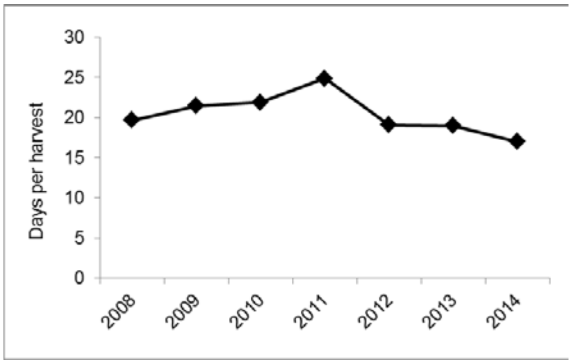

Figure 3. Days hunted per deer harvested for all weapon types combined during the general season within District One (GMUs 101-121), 2008- 2014.

In the 2014 hunting season there was an estimated harvest of 988 antlerless and 4009 antlered white-tailed deer within District One (Table 1). Beginning in the 2010 season, Youth, Senior, and Hunters with Disability (Y/S/D) were allowed to only take antlerless white-tails (or legal bucks) for 4 days including the second weekend of the early modern firearm deer season (October dates only) within GMUs 101-121. There were also only 25 antlerless white-tailed deer permits allocated for modern firearm deer hunters within GMUs 101-121 not including special permits for master hunters; this was a tremendous decrease from previous seasons. As of 2014, the number of special permits for antlerless deer was increased to 170. Overall the proportion of antlerless white-tails taken per 100 antlered white-tailed deer for GMUs 101-121 was 26 in 2014 (Table 2).

Since 1997, mule deer bucks legal for harvest have been limited to a 3-point minimum. District wide (GMUs 101-121) in 2014, the mule deer buck harvest estimate for general season was 417 (Table 2). Most of these were taken by modern firearm in GMU 101.

Age, antler, and sex ratio data are collected from harvested deer for monitoring harvest and developing season recommendations (Figure 4). One way that the ratio of mature white-tail bucks in the harvest is monitored is by taking tooth samples from adult deer for age analysis. Excluding yearling white-tail bucks, the proportion of adult bucks over 4 years of age that were sampled at hunter check stations in 2011 increased from previous years . After 2011 that proportion declined substantially.

White-tail buck antler data are also collected from hunter check stations and mandatory harvest reports. This includes tallies of bucks that have 5 or more points on the high side of their antlers. Hunter check stations and estimated harvest in 2014 yielded 23% and 24%, respectively, of white-tail bucks with 5 points or higher in GMUs 101-121(Figure 4).

The proportion of white-tail yearling bucks brought to hunter check stations ranged from 19% to 48% for 2008- 2014. The mean age of adult white-tail bucks (yearlings excluded) checked in 2014 was 2.5 years (n = 25) which decreased from 2.9 years in 2013 (n = 76). The younger average age for 2014 was due to a high abundance of 2 year old bucks and only one 4 year old buck that came through the hunter check stations.

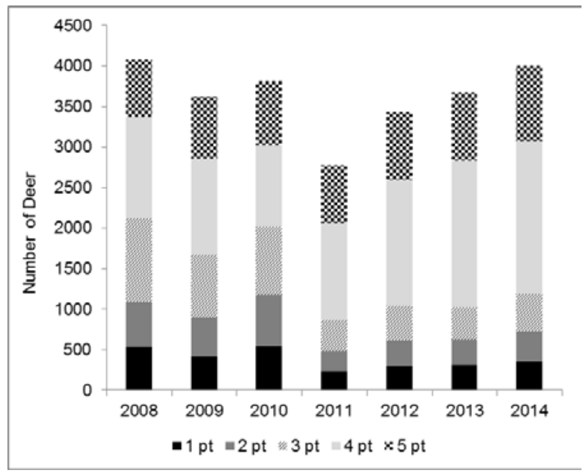

Figure 4. Estimated general season harvest of white-tail bucks by antler point within GMUs 101-121.

Surveys

A reliable estimate of the deer population size has been out of reach due to a lack of appropriate protocols that will work in this habitat. As a result, management decisions are often made with indices or surrogates of population size. One of these indices used within District One is the annual late summer (prior to the modern firearm season) deer composition survey. This survey is accomplished by counting all deer observed along 20 standardized transects set up on rural, secondary county roads that are widely distributed throughout District One. Each transect is 15 miles long and there is at least one transect in each GMU. The standardized routes have been surveyed consistently since 2011. In addition there are 6 “traditional” surveys transects of varying length that have been surveyed consistently every year since 2003.

Within the Selkirk Zone (GMUs 105-121) the proportion of white-tail bucks to does observed in the summer of 2014 moderately decreased from 2013, going from 31 to 28 bucks per 100 does (Table 3). Meanwhile the fawn to doe ratio observed in 2014 was 49 per 100 does, which was almost the same as 48 as observed in 2013. Important to note, however, is the wide variance in buck/doe/fawn ratios amongst all survey years with overlapping confidence intervals (Skalski et al. 2005).

Population status and trend analysis

The total deer harvest in 2014 increased from 2013 mainly on account of considerably more antlered white-tailed bucks taken (Figure 1). Last year was the third increase in the deer harvest for GMUs 101-121 as a whole since 2011, the lowest year. Total deer hunter numbers in 2014 were nearly the same as in 2013 (Figure 2).

In the late 1990s, there was unprecedented low representation of mature white-tail bucks in the harvest. This concern was addressed by maintaining conservative late buck seasons that did not extend beyond the middle of the rut. After 1999 there was consistent improvement in the percentage of older bucks based on monitoring antlers. Improvement in the general trend toward more bucks 4 years or older was also supported by cementum analysis of deer teeth. We are currently at a level that has reasonably good representation of mature bucks in the white-tail population. Now, better than 1 in 5 white-tail bucks harvested is 5 point or higher.

The total antlerless white-tailed deer harvest increased dramatically from 2001-2008. The proportion of antlerless white-tails taken per 100 antlered bucks went from 36:100 in 2002 to 59:100 in 2008. After two severe winters beginning in 2007 the opportunity for hunting antlerless white-tails was incrementally reduced. As a result, the overall ratio of antlerless to antlered white-tails in the harvest declined to 25 per 100 in both 2010 and 2011. In 2014 this ratio was still low, at 26. The largest proportion of antlerless deer harvested occurred within GMU 101 while the lowest proportions were within GMUs 105, 108, 111, and 113 (Table 1).

Disease and Predators

WDFW continues to test deer opportunistically for Chronic Wasting Disease (CWD) and many deer from northeastern Washington have been included in the statewide sample. To date no deer from Washington State have tested positive for CWD.

Cougar populations in northeastern Washington were exceptionally high in the middle to late 1990s. Cougars are a prominent predator of deer in northeastern Washington, but the impact on deer populations has not been well quantified. Black bears and coyotes are also abundant within the Colville District. Gray wolves established new packs within Washington including the northeastern part of the state where there is a prey base of elk and moose as well as deer.

Habitat condition and trend

Both survey and harvest data indicate a recent increase in the white-tailed deer population within the Colville District. Since the last severe winter of 2008-2009 the Colville District has had only mild or moderate winters. Consequently, winter deer kill has probably been negligible since 2009.

More insidious than occasional bad winters in northeastern Washington is the on-going conversion of farm and forest lands into rural-residential developments along with the loss of alfalfa and cereal grain production on established agricultural ground. Between 1985 and 2008 production of cereal grains and alfalfa hay within Stevens and Pend Oreille Counties declined approximately 45% (Source: National Agricultural Statistics Service, USDA). This change in agricultural production in combination with occasional severe winters and prolonged summer droughts has probably led to a reduction in white-tailed deer abundance but not their overall distribution.

Wildlife damage

Deer foraging in alfalfa, nuisance deer in urban areas and damage to automobiles by highway collisions are the primary economic losses reported. Antlerless permits and either-sex hunting opportunity by youth, senior, and hunters with disabilities are part of the management strategy to stabilize deer populations and control excessive damage. While deer continue to be a problem for farmers, the population and the damage complaints are presently at a reasonably tolerable level. A total of 31 Damage Prevention Cooperative Agreements (DPCA) were made between the Department and private landowners since last year. WDFW may issue Landowner Damage Prevention Permits when and where circumstances are appropriate as another means of addressing damage to lands open to hunting. On farms, these permits usually allow licensed hunters to take antlerless deer outside of general hunting seasons. This small-scale program has proven popular and effective, especially in providing landowner satisfaction. In urban areas kill permits have been issued to the local police department with the meat donated to local food banks.

Management conclusions

The total deer harvest in District One increased in 2014, which was the third season with an increase since 2006. Meanwhile the number of days hunted per deer harvested decreased to 17 days in 2014 from 19 days in 2013. The low proportion of antlerless white-tails harvested in several GMUs should help increase escapement of female deer for continuing growth in the white-tail population back to previous levels. The proportion of 5 point or better antlered white-tail bucks in the harvest appears to be maintaining a reasonably high level at 24%. Maintaining adequate hunter field checks (check stations) along with analyses of harvest reports will be necessary to continue monitoring the age structure and antler classes of the deer population.

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Table 1. Estimated white-tailed deer harvest by GMU and user group in 2014.

GMU	Antlerless				Antlered	Antlerless per 100 Antlered
	Archery	Permit[1]	Y/S/D[1,2]	Total[3]		
101	70	9	160	239	605	40
105	21	0	25	46	276	17
108	7	0	40	47	345	14
111		0	70	70	465	15
113		3	39	42	378	11
117	53	16	158	227	765	30
121	61	50	262	373	1175	32
Total	212	78	754	1044	4009	26

[1]Not estimated
[2]Y = youth, S = senior, D = disabled
[3] includes multi-weapon

Table 2. Estimated mule deer buck harvest by user group within District 1 (GMUs 101-121), 2008-2014.

Year	Archery	Muzzleloader	Modern Firearm	Total	# 4pt+	%4pt+
2008	22	45	375	442	224	51%
2009	22	28	459	509	313	61%
2010	33	16	410	459	246	54%
2011	19	25	239	283	141	50%
2012	36	32	301	369	197	53%
2013	21	29	380	430	250	58%
2014	34	31	352	417	221	53%

Table 3. Summary of white-tailed deer late-summer composition surveys within GMUs 105-121, 2008 – 2014.

Year	August		90% Confidence Interval	September		90% Confidence Interval
	# Deer Counted	# Bucks : 100 Does		# Deer Counted	# Fawns : 100 Does	
2008	574	23	+/- 9	884	48	+/- 10
2009	451	29	+/- 11	542	54	+/- 16
2010	1522	24	+/- 5	1533	48	+/- 7
2011	765	28	+/- 9	1098	54	+/- 15
2012	878	21	+/- 6	465	57	+/- 25
2013	981	31	+/- 8	653	48	+/- 15
2014	1123	28	+/-10	634	49	+/-13

DEER STATUS AND TREND REPORT: REGION 1

GMUs 124, 127, 130, 133,136, 139, & 142

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CARRIE LOWE, Wildlife Biologist

Population objectives and guidelines

Game Management Units (GMUs) in District 2 include 124-Mount Spokane, 127-Mica Peak, 130-Cheney, 133-Roosevelt, 136-Harrington, 139-Steptoe, & 142-Almota. The geography of District 2 includes the edge of the Rocky Mountain Range in the east, the Columbia Basin in the west and the Channeled Scablands and Palouse Prairie in between. This diverse geography supports a wide range of habitats that include mixed coniferous forests dominated by Douglas fir and larch, dry Ponderosa pine forests, some aspen groves, scabland, sagebrush steppe, grasslands, and extensive agricultural lands. Topography varies from ~500ft above sea level along the Snake River in the south to 5883 foot Mt. Spokane in the north. Dominant river drainages include the Spokane, Palouse, Columbia, & Snake Rivers.

Both white-tailed deer (*Odocoileus virginianus*) and mule deer (*O. hemionus*) species are found in District 2. Management objectives for white-tailed deer populations in District 2 are to maintain the population at current levels and to retain the current general and permit only season hunting structures (WDFW 2010). Increase in the population would be acceptable as long as agricultural damage does not become a problem (WDFW 2010). The white-tailed deer populations in District 2 are currently at acceptable levels. Mule deer populations in District 2 are also currently within acceptable levels. The mule deer management plan is not complete at this time, but interim management objectives are to maintain the population within landowner tolerance, and to provide as much recreational use of the resource for hunting and aesthetic appreciation as possible. Further objectives for both species are to meet the Game Management Plan (WDFW 2014) guidelines for buck escapement (15 to 19 bucks per 100 does post-hunt) and to maintain healthy fawn to doe ratios while minimizing agricultural damage from deer.

Hunting Seasons

All GMUs in District 2 contain populations of white-tailed deer and mule deer, with more white-tailed deer harvested annually in GMUs 124, 127, 130, & 139 and more mule deer harvested annually in GMUs 133, 136, & 142.

In GMUs 127-142 a 3-point minimum regulation on antlered white-tailed and mule deer applies to all hunts, with antlerless harvest options available to archery, muzzleloader, senior, youth, and disabled hunters. WDFW offered a nine-day early modern firearm season in mid-October for both mule and white-tailed deer. The modern firearm general late white-tailed deer season was removed in 2006 and replaced with the Palouse Special Permit Hunt, a permit-only late white-tailed buck hunt in November. A total of 750 permits were offered for the block hunt, which allowed permitees to hunt within the six GMUs (127-142).

In GMU 124 mule deer hunting seasons follow the same system as described above. However, for white-tailed deer modern firearm there is no antler point restriction, the early season is 14 days long, and the late season is a general season in mid-November.

Archers were offered both early and late general hunting seasons. The early archery deer hunt occurs in September in all GMUs and the late season runs from November 25 to December 15 in GMUs 124 & 127. Muzzleloaders were offered both early and late general seasons as well. Muzzleloader early season runs from late September into early October in all GMUs. The late season runs from November 25 to December 8 in GMUs 130-139.

In addition, permit hunt opportunities for quality deer, buck, and second deer (antlerless only) are offered in all GMUs.

Harvest trends

Total general season deer harvest has averaged 6,082 deer for the past 10 years in District 2, with mule deer comprising on average 28% of the harvest (Table 1). White-tailed deer buck harvest in 2014 was 15% above the 10-year average and the highest buck harvest since mandatory reporting was implemented in 2001. Mule deer buck harvest was also higher (11%) than the 10 year average, but was lower than buck harvest the two previous years (Table 1). Percent 5-point or greater white-tailed bucks in the harvest was down this year relative to the 10 year average, but in line with the previous three years. Percent 4-point or greater mule deer bucks in the harvest was higher than the 10 year average and at the high end of the range observed. In

2012 there was a significant increase in general season buck harvest, exceeding previous highs for both species (Table 1 and Fig. 1). Since 2012 harvest has remained high setting new harvest records for mule deer in 2013 and white-tailed deer in 2014 (Table 1). This return to pre2008 harvests levels indicates full recovery of the deer populations in the District from the hard 2007 and 2008 winters.

Hunter participation varies across all GMUs that comprise District 2, but in general GMUs 127-142 received a similar level of pressure, while GMU 124 receives 3-4 times that of any other GMU (Table 2 and Fig. 2). Overall hunter numbers have remained relatively stable in GMUs 127-142, while GMU 124 has seen a small decline (Fig 2). The decline in GMU 124 is driven by loss of modern firearm hunters; there were 5887 modern firearm hunters on average prior to 2009 compared to 5137 post-2009. This trend is seen across all GMUs to varying degrees, but in many has been offset by increases in muzzleloader, archery, and/or multi-weapon hunters.

General season hunter success was 36% in 2014, for all weapon types combined (Table 2). This is similar to last year’s success rate (35%) and higher than the 10-year average of 33%. All GMUs show a positive trend in hunter success over the past 10 years (Fig. 3) and hunters had higher success rates in 2014 compared to their previous 10 year average, except for GMU 133 which was 1% lower than the 10 year average of 30%.

Days hunted per deer harvested (days/kill) averaged 11 days in 2014 for all weapon types combined (Table 2). This is similar to last year’s average days/kill of 12 and lower than the previous 10 year average of 13 days/kill. Days/kill for all weapon types combined, hit a low in 2008 in GMUs 127-142 and has been relatively stable since (Fig 4). Days/kill in all GMUs, except 133, was lower in 2014 compared to their previous 10 year average.

Converting the late general modern firearm season in GMUs 127-142 into the Palouse Special Permit hunt has resulted in a32% reduction in harvest on average by modern firearm hunters. However, for all weapon types white-tailed buck general season harvest for these GMUs is only 14% lower on average. Hunt Results for the Palouse special hunt show higher success rates (57% average) than in the general season modern firearm hunt (Table 3), though in 2010 success was not substantially higher. The percentage of 4+ and 5+ bucks in the Palouse hunt harvest has averaged 88% and 36%, respectively, compared to the general season harvest were 4+ and 5+ bucks have averaged 80% and 27%, respectively.

The majority of the land base in District 2 is agricultural private lands. This presents WDFW with the difficult job of balancing deer population objectives with landowner tolerance. Deer population levels are most sensitive to doe survival and fawn recruitment, thus the primary management tool to regulate deer numbers is antlerless harvest. District 2 offers a white-tailed deer general season antlerless opportunity in all GMUs for archery hunters and senior, youth, and disabled modern firearm hunters and in GMUs 130-139 for muzzleloaders. In 2014 the white-tailed antlerless harvest was above the 10 year average, but within the range (908-1467) reported since 2001 (Table 1). Mule deer antlerless general season opportunity is more conservative with only archers allowed to take antlerless in all GMUs and muzzleloaders allowed to take antlerless in GMU 130. In 2014 the mule deer antlerless harvest was below the 10 year average, but in line with the past five years harvests (Table 1).

District 2 also offers antlerless (either species) permits. Since 2008 these permits have been 2nd tags, meaning the hunter can harvest an antlerless animal in addition to their general season tag harvest. 975 permits spread across all GMUs with an additional 975 permits in deer areas created around Spokane and Colfax were offered in 2014. 800 deer were harvested with an overall success rate of 70%.

WDFW also works with individual landowners through Damage Prevention Cooperative Agreement (DPCA). Landowners that enter into a DPCA are eligible to apply for crop damage compensation from the state, but must first work with the department to reduce/prevent deer damage. There are 26 landowners enrolled in DPCAs in District 2 spread across all GMUs, but with the majority (10) in GMU 124. There are several non-lethal tools landowner can use to deter deer, the primary tools used in District 2 are: 1) Herding by foot and with dogs. 2) Pyrotechnics (e.g., shot launchers, propane cannons). 3) Barriers for hay stacks. 4) Use of hazing equipment by Master Hunters, Conflict Specialist, and other increased human presence activities. Lethal tools include funneling of doe hunters to landowners suffering damage during legal hunting seasons.

Surveys

Available resources, land ownership, and deer behavior all combine to limit WDFW’s ability to conduct surveys over the entire District (GMUs 124-142) and during all seasons. Pre-hunt ratios come from ground surveys conducted during August (for buck to doe ratio) and September (for fawn to doe ratio). They provide an estimate of fawn production for the year and buck recruitment pre-hunt. Post-hunt ratios come from helicopter surveys conducted during late November or

December. Post-hunt surveys reflect the effects of harvest on these herds, predominantly the antlered portion of the herds. However, due to the nocturnal behavior of bucks that is intensified by hunting, the post-hunt buck to doe ratio is probably a conservative measure of true composition. The hunt in pre-hunt and post-hunt refers to the modern firearm season only.

The pre-hunt mule deer buck to doe ratios have remained relatively stable over the past 13 years (Fig. 5) averaging 0.38. The pre-hunt mule deer fawn to doe ratios show a slight negative trend (Fig. 6); however the large 90% Confidence Intervals (CI) indicate that there is no significant difference in these ratios across time. The 2014 mule deer fawn to doe ratio is the lowest on record; however the 90% CI indicate that it is not significantly different than previous low year (2009 & 2012). Pre-hunt ratios for white-tailed deer show a slight negative trend over the past 12 years (Fig. 7 & 8), but again the 90% CI indicate that there is no significant difference in these ratios across time. Both buck and fawn ratios have been stable for the past six years.

These negative trends in ratios may indicate a decline in the number of bucks and fawns, or an increase in the number of does, or the trend may just be a product of survey effort. Without population estimates it is difficult to determine which is occurring. However, the increase in number of surveys in recent years (via increased staff time and use of volunteers), the stability of ratios during this time, and the increased precision of these estimates, all indicate that the negative trends are likely due to lower sample sizes in early years which resulted in biased estimates.

All post-season composition data (Table 3) was collected via helicopter or fixed-wing flights. The number of flights is limited to available funds and surveyable terrain, which results in incomplete coverage of the district. In 2013 & 2014 white-tailed deer were not counted during mule deer aerial surveys due to time/funding constraints. White-tailed post-season buck to doe ratios for previous years appear to be well above management goals (15-19 bucks per 100 does). Fawn to doe ratios also appear to be satisfactory. However, all of the post-season data is based on relatively small samples from surveys conducted in more open GMUs (133-142) with high visibility, with the focus on mule deer populations, and were not conducted in the forested GMUs of 124 and 127 which are the core white-tailed deer areas for District 2.

Post-season mule deer fawn ratios were low in 2007 and 2008; however flights and coverage were limited in both years. Since 2009 more intensive flights have been conducted in mule deer winter concentration areas and fawn numbers appear good to high in most years. The lower pre and post mule deer fawn ratios may have been due to lower summer fawn survival as a result of moderate drought conditions. Post-season mule deer buck to 100 doe ratios have been relatively stable the past eight years (average is 23 bucks to 100 does) regardless of survey intensity. If we limit the analysis to adult bucks, the average post-hunt buck to doe ratio for the past five years is 6:100, indicating that the current mule deer harvest is sustained by recruitment of yearling bucks.

Habitat and Disease

Mass conversion of natural habitats to agriculture occurred in past decades, but represent relatively minor changes today. Gains have been made in deer habitat with enrollment of agricultural acres into the Conservation Reserve Program (CRP). However, with current wheat, lentil, and hay prices, several landowners have chosen not to re-enroll in CRP after their contracts expired. Current outlook for the Farm Bill is for a reduction in CRP acreage which will negatively impact deer in this district. Additionally, emergency haying and grazing of CRP acreage occurs often in response to severe drought or similar natural disaster. Though these are temporary measures and do not remove the acreage from CRP, it does reduce the quality of the land during a time of high stress, when wildlife may need it most.

Habitat loss due to development is of primary concern in this district, especially in GMU 124, 127, and 130, with the redistribution of Spokane's urban populations outward into rural settings. High-density development (>1house per acre) removes less habitat then low-density development (<1house per 10 acres), but tends to permanently displace the deer. While low-density development incorporates more habitat, direct disturbance is less, and more habitat is usable by deer post-construction. However, these deer tend to become damage/nuisance deer. Currently the district promotes high-density clustered development with larger open space areas, with the hope of maintaining larger tracts of habitat that supply some connectivity.

Epizootic Hemorrhagic Disease (EHD) mortalities in white-tailed deer populations in District 2 were high in 1998, 1999, 2003, and 2004, but have been low to nonexistent since. Drought conditions often coincided with these large EHD outbreaks and likely exacerbated them. To date no large die offs have been reported in connection with the 2014 drought. There are some indications that mule deer expanded back into areas that were occupied by white-tailed deer prior to the outbreak of EHD. This trend appears to be reversing as white-tailed deer populations recover.

Though Chronic Wasting Disease (CWD) has not been detected in Washington, it is a concern in District 2 due to its proximity with Idaho and Montana, which have several game farms. Lymph nodes were taken from hunter-killed and road-killed deer throughout the district from 2006-2011 to test for CWD. None of the samples were positive. Though no more field testing is planned, samples will be taken opportunistically from any deer exhibiting symptoms of CWD.

Management Conclusions

Mule Deer

Currently we are meeting the Game Management Plan guidelines for mule deer buck escapement (15 to 19 bucks per 100 does post-hunt). However, the low adult mule deer buck to doe ratios indicate that our harvest is being sustained primarily by recruitment of yearlings (i.e., we are harvesting most of our old age classes). With accommodating weather and productive habitats these populations produce a sustained harvest. Reductions in productivity for one or more years, however, could result in pronounced declines in harvest and hunter success. With low pre- and post-season mule deer fawn to doe ratios we may see lower buck harvests in 2015 and 2016. Current recommendations are to maintain the general season structure as is, continue post- season monitoring of the population, and continue working with Districts 4 and 5 to integrate our population monitoring and management.

White-tailed Deer

The positive trend in harvest and success, relatively stable hunter numbers, and negative trend in days/kill all indicate the white-tailed deer population has fully recovered from the hard winters of 2007 and 2008 and is likely expanding. We have met the Game Management Plan guidelines for post-season buck ratios for white-tailed deer in those years that we have postseason data (WDFW 2014). However, post-season surveys have been more focused in mule deer habitat (i.e., open terrain) than in white-tailed deer habitat and thus may not accurately reflect their status across the entire district. Attempts at post-season ground surveys in the more forested GMUs (124,127, & 133) have routinely produced low counts and low buck to doe ratios. Rather than actual buck numbers, this more likely reflects the poor visibility and nearly nocturnal activity patterns of bucks once hunting season opens. To address these problems WDFW has initiated a pilot project in northeast WA, investigating line distance survey techniques for white-tailed deer in forested habitats.

Those GMUs near the Spokane urban center continue to receive high hunting pressure and will need to be closely watched to avoid over- or under-harvest. So far urban deer problems in Spokane have remained relatively stable, but are showing signs of increasing. High numbers of vehicle collisions with white-tailed deer are a problem along Highway 2, Highway 395, Highway 290, and I-90 in Spokane County and with mule deer and white-tailed deer along Highway 26 in Whitman County. Additionally, crop damage is reported annually in some portions of all GMUs and appears to be increasing as farmers switch to higher value crops like garbanzos. Intensive recreational harvest, with a wide range of seasons and antlerless opportunities, has helped mitigate some of the damage claims and perceived urban population issues. We will continue to offer 2nd tag antlerless hunts by permit in all GMUs, as well as general white-tailed deer antlerless seasons for archery, muzzleloader, youth, senior, and disabled hunters in units near the urban area of Spokane and in rural units experience widespread damage issues.

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Washington Department of Fish and Wildlife (WDFW). 2010. Washington State Deer Management Plan: White-tailed Deer. Wildlife Program, Washington Department of Fish and Wildlife, Olympia. WA, USA.

Washington Department of Fish and Wildlife. 2014. 2015-2021 Game Management Plan. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA, USA.

Table 1. Spokane District (GMUs 124-142) general season deer harvest by species (permit harvest NOT included).

	White-tailed Deer			Mule Deer		
Year	Antlerless	Antlered	%5+pt	Antlerless	Antlered	%4+pt
2004	1429	3481	22%	846	1485	45%
2005	908	3635	23%	302	1350	53%
2006	1035	2759	24%	188	1357	57%
2007	1050	3145	25%	237	1321	55%
2008	1150	3491	23%	269	1538	54%
2009	1053	2972	25%	281	1342	53%
2010	963	3094	28%	165	1330	58%
2011	1072	2784	23%	189	1301	54%
2012	1327	3661	23%	193	1618	54%
2013	1106	3488	22%	191	1709	57%
10yr Average	1109	3251	24%	286	1435	54%
2014	1184	3753	22%	165	1593	57%

Table 2: 2014 General season harvest metrics for each weapon and GMU within District 2.

		GMU							
Weapon	**Data**	124	127	130	133	136	139	142	Average
All Weapons	Harvest	2735	541	713	521	482	1013	690	956
	Hunters	6883	1496	2216	1781	1391	2452	1697	2559
	Success	40%	36%	32%	29%	35%	41%	41%	36%
	Days/Kill	12	14	13	13	11	8	7	11
Archery	Harvest	543	239	77	77	40	35	22	148
	Hunters	1407	560	267	194	102	96	69	385
	Success	39%	43%	29%	40%	39%	36%	32%	37%
	Days/Kill	17	16	21	13	16	15	17	16
Modern	Harvest	2111	275	356	291	351	788	589	680
	Hunters	5211	855	1211	1171	1048	1890	1418	1829
	Success	41%	32%	29%	25%	33%	42%	42%	35%
	Days/Kill	11	11	12	14	10	8	7	10
Multi Weapon	Harvest	52	23	39	45	33	36	15	35
	Hunters	134	51	84	94	73	77	41	79
	Success	39%	45%	46%	48%	45%	47%	37%	44%
	Days/Kill	20	15	15	13	15	13	13	15
Muzzle loader	Harvest	29	4	241	108	58	154	64	94
	Hunters	131	30	654	322	168	389	169	266
	Success	22%	13%	37%	34%	35%	40%	38%	31%
	Days/Kill	17	32	11	11	10	9	8	14

Table 3. Palouse special permit hunt results

	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average
Num. of Hunters*	342	395	342	411	459	380	355	386	352	380
Hunter Success**	57%	42%	59%	57%	36%	58%	67%	67%	72%	57%
Percent 4+ bucks**	85%	88%	89%	85%	91%	89%	89%	90%	87%	88%
Percent 5+ bucks**	29%	37%	37%	35%	50%	33%	36%	34%	36%	36%

* Number of tag holders that hunted in one of the Palouse GMUs (127 – 142).
** Calculations based on kills that occurred during the constraints of the permit hunt.

Table 4. Post-hunt ratios from flights only.

Species	Year	(Buck:Doe:Fawn) Post-hunt	Total Count	# GMUs
Mule Deer	2006	25:100:70	3050	5
	2007	22:100:59	444	1
	2008	22:100:52	684	2
	2009	22:100:71	2470	4
	2010	20:100:79	2526	3
	2011	24:100:79	3088	4
	2012	23:100:86	2089	2
	2013	25:100:87	3250	2
	2014	22:100:62	2719	2
White-tailed Deer	2006	9:100:63	260	5
	2007	10:100:44	237	1
	2008	36:100:48	46	2
	2009	31:100:64	214	4
	2010	30:100:62	589	3
	2011	25:100:83	248	3
	2012	29:100:84	124	2
	2013-2014	*	*	*

* White-tailed deer were not counted during mule deer aerial surveys these years due to time constraints.

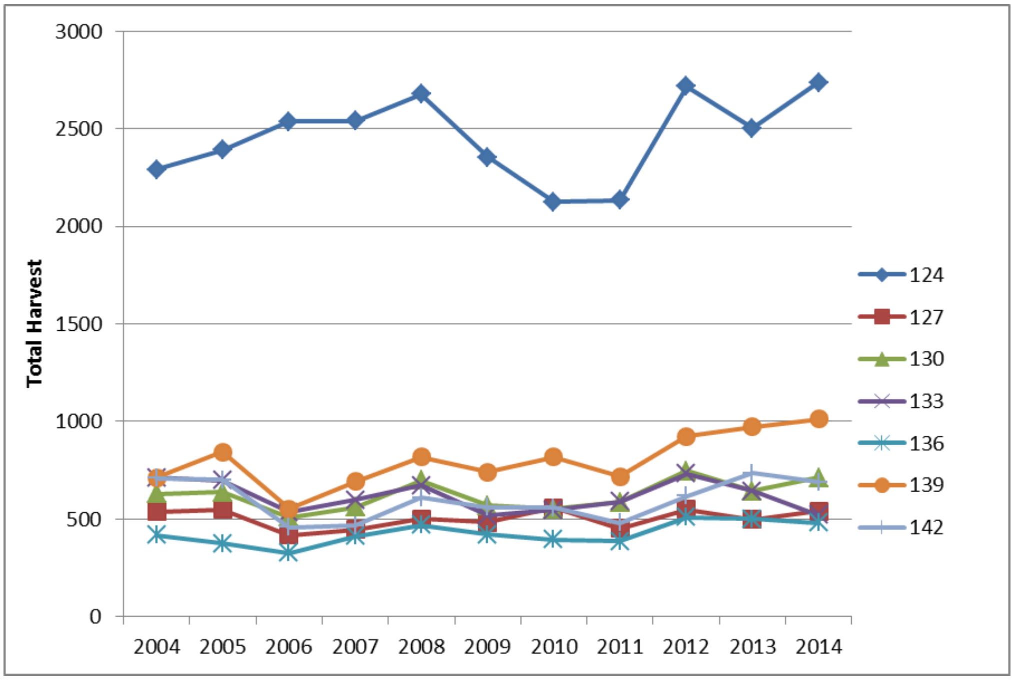

Figure 1. General season total harvest by GMU, all weapon types combined.

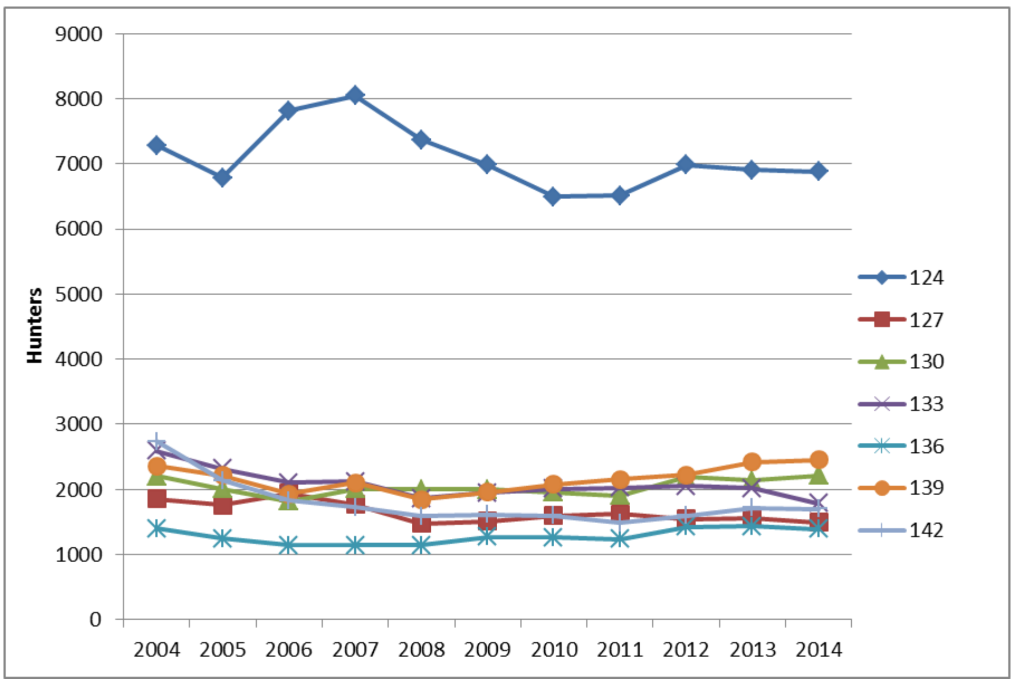

Figure 2. General season hunter numbers by GMU, all weapon types combined.

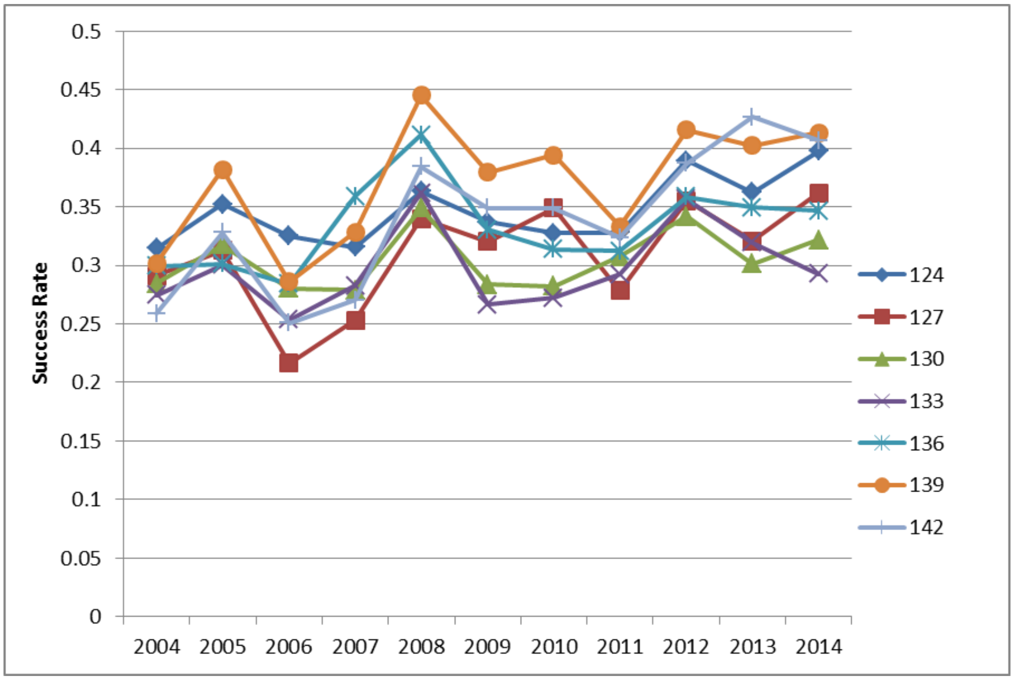

Figure 3. General season hunter success rate by GMU, all weapon types combined.

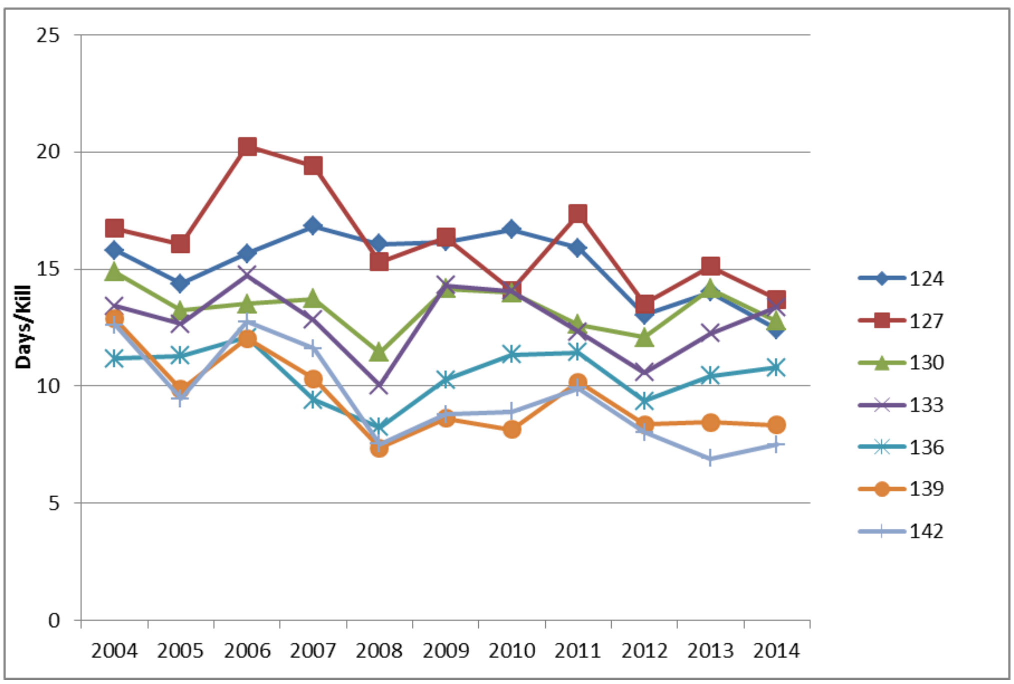

Figure 4. General season days hunted per deer harvested (days/kill) by GMU, all weapon types combined.

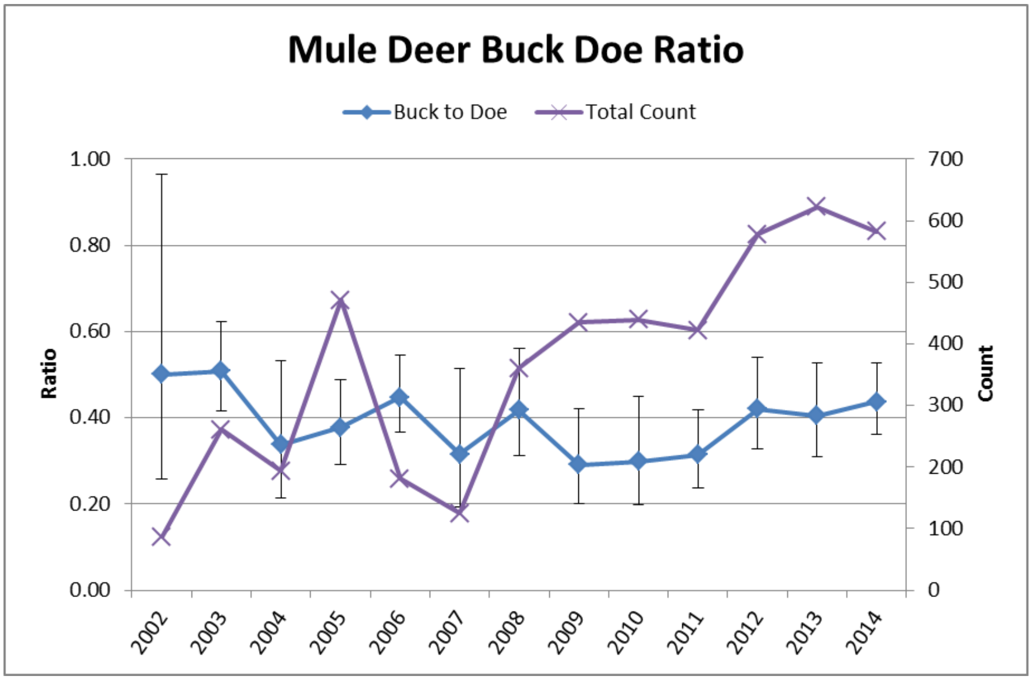

Figure 5. Pre-hunt mule deer buck to doe ratios and total count (bucks, does, & fawns).

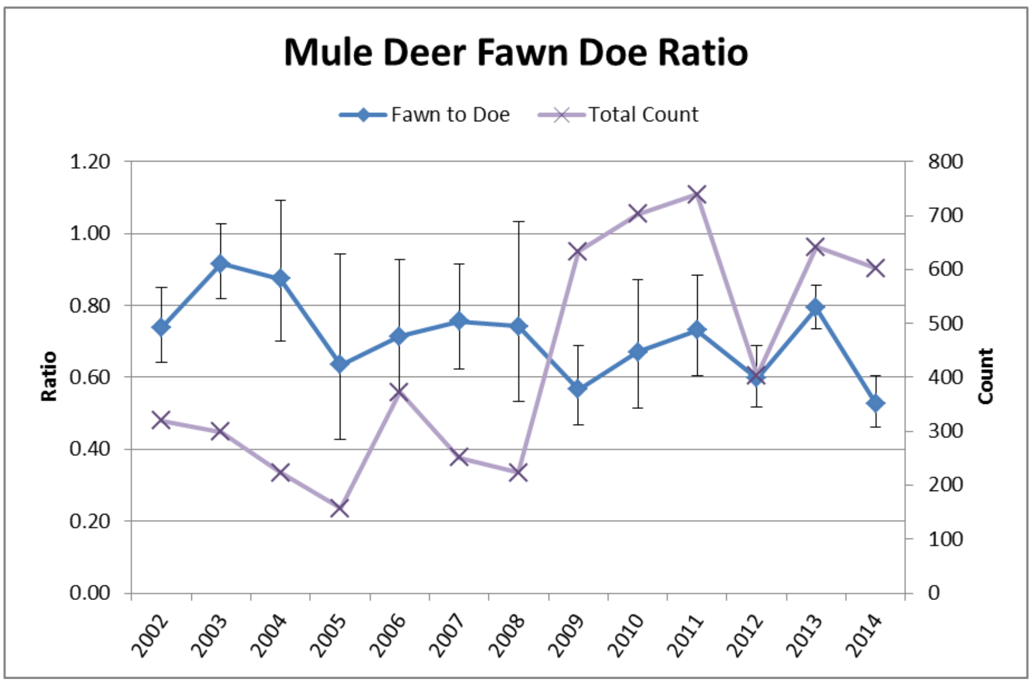

Figure 6. Pre-hunt mule deer fawn to doe ratios and total count (bucks, does, & fawns).

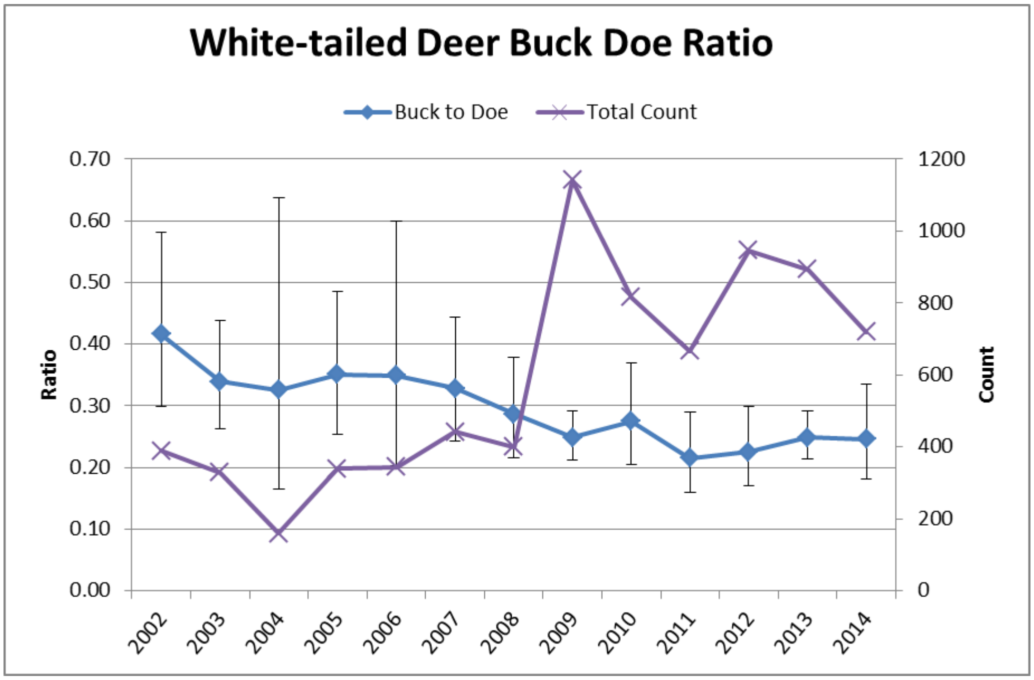

Figure 7. Pre-hunt white-tailed deer buck to doe ratios and total count (bucks, does, & fawns).

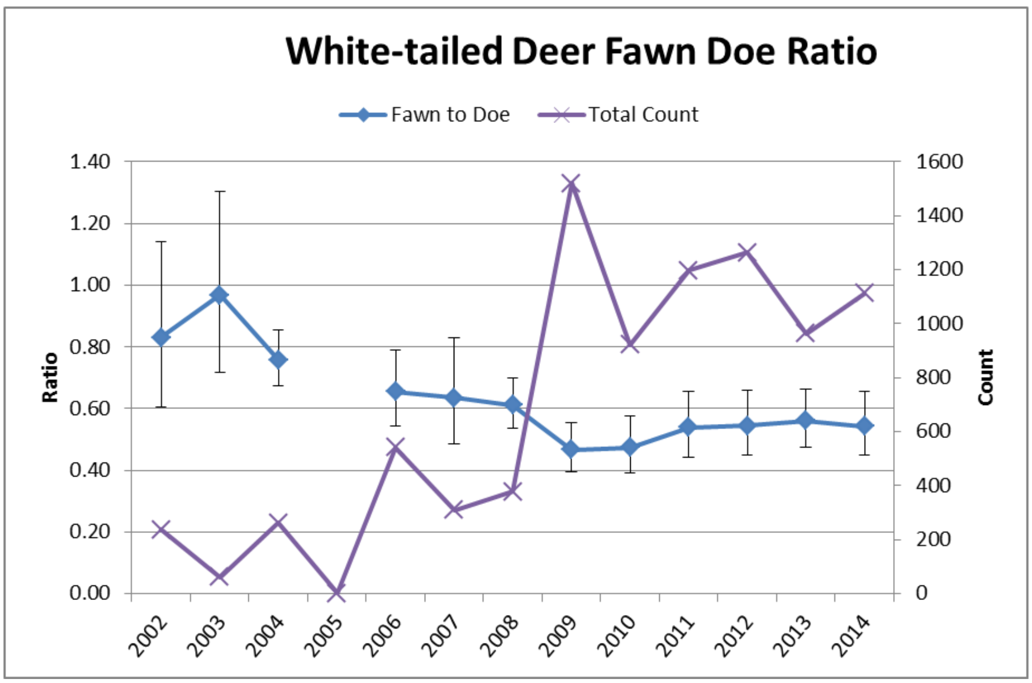

Figure 8. Pre-hunt white-tailed deer fawn to doe ratios and total count (bucks, does, & fawns). In 2005 September surveys in white-tailed deer areas were not conducted.

DEER STATUS AND TREND REPORT: REGION 1

GMUS 145, 149, 154, 162, 163, 166, 169, 172, 175, 178, 181, 186

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Population Objectives and Guidelines

The goal set by the Washington Department of Fish and Wildlife (WDFW) for the management of deer populations in Washington is to maintain numbers within habitat limitations. Landowner tolerance, a sustainable harvest, and non-consumptive deer opportunities are considered within the land base framework (WDFW 2008). The Blue Mountains District (Region 1, District 3) is located in southeast Washington and includes Game Management Units (GMUs) 145 – 186. Our deer management goals are to maintain both white-tailed deer (*Odocoileus virginianus*) and mule deer (*O. hemionus*) numbers at levels compatible with available habitat, landowner tolerance, and provide as much recreational use of the resource for hunting and aesthetic appreciation as possible. Further objectives are to meet the Game Management Plan (WDFW 2008) guidelines for buck escapement (post-hunt), which are 15-19 bucks per 100 does in predominately agricultural units, and 20 to 24 bucks per 100 does in public land units, while maintaining healthy fawn to doe ratios. In addition, the population goal from WDFW's white-tailed deer management plan (WDFW 2010) for the Palouse Zone and Blue Mountains Zone is to maintain the population at its current level or allow a slight increase as long as agricultural damage does not become a problem. The stated strategy to achieve this goal is to recommend hunting season structures and opportunity that will maintain white-tailed deer at their current numbers and distribution, while still attempting to maintain harvest opportunity for all user groups.

Based on aerial surveys, ground counts, and harvest estimates, the mule deer population in the Blue Mountains has increased along the breaks of the Snake River over the last 10 years. Mule deer populations in the mountains may still be depressed, but appear stable, and GMUs 175 and 181 have recently reversed long-term declines in harvest estimates. White-tailed deer populations have recovered from severe epizootic hemorrhagic disease (EHD) outbreak in the early 2000's in the western Blue Mountain foothills.

Hunting seasons

GMUs 145, 149, 154, 163, 178, and 181 contain primarily agricultural habitat with a mixture of Conservation Reserve Program (CRP) grasslands, large expanses of grasslands/canyonlands, small amounts of shrub-steppe, and forested riparian areas along numerous rivers and creeks. Portions of GMU 154, GMU 178, and GMU 181 have forested habitat along north-facing draws and upper elevations of the Blue Mountains foothills. GMUs 157, 162, 166, 169, 172, 175, and 186 contain a mix of foothill agricultural lands, forested draws, high elevation forestlands, and riparian areas. Both groups of GMUs contain white-tailed deer and mule deer, with more mule deer harvested in areas along the Snake River breaks and slightly more white-tailed deer harvested annually in the foothills. If hunters wish to target an individual species, hunts should be planned on a GMU basis, with mule deer the dominant harvest in most units, but with white-tailed buck harvest predominating in GMUs 154 and 162. A substantial number of white-tails are also harvested in GUMs 145, 149, 178, and 181.

A 3-point minimum regulation on antlered deer applies to all hunts, with general season antlerless harvest options available to archery, muzzleloader, senior, youth, and disabled hunters. WDFW offers a nine-day general early modern firearm season in mid-October for both mule and white-tailed deer. Archers are offered both early and late general hunting seasons in selected GMUs. The early archery deer hunt occurs in September and the late season runs in late November to early December. Muzzleloaders are offered both early and late general seasons in selected GMUs, as well. Muzzleloader early season runs from late September into early October and the late season from late November through early December. Permit hunt opportunities for quality deer, buck, antlerless, and second deer (antlerless only) are offered in multiple GMUs, along with special permits for youth, seniors, and disabled hunters.

Harvest trends

For the 10-year period from 2004-2013, District 3 combined general and permit season buck harvest averaged 2,092 bucks/year, and ranged from 1,789 to 2,769. In 2014, hunters harvested 2,512 bucks (Table 1), 20% above the 10-year mean and the 3rd highest harvest in the last 18 years. In 2014, the mule deer buck harvest averaged 59.0% four-point or better, similar to the 60.0% mean in 2013 and higher than the 10-year mean of 54.3%. White-tailed deer harvest averaged 25.8% five-point or better, similar to the 25.5% mean in 2013 and slightly higher than the 10-year mean of 22.7%. General season hunter success was 29.7%, spread across all GMUs and all user groups (Table 2). This was similar to success over the last 3 years (30.2% and 31.4% in 2012 and 2013) and the 3rd highest success in the last 14 years. Success was also higher than the 10-year mean of 26.1%.

Table 1: Blue Mountains deer harvest summary (2004 – 2014).

	All Deer			Mule Deer		White-tailed Deer	
Year	Buck	Doe	Total	% ≥ 4 point*	Doe kill:100 Bucks	% ≥ 5 point*	Doe kill:100 Bucks
2004	2,015	1,303	3,318	49%	48	21%	88
2005	1,927	927	2,854	53%	31	20%	69
2006	1,931	713	2,644	56%	18	20%	62
2007	1,789	583	2,372	51%	14	22%	57
2008	2,033	574	2,607	53%	15	23%	48
2009	1,974	504	2,478	54%	9	26%	53
2010	2,104	553	2,657	59%	9	22%	56
2011	1,963	491	2,454	55%	9	24%	51
2012	2,419	566	2,985	54%	9	22%	44
2013	2,769	518	3,287	60%	10	25%	35
10-yr mean	2,092	673	2,812	54%	17	23%	56
2014	2,512	651	3,163	59%	13	26%	48

Note: % ≥ 4 point calculated from harvest under 3-point minimum regulation.

Table 2: 2014 General season hunter success and effort for each weapon and GMU within the Blue Mountains district.

		GMU												
Weapon	Data	145	149	154	162	163	166	169	172	175	178	181	186	Totals
All Weapon	Reported Harvest	365	741	320	422	137	108	34	72	72	272	226	33	2,802
	Success	47.8%	35.9%	27.6%	22.7%	26.0%	15.9%	13.4%	25.2%	14.2%	40.7%	41.5%	28.2%	29.7%
	Days/GMU	2,324	6,630	4,889	7,056	2,222	2,597	1,111	1,150	2,263	2,213	1,958	450	34,863
	# Hunters	764	2,065	1,159	1,861	526	679	254	286	508	668	544	117	9,431
	Harvest/ day	0.157	0.112	0.066	0.060	0.062	0.042	0.031	0.063	0.032	0.123	0.115	0.073	0.080
Archery	Reported Harvest	24	31	77	34	37	16	1	4	4	33	11	1	273
	Success	38.1%	22.0%	36.7%	19.3%	25.0%	15.7%	3.4%	20.0%	4.1%	27.3%	39.3%	12.5%	23.9%
	Days/GMU	317	887	1,350	1,039	986	504	134	128	633	649	140	25	6,792
	# Hunters	63	141	210	176	148	102	29	20	97	121	28	8	1,143
	Harvest/ day	0.076	0.035	0.057	0.033	0.038	0.032	0.007	0.031	0.006	0.051	0.079	0.040	0.040
Modern	Reported Harvest	312	577	235	374	98	85	31	40	53	238	146	30	2,278
	Success	49.9%	36.3%	25.8%	22.8%	26.6%	15.3%	14.9%	20.4%	15.4%	44.3%	41.8%	30.0%	30.7%
	Days/GMU	1720	4,530	3,346	5,829	1,200	1,999	884	711	1,377	1,518	1,095	387	24,596
	# Hunters	625	1,589	910	1,640	368	554	208	196	344	537	349	100	7,420
	Harvest/ day	0.181	0.127	0.070	0.064	0.082	0.043	0.035	0.056	0.038	0.157	0.133	0.078	0.093
Multi Weapon	Reported Harvest	7	41	8	14	2	7	2	5	9	1	6	2	115
	Success	41.2%	46.6%	20.5%	31.1%	20.0%	30.4%	11.8%	41.7%	32.1%	10.0%	50.0%	50.0%	37.7%
	Days/GMU	93	416	193	188	36	94	93	53	128	46	62	9	1,411
	# Hunters	17	88	39	45	10	23	17	12	28	10	12	4	305
	Harvest/ day	0.075	0.099	0.042	0.074	0.056	0.074	0.022	0.094	0.070	0.022	0.097	0.222	0.082
Muzzle loader	Reported Harvest	22	92						23	6		63	0	206
	Success	37.3%	37.2%						39.7%	15.4%		40.6%	0.0%	36.6%
	Days/GMU	194	797			No Hunt			258	125	No Hunt	661	29	2,064
	# Hunters	59	247						58	39		155	5	563
	Harvest/ day	0.113	0.115						0.089	0.048		0.095	0.000	0.100

Deer population levels are most sensitive to doe survival and fawn recruitment and survival. Antlerless harvest is one of the best management tools to regulate deer numbers within population objectives. High antlerless permit numbers during the late 90s-early 2000s, coupled with disease outbreaks resulted in lower than normal doe survival and subsequent population declines, especially in white-tailed deer, which are more susceptible than mule deer to EHD outbreaks. Other factors likely contributed to mule deer declines, such as climate impacts on habitat, and factors resulting in habitat loss or conversion. After severe reductions in antlerless permits, we have slowly been increasing antlerless harvest opportunity over the last few years, particularly in the agricultural GMUs where we have seen improving harvest metrics. General season antlerless harvest has remained relatively stable for both mule deer and white-tailed deer, with 10-year means of 64 and 300 respectively, and 2014 antlerless harvest consisted of 89 mule deer and 350 white-tailed deer.

Total antlerless harvest mainly reflects changes in antlerless permit numbers, which are decreased in response to population altering events like fire or EHD outbreaks, or increased in response to increasing harvest metrics or agricultural damage. Antlerless permits peaked at a high of 2,470 in 2001, declined to a low of 485 from 2009-2011, with 598 offered in 2014 and 761 being offered for 2015. Total antlerless harvest was 651 deer in 2014 (Table 1), with 201 mule deer and 447 white-tailed deer harvested (3 unknown species). This is similar to the 10-year mean of 673 antlerless deer, but higher than the 5-year mean of 526 deer from 2009-2013, which is more reflective of similar permit levels. For comparison, the mean antlerless harvest for the 6-year period from 2001-2006 with high permit levels was 1,122 antlerless deer. With recent increases in hunter success (Figure 1) and harvest per unit effort (HPUE, Figure 2) in most of the agricultural GMUs (145, 149, 163, 178, 181), we were able to reinstate antlerless permit opportunity in GMUs 145 and 149 beginning with the 2013 season. GMUs 162 and 163 also historically had high antlerless permit levels. GMU 163 has shown recent improvement in HPUE and success, and may warrant an increase in opportunity, while GMU 162 continues to be among GMUs with the lowest success and HPUE rates, and already has a high harvest of antlerless white-tailed deer during the general season and a moderate level of antlerless permits.

Figure 1. Harvest success for District 3 GMUs.

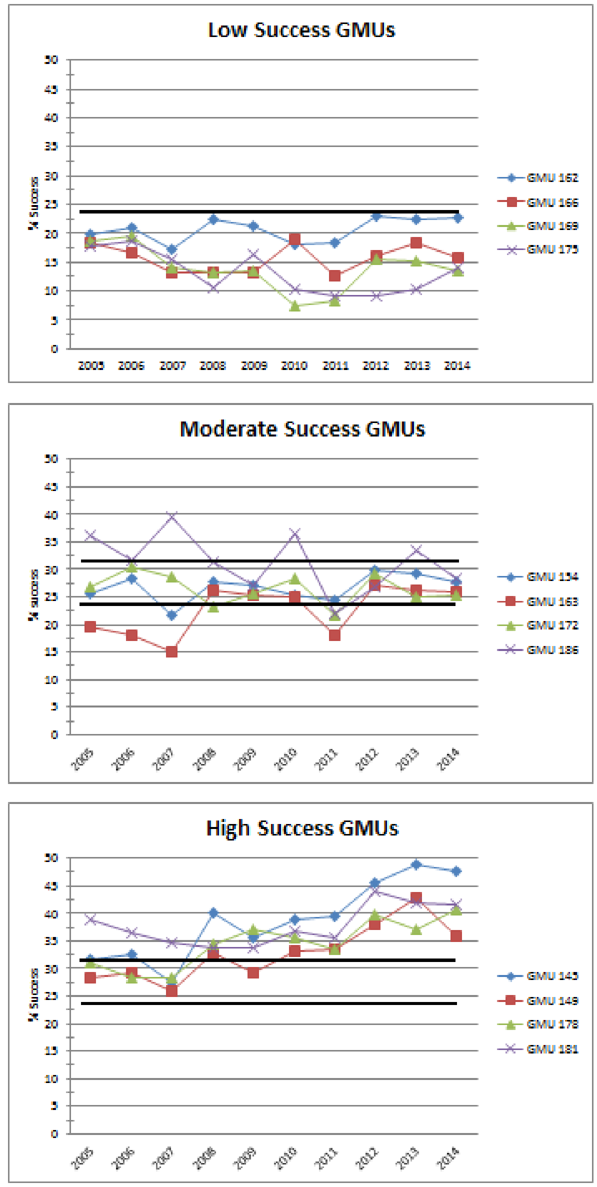
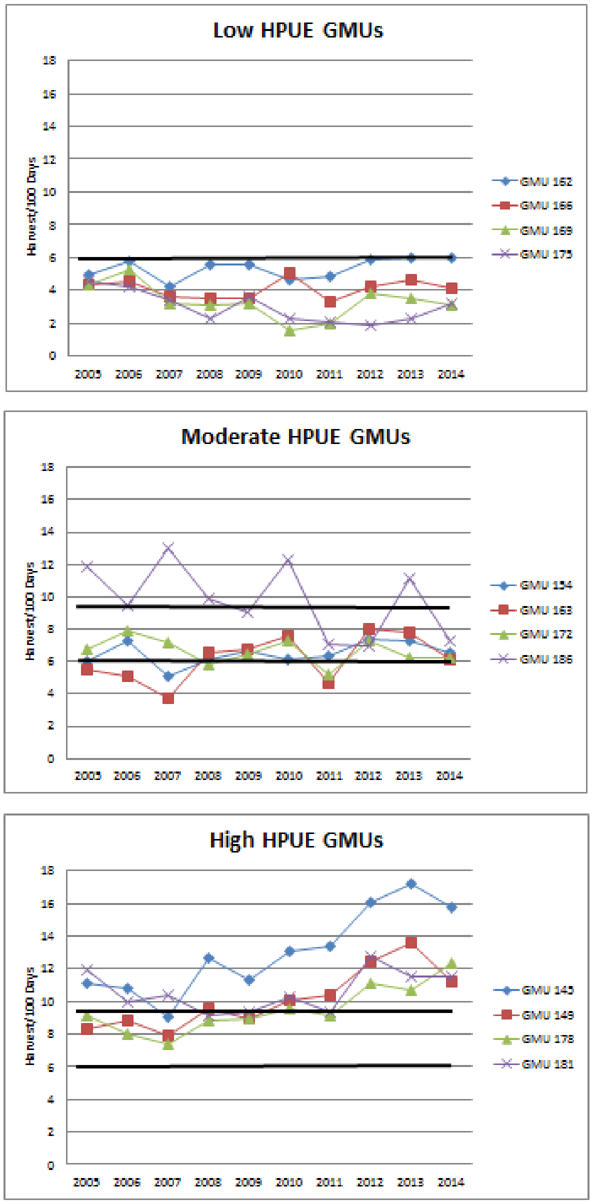


Figure 2. Harvest per 100 days for District 3 GMUs.



Three user groups have general seasons in the Blue Mountains: modern firearm (MF), muzzleloader (ML), and archery (AR). The number of MF hunters has gradually declined since 1996, from a high of 13,423 to a low of 6,914 in 2008. Numbers have since stabilized and 7,420 hunters participated in 2014 (Table 2). MF hunters harvested 2,278 deer in 2014; 2,001 bucks and 277 antlerless deer. General season MF hunter success was 30.7%. Higher harvest over the last 3 years has reversed long-term harvest declines, although harvest was lower this year than the last 2 years. While much of the decrease in harvest numbers can be attributed to decreasing MF hunter numbers, other factors may be affecting deer populations and harvest numbers, such as habitat loss (CRP, non-native plants, conversion) or changes (fire, fire suppression, logging), predation, climate, and disease (EHD).

Muzzleloader hunter numbers increased dramatically with the introduction of a general muzzleloader season in 2000. The first year, only 117 ML hunters participated, but by 2004 that number increased to 734 hunters. ML hunters have declined since 2004, but appear to have stabilized recently at around 500 hunters, with 563 participating in 2014. ML hunters harvested 206 deer in 2014, 172 bucks and 34 antlerless. Muzzleloaders enjoyed a success rate of 36.6% (Table 2).

Archery hunter numbers have been relatively stable since 2002, with 1,143 AR hunters participating in 2014. Archers harvested 273 deer, 115 bucks and 158 antlerless, which was well above the 10-year mean of 218 deer. The AR hunter success rate was the lowest for all user groups at 23.9% (Table 2).

Species composition of the general buck harvest in 2014 was comprised of 65% mule deer and 35% white-tailed deer, similar to previous years but slightly skewed toward more mule deer than the 10-year mean of 62% mule deer in the harvest. The total antlerless harvest consisted of 20% mule deer and 80% white-tailed deer, and similar to buck harvest, was slightly skewed towards higher mule deer harvest compared to both last year (17.9%) and the 10-year mean of 17.2%. The antlerless deer harvest continues to focus on white-tailed deer due to persisting low numbers of mule deer in many units, although we have been able to increase either-species antlerless opportunity in GMUs 145 and 149, and continue to look for other GMUs to increase opportunity. A total of 398 either-species antlerless deer permits (increased from 309 in 2012) along with 200 permits for antlerless white-tailed deer (increased from 195 in 2012) were issued in 2014.

The antlered permit controlled hunt opportunities have been expanded in recent years, with modern firearm rut hunts available for mule deer in limited numbers and muzzleloader opportunities in the mountain GMUs prior to the modern firearm general season. The largest opportunity is still the late white-tailed deer hunts during November for modern firearm and muzzleloader hunters, which increased in 2011 from 210 to 230 permits and remained at 230 for 2014 (Table 3). For all permit hunts combined, 55% of tag holders reported hunting with their permit, and of those, 67% were successful.

Table 3.Ten-year history of late white-tailed deer harvest, modern firearm and muzzleloader combined.

Year	Permits	Buck	Doe	Total+	Success Rate*	%Buck ≥ 5 pt.
2005	210	84	9	93	60%	37%
2006	210	84	8	92	74%	40%
2007	210	70	11	81	53%	48%
2008	210	86	18	104	65%	34%
2009	210	87	13	100	69%	37%
2010	210	77	3	80	59%	40%
2011	230	87	5	92	65%	37%
2012	230	87	0	87	64%	31%
2013	230	95	0	95	61%	44%
2014	230	108	0	108	70%	37%

+harvest totals may be higher depending on success of non-reporting permit holders
*success calculated from hunters actually hunting with permit

Surveys

Both aerial and ground surveys are used to determine pre- and post-hunt herd composition. We conducted pre-hunt surveys from the ground between August and September, and classified 1,009 mule deer during August, followed by 943 classified in September along most of the same routes. We classified 808 and 537 white-tailed deer during these same time periods and along the same routes. Using only the August survey data, we found 44 bucks:100 does and 36 fawns:100 does for mule deer, and 49 bucks:100 does and 30 fawns: 100 does for white-tailed deer. August surveys generally underestimate fawn:doe ratios, as many fawns are still difficult to detect at this time. September surveys resulted in 39 bucks:100 does and 51 fawns:100 does for mule deer, and 35 bucks:100 does and 54 fawns:100 does for white-tailed deer. We conducted 2014 aerial post-hunt surveys exclusively in the northern half of GMU 149, so results are likely not representative of the District as a whole. Our counts resulted in 4,805 mule deer classified (Table 4). The mule deer fawn: doe ratio was 33.2 fawns:100 does (90% CI +/-1.0), which was much lower than the estimate for last year in the north-central survey area (50.1 fawns:100 does, 90% CI+/-2.2) and lower than the 10-year mean of 48.2 fawns:100 does (90% CI +/-3.5). We have not had consistent pre- or post-hunt surveys across all GMUs or sufficient sample sizes within each GMU to detect differences in fawn ratios across different parts of the District.

The post-hunt mule deer buck:doe ratio was 20.4 bucks:100 does (90% CI +/-1.4) for GMU 149, which is slightly higher than the 10-year mean of 18.6 bucks:100 does (90% CI +/-2.0, Table 4). The 10-year mean of mule deer bucks ≥2 years of age is 38.1% of the post-hunt buck population. In 2014, 35.2% of the bucks were ≥2-years old. Again, comparisons should be viewed with caution because surveys were limited to the northwestern portion of the District, which is also typically the driest area in the District.

Table 4. Ten-year history or post-hunt mule deer surveys, Blue Mountains, Washington.

	Bucks					Ratios (90% C.I.)	
Year	Ad	Yrlg	Doe	Fawn	Total	Fawn (CI)	Bucks (CI)
2005	85	229	1,870	688	2,872	37 (34, 39)	17 (15, 18)
2006	80	147	1,350	645	2,231	48 (44, 51)	17 (14, 19)
2007	80	112	1,166	505	1,862	43 (40, 47)	16 (14, 19)
2008	113	132	1,444	697	2,386	48 (45, 52)	17 (15, 19)
2009	72	162	1,363	769	2,366	56 (52, 61)	17 (15, 19)
2010	80	290	2,232	1,088	3,704	49 (46, 52)	17 (15, 18)
2011	74	124	831	466	1,495	56 (51, 61)	24 (21, 27)
2012	181	179	1,719	773	2,852	45 (42, 48)	21 (19, 23)
2013	562	576	4,284	2,145	7,567	50 (48, 52)	27 (25, 28)
2014	224	413	3,130	1,038	4,805	33 (31, 35)	20 (19, 22)

Unlike mule deer, white-tailed deer have not been the focus of District 3's post-hunt deer surveys because they are harder to detect in forested and riparian habitats, which results in fewer deer being observed and classified, and white-tailed deer survey conditions do not conform to the constraints of the mule deer sightability model. However, GMU 149 does not include significant amounts of forested or typical white-tailed deer habitat, and low numbers from this survey effort are a result of low white-tailed deer densities. In 2014, 369 white-tailed deer were classified, all during aerial surveys. The fawn:doe ratio for white-tailed deer was 46.9 fawns:100 does (90% CI +/-9.3). The buck ratio was 26.3 bucks:100 does (90% CI +/-6.5). Although GMU 149 is generally marginal white-tailed deer habitat, the ratios are similar to 10-year means for the District of 51.7 fawns:100 does (90% CI +/-11.5) and 21.1 bucks:100 does (90% CI +/-6.3).

Population Status and Trend

The mule deer population appears to have increased over the last 10 years in the lowlands and along the Snake River breaks, but is still below the population levels that occurred from 1996-2003 based on harvest data comparisons. Mountain populations appear stable, except for GMU 175, where harvest metrics indicate a recent increasing trend after a long-term decline.

In response to wind power development in the Lower Snake River Wind Development Area, we instituted the use of sightability surveys over a significant portion of the District for mule deer for the first time in 2010. Subsequent survey efforts over approximately 2/3^{rds} of the District were conducted in 2012 and 2013, and we planned 2014 surveys to cover the remaining western 1/3rd in GMU 149. Sightability surveys for the portion of GMU 149 north of highway 124 yielded an estimate of 6,052 (90% CI+/-333) mule deer. Recognizing that there is annual variation in mule deer numbers across the District, we combined estimates over the last 3 years to obtain a reasonable baseline population estimate for the area surveyed, primarily agricultural areas and the Snake River breaks. The resulting estimate is just under 20,000 mule deer for most of the agricultural GMUs outside the foothills of the Blue Mountains. The current plans are to reproduce previous surveys in the next 3-5 years and develop an integrated population model approach to estimate populations during periods without population survey data.

In general, recruitment across the District has been low compared to similar mule deer areas in WA State. This year's estimate applies only to the driest portion of the District in GMU 149, and may not be representative of the entire District, but in 2014, the estimate was 33.2 fawns:100 does, (90% CI+/-2.0) lower than the 10-year mean (48.2 fawns:100 does, 90% CI+/-3.6) and the lowest since 1989. Only 2002 and 2005 fawn ratios were similar in the last dozen years. What seems to be a long-term dry pattern that is persisting into 2015 may be having a lasting effect on mule deer habitat resulting in chronically low recruitment. Overall, mule deer fawn ratios are low compared to the Columbia Basin north of the Snake River (76-80 fawns:100 does, 2009-11, Hoenes et al 2012), the Lower Salmon region in ID (47-62 fawns:100 does (1999-2005, Racheal ed. 2011)) and other western states, except for Nevada, which generally has fawn ratios in the 40's and notes that a small difference in fawn recruitment can make the difference between stable or declining populations (Wasley 2004). With recent increases in our antlerless permits, particularly in the GMU 149 survey area, we will need to closely monitor fawn recruitment to avoid population level impacts due to harvest.

White-tailed deer populations have improved since an EHD die-off in 2008 in the Touchet River drainage and other areas of the Blue Mountains. In general, harvest metrics indicate that white-tailed deer numbers across the Blue Mountains are stable and vary within a narrow range for most GMUs. On the east side of the Blues, GMUs 172, 178, and 181 have the only significant white-tailed buck harvests (>25/year), and they all show relatively stable trends. On the west side, white-tailed buck harvests are generally much larger excluding GMU 169, and all have shown increased harvests since 2008-2009. However, with predicted drought occurring across WA State this season, conditions are likely to be ideal for the midge responsible for EHD transmission, and we are wary of a severe outbreak. Unfortunately, there is little that can be done to reduce the risk of an outbreak. An apparent mild outbreak that occurred across portions of the District last year may give some deer, particularly does and their fawns, immunity to the virus (Gaydos et al 2002a, 2002b). Immunity should not be overstated, as with very low survival rates to infection (<30%), not many deer are likely to be immune.

Habitat

Monthly total precipitation has only been within at least 90% of normal across the District in 27 of the last 72 months, with 2009, 2013, and 2014 having the fewest normal months of precipitation. 2015 also will likely join this list, as there is only one month of six so far that is not below normal in precipitation. Timely precipitation can negate some of the low moisture effects on habitat, and October precipitation has generally been at or above normal over the last 6 years. Whether or not October precipitation alone is enough to provide for normal fall green-up is unknown. Fall green-up is extremely important for mule deer along the breaks of the Snake River and in the lowland areas. Green-up provides the nutrition necessary for deer to increase fat reserves needed for winter survival and increased fecundity. A drought during the summer-fall is thought to result in poor physical condition for breeding and increased winter mortality, and can also result in poor fawn production/survival the following spring. Our recent hot, dry summers may be part of the reason for lower fawn recruitment seen last year, at least in GMU 149. Winter conditions over the last 7 years have been generally mild, with only slightly higher than normal spring snow pack in 2011 and 2012. Despite poor fall conditions, mild winters and normal to above normal spring precipitation have likely contributed to good over-winter survival the last several years. Late summer/fall precipitation in 2014 was near normal except for low precipitation in September, and again having mild winter conditions over 2014-2015 should translate into good over-winter fawn survival.

The Conservation Reserve Program (CRP) dramatically improved habitat conditions for deer in the lowland agricultural areas, providing nearly 300,000 acres of additional habitat in the 4 counties.

These large areas of habitat provide connectivity across the landscape, quality forage, and fawning areas where little existed prior to this program. Unfortunately, large acreages of CRP are being lost in all counties except Walla Walla, as old contracts expire and are not eligible for renewal. To date, the CRP acreage in District 3 has shown a small but significant decline at the county and GMU level. Through 2014, Asotin County acreage has decreased by 26% (no drop in 2014), Columbia County by 22% (11% drop in 2014), Garfield County by 18% (9% drop in 2014) and Walla Walla County by 3% (1.5% drop in 2014). Nationally, a lower cap on CRP acreage has been established and is likely to result in decreased CRP habitat as contracts expire. The habitat provided by the CRP program has been a contributing factor to the increase in mule deer populations during the 1990s and 2000s. If CRP acreage declines significantly, we may expect a similar decline in mule deer populations in the lowlands of southeast Washington.

Yellow star-thistle (*Centaurea solstitialis*) is a major problem in the foothills and along the breaks of the Snake River south of Asotin, the breaks of the lower Tucannon River, and throughout the rangelands of western Walla Walla County. Yellow star-thistle has inundated thousands of acres of deer habitat in GMU-181 along the Snake River breaks, and this problem surely contributes to a lack of improvement in the mule deer population in this unit. While WDFW has partnered with private landowners and the Rocky Mountain Elk Foundation to fund star-thistle control efforts along the forest/ag-land interface, there has not been a similar focus on rangeland habitats. If partnerships and funding sources could be identified and developed, there may be the opportunity to improve deer habitat throughout rangeland areas of District 3.

Weed control projects have been implemented on WDFW Wildlife Areas and on private lands, which should continue to improve habitat conditions for deer. Shrubby brush and forb regeneration after the wildfires of 2005 and 2006 will also have a positive impact on deer habitat in GMU's 154, 162, 166, and 178.

Wind power development continues to expand in southeast Washington. New construction was started in Columbia County in 2013 and continued into 2014, again with associated temporary hunting closures. The overall development plan includes approximately 850 turbines to be constructed in northern Garfield and Columbia Counties. Another development has been proposed for northeastern Garfield County, effectively making these combined developments the largest planned windpower site in the country. It is unknown whether windpower development will negatively affect deer populations. At the very least, the loss of habitat to roads and turbine pads will decrease the amount of habitat available for deer.

Damage complaints attributed to deer have been minimal in southeast Washington compared to deer densities, although we are seeing increasing complaints in some of the winery areas near Walla Walla. To date in District 3, there are 117 active Damage Prevention Cooperative Agreements (DPCA), some of which include cash payments for lure crops, but all of which require some public hunting access to harvest problem deer and elk. Farmers are not eligible for wildlife crop damage compensation unless they have a signed DPCA that allows public hunting access. Landowners may also be issued kill and damage permits to assist with hazing of wildlife from agricultural crops, and WDFW has one full-time and one part-time Wildlife Conflict Biologist, in addition to one full-time technician available to assist with hazing efforts.

Management Conclusions

Mule deer populations along the breaks of the Snake River and in the lowlands appear to be stabilizing after recent increases as suggested by harvest data, although in 2014, nearly every GMU saw declines in mule deer harvest. The exceptions were GMU 175 and 181, where harvests had been in long-term decline, but showed increases last year. Mule deer populations in the mountains are thought to be considerably below desired levels, but may be slowly improving.

Periodic summer/fall drought along with localized severe winter conditions (snow pack) over the last fourteen years (2001-2003, 2005, 2007, 2011, and 2012) may have resulted in lower winter fawn survival for mule deer in the arid lowlands and along the breaks of the Snake River. Fawn production/survival in four of the last six years has been above average, but still below levels attributed to increasing populations. The higher recruitment in 2009 may have contributed to increased harvest success seen in 2012; however 2012 fawn production saw a return to chronically low recruitment and may be one reason for the lower harvest observed in 2014. 2013 fawn recruitment was above normal, but 2014 fawn recruitment (results limited to GMU 149) was the lowest since 1989, and harvest opportunities in 2016 may be impacted. Given favorable winter conditions in 2014/15 and apparently good over-winter survival, populations may remain stable through the 2015 hunting season.

The 2014 post-hunt mule deer buck ratio was the lowest since 2010, and suggests the low fawn production in 2012 may be reflected in the buck ratio along with the harvest. In addition, only 14% of the post-season bucks classified during winter surveys appeared to be 3-years old or older, and these were predominantly observed on private land. For comparison, 30% of 2012 post-season bucks were classified as ≥ 3years-old, and buck harvest in 2013 was the highest in the last 17 years. Although surveys were limited to GMU 149, that GMU also has the largest harvest, and the low percentage of adult bucks may not bode well for the 2015 hunting season. The low fawn ratios may indicate poor back-to-back seasons are ahead when projecting harvest for the 2016 season as well.

The quality of bucks harvested under the three-point program has improved, compared to the era when hunters could harvest any buck. Since 1992, the mule deer buck harvest has averaged 51% four point or larger, compared to 11% prior to the three-point regulation. The white-tailed buck harvest has averaged 20% five point or better, compared to 9% prior to the three-point regulation.

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DEER STATUS AND TREND REPORT: REGION 2, DISTRICT 6

GMUS 203, 204, 209, 215, 218, 224, 231, 233, 239, 242, 243

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Population objectives and guidelines

In general, the Okanogan District is managed for maximum productivity and sustainable harvest of mule deer (*Odocoileus hemionus*) and white-tailed deer (*O. virginianus*) with an emphasis in Western Okanogan County (all GMUs except 204) on quality buck opportunity. As per the statewide game management plan, the post-season sex ratio target is a minimum of 15 bucks per 100 does; however, west of the Okanogan River the preferred ratio is a minimum of 25 per 100. In addition to harvest information, data on buck:doe ratios, fawn production, and fawn recruitment are collected during field surveys to assess success in achieving management objectives. Efforts to produce population estimates from quadrat surveys and sightability modeling are also underway.

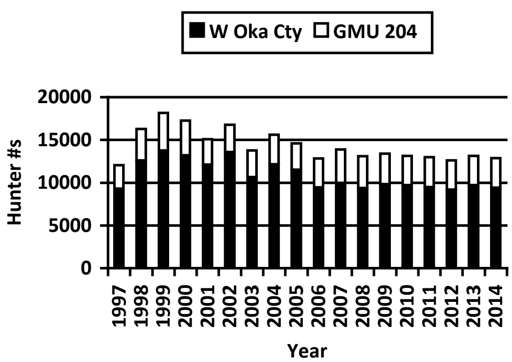

Figure 1. Trend in hunter numbers in District 6.

Hunting seasons and harvest trends

The general modern firearm season remained at 9 days in 2014. Originally, antlerless permits throughout the district had been set at conservative levels due to mediocre over-winter fawn recruitment in recent years. However, in the wake of the Carlton Complex Fire, we increased antlerless permits in the affected GMUs several fold to mitigate for the landscape's reduced ability to support wintering deer. This resulted in a modest harvest increase of about 400 additional antlerless animals.

Hunter numbers, harvest, and hunter success had been quite stable over the last eight years throughout the district (Figures 1-3). In 2014 both harvest and success increased noticeably. These gains occurred consistently across the county and included both bucks and antlerless animals, suggesting the additional antlerless permit harvest was only a minor factor driving the increases. Possible explanations include the unusually wet fall weather and increased harvest vulnerability due to fire activity.

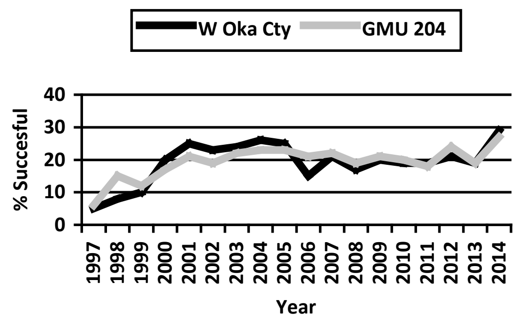

Figure 2. Trend in hunter success in PMUs 21 & 22.

WDFW check station personnel surveyed 249 hunters and examined 63 deer in 2014 (Table 1). Interestingly, check station data did not reflect the uptick in success, likely because the Winthrop station received relatively few deer from the fire affected GMUs. Nonetheless, the new location we have been employing at the Winthrop Barn continues to be a better barometer of district-wide activity than the old site on the East

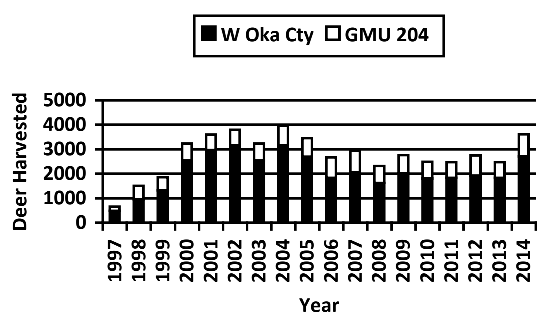

Figure 3. Trend in harvest in PMUs 21 and 22.

Table 1. Chewuch Check Station Results.

	Deer Type				
Year	Bucks	Antlerless	Total	Hunters	%Success
1997	5	0	5	729	1
1998	33	0	33	980	3
1999	53	0	53	1414	4
2000	72	0	72	1250	6
2001	106	27	133	1314	10
2002	54	45	99	1265	8
2003	71	6	77	840	9
2004	72	5	77	1093	7
2005	49	17	66	1114	6
2006	24	13	37	519	7
2007	41	25	66	715	9
2008	27	13	40	795	5
2009	62	13	75	796	9
2010	66	11	77	375	21
2011	37	6	43	245	18
2012	44	5	49	253	19
2013	72	6	78	252	31
2014	58	5	63	249	25

Chewuch Road.

Surveys

Post-hunt surveys are conducted to collect mule deer population composition data and monitor herd condition relative to demographic objectives. Helicopter surveys take place in early December when most hunting seasons have ended, when most bucks are still with does and have not dropped antlers, and when deer are concentrated on winter ranges. Deer are counted, identified to species, and classified as ≥ 3-pt buck, < 3-pt buck, doe, or fawn.

This year as in 2013, we flew our surveys by quadrat in an attempt to generate a population estimate in conjunction with a sightability model. Despite classifying over 4100 deer in 2013, our efforts did not produce a population estimate with acceptable accuracy or precision. As a result, in 2014 we restricted the effort to only the Methow Watershed and flew a more representative sample of low and high density quadrats in an attempt to improve the model output quality. Data from that effort are still being analyzed; however, preliminary calculations suggest the methodology will require further refinement. In addition to the quadrat counts we collected traditional ratio data, with the results ending up similar to the 10-yr averages (Table 2 & 3).

Hiking surveys are conducted in early spring just as winter ranges begin to green-up, and before mule deer begin to migrate to summer range. Deer are classified as fawn or adult, and these data in combination with the post-season survey results are used to estimate over-winter fawn survivorship, and provide insight into population trend.

Despite the loss of winter range browse due to the Carlton Complex Fire, spring surveys after the mild winter produced an estimated over-winter fawn mortality of 47%. This is below the long-term average of 52%, indicative of a stable to slightly growing population.

Table 3. Long-term post-season mule deer population composition counts for Western Okanogan County. F:100:B is fawns and bucks per 100 does.

	Bucks					
Year	≥3 pt	<3 pt	Doe	Fawn	Total	F:100:B
1997	64	113	1464	1061	2712	72:100:12
1998	103	185	1735	1520	3544	87:100:17
1999	102	225	1301	1150	2778	88:100:25
2000	123	264	1425	1321	3133	93:100:27
2001	168	318	2067	1841	4394	89:100:24
2002	214	319	2059	1607	4199	78:100:26
2003	193	329	2854	1938	5314	68:100:18
2004	95	191	2086	1676	4048	80:100:14
2005	174	433	3367	2841	6815	84:100:18
2006	214	412	3343	2148	6117	64:100:19
2007	141	176	1935	1409	3661	73:100:16
2008	105	146	1499	1119	2869	75:100:17
2009	128	221	1762	1360	3471	77:100:20
2010	147	183	1371	1126	2827	82:100:24
2011	152	235	1327	1050	2764	79:100:29
2012	238	254	1433	1117	3042	78:100:34
2013	242	252	2006	1631	4131	81:100:25
2014	129	130	1123	896	2278	80:100:23

Table 2. 2014 post-season mule deer population composition counts in the Methow Watershed. F:100:B is fawns and bucks per 100 does.

	Bucks					
Area	≥3 pt	<3 pt	Doe	Fawn	Total	F:100:B
Methow	129	130	1123	896	2278	80:100:23

Population status and trend analysis

Since record keeping began in the early 1900s, the history of the mule deer population in Okanogan County is characterized by gradual long-term trends, largely in response to changes in habitat quality. In the early twentieth century, the implementation of modern game management coincided with the advent of effective wildfire suppression at the landscape level. Fire suppression allowed for the widespread establishment and growth of shrub forage species on critical lower elevation winter ranges. Improving winter forage quantity and quality, coupled with controlled harvest, allowed for steady herd growth for several decades, as evidence by historical harvest data. Range condition and population levels likely peaked in the middle of the twentieth century.

Table 4. Spring mule deer population composition counts from 2015, by area for Western Okanogan County. F:100A is fawns per 100 adults.

Area	Adult	Fawn	Total	F:100A
Methow	1639	608	2247	37:100
Oka	499	210	709	42:100
Total	2138	818	3956	38:100

For roughly the last few decades, harvest data and population estimates suggest a gradually declining population. This is likely a function of the reduced shrub diversity, declining productivity of aging shrubs (particularly bitterbrush and ceanothus), and the lack of recruitment of new shrubs under continued fire suppression regimes. As a result, even during periods of extended mild winter weather, the population is not rebounding to the historic highs of the mid 1900s, suggesting a reduction in landscape carrying capacity for deer.

Overlayed on the general long-term population trends are significant short-term fluctuations driven by severe winter weather events and spikes in crop damage related doe harvest. Prior to the 1968 freeze, heavy orchard depredation by deer led to periodic culling events, but the populaltion rebounded quickly as soon as harvest pressure eased. Similarly, mule deer numbers bottomed out in 1997 following a string of hard winters; however, modelling suggests they quickly rebounded and had almost doubled, peaking in 2000 following several consecutive mild winters (Figure 4). Since then, herd size has fluctuated less dramatically in response to changes in winter severity.

Unlike mule deer, white-tailed deer have increased in the district over the long-term. Development patterns and agricultural practices, may have promoted the expansion of white-tailed deer. Whitetails are widespread in the eastern part of the district, and now inhabit most of the major drainages and valley bottoms in the western half of the county, including many places where they had not been seen historically. Relatively flat harvest figures suggest the whitetail population may now be fairly stable. Whitetail also sustained significant winter losses in the 90s, but populations rebounded with milder winters and have likely fluctuated since similar to mule deer.

In contrast to population size, herd composition is tied to harvest rather than habitat. Heavy hunting pressure on antlered mule deer in the past caused the buck:doe ratio to consistently drop below the historical minimum threshold of 10:100. Implementation of more restrictive seasons and a minimum management objective of 15 bucks per 100 does, have improved post-season sex ratios for the last 15 years. In response, the general rifle season was lengthened to 14 days in 2003; however, ratios began declining again immediately and season length returned to nine days in 2006 and has remained there since. For the next 3 years, the season has been lengthened to 11 days and will be reevaluated at the end of the 3-year cycle.

Table 5. Long-term spring mule deer population composition counts from Western Okanogan County. F:100A is fawns per 100 adults.

Year	Adults	Fawns	Total	F:100A
1997	1404	232	1636	17:100
1998	1279	462	1741	36:100
1999	1393	833	2226	60:100
2000	1496	838	2334	56:100
2001	1593	707	2300	44:100
2002	1661	626	2287	38:100
2003	1516	506	2022	33:100
2004	925	335	1260	36:100
2005	1643	722	2365	44:100
2006	1635	288	1923	18:100
2007	1314	269	1583	20:100
2008	1762	436	2198	25:100
2009	1564	503	2067	32:100
2010	1943	768	2711	40:100
2011	2259	696	2955	31:100
2012	2144	728	2872	34:100
2013	1934	600	2534	31:100
2014	2147	961	3108	45:100
2015	2138	818	3956	38:100

Habitat condition and trend

Up until recently, winter range habitat quality and quantity have likely suffered from decades of fire suppression. The resulting tree encroachment, loss of early to mid-successional forage conditions, and lack of shrub regeneration diminish forage quality and quantity in the long-term, and this situation has been exacerbated by the spread of introduced noxious weeds.

In the summer of 2014, however, conditions changed dramatically at the landscape level. Wildfires consumed over 270,000 acres primarily in the Methow Watershed, and the majority of the burned area overlays important mule deer winter ranges. Analysis suggests the fires burned about 40% of the winter range in the watershed including at least 25% of the high deer density areas. At the time of this report another even larger complex of fires is currently burning in Okanogan County and much of burn overlays deer winter range areas. When analysis of the new fire is done it will almost certainly show that the majority of total and high density winter range in the western portion of the district had burned in the last two years. In addition, huge areas of winter range have also burned in the eastern portion of Okanogan County.

For the most part, these fires burned hot and fast and consumed the vast majority of the critical winter shrub forage within their perimeters. This will significantly reduce the habitat carrying capacity for deer in the immediate future and likely for several years to come until shrubs reestablish and grow large enough to function as winter browse. Conversely, the eventual reestablishment of a younger rejuvenated shrub component on important deer winter range areas should improve carrying capacity and deer numbers in the long-term.

Besides fire, other influences have and will continue to affect habitat in the long-term. For instance, loss of winter range, due to increased human population and associated development has likely reduced landscape carrying capacity to some degree. Historically this has been most true in the Methow Valley, but more recently, development pressure has accelerated district-wide. Until recently, this had been mitigated somewhat by land acquisition and conservation easement purchases by WDFW and local land trusts; however, opposition to such activities by local elected officials has curtailed these efforts. Even in the absence of opposition, WDFW and other partners can only raise the resources to protect a fraction of the available vital deer habitat, particularly as land prices and development pressure have rebounded with the recovering economy. More aggressive growth management planning is needed if critical private lands are going to continue to play an important role in deer conservation.

Over the last 15 years and prior to the infernos of the last two summers, wild fires burned over 400,000 acres of deer habitat within the district, primarily at mid to higher elevations. This has noticeably improved summer forage quality and availability. Significant additional summer range areas are burning again this year, and unlike winter range habitat, these areas will be productive again for deer almost immediately.

Decades of proactive road management have benefited deer and other wildlife; however, county officials recently opened significant additional road mileage to all-terrain vehicles, and the USFS is under constant pressure to expand ATV opportunities. This will likely increase the amount and distribution of motorized use on public lands. Similarly, recent national attempts to reverse protections for roadless areas could result in expanded road construction and motorized use locally. Overall increases in motorized use and roaded forest land would result in habitat loss and degradation, and would likely increase disturbance and illegal harvest of deer.

Despite these challenges, it is hoped that a combination of habitat conservation activities, habitat restoration actions (wildfire restoration, weed control, native plant establishment, etc.), and sensible motorized use policies will slow, and perhaps even reverse the habitat degradation and population decline over the long-term. Public support and local politics will significantly influence the success or failure of these efforts.

Management conclusions

In the short-term, the recent fires will reduce the landscape carrying capacity for deer, particularly in the western portion of the District. On the bright side, robust shrub reestablishment in the burned areas over time could improve carrying capacity and could reverse the gradual long-term decline in mule deer numbers seen over the last few decades. To avoid retarding shrub reestablishment and thus maximize the quality of recovering winter range in the burned areas, it will be important to keep animal numbers in line with the landscapes reduced ability to support deer. To this end, implementation of short-term supplemental harvest and long-term restoration work is already underway and will be further expanded as resources allow. In addition continued efforts to protect existing habitat and maintain or improve land use planning tools will be important for maintaining habitat and a correspondingly robust herd.

Over 15 years ago, the mule deer population hit a short-term low following a string of bad winters. Almost immediately, this reduced pressure on seasonal ranges, improved productivity and recruitment, and allowed the herd to rebound quickly during a string of mild winters. Conservative antlerless hunting seasons aided recovery.

Following recovery, herd growth and harvest reached a plateau, with productivity and recruitment falling off as the population appeared to reach or exceed the landscape carrying capacity for deer. We implemented more aggressive antlerless harvest to stabilize or slightly reduce herd size in an effort to improve productivity, maintain sustainable harvest, and reduce overuse of seasonal ranges.

More recently, moderately tough winters had reduced recruitment and likely reduced overall herd size. As a result, we have reduced antlerless permits accordingly and mule deer populations have been stable or rising slowly; aided by mild conditions the last two winters.

For deer in the short term, loss of winter range to fires the last two summers is anticipated to lower fawn recruitment and thus reduce overall herd size. This will eventually be reflected in similar reductions in legal buck availability. For the next year or two though, the robust post-season buck:doe ratio and the expanded general season falling later in October will offer a good opportunity for hunters to harvest an older age class buck.

Over the last couple of decades, populations of resident deer on the Methow and Okanogan Valley floors had increased significantly to problematic levels. Nuisance/damage complaints had risen sharply and population levels had surpassed social tolerance. Reduced harvest pressure associated with increasing development and housing density is the major contributing factor. A winter feeding effort in 1997 likely exacerbated the problem as does taught succeeding generations of fawns to look for winter forage near the feeding sites, despite the discontinuation of the feeding effort in subsequent years. Mild winters allowed deer to survive with this strategy, but more recently, tougher winters have resulted in higher fawn mortality in developed areas and damage complaint issues are down substantially. Ironically, increases in winter fawn mortality generated public calls to reinitiate feeding efforts, a move that would only start the cycle over again and expand the nuisance problems.

Instead, we have implemented antlerless permit hunts season on resident, valley-bottom deer on private land to address nuisance/damage issues. Permit numbers fluctuate with level of reported damage incidents. To date, the program is operating smoothly and appears to be helpful in reducing deer nuisance/damage complaints. The addition of a new conflict specialist to the district staff will also help address these issues.

DEER STATUS AND TREND REPORT: REGION 2
GMUS 243 - 269

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JON GALLIE, Wildlife Biologist

Population objectives and guidelines
The majority of deer in the Wenatchee District are mule deer, with white-tailed deer occurring at low density in certain limited areas. Management objectives for Douglas County are a post-hunt buck ratio of 15 to 19 bucks per 100 does, and a mule deer population size within landowner social tolerances. Management objectives for Chelan County is conservative, with a post-hunt buck ratio objective of 25 or greater bucks per 100 does, to maintain deer populations in balance with available winter forage, and to limit conflicts with agriculture. Composition surveys, harvest estimates, modeling, and end of winter browse observations are used to monitor the population relative to objectives.

Hunting seasons and harvest trends
All mule deer buck harvest is restricted to a 3-point minimum, whereas, white-tailed deer seasons allow harvest of any buck. Doe harvest is offered within some general archery seasons and through permit harvest opportunities in several GMUs for youth, senior and disabled hunters. Many of the antlerless permits offered are to second-deer permits. Deer seasons begin with the September early archery general deer season. A modern firearm and muzzleloader High Buck season run from September 15-25 in the Lake Chelan National Recreation Area, the Glacier Peak Wilderness, the Henry Jackson Wilderness and the Alpine Lakes Wilderness. The High Buck hunts overlap GMUs 244 and 249 in Chelan County. Early muzzleloader general deer season was open in twelve GMUs for nine days in late September and early October. The early modern firearm general deer season was open 9 days in October in all Chelan and Douglas County GMUs. Early archery general deer season hunting was open in September for 26 days in most GMUs, and late archery general season deer hunting was open in 2 GMUs in late November and early December for mule deer in GMUs 250 and 243, and white-tailed deer in GMU 243. All late season modern and muzzleloader opportunity is offered under drawing permits.

The 2014 hunting season marked the fifth year of a restructured permit drawing system for limited-entry hunts. Hunt categories had increased from five to seven with the addition of Quality and Second-deer permits. More importantly, each hunt category drawing was conducted independently of the each other category, giving hunters the opportunity to be drawn for more than one permit hunt since the change in 2010. Total permits issued for the district in 2014 were consistent with the past several years, yet less than the 935 offered in 2009. Most antlerless permits were shifted into Second-deer permits in 2010, and numbers reduced slightly in anticipation of increased harvest rates under a second-deer opportunity.

In 2001, WDFW moved away from harvest report cards, and instituted mandatory reporting to monitor statewide big game harvest. The change brought more accurate reporting of harvest and an increased ability to monitor population change. Over three thousand bucks were harvested in the Wenatchee district in 1991. By 1997, reported buck harvest had dropped to roughly 600, indicating a significant population decline. Since 2001, the average buck harvest for the district has been 1,458, compared to an average 1,739 bucks during the period from 1991 through 2000. From 2001 through 2004 the district showed an increasing buck harvest. In 2004 the buck harvest was roughly 2000, with an alternating pattern of increasing then decreasing years through 2010. In 2009, the buck harvest increased 23% over 2008's harvest then decreased 11% in 2010 from 2009 (Fig.1). In 2014, the overall harvest in the district increased 10% above 2013. The pattern was similar for both Chelan at 10% and Douglas County at 13% .

In the Chelan GMUs, the 1997 harvest of 247 bucks was the lowest on record. The reduction in harvest by 1997 was primarily influenced by the following factors: severe winter of 1996-1997, Tyee and Dinkelman fires , short modern-firearm hunting season, and 3-point minimum regulation. Conservative hunting seasons have been maintained since 1997.

Douglas GMUs buck harvest decreased dramatically from 1996 to 1997, then, increased through 2002. Since 2002, the buck harvest has decreased each year through 2009. During the past two years harvest had increased slightly. %. While some of the decrease in past years is likely due to reduced participation and changing from general to permit only youth, senior and disabled hunting opportunities in 2005, it appears deer numbers have also decreased over time, as have landowner complaints.

All Chelan data support an increasing trend toward habitat carrying capacity 1997-2004, and reaching winter habitat limitations in 2005. Chelan's buck harvest in 2004 increased 26% from 2003, but is still only 55% of the 1992 harvest of 2,206 bucks (Figure 1). The 1992 buck harvest level may not be attained again with the 3-point restriction for general seasons, even as winter ranges mature post-fire and populations increase. During 2010, 758 bucks were harvested in Chelan County, a decrease of 16% from 2009. In 2011 and 2012, 674 and 713 bucks were harvested. County buck harvest in 2014 was 828. In Douglas County, buck harvest has been raising since 2008 to a high of 679 in 2012, 672 in 2013 and 757 in 2014. (Tables 1, 2, 3)

The number of deer hunters in the Wenatchee District declined dramatically from 21,082 in 1992, to 6,438 in 2001. From 2001 to 2010 the number of hunters has been relatively stable, fluctuating roughly from 6500 to 8500 hunters. Since then, Douglas County hunter numbers have been stable while Chelan County numbers have dropped. General season hunter numbers between 2013 at 8,209 and 2014 at 8,177. (Table 1).

Vehicles kill a large number of deer each year in the Wenatchee District, based on data collected by the Department of Transportation. More deer are killed in Chelan County than Douglas County because mountainous terrain forces migratory deer to lower elevations in the winter to avoid deep snow. Deer kill peaks in winters with deep snow accumulation at lower elevations. Construction of the wildlife fence along S.R. 97Abetween Wenatchee and Entiat has significantly reduced annual vehicle collisions along this roadway.

In 2009, the post-hunt buck ratio objective for GMUs 244, 245, 246, 247, 249, 250, 251was changed from standard (15-19 bucks: 100 does) to conservative (25+ bucks: 100 does) in order to match the values of hunters utilizing Chelan County and to maintain buck numbers following the harvest peak in 2004. Post-hunt buck ratios for Douglas County remained as standard (15-19 bucks: 100 does).

In the Chelan GMUs, observed post-hunt ratios were 29 bucks and 83 fawns per 100 does in 2011. Surveys in 2012, 2013 and 2014 were precluded by poor flight weather and or poor snow conditions. Legal bucks (3+ points) bucks comprised 54% of Chelan bucks, while sub-legal bucks (1 or 2 points) bucks comprised 47% of observed bucks in Chelan. The observed winter/spring fawn: adult ratio for the Chelan GMUs was 44:100. Douglas County was surveyed with ground counts in 2014 and had a post hunt buck ratio of 26 bucks:100 does, and a ratio of 7 legal bucks:100 does. The fawn to doe ratio was 59.

Population status and trend analysis

The deer population in the Douglas GMUs was reduced by the severe winter of 1996-97. However, winter conditions for these deer have been mild since this time, and the population quickly recovered. In addition, there have been significant habitat enhancements associated with the Conservation Reserve Program that have been beneficial for deer. Seasons from 2001-2003 were designed to reduce deer, and this objective was met. As a result, 2004 and 2005 seasons were more conservative, with reduced harvest opportunities for antlerless deer. Antlerless deer opportunities were increased for 2006 and 2007, and then reduced in 2008 and 2009 to slow overall declines. In the Chelan GMUs, conservative seasons since 1997, and a series of mild winters, allowed this population to increase steadily through 2005.

In Douglas and Chelan herds, there was little harvest of antlerless animals from 1997 to 2000 (range 0-40). The average yearly antlerless harvest from 1992 to 1996 was 233 in Douglas and 441 in Chelan. The 2002 antlerless harvest in Douglas, 426, is the highest in at least 11 years. Antlerless harvest was reduced in 2004 and 2005 in the Douglas GMUs, through reduction of antlerless opportunity permits. Antlerless harvest was 269 deer in 2013 in District 7, 299 antlerless deer 2014.

The Chelan County herd was severely impacted by the 1994 Tyee fire, which severely burned a large portion of the winter range, greatly reducing browse. In addition, the winter of 1996-97 was severe. As a result of lost habitat and winter weather, the deer population within the Chelan GMUs declined. It has now recovered, based on the increase in the number of bucks harvested, high postseason buck:doe ratios, and high mature buck representation. The deer population in Chelan County is predominantly migratory (89% based on a radio-collared sample of does), and is typically widely dispersed during the modern firearm season in mid-October. Forty-five percent of the bucks observed in Chelan County during post-hunt surveys in 2006 were legal (3 point +) bucks. This percentage dropped to 13% in 2007, increasing to 17% in 2008, however, survey conditions may have played a role in producing these low results. In 2011, 53% of the bucks observed during post-season survey were legal bucks. In 2011, total bucks per 100 doe ratios in the Chelan GMUs increased to 29 bucks per 100 does. Even though aerial surveys were unable to be conducted in

2014, the percentage of mature bucks appears to have remained high. It appears the herd reached carrying capacity of the winter forage base postseason 2005, based on elevated fawn mortality and heavy browse utilization. Informal observations of winter range shrub conditions suggest deer use of available forage rapidly increased 2001-2005, and population growth rate has slowed as winter habitat carrying capacity is approached. The drop in harvest in 2005, in combination with observed increased use of winter range browse and reduced fawn:doe ratios in 2005, suggest the herd had reached the biological carrying capacity of the winter range. As a result, near-term future management will be directed toward maintaining a stable, to slowly increasing, mule deer population.

The Chelan GMUs have a deserved reputation for producing large numbers of mature bucks, and many hunters express interest in maintaining the high quality of bucks. Buck post-season composition data suggest hunting pressure truncates the buck age structure in the Douglas GMUs. Although hunting pressure is reduced in some locations due to the predominance of private lands, low numbers of 3+ aged bucks post-season suggest hunters are able to kill the majority of larger bucks due to high visibility and ease of physical access to most areas. By contrast, the high proportion of older-aged bucks in the Chelan GMUs support perceptions that many deer are unavailable for harvest under the current, early modern firearms general season structure. Figures 2 and 3 show the increasing harvest trend of mature 4 pt. and 5+ point deer in the district. The figures also show that while the harvest of mature deer is increasing, late season permits account for a decreasing percentage of that harvest. In 2014, only 11% of the 303 5+ pt. deer were harvested under permits.

Population Surveys

Both helicopter and ground surveys have been used to monitor population composition. Surveys conducted during late December or early January coincide with deer concentrating on winter range but before most antlers are dropped. These surveys were used to monitor post-hunt buck and fawn ratios relative to does. Ground surveys are conducted in late winter and early spring, after most winter weather but before dispersal, to monitor fawn: adult ratios as an index to survival. Prior to 2010 surveys were composition counts only. Poor weather conditions have precluded survey flight in recent years. New survey strategies are being evaluated to overcome these problems.

In 2010, WDFW implemented the first of a series of annual helicopter surveys designed to establish a formal population estimate for mule deer in GMUs 247, 250, 251. A total of 30 sampling units were surveyed within delineated mule deer winter range this first year. A total of 2442 deer were observed during three days of flights. Thirty-five percent of the deer were observed on winter ranges in the Swakane unit, 25 % in the Entiat unit and 41% in the Mission unit.

Surveys were again flown in 2011 sampling 32 units within the winter range and observing 2795 deer. The distribution of deer between the Mission, Swakane and Entiat units were proportionally similar, differing from the previous year by minor amounts. Our attempt at a third year's surveys was hampered by poor weather; therefore, no estimates were obtained in 2012, 2013 or 2014.

Surveys were flown using sightability protocols. Winter range is stratified into low medium and high density areas based on biologist's experience. A subset of each stratum is surveyed, and the program projects the total number of deer based on the number of units per strata. In addition, the program applies a correction factor based on the previously measured sightability of deer in various habitat structures. The ability to see deer varies based on the type of cover, snow cover and the activity of the deer. Certain conditions make observing deer more difficult, therefore the program adjust upward the number of deer in that unit based on observed conditions and deer activity. In units with minimal cover and high sightability values for deer, the program provides little or no correction to the observed numbers.

In 2010, we delineated 159 winter range sample units, stratified into low medium and high density based on elevation, habitat and previous survey results. Thirty sample unit were surveyed over a three flight days. The survey resulted in an estimate of 15,798 mule deer. High amounts of variability within each stratum, combined with a relatively low numbers of sampled units resulted in wide confidence intervals for the first survey year. For 2011, we re-stratified the sample units and truncated the winter range based on observed distributions of deer. From a total of 143 sample units we surveyed 32 in 2011. We decreased within strata sample variance, yet still produced confidence interval higher than we are comfortable with. The 2011 survey estimated 18,076 were occupying winter ranges.

Post survey discussions have focused on methods to increase the proportion of sample units in order to tighten confidence intervals. We are also exploring other methods of stratification for future surveys. Attempts to survey in 2012 and 2013 were thwarted by bad weather.

Habitat condition and trend

Wildfires caused short-term negative impacts to deer winter range in Chelan County for several years following 1994, but in some areas deer are now benefiting due to increased quantity and quality of forage. However, shrub recovery has been slow in some winter ranges, particularly at the lowest elevations, where deer are concentrated by snows that accumulate at higher elevations. The Manson unit (GMU 243) in particular has been severely impacted by the 2000 Rex Creek fire and 2001 Deer Point fire, which collectively consumed 100,000 acres and severely reduced winter browse. This herd segment is beginning to show signs of recovery, with harvest increasing since 2008. The Douglas population is more dependent upon agricultural crops (especially alfalfa and wheat) during winter than the Chelan population.

The human population is increasing by nearly 2 % per year within the Wenatchee District. Residential and orchard development associated with this population growth continue to reduce winter range throughout the district. In 1967, Chelan County supported a harvest of 5,180 deer; it is unlikely the deer population will ever again sustain this level of harvest.

Management conclusions

Buck age structure in the Chelan GMUs will require close monitoring in the future to avoid dramatically reducing buck numbers and age structure. We could probably meet buck escapement goals under the current season structure in Chelan without the 3-point regulation because many buck do not migrate to lower elevations where they are vulnerable to harvest until after the general modern firearms hunting season. However, the 3-point restriction is very popular with a large segment of the public, and is often credited for the large numbers of older, mature bucks seen on winter ranges. Consistent retention of this regulation for mule deer may also improve compliance with hunting regulations. However, this population can be strongly regulated by winter conditions, and is susceptible to weather-related declines. For the 2006-2014 general season, modern firearm hunting season length was reduced from 14 to 9 days in Chelan and Okanogan counties, in response to concerns about lowered buck escapement in Okanogan County, and hunter desires to maintain older aged, large bucks in the Chelan population.

With the more open habitat conditions in Douglas, the 3-point regulation is working well and has increased total buck escapement. Prior to the implementation of the 3-point restriction in Douglas, buck escapement was low, estimated between 6-10 bucks:100 does. There are, however, concerns about the long-term ramifications of poor recruitment of older age bucks, as it appears most bucks are still being harvested by 3.5 years of age. Due to the open nature of these GMUs, it is unlikely that age structure truncation can be avoided under general modern firearms season structure.

Population modeling of the Douglas GMUs has been hampered by insufficient, inconsistently collected postseason composition data. Additional helicopter composition survey resources would help address this shortcoming; currently, limited resources are prioritized in favor of the Chelan herd, due to the majority of public land with unrestricted public access. Additionally, interchange between the Douglas population and the population to the south, (primarily in GMU 272), may be so extensive that it does not function as a closed population. If additional, consistent efforts to classify deer do not result in improved alignment of simulations with observed data, a marking study may be necessary to quantify interchange between these populations.

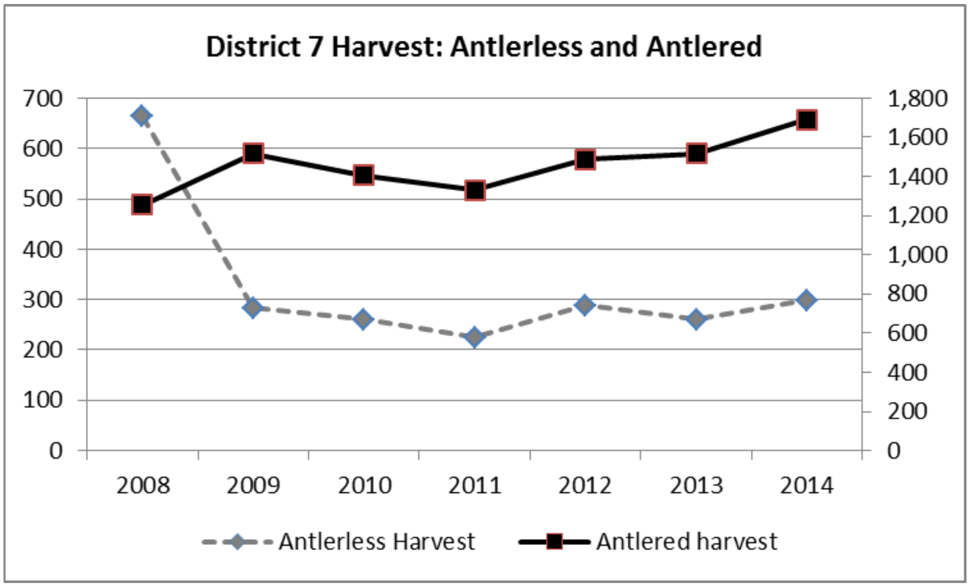

Figure 1. District 7 antlerless and antlered harvest from 2008 to 2014.

Harvest Year	Method	Antlerless Harvest	Antlered Harvest	Total Harvest	Antler Points 1	2	3	4	5+	Number Hunters	Hunter Success	Hunter Days	Days/Kill
2014	Archery	122	176	298	0	0	83	55	38	1,219	24.40%	5,921	19.9
2014	Modern Firearms	0	1,184	1,184	0	3	577	419	185	6,058	19.50%	22,495	19
2014	Multiple Weapons	10	120	130	1	0	48	41	30	480	27.10%	2,513	19.3
2014	Muzzleloader	0	105	105	0	1	47	40	17	420	25%	1,500	14.3

Harvest Year	Method	Antlerless Harvest	Antlered Harvest	Total Harvest	Antler Points 1	2	3	4	5+	Number Hunters	Hunter Success	Hunter Days	Days/Kill
2013	Archery	91	107	198	0	0	36	47	24	1,211	16.40%	6,150	31.1
2013	Modern Firearms	0	1,130	1,130	2	4	505	443	176	6,215	18.20%	22,597	20
2013	Multiple Weapons	11	88	99	0	0	33	40	15	398	24.90%	2,214	22.4
2013	Muzzleloader	0	93	93	0	1	41	42	9	385	24.20%	1,409	15.2

Table 1. Harvest, hunter participation, and hunter success by hunting method in 2013 and 2014.

Chelan County

Harvest Year	GMU	Antlerless Harvest	Antlered Harvest	Total Harvest	Antler Points 1	2	3	4	5+
2014	243	1	116	117	0	1	50	41	24
2014	244	3	29	32	0	0	8	8	13
2014	245	27	119	146	0	0	51	42	26
2014	246	6	41	47	0	0	15	14	12
2014	247	44	197	241	0	1	97	63	36
2014	249	1	27	28	0	0	8	11	8
2014	250	16	193	209	0	1	79	70	43
2014	251	0	106	106	0	0	47	37	22
	Total	98	828	926	0	3	355	286	184

Chelan County

Harvest Year	GMU	Antlerless Harvest	Antlered Harvest	Total Harvest	Antler Points 1	2	3	4	5+
2013	243	1	88	89	0	1	42	36	9
2013	244	1	24	25	0	0	8	11	5
2013	245	26	104	130	0	0	40	42	22
2013	246	7	54	61	0	0	24	17	13
2013	247	35	170	205	0	0	61	73	36
2013	249	2	37	39	1	0	5	19	12
2013	250	12	158	170	1	3	54	62	38
2013	251	1	112	113	0	0	54	46	12
	Total	85	747	832	2	4	288	306	147

Table 2. Harvest from Chelan County by GMU in 2013 and 2014.

Douglas County

Harvest Year	GMU	Antlerless Harvest	Antlered Harvest	Total Harvest	Antler Points 1	2	3	4	5+
2014	248	7	197	204	1	0	103	78	15
2014	254	1	127	128	0	0	59	50	18
2014	260	15	134	149	0	0	78	43	13
2014	262	3	130	133	0	1	73	39	17
2014	266	7	91	98	0	0	44	32	15
2014	269	1	78	79	0	0	43	27	8
	Total	34	757	791	1	1	400	269	86

Douglas County

Harvest Year	GMU	Antlerless Harvest	Antlered Harvest	Total Harvest	Antler Points 1	2	3	4	5+
2013	248	4	178	182	0	1	97	66	14
2013	254	0	92	92	0	0	48	32	12
2013	260	4	113	117	0	0	52	45	16
2013	262	1	106	107	0	0	52	42	12
2013	266	7	92	99	0	0	35	46	11
2013	269	1	90	91	0	0	43	35	12
	Total	17	671	688	0	1	327	266	77

Table 3. Harvest from Douglas County by GMU in 2013 and 2014.

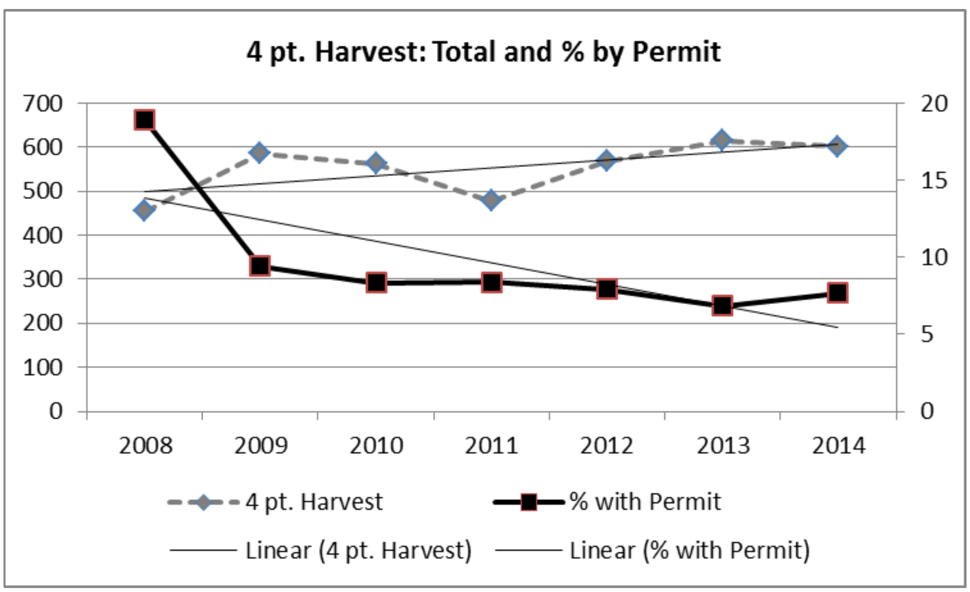

Figure 2. Harvest of 4 pt. deer from D7 in 2014 and the percentage harvested during permit hunts.

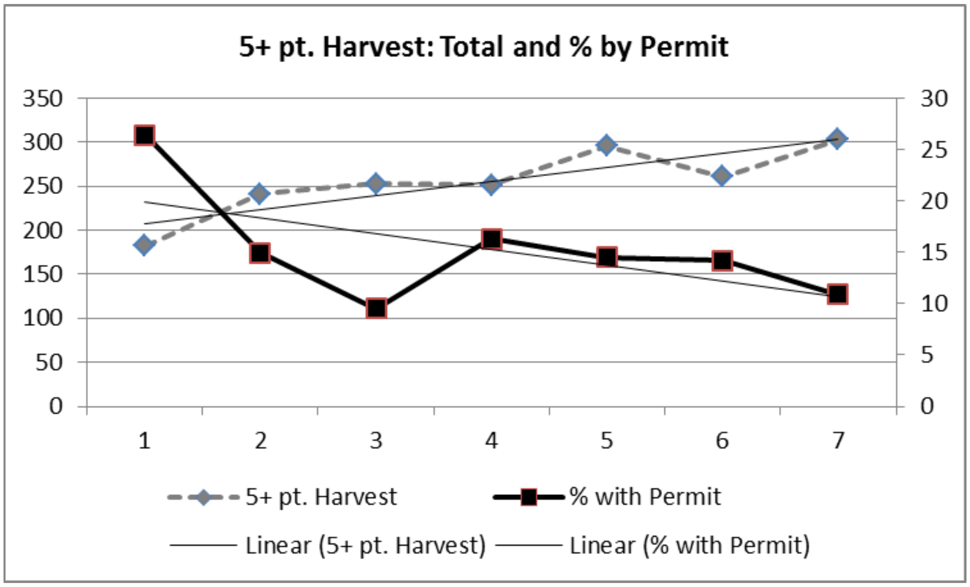

Figure 3. Harvest of 5+ pt. deer from D7 in 2014 and the percentage harvested during permit hunts.

DEER STATUS AND TREND REPORT: REGION 2
GMUs 272, 278, 284 AND 290

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Population objectives and guidelines

Both mule deer (*Odocoileus hemionus*) and white-tailed deer (*O. virginianus*) occur in the Columbia Plateau Ecoregion. However, mule deer dominate the harvest and white-tailed deer are only present in small groups widely distributed across the landscape. Consequently, white-tailed deer contribute less than 10% of total annual deer harvest in GMUs 272 (Beezley), 278 (Wahluke), 284 (Ritzville), and 290 (Desert).

Management objectives for these GMUs focus primarily on mule deer. The overall management goal for GMU 272, 278, and 284 is to increase deer herds to levels that are within the limitations of available habitat while minimizing landowner conflicts. Additional management objectives include maintaining a post-hunt buck:doe ratio of $\geq$ 15:100, while retaining or increasing hunt opportunity and hunt quality.

Overall management goals for GMU 290 (Desert) differ from those outlined above. GMU 290 is managed to maintain a post-hunt buck:doe ratio of $\geq$ 30:100 and ensure that at least half of the male segment of the population is comprised of bucks $\geq$ 2.5 years old. Similar to the general hunt units, GMU 290 is managed to maintain populations within the limitations of available habitat and minimize landowner conflicts.

Hunting seasons and harvest statistics

GMUs 272, 278, and 284 were open to mule deer bucks with ≥3 points and any white-tailed buck during the general modern firearm season. These GMUs had an early archery season where hunters could harvest mule deer does and bucks with ≥3 points or any white-tailed deer. Additionally, a late archery season was offered in GMU 272 and 278 where hunters could harvest mule deer does and bucks with ≥3 points or any white-tailed deer. GMUs 272, 278, and 284 were open during the early muzzleloader general deer season and hunters could harvest mule deer bucks with ≥3 points or any white-tailed buck.

All special permit opportunities in GMU 272 were restricted to antlerless permits. In 2014, antlerless permits specifically for youth hunters and hunters with disabilities were offered. Additional antlerless opportunities in GMU 272 included permits for Deer Area 2011 (Lakeview) and in areas managed by the BuckRun Landowner Hunting Permit (LHP) Program. Special permit opportunities in GMU 284 were primarily limited to antlerless permits in Deer Area 2010 (Benge), but limited opportunities were available for modern firearm, muzzleloader, and archery hunters during late season hunts for any buck. No special permit hunts were offered in GMU 278.

GMU 290 is restricted to special permit only. Opportunities in 2014 were available for modern firearm, muzzleloader, and archery hunters. During these seasons, permit holders could harvest any buck. Fifty antlerless modern firearm permits were also offered in GMU 290.

GMU 272

Harvest estimates have been relatively stable with about 300 bucks and 50 does taken annually, by about 1,300 hunters (Table 1). Since 2005, hunters participating during the general modern firearm season have, on average, accounted for 71% of the total harvest in GMU 272. In 2014, harvest during the modern firearm season again constituted the majority (61%) of harvest. Harvest during the archery, muzzleloader, and permit (including multi-weapon and antlerless for youth and hunters with disabilities) seasons constituted 16%, 8%, and 15% of the total harvest, respectively (Figure 1). Approximately, 4% of the deer harvested in GMU 272 were reported as white-tailed deer.

The number of deer harvested on BuckRun has been steadily declining since 2005 and averages 60 deer annually. Declining trends in harvest levels on BuckRun have been a result of decreases in landowner harvest rather than decreases in local deer herds.

Table 1. Estimated number of deer harvested, number of hunters, hunter success rate (Suc), and days/kill (D/K) in GMU 272, 2005–2014. Harvest estimates include deer harvested on BuckRun LHP.

	Harvest[1]					
Year	B	D	T	Hunters	Suc[2]	D/K
2005	257	86	343	1,325	0.26	14.5
2006	294	52	346	1,165	0.30	12.7
2007	304	35	339	1,210	0.28	14.7
2008	268	51	319	1,350	0.24	17.4
2009	263	33	296	1,359	0.22	18.7
2010	290	58	348	1,337	0.26	15.2
2011	254	66	320	1,410	0.25	17.6
2012	339	64	403	1,405	0.29	14.7
2013	316	43	359	1,408	0.25	15.2
2014	310	59	369	1,355	0.27	14.4
Avg.	*290*	*55*	*344*	*1,332*	*0.26*	*15.5*

[1] B = bucks, D = does, T = total harvest.
[2] Success rates are for all weapon types and general seasons combined.

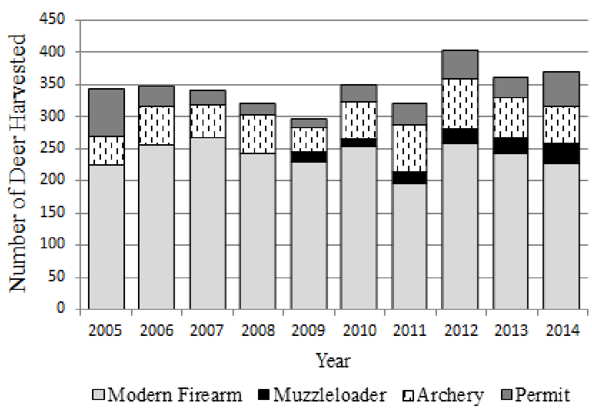

Figure 1. Estimated number of deer harvested by permit (including multi-weapon) and during the general modern firearm, muzzleloader, and archery seasons in GMU 272, 2005–2014.

GMU 278

Consistent with historic harvest levels in GMU 278, harvest remained low with only 57 mule deer harvested during 2014. Compared to 2013, hunter numbers decreased slightly from 281 to 226 in 2014 . However, hunter effort has been steadily increasing since 2001 when the unit had 158 hunters. Overall hunter success during 2014 was 25% and well above the long-term average of 19%. One deer harvested in GMU 278 during 2014 was reported as white-tailed deer.

GMU 284

Success rates in GMU 284 reached a 10-year high during the 2012 season (50%) but dipped slightly during 2013 and 2014 (44% and 48% respectively) while hunter numbers continued to increase, reaching a 10-year high (Table 2). Harvest levels in GMU 284 also reached a 10-year high (423). Harvest during the general modern firearm season accounted for 77% of the harvest in 2014, and was close to the 10-year average of 78%. Hunter success was 48% in 2014 well above the 10-year average of 40%. Approximately, 7% of the deer harvested in GMU 284 were reported as white-tailed deer.

Table 2. Estimated number of deer harvested, number of hunters, hunter success rate (Suc), and days/kill (D/K) in GMU 284, 2005-2014.

	Harvest[1]					
Year	B	D	T	Hunters	Suc[2]	D/K
2005	235	17	252	671	0.38	7.8
2006	245	28	273	643	0.42	7.3
2007	185	31	216	613	0.35	9.5
2008	208	23	231	681	0.34	9.5
2009	273	25	298	802	0.37	8.8
2010	220	37	257	692	0.37	8.6
2011	240	36	276	752	0.37	9.7
2012	376	39	415	832	0.50	6.4
2013	351	28	379	869	0.44	7.4
2014	393	30	423	886	0.48	6.6
Average	***273***	***29***	***302***	***744***	***0.40***	***8.2***

[1]B = bucks, D = does, T = total harvest
[2]Success rates are for all weapon types and general season combined.

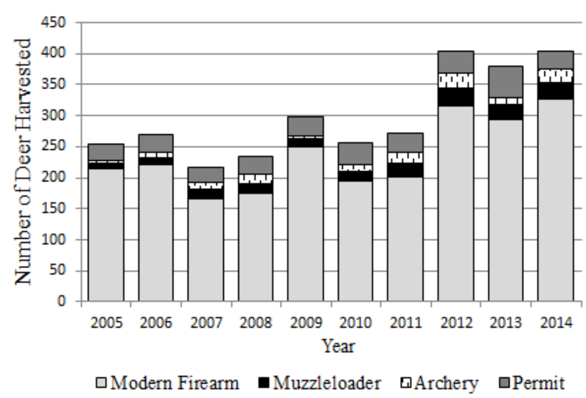

Figure 2. Estimated number of deer harvested by permit holders and during the general modern firearm, muzzleloader, and archery seasons in GMU 284, 2005–2014.

Table 3. Estimated number of mule deer harvested in GMU 290 and success rates of hunters that hunted modern firearm any deer permits (MF Any), modern firearm doe permits (MF doe), archery permits, muzzleloader permits, and youth permits, 2005–2014. Values in parentheses are the number of permits that were available.

	Harvest			Hunter Success				
Year	Buck	Doe	Total	MF Any	MF Doe	Archery	Muzzleloader	Youth
2005	19	12	31	1.00 (15)	1.00 (50)	0.25 (21)	0.75 (4)	na
2006	32	30	62	0.93 (15)	0.88 (50)	0.60 (14)	1.00 (3)	0.65 (30)
2007	11	31	42	0.91 (15)	0.76 (50)	0.00 (12)	1.00 (2)	0.20 (6)
2008	17	28	45	0.86 (15)	0.67 (50)	0.30 (16)	0.00 (2)	1.00 (6)
2009	23	20	43	0.94 (19)	0.64 (50)	0.21 (24)	1.00 (2)	0.50 (6)
2010	21	22	43	0.89 (19)	0.63 (50)	0.13 (18)	0.50 (2)	na
2011	21	22	43	0.95 (19)	0.65 (50)	0.06 (20)	1.00 (2)	na
2012	20	22	42	0.77 (22)	0.73 (50)	0.04 (29)	0.67 (3)	na
2013	18	24	42	0.83 (23)	0.57 (50)	0.08 (32)	0.33 (3)	na
2014	22	26	48	0.79 (21)	0.72 (50)	0.23 (37)	1.00 (2)	na
Avg.	*20*	*24*	*44*	*0.89*	*0.73*	*0.19*	*0.73*	*0.62*

[1]na = years when specific hunt types were not offered.

GMU 290

Hunters harvested 20 bucks and 26 does in 2014 (Table 3). Success for modern firearm buck hunters was 79% which was a slight decrease from the 2013 success rate (83%). This is lower than the long term average of (89%). The success rate for the modern firearm antlerless season was similar to the long-term average of 73%. Archery hunters performed better than the long term average (19%) with 23% of archers successfully harvesting a buck in 2014.

Surveys

Post-hunt surveys are conducted to evaluate trends in productivity rates (fawns:100 does), adult sex ratios (bucks:100 does), and age structure of mule deer herds in GMUs 272, 284, and 290. Collectively, these data allow managers to evaluate the current status of mule deer populations. Due to the limited number of deer in GMU 278 post-hunt surveys are not conducted.

GMU 272

Since 1996, post-hunt herd composition surveys have been conducted annually in GMU 272 using a variety of techniques (e.g., fixed-wing, helicopter, ground surveys, etc.) and survey date has varied from late-October to early-January. However, surveys are typically conducted by ground during late-October. In 2014, biologists conducted post-hunt surveys in December using ground based road surveys. 781 deer were classified with a resulting buck:doe:fawn ratio of 26:100:50.

GMU 284

Post-hunt surveys in GMU 284 were conducted using fixed-wing aircraft from 2000 through 2007. Surveys were not conducted in 2005 or 2006 and were conducted using ground based road surveys in 2008. From 2009-11, aerial surveys were conducted in GMU 284 as part of a cooperative effort to monitor migratory deer herds that winter in Adams, Franklin, and Whitman counties. In the future, this aerial survey effort will likely be utilized to supplement ground count data every few years with a population estimate. Thus since 2012, survey methods reverted back to a ground effort, which took place during December. Biologists classified 340 deer with a resulting buck:doe:fawn ratio of 33:100:41.

GMU 290

Post-hunt surveys in GMU 290 had been conducted annually since 1998 using volunteer based ground surveys. However, during 2012, due to liability and habitat degradation concerns associated with the use of ATVs, the volunteer based survey was discontinued in favor of an aerial approach. The survey is conducted by helicopter and is believed to provide more reliable data due to increased detectability, reduced potential for double-counting and improved classification.

Because of ongoing hunts in GMU 290, survey timing must either occur during the rut or when hunting seasons have ended (January). We selected January for surveying the unit during 2012 for a number of reasons. First, fog is common in the unit during November. Second, a January survey represents a true, post-harvest survey which does not require correction for harvest that occurs after the survey. And lastly, many eastside biologists are relying on a limited number of survey vendors during this time of year. Unfortunately, we believe bucks were not well represented in this survey, as evidenced by a sharp decline in buck:doe ratio. We adjusted during 2013 and 2014 by surveying during the rut in November.

Population status and trend analysis

GMU 272

Both harvest and survey data suggest mule deer populations in GMU 272 have remained relatively stable since 2005. The average post-hunt fawn:doe ratio from 2005–2014 has been 55:100 (Table 4) and with the exception of data from 2009 has shown low to moderate variability [Coefficient of Variation (CV) = 16%].

Long-term average buck:doe ratio is 23:100 (CV = 23%). The 10-year average proportion of adult bucks (≥ 2.5 years old) observed during post-hunt surveys is 40% and has shown moderate variability (CV = 19%).

Trends in the total number of deer harvested in GMU 272 suggest a stable population (Table 1). Since 2005, there has been little variability in the overall number of deer harvested (CV = 9%).

Table 4. Number of bucks (B), does (D), fawns (F), unclassified deer (U), total deer (T), bucks and fawns per 100 does (B:D:F), and proportion of bucks classified as ≥ 2.5 yr old (%), during post-hunt surveys in GMU 272, 2005-2014.

Year	B	D	F	U[1]	T	B:D:F	%
2005	62	272	146	0	480	23:100:54	0.39
2006	67	377	197	0	641	18:100:52	0.30
2007	72	415	227	0	714	17:100:55	0.38
2008	77	366	252	12	707	21:100:69	0.31
2009	49	256	97	37	439	18:100:38	0.39
2010	100	425	246	101	872	24:100:58	0.43
2011	105	348	244	37	734	30:100:70	0.34
2012	40	151	88	18	297	26:100:58	0.42
2013	186	646	377	57	1266	29:100:58	0.55
2014	102	395	196	90	783	26:100:50	0.49
Average	*82*	*369*	*208*	*26*	*686*	*22:100:55*	*0.40*

U[1] = Deer that were observed during surveys but could not be positively identified.

GMU 278

Because post-hunt surveys are not conducted in GMU 278, harvest trends are the only indication of relative population size. Harvest levels have historically been low (approx. 40 deer harvested annually), but have shown a significant degree of variation in the last 10 years (CV = 27%). Harvest during 2012 reached a 10-year high of 67 deer and although 2014 harvest was lower at 57 deer, it was still above the 10-year average (49 deer).

GMU 284

Because of the poor survey conditions present during 2007 surveys, few deer were observed and smaller bucks were not readily visible from an airplane. Consequently, data from 2007 is likely biased low for both bucks and fawns causing trends that include this data to be misleading. As such, the following analyses do not include data collected during 2007 surveys.

The average number of fawns:100 does from 2004–2014 was 65:100 and showed marginal amounts of annual variation (CV = 21%; Table 5). This suggests that herd productivity remained relatively constant during this time period. Harvest levels have shown moderate variability (total harvest CV = 24%) while trends in hunter effort (CV = 12%) have shown relatively low variability over the last 10 years.

Buck:doe ratios have shown significant annual variation since 2008 (CV = 32%). Meanwhile, age structure of the male segment of the population (% of bucks ≥ 2.5 year old) has shown moderate annual variation (CV = 20%). Post-hunt buck:doe ratios were above the long-term average following the 2014 season .

Table 5. Number of bucks (B), does (D), fawns (F), unclassified deer (U), total deer (T), bucks and fawns per 100 does (B:D:F), and proportion of bucks classified as ≥ 2.5 yr old (%), during post-hunt surveys in GMU 284, 2004-2014. Surveys were not conducted in 2005 and 2006 and averages exclude data from 2007 due to the bias associated with this data set.

Year	B	D	F	U[1]	T	B:D:F	%
2004	63	445	270	0	778	14:100:61	0.6
2007	15	241	117	0	373	6:100:49	0.47
2008	51	211	123	31	416	24:100:58	0.35
2009	83	438	360	0	881	19:100:82	0.34
2010	46	100	82	0	228	46:100:82	0.26
2011	36	122	83	9	250	30:100:68	0.44
2012	57	195	114	14	380	29:100:58	0.49
2013	34	169	115	6	324	20:100:68	0.41
2014	63	189	77	12	341	33:100:41	0.38
Average	*53*	*240*	*164*	*9*	*465*	*27:100:65*	*0.41*

U[1] = Deer that were observed during surveys but could not be positively identified.

GMU 290

Harvest levels were below the long-term average for modern firearm buck and doe hunts (Table 3). Archery and muzzleloader permit holders that hunted experienced success that was slightly higher than the long term average.

Survey methods have varied annually, which makes it increasingly difficult to rely on the raw counts observed during surveys to adequately reflect trends in population size. Future surveys are intended to be conducted aerially, in a standardized manner to better understand population trend.

Fawn:doe ratios indicate that productivity rates for this herd remained at moderately low levels since 2004 (Table 6) but that rates are increasing. Coincident aerial survey data during 2011 confirmed suspicions that fawns are often misclassified during the volunteer ground count. GMU 290 provides high quality habitat and fawn development is rapid, making them difficult to differentiate from does based on size alone. Aerial surveys have the added advantage of giving surveyors a better view and more time to make accurate classifications. We expect that shifting to an aerial survey will increase the reliability of our data.

Long term buck:doe ratios remain at or above management objective of 30 bucks:100 does. The proportion of bucks observed from 2005-2014 that were ≥ 2.5 years has been relatively stable (avg. 60%; CV = 7%; Table 6). The average age of harvested deer during 2013 was 4.1 and 5.3 years for bucks and does, respectively. Tooth age analyses of deer harvested during the 2014 season were not available for this report. Average age of bucks harvested during 2013, however, was on the lower end of our long term goals for GMU 290. If this trend continues, we may have to reduce buck permits to allow more bucks to mature before harvest. It may also be necessary to reduce antlerless tags to increase the number of reproducing does on the landscape. By increasing the number of reproductive does, the number of buck fawns produced each year is likely to increase.

Table 6. Number of bucks (B), does (D), fawns (F), unclassified deer (U), total deer (T), bucks and fawns per 100 does (B:D:F), and proportion of bucks classified as ≥ 2.5 yr old (%), during post-hunt surveys in GMU 290, 2005-2014.

Year	B	D	F	U[1]	T	B:D:F	%
2005	154	306	137	32	629	50:100:45	60
2006	102	314	140	33	589	32:100:45	67
2007	122	264	108	15	509	46:100:41	59
2008	123	246	142	49	560	50:100:58	50
2009	146	270	125	31	572	55:100:50	62
2010	144	291	116	12	563	52:100:43	63
2011	97	207	60	7	371	47:100:29	57
2012	55	181	91	7	334	30:100:50	60
2013	54	117	64	0	235	46:100:55	61
2014	66	149	68	1	284	44:100:46	58
Avg.	*106*	*235*	*105*	*19*	*465*	*45:100:46*	*60*

U[1] = Deer that were observed during surveys but could not be positively classified.

Table 7. Number of bucks harvested by age class, yearly average age (Avg.), and sample size (N), from GMU 290 from 1996-2013, for all submitted teeth. Dotted line between rows denotes yearly gaps in data collection. Lab tooth age analyses of deer harvested during 2014 have not been completed at time of publication.

	Age Class										
Year	1.5	3	4	5	6	7	8	9	10	Avg.	N
1996	0	3	2	1	1	0	0	0	1	4.3	8
1997	0	9	4	3	2	1	1	0	0	3.8	20
1999	1	3	2	2	0	0	0	0	0	3.1	8
2000	0	1	3	4	0	0	0	0	0	3.9	8
2001	0	1	3	2	0	0	0	0	0	3.7	6
2002	0	3	0	1	4	1	1	0	0	4.8	10
2011	0	1	4	5	4	1	0	1	0	4.8	16
2013	0	6	3	1	3	1	0	0	0	4.1	14

Habitat condition and trend

GMUs 272, 278, and 284

Mule deer habitat in these GMUs is characterized by highly fragmented shrub-steppe, lands enrolled in the Conservation Reserve Program (CRP), and agricultural fields (primarily wheat, alfalfa, and orchards). Dominant native plant species include big sagebrush (*Artemisia tridentata*), rabbitbrush (*Chrysothamnus nauseosus*), greasewood (*Sarcobatus vermiculatus*), and spiny hopsage (*Grayia spinosa*).

Bitterbrush (*Purshia tridentata*), an important deer browse, can be located in small and widely scattered stands. However, much of the remaining native shrub-steppe has been highly degraded and is now dominated by non-native cheatgrass (*Bromus tectorum*) and native and non-native annual forbs. Additionally, with the exception of bitterbrush, most shrub species possess little to no value as winter deer food. Consequently, deer in these regions rely heavily on winter-wheat and cool season grasses to meet their metabolic demands during winter months and most often concentrate near shrub-steppe/agricultural interfaces. The threat of losing more native shrub-steppe is always present, but significant losses are not expected in the near future.

GMU 290

Although mule deer habitat in GMU 290 is also comprised of a mixture of shrub-steppe and agricultural lands, the vast majority of the deer herd is located on the Desert Wildlife Area adjacent to Potholes Reservoir. Most mule deer habitat is comprised of wetlands and shrub-steppe. Bitterbrush occurs in relatively large stands and is an important food source for this herd during winter months. Anecdotal observations suggest many of these stands are in older seral stages, characterized by mature decadent plants that provide reduced value as mule deer forage. Continued maturation of bitterbrush in GMU 290, without the establishment of younger stands, is likely to decrease the winter carrying capacity of this unit and could result in increased crop depredation on adjacent lands.

Wildlife damage

Deer related damage complaints in GMUs 272, 278, 284, and 290 have historically involved orchards, alfalfa fields and haystacks, winter-wheat fields, and ornamental trees and shrubs. Orchard tree damage and damage to alfalfa haystacks are the most commonly reported types of damage to private property. Orchard damage and the potential for it, is most prevalent in GMU 272. Depredation issues related to orchards and haystacks have been marginal in recent years and were again low in 2014.

Management conclusions

Trend data in GMUs 272, 278, and 284 indicate relatively stable populations. GMUs 272 and 284 have post-hunt buck:doe ratios that satisfy the management goal of ≥15 bucks:100 does. Damage complaints associated with these herds have also been relatively low in recent years, indicating they have not exceeded the social carrying capacity that exists in agricultural settings. Consequently, current harvest restrictions and season lengths appear to be appropriate for these herds and will likely change little in the near future.

As deer populations approach carrying capacity they are often characterized by suppressed levels of productivity, decreased fawn survival rates, and an adult female population that is dominated by older age classes (Fowler 1981). Fawn:doe ratios have been low, suggesting that this population may be fluctuating around carrying capacity.

Because surveys in GMU 290 were conducted using volunteers, estimated ratios prior to 2012 must be interpreted with caution. Surveys were conducted in mid- to late-December when it can be difficult to correctly identify a large fawn from a young doe. If fawns are commonly mistaken for an adult female, there are 2 primary consequences. First, productivity rates are likely to be underestimated as the fawn:doe ratio would be biased low. Secondly, the buck:doe ratio would also be biased low because the number of does observed during surveys was overestimated. Therefore, observed trends in productivity rates and the adult sex ratio may also be viewed as highly conservative estimates.

Literature Cited

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DEER STATUS AND TREND REPORT: REGION 3

GMUS 328 - 373

JEFFERY A. BERNATOWICZ, District Wildlife Biologist

Population objectives and guidelines

The population goals for mule deer (Odocoileus hemionus) in these Population Management Units (PMUs) are to maintain maximum population levels compatible with available habitat base, provide recreational opportunity, and minimize damage complaints. The buck escapement objective is ≥15 bucks per 100 does post-hunting season.

Hunting seasons and harvest trends

Game Management Units (GMUs) 329 and 371 are restricted to permit only hunting. All other units are open during the general modern firearm season for 3-point minimum bucks. The late archery season is open in GMUs 346, 352, 364, and 368. Archers were allowed to take antlerless deer during 2003-2006. GMUs 328, 330-342, 352-360, and 368 are open for muzzleloader hunters. The number of units open to muzzleloaders increased from 3 to 10 units in 2003. Antlerless harvest for modern and muzzleloader hunters was by permit only. Most antlerless hunting by all user groups was eliminated in 2007.

Deer hunter numbers increased slightly in 2014, but were 13% below the 10 year average (Table 1). This is likely a response to lower deer numbers and less antlerless hunting opportunity. Harvest decreased 10% in 2014 and was 64% below the average for the 1990s and 32% below the 10 year average. (Table 2).

Surveys

Ground surveys were conducted in December for GMUs 328-335, 336-346, and 364-368 (Table 3). Buck ratios were above objective in PMU 336-342 and 364-368. Fawn ratios were high for the district.

An aerial survey was conducted in April for deer in GMUs 336-346. The population increased 32% since 2013 (Table 4).

Table 1. Number of deer hunters and success rate GMUs 328-373, 1991-2014.

Year	Modern Firearm	Muzzle-loader	Archery	Total	Success Rate (%)
1991-99	20,242	708	5163	26,113	8
2000	11,688	147	3,599	15,434	9
2001	9,946	132	2,648	12,726	11
2002	9,659	106	2,577	12,342	12
2003	10,314	869	3,772	14,955	15
2004	11,677	1,069	4,024	16,770	13
2005	11,542	966	3,836	16,344	14
2006	11,430	985	3,602	16,017	9
2007	9,928	891	2,799	13,618	9
2008	9,760	860	2,890	13,510	6
2009	9,164	763	2,622	12,549	9
2010	8,650	672	2,332	11,654	7
2011	8,587	632	2,337	*11,887	8
2012	7,190	690	2,255	*10,640	9
2013	7,827	613	2,258	*11,119	9
2014	7,760	740	2,381	*11,636	8
10-Yr Avg	9,576	814	2,896	13,411	9

*Includes multi weapon tags

Population status and trend analysis

Deer populations in the district now appear to be increasing the last few years, but still below historic highs. Mild winters have helped slightly boost populations. Reported buck harvest has been fairly flat since 2006. However, reported harvest is only for non-tribal hunters. Two tribes now hunt deer in the district. The Yakama Nation (YN) does not collect harvest data. The MIT has been hunting the district since ~2010. If tribal harvest were included, there would likely be a slightly increasing trend in harvest.

Table 2. Deer harvest for PMUs 32-36.

	GMUs 328-335		GMUs 336-346		GMUs 371-373		GMUs 352-360		GMUs 364-368		Total	Total
Year	Buck	Doe	Buck	Doe	Buck	Doe	Buck	Doe	Buck	Doe	Buck	Doe
1980-89	996	54	721	82	112	8	370	72	250	21	2,449	237
1991-99	761	108	714	79	155	9	302	56	216	52	2,154	305
2000	482	0	461	0	179	17	140	0	121	0	1,383	17
2001	459	28	371	62	179	35	121	0	103	0	1,233	125
2002	531	62	446	75	194	32	100	3	168	1	1,439	173
2003	517	242	518	261	146	32	173	144	145	92	1,499	769
2004	633	157	540	200	155	40	148	59	140	69	1,616	525
2005	510	349	399	354	147	50	143	101	188	119	1,387	973
2006	361	197	265	144	135	41	65	49	96	74	922	505
2007	364	0	297	0	139	29	105	0	117	0	1,022	29
2008	318	0	188	0	125	11	70	0	124	0	825	11
2009	512	0	392	1	201	58	109	0	197	0	1,411	59
2010	311	0	266	0	120	8	64	0	100	0	861	8
2011	339	0	328	0	134	6	52	0	130	0	983	6
2012	312	5	286	0	122	47	75	0	143	0	938	47
2013	316	4	304	0	146	24	58	0	143	0	967	28
2014	332	2	261	1	105	20	71	0	101	0	870	23
10-Yr Avg	398	71	327	70	142	31	89	21	131	30	1,086	223

There appears to be a strong relationship between the expansion of an exotic louse *Bovicola tibialis* and deer population decline circa 2004. Observations of deer with hairloss are still common throughout the district. *Bovicola tibialis* is different from the exotic louse *Damalinia* (*Cervicola*) sp., which has caused hairloss in black-tailed deer in western Washington and Oregon. The louse and hairloss has probably suppressed fawn recruitment and slowed population recovery.

All GMUs have typically had buck ratios at or above the goal of 15 bucks per 100 does when surveys have had adequate sample sizes. Bucks tend to be somewhat isolated from doe/fawn groups in December and short term declines may be due to missing a few groups of bucks. Also, the majority of deer seen on surveys are <3.5 years old. One year of high fawn mortality can greatly influence subsequent buck ratio estimates.

Damage
Deer damage to crops is minimal over GMUs 328-373. The one area with problems in recent yers has been the river bottom area of the Yakima River from Ellensburg north. One landowner was prioivided with fencing and there were 3 Damage Prevention Contract Agreements (DCPAs). Master hunters were also used to target antlerless deer in a few locations.

Habitat condition and trend
There are few data on the historic or current condition of the deer range. Fires have probably negatively impacted woody browse in the lower elevations where cheatgrass often replaces shrubs after fire. In the mid to upper elevations, fire usually promotes quality forage. Unfortunately, the frequency of fire has been much higher in the lower elevations. A drought cycle temporarily broken 2009 -2011 has returned. Large fires swept over prime winter range in GMUs 329-335 in summer of 2012, 2013 and 2014. Forage production has been reduced, but no significant winter mortality has been noted yet. When a severe winter does occur, deer are expected to die in large numbers due to inadequate browse above the snow.

Management conclusions
It is unknown how the lice will affect mule deer in the long-term. Despite no antlerless hunting since 2006 and relatively favorable weather, the deer population in the district is responding slowly. Statewide, the

average deer hunter success is 28% compared to 8% in 2014 for the district. The Muckleshoot Indian Tribe (MIT) initiated a doe survival study in February of 2013. WDFW is cooperating on the study and there is a strong indication that high doe mortality is impacting population growth.

Table 3. Deer composition survey data

Year	GMUs	Total Sample	Fawns: 100 does	Bucks: 100 does
1996	328-335	704	49	2
1997	328-335	326	46	10
1998	328-335	325	78	16
1999	328-335	255	58	21
2001	328-335	559	47	14
2002	328-335	372	48	13
2004	328-335	1095	42	16
2006	328-335	194	40	18
2007	328-335	205	46	17
2008	328-335	268	57	11
2010	328-335	273	54	20
2011	328-335	127	48	26
2012	328-335	153	48	15
2013	328-335	257	63	21
2014	328-335	248	51	12
1996	342-346	863	58	2
1997	342-346	427	37	8
1998	342-346	645	75	11
1999	342-346	609	44	17
2001	342-346	481	37	15
2002	342-346	1017	44	17
2003	342-346	666	53	11
2004	342-346	1050	46	20
2006	342-346	236	47	11
2007	342-346	251	60	17
2008	342-346	277	55	15
2010	342-346	322	55	17
2011	342-346	316	48	19
2012	342-346	218	47	13
2014	342-346	230	61	20
1996	371	67	56	17
1999	371	120	54	20
2000	371	372	54	28
2009	371	179	45	28
1996	352-360	85	40	NA
1997	352-360	193	56	NA
1998	352-360	57	62	16
2002	352-360	191	38	30
1996	364-368	659	55	3
2002	364-368	352	48	22
2006	364-368	287	59	19
2007	364-368	269	66	18
2008	364-368	195	44	16
2011	364-368	108	52	9
2014	364-368	175	51	31

Table 4. April deer population estimates.

	GMUs			
Year	**328-335**	**342-346**	**352-360**	**364-368**
2003	6315 ± 669	5049 ± 666	1221 ± 133	1662 ± 94
2004	5462 ± 505	5067 ±1065	NA	NA
2005	NA	NA	1191 ± 123	1482 ± 127
2006	NA	2633 ± 275	NA	NA
2007	2771 ±236	2549 ±244	NA	~880
2008	3648 ±370	NA	NA	NA
2009	NA	NA	649 ± 73	936 ± 81
2011	NA	2961± 206	NA	NA
2012	4916 ±808	NA	NA	NA
2013	4275± 459	3364 ± 265	748 ± 176	1284 ± 147
2015	NA	4430 ± 329	NA	NA

DEER STATUS AND TREND REPORT: REGION 3

GMUS 379, 381

JASON FIDORRA, District Wildlife Biologist

Population objectives and guidelines

This report covers the 2014 deer season harvest and winter surveys in Game Management Units (GMU) 379 - Ringold and 381 - Kahlotus. These GMUs previously made up Population Management Unit (PMU) 31. WDFW is transitioning from the PMU system to broader management zones that more accurately delineate populations for more effective population managment.

These GMUs are primarily mule deer units, but a few white-tailed deer are harvested here each year. The population is managed to provide diverse recreational opportunity while maintaining socially acceptable deer densities. Post-hunt buck to doe ratio objectives are ≥15 bucks per 100 does.

Hunting seasons and harvest trends

Since 2000, early archery general seasons for any white-tailed deer and 3-point or antlerless mule deer have occurred in September. Muzzleloader general seasons were first established in 2001. In 2014, a 9-day early muzzleloader season occurred, allowing harvest of any white-tailed or 3 point minimum mule deer in GMU 379. GMU 379 also had an 11-day late muzzleloader season with any white-tailed deer and 3-point minimum mule deer legal to harvest. In addition, an 11-day late general muzzleloader season offered an opportunity for harvest of any white-tailed deer and 3-point minimum or antlerless mule deer in GMU 381. Twenty muzzleloader special permits were issued during 27 September - 5 October for any buck in GMU 381.

The modern firearm general season was 9 days long (11-19 October) in 2014 with a 3-point minimum restriction for mule deer and any white-tailed deer opportunity. Ten youth, 10 senior, and 10 disabled special modern firearm permits for antlerless deer were also issued in GMU 381. In addition, 10 modern firearm quality deer permits for any buck in mid-November and 20 modern firearm antlerless second deer permits for early-December were issued in GMU 381.

Total deer harvested in 2014 was 564 (Table 1), above the long term average of 393 (range 147 - 674; SE = 35.9) since 2000. There has been an increasing harvest trend which is mainly due to the increase in the number of hunters in these GMUs. The number of hunters reported in 2014 was the highest for the 14-year monitoring period. GMU 381 accounted for most of the havest: 532 deer (94%). Most antlerless deer were haversted during the general muzzleloader season, whereas bucks were harvested by modern firearm. Modern firearm hunters harvested 83% of bucks harvested during the general season. The percentage of general season harvest contributed by muzzleloader hunters was 37%. Archery remained a small portion of the total harvest at 2%.

Table 1. Annual deer harvest and hunters in GMUs 379 and 381 since 2000. Data are combined for general and permit seasons.

	Harvest			Hunters	
Year	Buck	Doe	Total	Number	Success
2000	119	28	147	579	25%
2001	205	72	277	699	40%
2002	239	99	338	808	42%
2003	220	60	280	913	31%
2004	214	67	281	1125	25%
2005	251	62	313	997	31%
2006	190	86	276	1017	27%
2007	235	100	335	1158	29%
2008	303	85	388	1180	33%
2009	335	170	505	1249	40%
2010	282	165	447	1192	38%
2011	337	202	539	1356	40%
2012	372	161	533	1418	38%
2013	449	225	674	1485	45%
2014	349	215	564	1524	37%
Avg.	**273**	**120**	**393**	**1113**	**35%**

Surveys

From 2009 to 2011, coordinated aerial surveys across Regions 1, 2 & 3 were completed in late November and early December to estimate deer herd size at a meaningful scale. The surveyed area included randomly selected units in Whitman, Franklin, and Adams Counties. Research and observations indicated this herd is strongly migratory. Surveys were spatially and temporally designed to account for seasonal deer movements. During the aerial surveys, deer counts averaged 5,106 mule deer over the 3 years. In 2011, 27% of the deer were classified in GMU 381, primarily on private land above the breaks of the Snake River. Estimated ratios for the GMU were 19 bucks and 67 fawns per 100 does, which compared well with ground surveys that year (Table 2). These values will provide a reliable baseline for aerial surveys in the coming years.

Post-hunt roadside composition surveys were initiated in 2004 to estimate buck:doe:fawn ratios. These surveys are conducted from vehicles in the eastern portion of GMU 381 near the Snake and Palouse Rivers each winter prior to antler drop. Two repeat surveys completed in early December 2014 yielded estimates of 13 bucks and 64 fawns per 100 does, with a high count of 631 deer classified (Table 2).

Table 2. Post-hunt deer surveys in GMU 381 during 2004 - 2014. Buck, doe, and fawn numbers were from the survey that yielded the highest count. Ratios were averaged across the two surveys.

					Per 100 Does	
Year	Bucks	Does	Fawns	Total	Bucks	Fawns
2004	23	135	80	264	17	59
2005	26	120	92	238	23	77
2006	35	142	90	283	26	62
2007	18	129	87	247	21	70
2008	64	367	165	608	17	48
2009	21	158	63	242	16	43
2010	57	365	210	632	20	56
2011	58	332	183	573	19	59
2012	67	332	145	544	18	46
2013	47	321	221	589	15	69
2014	46	343	242	631	13	64

Over 80% of the bucks observed during roadside and aerial surveys had less than 3-point antlers. It is expected that the majority of legal bucks are harvested each year in this open country. Roadside surveys, however, may be biased against observing mature bucks if they are less likely to occupy areas adjacent to roads or are less active during the day. Harvest trends indicate 3-point or better bucks continue to be available to hunters. Over the last 13 years, greater than 3 point bucks have comprised over 40% of the buck harvest and have comprised over 50% in the last five years (Figure 1).

Population status and trend analysis

The results of the coordinated aerial survey across regional boundaries provided a snapshot of mule deer population size across several management units. Several more years of repeated surveys are planned that will yield better trend data. Post-hunt buck:doe ratios in GMU 381 fell below management goals of 15 bucks per 100 does for the first time since surveys began in 2004. This ratio has been on a slow decline since 2010 (Table 2).

No survey data are available for GMU 379. For several years the GMU was managed with very liberal harvest seasons to reduce crop damage risk from deer. Because of no recent deer damage complaints, it was decided to reduce harvest beginning in 2009 to increase the herd, especially on the Hanford Monument. As a result, harvest in the unit has declined from an average of 76 deer during 2006-2008 to an average of 29 since 2009. In the last 5 years, harvest has declined, especially of does. In the long term, it is anticipated that the herd will increase and eventually more deer will be available to hunters.

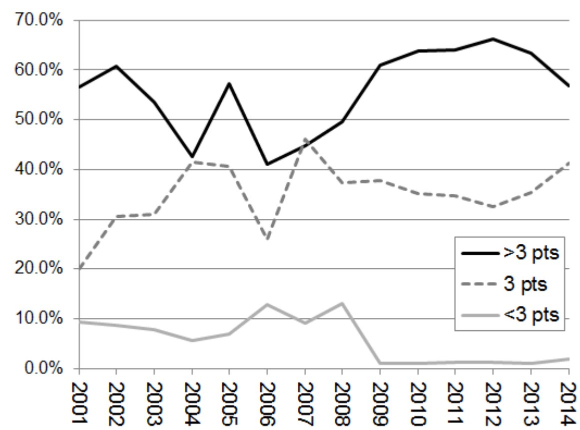

Figure 1. Percentage of bucks harvested in GMU 379 & 381 within each antler point category

Habitat condition and trend

GMU 379 includes the south Columbia Basin Irrigation Project and the Hanford Reach National Monument. Intense agriculture in the irrigation project has significantly reduced historical deer habitat. Irregular terrain and shallow soils in the northern portion of the unit resulted in some habitat not being cultivated. Most of these lands receive various levels of livestock grazing. Numerous irrigation waterways traverse this landscape, which depending upon their construction design either provide additional resources for deer, or act as barriers and fatal traps. WDFW often responds to calls regarding exhausted deer trapped in steep sided, concrete canals..

Wildfire throughout the region remains a primary risk to mule deer populations and the shrub-steppe ecosystem in general.Fires on the Hanford Reach National Monument in 2005, and again in 2007, reduced the amount of habitat, especially shrub cover, for deer. Fire risk is increasing due to invasive weeds and grasses that provide fire fuel and carry it quickly across the landscape, increased human activity, and recent climactic changes that have resulted in drier and hotter conditions.Reduction of vegetation makes deer more vulnerable to hunters and predators and causes them to move elsewhere to find forage and cover. In the long term, successful restoration of native vegetation may improve conditions for deer. Failure to restore native vegetation will result in expansion of cheatgrass and other invasive weeds and further degradation of deer habitat.

GMU 381 is comprised of a mixture of dryland wheat, land planted according to the Conservation Rerserve Program (CRP) and shrub steppe. Acreage in CRP increased significantly with the 1998 signup, and has increased and improved habitat for deer. The Farm Bill outlines commodity prices for wheat. Those wheat values influence farmers' decisions about whether to reenroll their fields in CRP or return to farming them. If the latter case prevails, then deer habitat in the GMU will be reduced.

Management conclusions

Deer hunting seasons are structured to provide abundant opportunity for both general season and special permit hunters. The GMU 381 antlerless late muzzleloader general season is a unique mule deer opportunity in eastern Washington. Maintaining this opportunity and the numerous special permit seasons requires reliable survey and harvest data. It also requires the willingness to change seasons and permit levels if the available data indicate it is necessary.The population in GMU 381 migrates across several different manamgent units in 3 different WDFW administrative districts. Monitoring has successfully been coordinated across these boundaries and this population will benefit from new efforts by WDFW to manage and monitor Mule Deer on a population scale. While no changes have been proposed for the 2015-2016 hunting season, changes to hunting season regulations across several GMUs may be required to maintain quality recreational opportunities and achieve management goals for this herd in the future.

Continuing coordinated aerial surveys will provide important trend data and facilitate more informed harvest management decisions at the appropriate landscape scale. An aerial survey is currently scheduled for the fall of 2015. The substantial increase in doe harvest since 2009 with advent of the late muzzleloader general season requires monitoring to assure harvest is not reducing the population below desired levels. Post-hunt ground-based surveys will be continued to assess buck:doe:fawn ratios.

DEER STATUS AND TREND REPORT: REGION 4

GMUS 407, 418, 426, 437

R. FENNER YARBOROUGH, Wildlife Biologist
PAUL M. DEBRUYN, Wildlife Biologist

Population objectives and guidelines

Population goals for black-tailed deer (*Odocoileus hemionus columbianus*) are to maintain maximum relatively stable populations within the limitations of available habitat, landowner tolerance, and accounting for extreme weather events (WDFW 2014).

Hunting seasons

Hunting season formats differ between individual Game Management Units (GMUs) based upon geographic variation. GMU 407 is a low elevation coastal area with a high human population distributed throughout the habitat base.

GMUs 418 and 437 are mainland areas of mid to high elevation with lower human population densities than the more urbanized coastal regions. GMU 426 is a high elevation area situated well into the Cascade Mountain range. Extremely low human population, limited road access, and severe geography characterize this unit.

Hunting seasons in GMU 407 include any buck modern firearms season and any deer archery and muzzleloader seasons. There are firearms restrictions west of Interstate 5 limiting hunters to archery, muzzleloaders, shotguns, or crossbows. GMU 407 has early and late seasons for all weapons types.

Hunting seasons in GMU 437 are the same as GMU 407 with the exception that the late season is limited to archery.

Hunting seasons in GMUs 418 and 426 are the same as GMU 407 with the exception of no late season hunts for any weapon types. There is a quality (special permit) modern firearm hunt in GMU 418 during November.

There is a high buck hunt from15 to 25 September in the Mount Baker Wilderness in GMU 418 and in the Pasayten Wilderness in GMU 426.

Harvest and recreational opportunity profiles for GMUs 407, 418, 426and 437

Black-tailed deer harvest in GMUs 407, 418, 426 and 437 during the 2014 season totaled 957 animals (Table 1). Antlerless harvest for the 2014 season totaled 172 animals (18% of total harvest) while antlered harvest totaled 785 animals (82% of total harvest). In GMUs 407,418, 426, and 437, the number of hunters was up from 2013, and harvest was lower. The proportion of deer harvested within GMUs 407, 418, 426 and 437 (957 animals) as compared to the statewide harvest for the 2014 season (35,216 animals) indicates that these northern Region Four GMUs represent 2.6% of the statewide general season harvest.

Tribal harvest in District 14 GMUs 407− 437 for the 2014 season consisted of 11 bucks and 11 does harvested in GMU 407, 39 bucks and 38 does in GMU 418, and 19 bucks and 15 does in GMU 437.

Population status and trend analysis

The only monitoring of population status and/or trends in the mainland GMUs is the anecdotal observations of hunters, WDFW field employees (enforcement officers, fish and wildlife biologists) and the field observations of other natural resource agencies (DNR, State Parks, National Parks, and U.S. Forest Service). Black-tailed deer are difficult to survey due to the habitat they occupy, making it difficult to quantify population trends (WDFW 2014).

Wildlife damage

Deer related damage to private property has remained a chronic problem throughout all of the mainland portions of north Region Four. No damage payments were made in this general area in 2014. Six kill permits were issued by WDFW enforcement officers in Whatcom and Skagit Counties to remove antlerless deer from agricultural operations experiencing damage problems.

Habitat condition and trend

Black-tailed deer habitat has been reduced in western Washington due to human encroachment, a reduction in timber harvest, and the natural progression of aging timber stands (WDFW 2014).

Management conclusions

Future goals for effectively managing north Region Four deer populations include:

1. Preserve protect, perpetuate, and manage deer and their habitat to ensure sustainable populations.

2. Manage deer for a variety of recreational, educational, and aesthetic purposes including hunting, scientific study, cultural, subsistence, and ceremonial uses by Native Americans, wildlife viewing, and photography.

3. Manage deer populations for a sustainable annual harvest.

4. Establish and implement consistent survey protocols for black-tailed deer.

Type	Modern	Archery	MZL	Multiple Weapons	Special Permit	Total
Antlerless	0	123	45	4	0	172
Antlered	590	93	45	43	14	785
Total	590	216	90	47	14	957

Table 1. State harvest information for different weapon types for GMUs 407,418,426, and 437 for 2014.

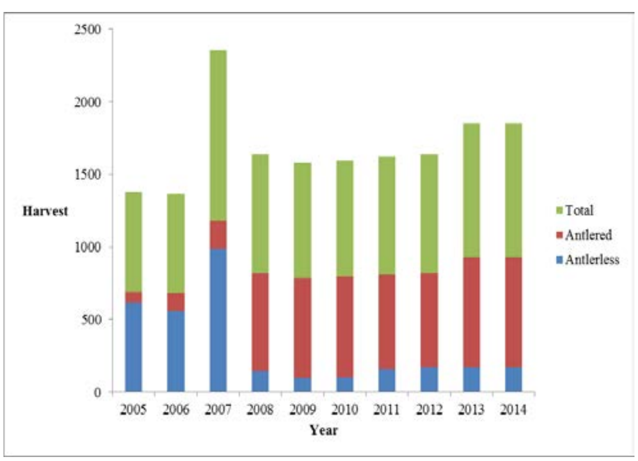

Figure1. Deer Harvest (total, antlered, and anterless) for GMUs 407,418, 426 and 437 for 2005 − 2014. This includes all harvest from special and general season permits.

DEER STATUS AND TREND REPORT: REGION 4
GMUs 410, 411, 412, 413, 414, 415, 416, 417, 419, 420, 421

RUTH L. MILNER, District Wildlife Biologist

Population objectives and guidelines
Objectives for Columbia black-tailed deer (*Odocoileus hemionous columbianus*) in the islands are to maintain healthy and stable deer populations within the tolerance level of island residents, and to maximize harvest opportunity and hunt quality despite an increasing human population, which may impact the availability and quality of habitat for deer.

In order to better understand harvest patterns within the islands, GMU 410, which formerly included all of San Juan and Island Counties was divided into eight island specific GMUs, including Guemes and Cypress Islands in Skagit County. All islands that did not receive a specific designation remain as part of GMU 410. This change was made prior to the beginning of the 2013 hunting season. The individual islands assigned a GMU are as follows: GMU 411: Orcas Island; GMU 412: Shaw Island; GMU 413: San Juan Island; GMU 414: Lopez Island; GMU 415: Blakely Island; GMU 416: Decatur Island; GMU 417: Cypress Island; GMU 419: Guemes Island; GMU 420: Whidbey Island; GMU 421: Camano Island.

Hunting seasons and harvest trends
The 2014 hunting season opened with the early archery season for any deer from Sept. 1- 26, the early muzzleloader season open for any deer from Sept. 27 through Oct. 5, and the general modern firearm season open for any deer from Oct. 11-31. Late archery season was Nov. 26- Dec. 31; late muzzleloader season was Nov. 27-Dec. 15; and the late modern firearm season was Nov. 13-16. Late season hunts were also for any deer. In addition to the general season tags, second deer permits for an additional antlerless deer were available in GMUs 411-117, and 419-421. In 2014, for all island GMUs, 20 permits each were allocated for archery and muzzleloader hunters. 30 to 40 permits were allocated for modern firearm hunters in all GMUs except GMUs 412 and 420. For Whidbey Island (GMU 420), 100 modern firearm permits were available; 20 permits were available for GMU 412.

An unusually high number of hunters (489) reported harvesting deer from GMU 410 in 2013 (Table 1). Given the relatively small and inaccessible islands that remain in GMU 410, it seemed likely that many of these hunters failed to review the hunting regulations, probably because they hunt the same property every year, and were therefore unaware of the change in GMU numbers. To correct for this, Master Hunter volunteers attempted to contact all successful hunters reporting their harvest from GMU 410, asking them to clarify the actual island from which they took their deer. This exercise was moderately successful; however, nearly 1/3 of hunters on the list could not be reached. The estimated 2013 harvest with the Master Hunter corrections factored into the estimates is given in Table 1. Those hunters who were contacted were reminded to enter the correct GMU in future years. In addition, the GMU changes were highlighted on the WDFW website under the 2014 Hunting Prospects for District 13 in an attempt to alert hunters that their GMU number may have changed beginning in 2013.

Table 1. Estimated 2013 Harvest for GMUs 410-417 and 419-421.

GMU #	Island Name	Total Harvest	Total Bucks	Total Antlerless
Unknown	Unknown	177		
410	Islands	5	4	1
411	Orcas	59	38	21
412	Shaw	26	18	8
413	San Juan	74	55	19
414	Lopez	47	32	15
415	Blakely	30	17	13
416	Decatur	8	7	1
417	Cypress	10	2	8
419	Guemes	12	9	3
420	Whidbey	321	246	75
421	Camano	32	16	16

The 2014 harvest report (Table 2) suggests that confusion over which GMU was actually hunted continues and thus, the harvest report is difficult to interpret. In 2013, 489 hunters reported hunting in GMU 410. In 2014, 586 hunters reported taking 255 deer from GMU 410. We believe these numbers are high for GMU 410, where access is extremely limited and includes only a few larger islands like Stuart and Henry Islands where deer are present, but also several islands like Waldron, Vendovi and Sinclair Islands, where deer are absent. In 2014, we did not attempt to call hunters who reported hunting in GMU 410.

Table 2. Estimated 2014 Harvest for GMUs 410-417 and 419-421.

GMU #	Island Name	Total Harvest	Total Bucks	Total Antlerless
410	Islands	255	201	54
411	Orcas	74	60	14
412	Shaw	35	20	15
413	San Juan	68	59	9
414	Lopez	49	40	9
415	Blakely	30	23	7
416	Decatur	17	12	5
417	Cypress	10	9	1
419	Guemes	6	2	4
420	Whidbey	280	208	72
421	Camano	34	23	11

Surveys

Population surveys were not conducted in these GMUs in 2014.

Population status and trend analysis

Insufficient data exist to model the deer populations in the islands with two exceptions: Blakely Island where summer deer densities from 2007 through 2011 averaged 28.5 -52.5deer/km^2 (Long et al. 2012); and Whidbey Island where Wingard (2015) estimated the population to be 6.2 deer/km^2 in 2014, which may be a low estimate.

Habitat condition and trend

Human development affects the amount of habitat available for deer in the island GMUs, particularly on the larger islands where local deer populations are apparently very robust. This may be a response to edge habitats and inadvertent forage enhancements such as gardens and ornamental plantings, which provide abundant food in safe environments where hunting is limited or prohibited.

Management conclusions

Safety concerns associated with increased human development, combined with changing attitudes towards hunting have resulted in fewer areas open to hunters on many of the islands. Public hunting sites are very limited in all island GMUs. We continue to look for opportunities to partner with private landowners to open more opportunity to hunters.

The number of hunters erroneously reporting their harvest GMU was a surprise in 2013 and apparently continued in 2014. We expect harvest data to improve as hunters become aware of the changes in GMU assignments and are committed to increasing hunter awareness of the changes. Our inability to contact a significant number of hunters in 2013 should be a reminder to ensure that hunters have up to date contact information on file with their WILDID as WDFW conducts a number of post-hunt surveys to validate harvest statistics.

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DEER STATUS AND TREND REPORT: REGION 4
GMUS 422, 454, 460, 466, 485

CHRIS ANDERSON, District Wildlife Biologist

Population objectives
Population objectives for Game Management Units (GMUs) 422, 454, 466, and 485 are to maintain healthy population levels of black-tailed deer (*Odocoileus hemionus columbianus*) within habitat limitations, to provide recreational opportunity, and to ensure long-term population persistence.

Population objectives for GMU 460 are to maximize harvest opportunity and maintain the post-hunt buck composition ratio at a minimum 15:100 does.

Hunting seasons and harvest trends
Management strategies are similar for GMUs 454 and 466. Both have a modern firearm season from mid-October to the end of October with annual calendar date adjustments. Each has a four-day late buck season in mid-November, also with annual calendar date adjustments. Both have an early and late archery season, for any deer. GMU 454 has both an early and late muzzleloader season for any deer.

GMU 422 was newly designated in the 2013 season and covers all of Vashon and Maury Islands. The unit has a modern firearm season from mid-October to the end of October, any deer, with annual calendar date adjustments. The unit has a four-day late any deer season in mid-November. The unit also has an early and late archery season, for any deer. GMU 422 has both an early and late muzzleloader season for any deer. The unit also has 100 modern firearm, 20 archery and 20 muzzleloader antlerless second deer permits available.

Hunting access on Vashon and Maury islands is largely on private agricultural and hobby farm properties. Hunters must take time to network with communities and property owners for opportunity and access.

GMU 454's more liberal seasons are designed to maintain the population at an acceptable level within an urban-wildlife conflict interface. However, habituated, small deer groups do occur in suburban and rural areas of GMU 454, and because of private property and safety concerns; they do not receive comparable hunting pressure.

GMU 454 exhibited a substantial increase in total buck harvest beginning in 1999 (Fig. 1). Total buck harvest post 1998 showed an approximate 82% increase in harvest compared to previous harvests. Annual harvest has been relatively stable since then.

Buck harvest in GMU 466 has oscillated back and forth indicating possible extrinsic factors in harvest rather than population changes (Fig. 2). GMU 466 antlerless harvest has generally been low with some annual variation. This is likely due to dry early fall weather and early winter snowfall, both influencing hunter success in this unit. In GMU 466, the Northwest Indian Fisheries Commission Big Game Harvest Reports show tribal harvest levels that add considerably to the total deer harvest in GMU 466. This is an additional mortality source to the total deer harvest for GMU 466. Tribal harvest numbers are considered when evaluating future hunting seasons and population trends for GMU 466. Overall, this unit receives less hunt pressure due to location and weather. However, this unit holds nice harvest opportunity and more solitude for a hunter willing to get out and put some time in working the area.

GMU 460 has been managed under an "any buck" general hunt for more than 30 years. Harvest has varied over this period, averaging about 460 deer per year from 1984 to 1998. The late buck season closure in 1998 certainly contributed to a 45% decline in total buck harvest compared to 1997. Since the late buck closure, harvest has been lower with less variation; averaging around 157 bucks taken annually from 1998-2014 (Fig. 3). Access fees in Hancock Forest Management lands in GMU 460 have increased over time and may contribute to lower number of hunters. Hunting pressure has decreased by more than half of hunters afield prior to access fees. However, a decline in hunting in this unit can be noted even before fee implementation (Fig. 4).

GMU 485 has had a limited entry special permit hunt since 1984. Concerns over population declines and hunter pressure have reduced permit numbers with accompanying reduced harvest (Fig. 5). In 2000, the special permit hunt was designated as buck only. Beginning in 2003, a limited number of state permits for persons with disabilities was added. An equally limited youth hunt was added in 2006. In 2014, an alternating schedule was adopted with permits for persons with disabilities being available during even years (2014) and youth hunt permits available during odd years (2015). In 2013, the modern firearm quality buck hunt was adjusted to "any weapon" tag. This tag requirement was broadened to provide equal opportunity for archery, muzzleloader, as well as modern firearm hunters. Overall, permit opportunity and harvest type are adjusted annually to maximize opportunity while maintaining herd population goals.

Deer that winter in the low elevations of GMU 485 may range into GMU 466 during other times of the year and be legally harvested (Raedeke 1995). Population guidelines for GMUs 466 and 485 are considered together, along with tribal harvest data, in order to make the best assessment of population trends.

Surveys

Currently no surveys are conducted in GMUs 422, 454, 460 and 466. The Muckleshoot Indian Tribe (MIT) has conducted early to mid-December post-season population flight surveys in GMU 485 since 2000. Flight data, along with individual monitoring efforts utilizing radio-collared deer are used in population estimates. Local monitoring of marked individuals provides ground truth data for utilization in mark-resight modelling for estimation of overall population parameters and resulting trends.

In 2003, a pre and post season composition flight was conducted in GMU 460. The flight resulted in classifying only 25 and 20 deer respectively. The extremely low sample size does not allow calculation of meaningful sex ratios from data. In addition, the scarcity of deer seen on these flights carried out under the same historic count methods (see Tables 1 and 2), raises concerns over a continued and apparent decline in deer numbers.

Table 1. Preseason Deer Composition Survey Results from Helicopter in GMU 460

Year	Fawn	Spike	Branch Buck	Total Buck	Total (N)
1995	67.0	8.3	6.0	20.0	114
1996	61.5	19.2	3.8	23.0	48
1998	72.0	14.0	2.3	16.3	86
1999	71.7	12.8	10.3	23.0	76
2000	51.0	11.4	0.0	11.4	57
2001	No Data				

Table 2. Postseason Deer Composition Ratios per 100 Does in GMU 460

Year	Fawn	Spike	Branch Buck	Total Buck	Total (N)
1996	62.5	3.7	8.5	12.2	144
1997 [a]	51	6.6	0	6.6	71
1998 [b]	59	4.9	13.1	18	108
1999	49	7.0	9.3	16.3	71
2000	33	3.0	19.0	23.8	35
2001	55	0	5	5	68

[a] flown 1-9-98
[b] flown 11-11 thru 12-14, 98

Population status and trends

Precise population estimates for GMUs 422, 454, 460, and 466 are unavailable. Since 2002, only mandatory hunter reports have been used to monitor deer population trends and determine hunting regulations.

Based on Muckleshoot Indian Tribe surveys, deer in GMUs 485 and 466 have appeared to be on the slight increase. However, confidence intervals are wide and therefore true changes in population are not likely to be detected. Radio-marked doe survival, previous fawn ratios, and low harvest do suggest that there should be a population increase in GMU 485 overall. That said, recent flights have not resulted in large enough deer numbers sighted to provide for as confident of an estimate as in the past (Table 3), (Vales unpubl. data 2014). This is likely due to a combination of poor weather and difficulty in spotting black-tailed deer due to their association with cover. Over a longer term of continued future survey we may see oscillation of numbers as a plausible artifact in difficulty of survey for this species. Other survey techniques may be examined in the future for comparable results and increased sightability.

Table 3. Trend in Deer Population in GMU 485 (ratios per 100 doe)

Year	# Seen	Fawn:Doe	Buck:Doe	Pop Est.
2000	118	50	19	350 ± 100
2001	106	34	31	440
2002	105	47	17	367
2003	106	56	18	434 ± 279
2004	127	55	34	402 ± 204
2005	144	60	12	645 ± 377
2006	97	53	17	572 ± 398
2007	83	48	18	578 ± 449
2008	120	38	31	681 ± 477
2009	88	64	31	505 ± 344
2010*	No Data			
2011	59	63	30	719 ± 641
2012*	50	45	16	310 ± 208
2013	49	37	23	265 ± 159
2014	63	58	11	242 + 130

Flight data provided by D. Vales, Muckleshoot Indian Tribe Biologist.
*Poor weather prevented completion of surveys.

Habitat condition and trend

In general, the long-term trend in GMU 454 deer habitat is for a continued decline. This is consistent with development of habitat currently used by deer. However, deer are taking advantage of 1-10 acre tracts that are cleared for homes. These tracts still provide and may even improve deer forage availability, particularly during winter months, thereby improving overall body condition. This alone can lead to higher productivity and increased survival. Further, because many of these private lands are not open to general public, hunting mortality may be reduced. This can lead to increasing deer densities and may prompt some deer dispersal to surrounding habitats that are accessible to hunters in GMU 454.

The significant majority of GMU 460 is managed for timber production. Annual timber harvests create a mosaic of seral stages that can be beneficial to deer. Openings of 1 to 10 acres exist that provide a good forage base as well as riparian corridors protected by Washington Forest and Fish rules. The forest stands in these corridors provide older age classes that diversify habitat and help intercept snow during harsh winters. This may provide deer access to forage in these sites, serve as travel corridors, and provide added winter shelter.

Apparent increases in timber harvesting in the Snoqualmie Forest portion of GMU 460 may provide an increased forage base for deer over time. However, the spraying of herbicides on private industrial timberlands is of concern to ungulate forage and is being examined via internal and external research. In 2004 King County announced the purchase of development rights on the King County portion of the Snoqualmie Forest (app. 90,000 acres). This will protect a large area of commercial forest as open space and de facto deer habitat. Continued additional research into the relationship between current landscape conditions, herbicide application, deer populations, and habitat quality is needed and a focus.

Deer habitat trends in GMU 466 and 485 are dependent on timber management and subsequent seral stage development that determines forage availability. There are several thousand acres of timberlands managed primarily for wood fiber production; with considerations for recreation, fish, and wildlife.

Wildlife damage and nuisance problems

In GMU 422 and 454 deer damage to ornamental shrubs and gardens can be a problem and numerous complaints are received every year. Further, deer are now being seen in small numbers within more urban areas, such as the Seattle suburbs, where hunting is obviously not feasible. These deer are supported by many citizens and equally condemned by others because of associated property damages. During 2014 in this part of Region 4, just one landowner entered into a Damage Prevention Cooperative Agreement to address deer damage (nursery plantings in GMU 422). In general, deer damage complaints are addressed through fencing recommendations, hazing and general season/permit hunting pressure (where appropriate). Further information on preventing conflicts with deer can be found on the WDFW Living With Wildlife website at: http://wdfw.wa.gov/living/deer.html. There are no damage complaints for deer in GMUs 460, 466 and 485.

Hair loss syndrome

"Hair loss syndrome" (HLS) of black-tailed deer was first described in Washington in 1995. The condition is caused by a heavy infestation with a Eurasian louse of poorly defined taxonomic status in the genus *Damalinia (Cervicola) sp.* The normal hosts of this louse are non-native deer and antelope, which are not seriously affected by the lice.

In contrast, when black-tailed deer become infested, they tend to develop a hypersensitivity (severe allergic) reaction to the lice, which causes irritation of the skin and excessive grooming by the deer. Eventually, this excessive grooming leads to loss of the guard hairs, leaving yellow or white patches along the sides. Infestations are heaviest during late winter and early spring, and many affected deer, especially fawns, die during this time. The geographical distribution of HLS has steadily expanded since its first appearance and now affects black-tailed deer throughout their range in western Washington.

In 1996, within GMU 460, field surveys documented a hair loss syndrome that affects deer during the late winter and early spring surveys. Over a three-year period Bender and Hall (2001) reported rates of "hair-slip syndrome" in fawns as 55, 74, and 46% from 1999-2001. However, they concluded that HLS, based on their study, was not significant in increasing fawn winter mortality and called for future research to better determine effects HLS has on black-tailed deer populations. Continued study since then has largely determined that HLS in black-tailed deer is largely not additive in winter mortality. It is thought that HLS may increase predation risk due to poor body condition overall. Poor body condition is attributed to a combination of potential factors including poor forage, low birth weight, timing of birth; as well as afflictions including, but not limited to, HLS.

Many HLS affected individuals tend to rebound in condition and health if they pull through the winter Ultimately, HLS is very likely only a portion of the regular annual mortality factors acting synergistically in given local populations.

WDFW provides more information regarding hair loss syndrome at our Wildlife Health website: http://wdfw.wa.gov/conservation/health/hair_loss/index.html

The effects of hair-loss syndrome on black-tailed deer throughout western Washington will likely never be completely understood.

Management conclusions

Deer in GMUs 422 and 454 should continue to be managed with liberal seasons designed to keep deer at acceptable levels in developing areas. Isolated groups of deer, generally on the eastern boundary of GMU 454, should continue to offer hunting and recreational viewing opportunity.

In GMU 460, the Region will maintain the late buck season closure for modern firearm. Future survey efforts, given funding, are desired to examine population status and sex ratios.

In cooperation with the Muckleshoot Tribe and Tacoma Water, surveys will continue in GMUs 485 and 466 to increase sample size for population estimation and gain a better assessment of herd composition.

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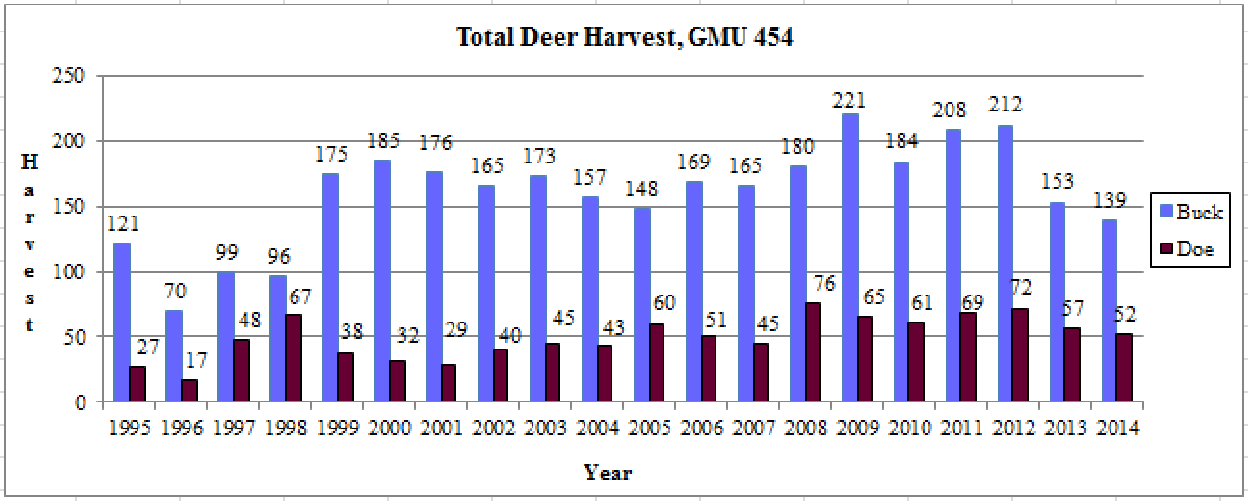


Figure 1. **Annual deer harvest in GMU 454, all weapon types, 1995-2014**.
*2004 harvest reflects uncorrected raw data reported from hunter report.

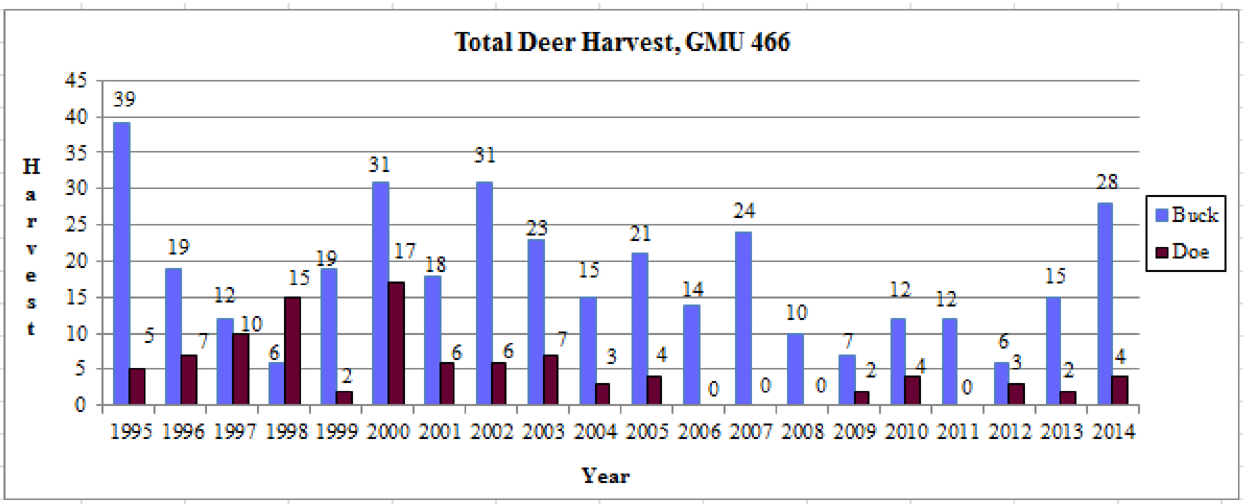


Figure 2. Annual deer harvest in GMU 466, all weapon types, 1995-2014.
*2004 harvest reflects uncorrected raw data reported from hunter reports.

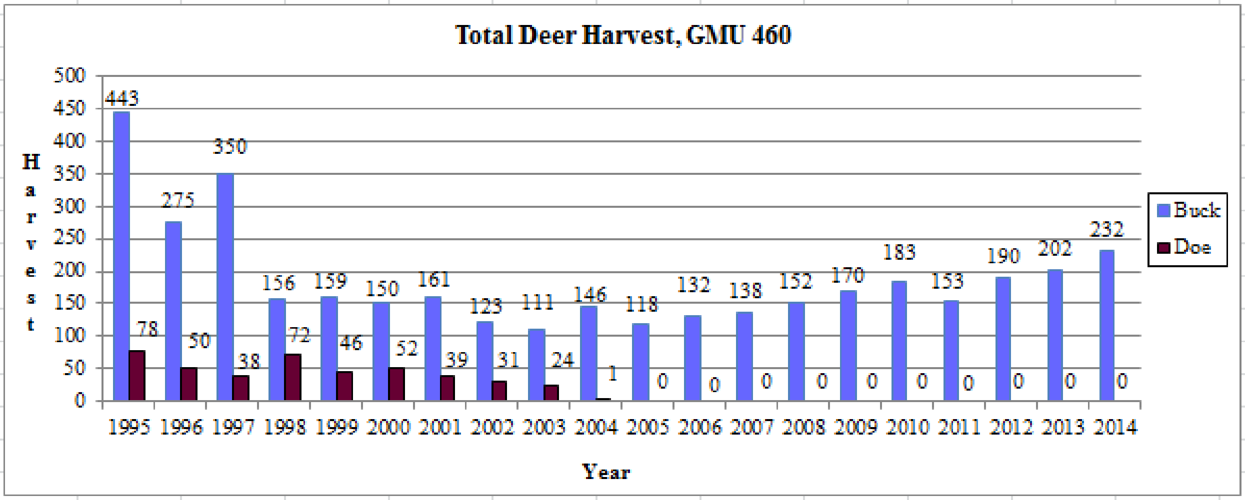


Figure 3. Annual deer harvest, GMU 460, 1995-2014, general season and special permit combined.
1997 was last year of late buck hunt.
2004 1st year of buck only archery hunt

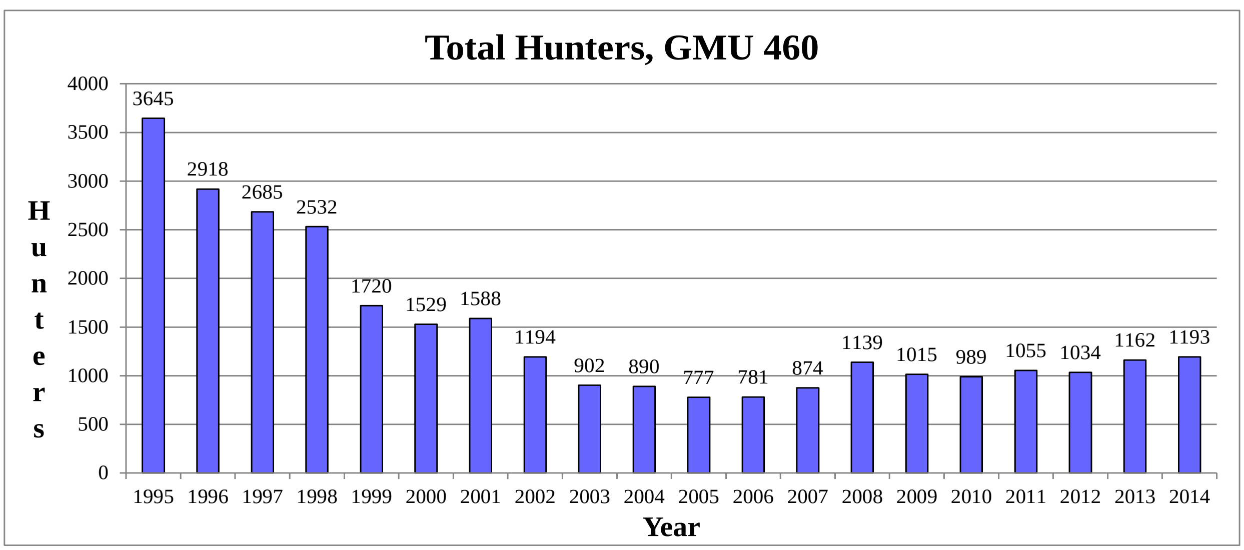


Figure 4. **Number of deer hunters, GMU 460, 1995-2014, general season and special permit combined.**
1997 was last year of late buck hunt.
2002 access fee added - Hancock Forest Management Snoqualmie Forest lands.

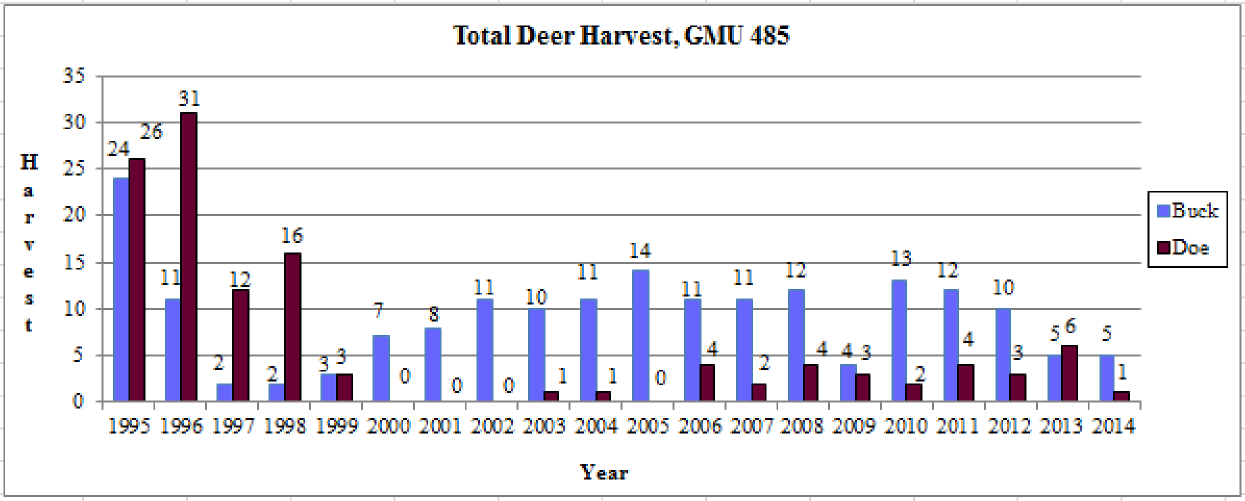


Figure 5. Annual state deer harvest in GMU 485, 1995-2014.

DEER STATUS AND TREND REPORT: REGION 4
GMUS 448, 450

RUTH L. MILNER, District Wildlife Biologist

Population Objectives and Guidelines
District 13 includes Game Management Units (GMUs) 450 and 448. GMU 450 is a higher elevation area that lies primarily in USDA Forest Service Wilderness. Most hunting takes place in GMU 448, which is the larger and more accessible GMU. Objectives for black-tailed deer (*Odocoileus hemionous columbianus*) in these Units are to provide healthy and stable deer populations for the long term and to maximize harvest opportunity and hunt quality despite an increasing human population, which is impacting the availability and quality of habitat for deer.

Hunting Seasons and Harvest Trends
The 2014 hunting season in GMU 448 opened with the early archery season for any deer from Sept. 1-26, the early muzzleloader season open for any buck from Sept. 27 through Oct.5, and the general modern firearm season open for any buck from Oct. 11-31. Ten modern firearm permits were available for the late buck hunt in GMU 448 from November 15-20. One hundred fifty-eight hunters with an average of 5 points put in for the late buck hunt. The high buck hunt in GMU 450 was open from September 15 through September 25 with a 3 point minimum.

Hunter numbers were about the same as the previous year with 951 hunters reporting that they hunted GMU 448 in 2014 compared to 966 hunters in 2013. General season harvest in GMU 448 increased slightly in 2014, with 182 deer harvested in 2014 compared to 169in 2013 (Figure 1). Hunter success rate for all weapons combined was 19% and about equal to the 2013 of 17% (Figure 2). Archery hunter success was consistent with previous years at 17%. Twenty-eight animals were harvested by archers, of which 19 were bucks. Modern firearm hunter success was 19% in 2014, which was about equal to the 18% success rate the previous year. In 2014, 143 bucks were harvested by modern firearm hunters. Only 22 muzzleloader hunters reported hunting in GMU 448, with no animals harvested. Two bucks were taken with multiple weapon tags.

In GMU 448, 78% of hunters used modern firearms, and this group harvested 79% of the deer in 2014. Archery hunters comprised 18% of hunters and took 15% of the deer. Muzzleloader hunters accounted for 2% of hunters (22 people); 4% of hunters (34 people) had multiple weapon tags. Ten permits are issued in

GMU 448 for the late buck hunt. In 2014, 50% of permittees were successful and five bucks were taken during the late season, reported as one two-point, one three-point, one four-point and two five-point or greater. Harvest increased compared to 2013 when only two deer were harvested in the late buck season. In 2012, four bucks also harvested during the late buck season, of which two were reported as four-point or greater.

Figure 1. Total Deer Harvest: GMU 448 2004-2014

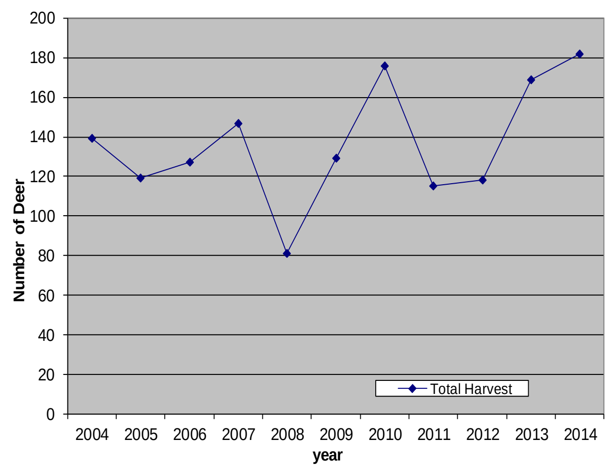
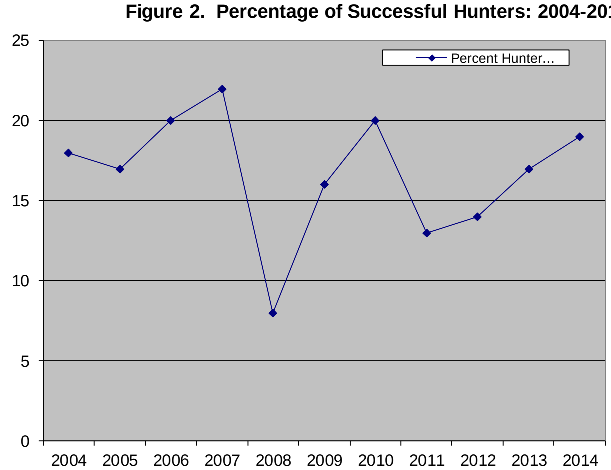


Figure 2. Percentage of Successful Hunters: 2004-2014



Seventy-seven hunters hunting in GMU 450 in 2014 used modern firearms, harvesting 15 bucks; eight hunters used archery equipment and were unsuccessful; four multiple tag holders took two deer. Success rate for the GMU was 19 % compared to previous success rates of about 5% in 2013 and 2012. As in previous years, relatively few people hunted in GMU 450.

PMU 46 is hunted by the Stillaguamish, Tulalip, and Sauk Suiattle Tribes. The tribes report harvesting five bucks and nine does from GMU 448 and no deer from GMU 450 in 2014.

Surveys

Population surveys were not conducted in GMUs 448 or 450 in 2014.

Population Status and Trend Analysis

Insufficient data exist to model the deer population in GMUs 448 and 450. Total harvest and the number of hunters increased slightly compared to the previous five years. In general, we believe that the deer population is stable in this geographic area.

Habitat Condition and Trend

Human development in Snohomish County affects the amount of habitat available for deer in GMU 448. In the western part of the GMU outside of the urban core areas, local deer populations are apparently very robust. This is in response to edge habitats and inadvertent forage enhancements such as gardens and ornamental plantings, which provide abundant food in safe environments where hunting is limited or prohibited.

In the eastern half of the GMU, much of the forest habitat available on USDA Forest Service land is in a mid-rotation age class, with relatively tightly stocked stands that provide limited under-story vegetation. These conditions provide limited forage for deer, with the nutritional quality of the forage available unknown. A few small scale thinning projects are being undertaken to try to improve understory habitat, which could potentially benefit local deer populations. Access to Federal lands has been reduced in recent years because many roads and trails have been poorly maintained or are impacted by damage caused by severe weather. Access on Federal lands can make hunting challenging.

Clear-cutting has increased on private and State owned timberlands in GMU 448. However, herbicidal sprays applied in many clear-cuts to control brush may limit forage available to deer in these regenerating stands, which may limit deer numbers. Access to large tracts of private and state owned timberlands continues to be a challenge in much of the PMU, as many landowners are gating or decommissioning their roads and prohibiting the use of motorized vehicles. These factors may affect harvest success in GMU 448.

We expect the trend of shrinking habitat available to deer to continue, as the human population of the County continues to grow. New home construction is increasing in Snohomish County, especially as housing prices climb in the greater Seattle area. As human development expands into rural areas, this GMU continues to see firearm restricted areas and no-shooting zones expand. These trends will limit access to hunters in GMU 448.

Management Conclusions

GMU 448 is hunted primarily by local residents who have access to private land or are well acquainted with access on public lands. Although the number of hunters has dropped compared to a decade ago, hunting is still a quality experience for those who know where to hunt in GMU 448. Hunters will find that crowding is not a problem in GMU 448 or GMU 450.

DEER STATUS AND TREND REPORT: REGION 5

GMUS 382, 388, 501 - 520, 524 - 578

ERIC W. HOLMAN, Wildlife Biologist
STEFANIE BERGH, Wildlife Biologist

Population objectives and guidelines

Black-tailed deer (*Odocoileus hemionus columbianus*) and mule deer (*Odocoileus hemionus hemionus)* 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 objectives are to maintain productive populations; manage for a variety of recreational, educational, and aesthetic purposes; and manage the population for a sustained yield (WDFW 2015).

Hunting seasons and harvest trends

Information on deer harvest and hunter effort is obtained from WDFW's mandatory reporting system. Estimates of total harvest, hunter effort, and hunter success are based on reports submitted by hunters. During the 2014 general deer season in Region 5, modern firearm hunters made up 74% of the hunters, archery accounted for 17%, and those choosing to hunt with a muzzleloader made up 5%. Finally, those utilizing multi-season tags accounted for approximately 4% of the Regional deer hunting effort.

Two primary harvest management strategies are employed for male deer in Region 5. During the general modern firearm season, the majority of Game Management Units (GMUs) are managed under an any-buck strategy, where any buck with visible antlers is legal for harvest. The three Klickitat County GMUs (578-West Klickitat, 388-Grayback, and 382-East Klickitat), are managed under a 3-point management strategy.

Harvest of antlerless deer during general archery season is legal in many GMUs. In addition to the general-season archery harvest, permits allowing for antlerless harvest are issued based on the estimated population of deer in selected GMUs. Additionally, the damage history and record of nuisance complaints (social carrying capacity) within GMUs are considered.

In 2014, an estimated 24,711 hunters spent a total of 132,107 days deer hunting in Region 5 (Table 1). Total general season harvest in 2014 was 4,599 with a hunter success rate of 19% (Table 1). The percentage of hunters that harvested a deer in 2014 was just above the previous 10-year mean of 17%. The total deer harvest was slightly below the mean harvest of 4,937 during the period from 2005-2014.

Table 1. Deer Hunter Numbers and Harvest Statistics for Region 5, 2005-2014.

Year	Hunters	Days	Harvest	Success (%)
2005	28,628	169,910	5,575	19
2006	31,966	174,738	5,222	16
2007	32,889	186,325	5,404	16
2008	31,013	204,116	4,911	16
2009	32,731	178,419	4,643	14
2010	30,394	163,342	5,316	17
2011	28,680	152,388	4,120	14
2012	25,838	139,119	4,791	19
2013	26,875	143,840	4,787	18
2014	24,711	132,107	4,599	19

Hunter participation rates and deer harvest were not evenly distributed throughout the Region. Deer hunter success was generally lower in the Cascade Mountain GMUs (510, 513, 516, 524, , 556, 560, 572) relative to other areas of Region 5. In turn, those GMUs contributed relatively less to the overall deer harvest than their lower elevation counterparts (Table 2). It is likely that this divergence in deer hunting success is the result of lower deer densities in the Cascade Mountain GMUs, a lack of openings within the forested landscape, and much lower road densities in these GMUs.

Table 2. Region 5 2014 Deer Hunters, Hunters/Square Mile, Harvest, Harvest/Square Mile, and Success / GMU.

GMU	Hunters	Hunters /SQ Mile	Total Kill	Kill/SQ Mile	Success (%)
382	1,481	1.8	504	0.62	34
388	1,782	3.7	392	0.80	22
501	1,388	6.0	210	0.26	22
503	379	6.8	34	0.07	9
504	276	2.8	68	0.08	25
505	1,339	1.7	290	0.60	22
506	1,154	2.4	254	0.31	22
510	563	2.4	88	0.18	16
513	346	6.2	37	0.05	11
516	936	9.6	86	0.18	9
520	1,865	2.3	306	0.38	16
524	94	0.2	3	0.01	3
530	1,818	7.8	403	0.50	22
550	1,614	2.0	261	0.54	16
554	220	0.5	33	0.04	15
556	587	2.5	103	0.21	18
560	1,414	25.3	99	0.12	7
564	1,699	17.5	444	0.91	26
568	2,342	2.9	416	0.51	18
572	923	1.9	84	0.17	9
574	776	3.3	155	0.19	20
578	1,714	30.6	229	0.47	13

In addition to the general season deer hunting effort and harvest discussed above, tags were offered for special permit hunts open only to permit holders. These special permits were made available to allow controlled harvest of antlerless deer in the Region while promoting hunting by young hunters, those with disabilities, and seniors. Additionally, "late-buck" hunts in GMUs 574, 578, and 388 were offered as a quality hunting opportunity for those fortunate enough to draw these permits. Hunters selected for deer special permits in Region 5 have typically enjoyed a pooled success rate of approximately 40%. Table 3 details the harvest of deer by special permit holders in Region 5 during 2014.

Table 3. Region 5, 2014 Special Deer Permit Harvest Summary.

GMU	Antlered Kill	Antlerless Kill	Total Kill
382	1	27	28
388	24	26	50
501	2	4	6
503	0	0	0
504	0	4	4
505	1	16	17
506	0	4	4
510	0	5	5
513	0	4	4
516	0	3	3
520	0	5	5
530	0	2	2
554	0	4	4
556	0	11	11
560	0	1	1
564	1	1	2
568	1	14	15
572	0	7	7
574	19	6	25
578	25	14	39
SUM	74	158	232

In aggregate, general and permit-only deer seasons in Region 5 during the 2014 hunting season resulted in a total harvest of 4,228 antlered and 603 antlerless deer.

Tribal Harvest

Members of the western Washington Treaty Tribes have hunting rights within portions of several Region 5 GMUs. Table 4 shows a summary of tribal deer harvest in the region (Northwest Indian Fisheries Commission 2014).

Table 4. Deer Harvest Reported by Western Washington Treaty Tribes in Region 5, 2014.

GMU	Antlered Kill	Antlerless Kill	Total Kill
503	5	10	15
505	1	0	1
513	4	6	10
516	6	20	26
520	0	1	1

Surveys

Region 5 deer demographics have historically been collected from several types of surveys and data collection efforts. These surveys include; (1) calculation of the annual buck mortality rate, (2) evaluation of female deer age structure from tooth analysis, (3) late summer productivity surveys, (4) spring counts of the Klickitat deer herd, and (5) post-hunting season surveys. The various data-collection efforts and their purpose are discussed below.

Historically, check station data were used to determine the percentage of yearling bucks in the total Regional buck harvest, i.e. Annual Yearling Buck Percentage (AYBP). In an age stable population, this percentage is assumed to be equal to the overall buck mortality rate. Essentially, yearlings are replacement animals filling voids left by the previous year's mortalities. However, small sample size and potential bias related to opening weekend deer hunting were problematic in this data set. Additionally, operation of the check stations is difficult logistically and requires far more staff than those available. For these reasons, the 2005 through 2014 AYBP used for calculation of the Sex Age Kill (SAK) model in Region 5 was generated from harvest data. Through this means, the buck mortality rate may be calculated from a sample of all reported deer harvested in the Region. Buck age is correlated to antler size in a consistent manner but varies throughout the Region. An appropriate buck mortality rate based on this correlation was applied to broad portions of the Region (Willapa, Cascades, and Klickitat). This method of calculation results in buck mortality rates of 25-50% across the Region.

The long-term estimate of annual doe mortality rates in the Region is 0.22. A large-scale effort to characterize doe mortality rates was undertaken in 2001. Tooth envelopes and an explanatory letter were sent to all hunters possessing an antlerless permit in Region 5. Additionally, incisors were taken from any female deer checked at the check stations or recovered from meat lockers. In 2001, a sample of 96 harvested female deer from the western portions of Region 5 resulted in an annual doe mortality rate of 0.219. A sample of 68 females from GMUs 578 and 588 (now 388) resulted in an annual doe mortality rate of 0.132.

Late summer deer productivity surveys were first established in 1995. In 2014, deer observations were conducted throughout the Region from August 15th to September 30th. Personnel from WDFW's Wildlife Management Program along with a variety of volunteers from within WDFW, the U.S. Forest Service, private timber companies, and interested individuals recorded observation data for all deer encountered during field activities or recreational outings. In addition to these incidental deer observations, multiple night deer surveys (spotlighting) were conducted by a combination of Wildlife Management Staff and volunteers. Deer group sizes and composition were determined. All deer were classified as bucks, does, fawns, or unknowns. However, only those groups of deer in which all individuals were classified were included in statistical analysis to help eliminate observer bias.

During the 2014 productivity surveys, a total of 884 deer were classified. The mean value of 0.68 fawns/doe is higher than the historical average of 0.52 per doe for the Region. This could be due in part to the relatively mild winter and early spring. The surveys are conducted after the peak of neo-natal mortality, so these values are closer representatives of recruitment than fecundity. For the purpose of calculating the SAK model, more specific productivity rates are assigned to aggregations of GMUs.

For spring counts, four permanent survey routes centered on the Klickitat Wildlife Area near Goldendale, were surveyed on March 12-13, 2015 (Table 5). Routes were driven on the evening of the 12th and morning of the 13th. Deer group sizes and composition were determined. All deer were classified as fawn, adult, or unknown and the fawn:adult ratio was determined. A total of 275 deer were classified during the March 2015 Klickitat deer survey. The resulting fawn:adult ratio of 0.66 is higher than the mean value of 0.51 over the 36-year history of this survey.

Table 5. Historic Fawn:Adult Ratios for the Klickitat Spring Deer Survey, 2006-2015.

Year	Total Deer Classified	Fawn:Adult
2015	275	0.66
2014	233	0.61
2013	242	0.49
2012	276	0.99
2011	363	0.45
2010	440	0.72
2009	277	0.53
2008	238	0.48
2007	344	0.67
2006	450	0.66

Limited post-season deer herd composition surveys were initiated in Region 5 in 2003. The surveys are intended to evaluate the effectiveness of current management strategies in meeting the buck escapement goals outlined in the Game Management Plan (WDFW 2015). Specifically, the post-season buck to doe objective in the 3 Klickitat County GMUs is 15-19 bucks per 100 does. Secondarily, the surveys provide an additional opportunity to evaluate the annual fawn to doe ratio. The sparsely vegetated habitats of Klickitat County offer suitable survey conditions during daylight hours in winter.

In 2014, Regional Wildlife Program Staff conducted aerial surveys during December in GMUs 382, 388, and 578. The timing of post-season surveys is designed to fall after the conclusion of the year's final hunting season (late archery) and prior to the initiation of antler casting (approximately January 1). A summary of these post-season deer surveys is listed in Table 6.

Table 6. Post-Season Deer Composition Survey Summary, GMU's 388, 382 and 578, 2005-14.

GMU	Year	Total Deer Classified	Bucks:Does:Fawns
388	2005	364	2:100:59
	2006	589	16:100:63
	2007	403	22:100:63
	2008	420	15:100:68
	2009	419	14:100:66
	2010	601	9:100:53
	2011	454	23:100:76
	2012	361	23:100:62
	2013	562	15:100:69
	2014	361	15:100:63
382	2005	165	15:100:57
	2006	428	10:100:62
	2007	418	17:100:70
	2008	301	11:100:81
	2009	211	10:100:64
	2010	660	11:100:68
	2011	220	18:100:65
	2012	543	11:100:51
	2013	685	11:100:65
	2014	738	21:100:67
578	2009	243	32:100:55
	2010	283	6:100:64
	2011	85	10:100:67
	2012	179	20:100:72
	2013	177	26:100:73
	2014	172	14:100:74
Klickitat Pooled	2005	529	6:100:58
	2006	1017	14:100:63
	2007	821	20:100:67
	2008	721	14:100:73
	2009	873	18:100:62
	2010	1544	10:100:61
	2011	759	20:100:72
	2012	1083	16:100:57
	2013	1424	14:100:67
	2014	1271	18:100:67

The results from these survey efforts indicate that 2006 changes in management regimes had a beneficial impact on the post-season buck to doe ratios in GMU 388 (Grayback). Specifically, the change to 3-point minimum with a reduction to 14 days of modern firearm hunting appears to have had a positive effect on the post-season buck to doe ratio. The initial 6 years of the 3-point antler restriction appears to have had a similar effect in GMU 578 (West Klickitat). A continuation of these survey efforts will be required to adequately assess ongoing management strategies. Ideally, this would include the availability of funding for continued aerial surveys in all 3 Klickitat County Game Management Units.

Population Status and Trend

Information compiled from hunting activity suggests a slow decline of the deer population in the Region. Hunter success rates over the past 10 years have dropped as low as 14%. Similarly, total deer harvest has also declined from roughly 5,600 to 4,600 annually during the same period. The reduced harvest in recent years can be partially explained by a concurrent reduction in the number of hunters choosing to pursue deer in Region 5. During the past 10 years deer hunters in Region 5 have declined from approximately 32,900 to 24,700. However, the success rates indicate slightly improved deer hunting during the 2012-2014 seasons.

Furthermore, the deer population is not evenly distributed throughout the Region. While the population in lower elevation portions of Region 5 remains relatively robust, those in the Cascade Mountain GMUs remain suppressed. An evaluation of estimated deer densities from population reconstruction (SAK Model), demonstrated this phenomenon as well. See Figure 1 for a graphic illustration of the estimated deer population in Region 5, generated from the Sex Age Kill Model.

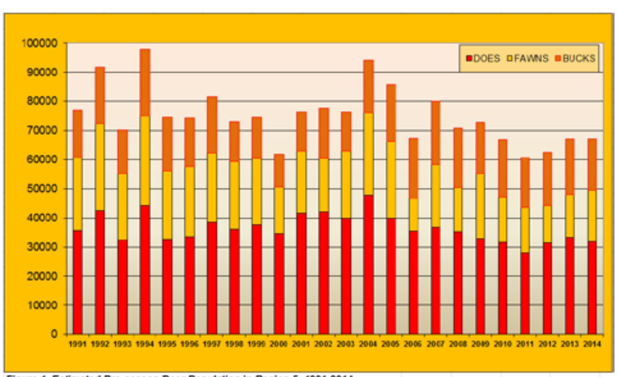


Figure 1. Estimated Pre-season Deer Population in Region 5, 1991-2014.

Deer damage

Deer damage reports occur at low levels in Region 5. Wildlife Conflict specialists work closely with producers by developing Damage Prevention Cooperative Agreements (DPCAs) which identify a plan to reduce the amount of damage incurred to agricultural crops using non-lethal and lethal methods. Region 5 conflict specialists and landowners use a variety of non-lethal means to discourage deer including: electrified fladry fencing, noisemakers (birdbangers, critter gitters, propane cannons), hazing and herding, scarecrow-like electronic devices, and odor-based repellents such as Plantskyyd. The total number of DPCAs in the Region related to deer for 2014-2015 was 10 (Table 7). This damage occurs in hay and alfalfa fields, berry fields, orchards, and other agricultural crops.

In many circumstances, the Department addresses damage complaints by working with landowners to increase access to their property during hunting seasons so that hunters can help to resolve the damage. The Department has also established Youth hunts in GMU 382 during December and January to address chronic damage issues and provide antlerless permit opportunities (Table 8).

Table 7. Number of DPCA Contracts Issued for Deer Damage in Region 5, 2014-2015.

GMU	Number of DPCA Contracts
382	2
388	2
564	3
574	2
677	1
SUM	10

Table 8. Hunts Designed to Alleviate Deer Damage in Region 5, 2014-2015.

Hunt	Number of permits issued	Number of hunters	Antlerless harvest
382-Youth	10	2	1
382-Youth	10	3	1
382-Youth	10	3	3
Region 5-Master Hunter	10	4	4
SUM	40	12	9

Habitat Condition and Trend

Increasing urbanization in several GMUs (504, western portion of 550, 554, and 564) is resulting in a loss of quality deer habitat, an increase in human-deer interactions, and loss of hunting opportunity. Additionally, the increase in residential development along the Lewis River drainage may be negatively impacting the quality of black-tailed deer range. A portion of this habitat loss is being addressed in mitigation agreements concerning the three major hydroelectric projects (Merwin, Yale, and Swift reservoirs) on the North Fork Lewis River (Pacificorps Energy 2008).

Additional negative impacts to deer habitat are the result of certain forest management activities. While forest canopy removal (natural or otherwise) generally increases forage production, certain aspects of forestry can be detrimental to black-tailed deer. Herbicides are used by both private and public forest managers to suppress/delay the establishment of "competing" vegetation (WADNR 2005; WADNR 1997). The broadleaf shrubs, trees, and forbs delayed by these efforts are the plants that primarily comprise the black-tailed deer diet (Crouch 1981; Brown 1961). Also, the stocking rates for seedlings in forest plantations are high, further reducing the competitive advantage that many forage species would normally have in early-successional forests. Once the densely stocked conifer seedlings reach approximately age 12, very little light is able to reach the ground, further reducing forage production. This removal of deciduous tree species along with shrubs and forbs comes at the detriment of deer and other early successional species in the forested environment. Furthermore, these dense conifer stands are harvested at approximately age 40. Harvest of such monocultural stands at a time prior to differentiation among the trees within the stand or generation of forest openings, reduces significant growth of understory shrubs.

However, silvicultural practices operate within a complex ecological relationship among geographic features, climate, soil, herbivory, etc. The complexities of these relationships are poorly understood and additional research into these dynamics could offer useful insights into both wildlife habitat management and forestry (e.g., the interaction effect of herbicides and herbivory on forage production). An initial investigation into this relationship revealed a short-term detrimental effect due to herbicide applications on industrial forestlands and long-term forage reductions due to herbivory (Geary, et. al. 2012).

Lastly, timber harvest requires the construction and maintenance of a vast system of forest roads to facilitate the removal of forest products. Studies have demonstrated the negative effects of roads on ungulates (Powell and Lindzey 2004; Rowland et. al. 2000), primarily the loss of security associated with increased human access to remote areas. Additional negative impacts from roads are weed dispersal, direct loss of habitat due to hardened surfaces, and soil erosion. In aggregate, these forest management activities cause delays or reductions in forage production, community complexity, and early successional vigor. These can have negative impacts on deer and are atypical of young forests following natural disturbances.

In the Cascades (GMUs 513, 516, 560, 572, and 574), suppression of the deer population is long-term and likely the result of habitat condition. Large amounts of forested habitat were clearcut in the 1980s prior to the listing of the northern spotted owl. Those forest stands harvested in the 1980s are now largely at an age (20-30 years) where forage production is minimal. In the Cascades, largely held in Federal ownership, subsequent timber harvest has been tremendously reduced. Additionally, active management (e.g., thinning) of forest plantations has not been extensively conducted. Furthermore, landscape-wide fire suppression assures that significant areas of fire-initiated early-succession habitats are not generated.

No specific habitat enhancements for black-tailed deer are planned outside of WDFW managed lands in Region 5. However, various management activities on Pacificorps' mitigation lands surrounding the North Fork Lewis River and limited thinning on USFS lands will benefit deer. Finally, both the Klickitat (Klickitat County) and Cowlitz (Lewis County) Wildlife Areas have on-going, long-term management practices designed to benefit black-tailed and mule deer habitat. A Habitat Guidelines reference is available to those managing black-tailed deer habitats (Nelson et al. 2008). This document has been distributed among those managing forested habitats in the Region.

Hairloss Syndrome

The habitat conditions discussed in the previous section likely influence the Region 5 deer population on a broad-scale. One potential cause of localized mortality on the deer population is hairloss syndrome. Reports of the problem began in GMUs 501, 503-506, 520, 530, and 550 during 1996. Since that time, numerous reports of affected deer have been received throughout the Region. Hairloss syndrome was observed in Klickitat County for the first time in 2000. Hairloss was first documented in GMU 382 (East

Klickitat) in the spring of 2006. Approximately 3% of the deer observed during the March 2015 Klickitat deer survey had noticeable signs of the syndrome. Late 1990s declines in harvest, increases in buck mortality rates, and reduced productivity in the western portions of Region 5 all roughly coincide with the onset of the hairloss syndrome. Anecdotal reports from hunters, homeowners, and citizens indicate that deer are now absent from areas where they were present in high numbers during the mid-1990s. An effort to quantify some aspects of the hairloss syndrome was conducted by WDFW from 2001-03. In this study, 30-39% of fawns were found to exhibit the syndrome. However, the establishment of an association between mortality and hair loss syndrome was inconclusive (Woodin 2004).

Both the hunter generated and the biological data discussed earlier in this document suggest a slow decline in the Regional deer population. It is likely that the impact of the hairloss syndrome has been offset by significant restrictions on antlerless deer harvest opportunities imposed in the late 1990s.

Studies indicate that the species of louse (*Damalinia (Cervicola spp.)* associated with black-tailed deer hairloss syndrome is not indigenous to North America (Bildfell et. al. 2004). Furthermore, recent collections of lice samples from Klickitat County and other portions of Central Washington indicate that the lice associated with the hairloss syndrome in these areas are those normally associated with fallow deer (*Bovicola tibialis)* (Bernatowicz et. al. 2008).

Current Research Projects

Under the direction of WDFW's Research Science Division, an effort to better understand the ecology and demographics of western Washington black-tailed deer is being conducted. Study animals are distributed in several locations on a combination of State forestlands and private industrial forests. Within Region 5, five does from the western portion of GMU 568 (Washougal), and 8 does from GMU 550 (Coweeman), were captured via helicopter net-gun in early 2014. The does were outfitted with collars carrying both traditional VHF and satellite transmitters.

Intensive monitoring was conducted during the May-June birthing period by Regional Wildlife Program Staff. Five does remained alive with functional equipment during the 2015 birthing period and a total of 6 fawns associated with the study does were captured and radio-collared. Subsequent work, conclusions, reports, and publications are anticipated in association with this research project.

Summary

The cumulative effects of increased development, certain forest management activities, reduced federal timber harvest, and hairloss syndrome have combined to slowly reduce the Region's deer population in recent years. There is also concern for changes in the deer population in the eastern part of the Region. Habitat changes and the growth of the wild horse population on the Yakama reservation may be impacting these deer.

Furthermore, distribution of the deer population is not uniform, with deer much more abundant in the lower elevation portions of the Region. As recently as the 1980s, habitat conditions were more favorable throughout the Region and anecdotal reports consistently state that there were many more deer in Region 5 during those years. Given the changes in habitat condition in the years that have followed, it is likely that these sentiments are correct. Unfortunately, monitoring methodologies have evolved throughout this time span and therefore meaningful comparisons of current population size to those of the past are not possible.

At this time, WDFW does not have the authority to implement landscape level programs or regulations that would change the habitat conditions that fundamentally control deer populations. Very large scale changes that would benefit deer at the population level would include such things as a moratorium on the sub-division of private property, changes to the Forest Practices laws, and the establishment (through cutting or burning) of tens of thousands of acres of early-successional forest on federally-managed lands. Favorable habitat changes of these magnitudes are not realistic in the foreseeable future of western Washington State.

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DEER STATUS AND TREND REPORT: REGION 6
ALL 600 SERIES GMUS

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Population objectives and guidelines
Black-tailed deer (*Odocoileus hemionus columbianus)* in Region 6 are managed to maintain productive populations, while providing for multiple uses; including recreational, educational and aesthetic, as well as a sustainable annual harvest (WDFW Game Management Plan 2015). We attempt to achieve these objectives largely through manipulating hunting seasons. Hunting regulations for Game Management Units (GMUs) generally provide liberal buck hunting intensity levels, which are indexed by post-season buck:doe ratio objectives ranging from 15-19 bucks per 100 does.

Hunting seasons and harvest trends
Buck harvest is generally any antlered buck, while antlerless harvest is limited to certain weapon types and/or by permit. A two-point minimum antler restriction was in effect in the Skokomish (636), Mashel (654) and Bear River (681) GMUs until 2015.

The general hunting season length varies depending on the weapon type. In 2014, modern firearm hunters had 25 days to hunt, while archery hunters had up to 62 days and muzzleloader hunters had up to 28 days. Modern firearm and muzzleloader hunters also had an additional 11 days to hunt during the September High Buck Hunt; a hunt that overlaps the general archery season and, in Region 6, occurs in the Olympic Wilderness Areas. Additional hunting opportunity was provided in Region 6 during the 2014 season with 870 special permits offered through the Department's special permit drawing.

Region-wide black-tailed deer harvest for general and permit seasons combined in 2014 was estimated to be 5,217 deer, a 6% increase from 2013; of these, 15% were does and 85% were bucks. The Skookumchuck (667) GMU by far had the highest deer harvest in Region 6 followed by Capitol Peak (663), Olympic (621), Satsop (651), and Mason (633), which comprise the top 5 GMUs for total deer harvested in the Region (Table 1). In most GMUs, 2-points comprise the highest portion of bucks harvested (Figure 1).

Table 1. The number of does, bucks, and total deer harvested in Region 6 during general and permit seasons combined in 2014 by GMU. GMUs are ordered from the highest total harvest to the lowest. Total does not include Tribal harvest.

GMU	Does	Bucks	Total
Skookumchuck (667)	146	676	822
Capitol Peak (663)	58	368	426
Olympic (621)	45	327	372
Satsop (651)	22	310	332
Mason (633)	42	263	305
Mashel (654)	60	207	267
Coyle (624)	37	225	262
Kitsap (627)	60	194	254
Deschutes (666)	63	183	246
Fall River (672)	38	191	229
Wynoochee (648)	32	196	228
Williams Creek (673)	39	172	211
Minot Peak (660)	16	194	210
Puyallup (652)	29	116	145
Skokomish (636)	19	116	135
North River (658)	12	119	131
Pysht (603)	2	104	106
Copalis (642)	11	88	99
White River (653)	1	80	81
Dickey (602)	0	75	75
Bear River (681)	4	48	52
Clearwater (615)	0	49	49
Hoko (601)	0	43	43
Sol Duc (607)	0	37	37
Long Beach (684)	8	17	25
Goodman (612)	0	21	21
Anderson Island (655)	11	10	21
Quinault Ridge (638)	4	16	20
Matheny (618)	0	10	10

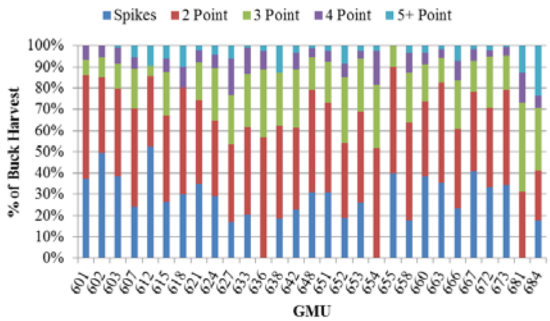

Figure 1. The proportion of spike, 2, 3, 4, and 5 or more point bucks reported in the general and permit seasons combined, for each GMU in Region 6 during 2014.

Ten-year (2005-2014) harvest statistics are presented for each GMU in Region 6. The apparent dramatic variation in hunter success observed in some GMUs is an artifact of low hunter participation and harvest.

Hoko - GMU 601

General season deer harvest in GMU 601 was estimated to be 43 deer in 2014; higher than 2013 and the previous 10-year average of 37 (Figure 2). No special permits were available in 2014. Modern firearm hunters comprise the largest user group in this GMU (Figure 3). Since 2005, general season success rates have averaged 12% for archery hunters and 23% for modern firearm hunters (Figure 4). There was no general season muzzleloader hunting in this GMU. On average, tribal hunting accounts for 17% of the total deer taken in this GMU each year.

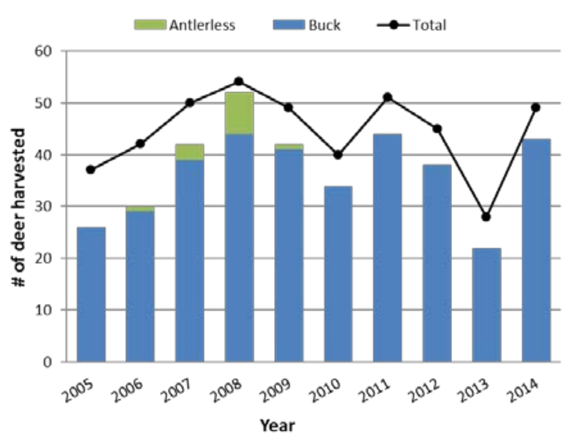

Figure 2. Total number of black-tailed deer harvested in GMU 601, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

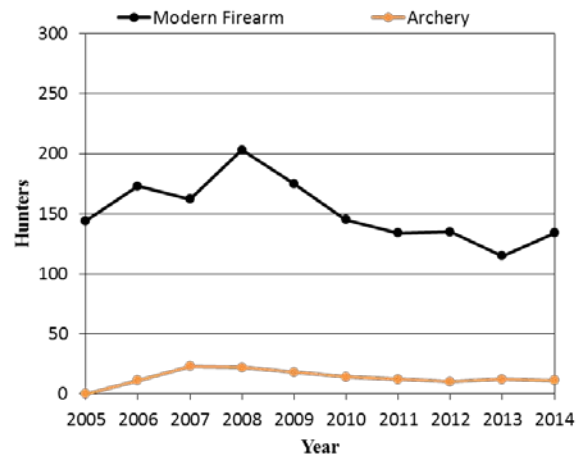

Figure 3. Number of general season deer hunters by weapon type in GMU 601, from 2005–2014.

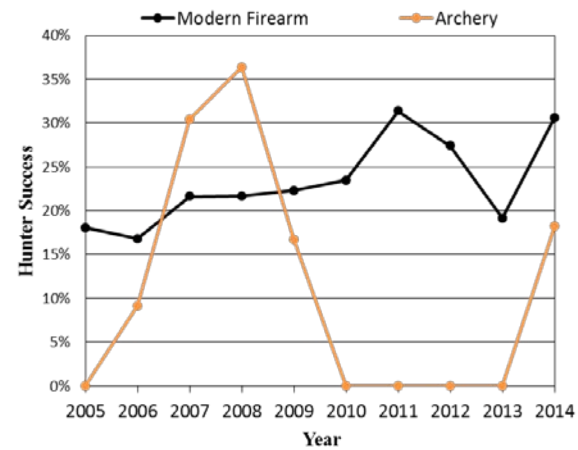

Figure 4. Hunter success by weapon type during the general season in GMU 601, from 2005–2014.

Dickey - GMU 602

General season deer harvest in GMU 602 was estimated to be 75 deer in 2014; 9% lower than 2013 and higher than the previous 10-year average of 70 (Figure 5). No special permits were available in 2014. Modern firearm hunters comprise the largest user group in this GMU (Figure 6). Since 2005, general season success rates have averaged 8% for archery hunters, 22% for modern firearm hunters, and 8% for muzzleloader hunters (Figure 7). On average, tribal hunting accounts for 18% of the total deer taken in this GMU each year.

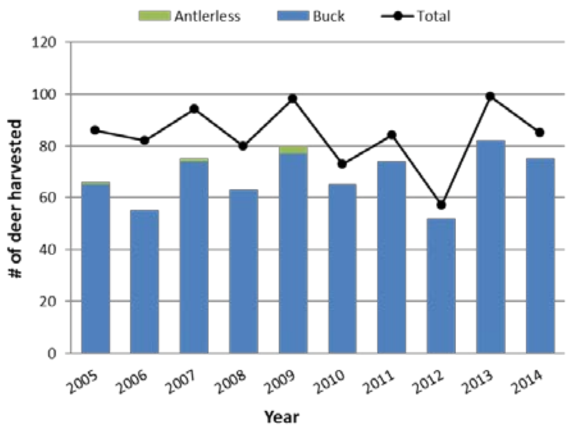

Figure 5. Total number of black-tailed deer harvested annually in GMU 602, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

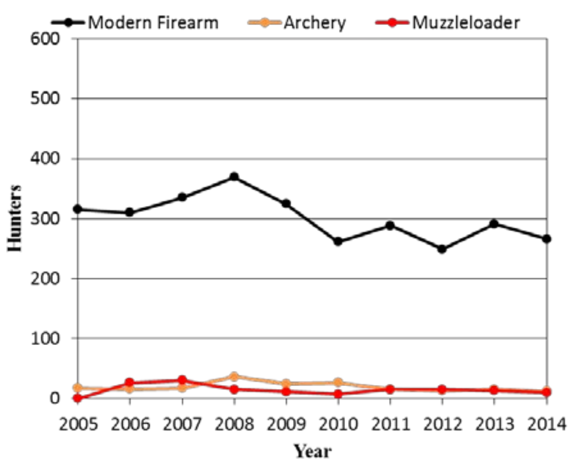

Figure 6. Number of general season deer hunters by weapon type in GMU 602, from 2005–2014.

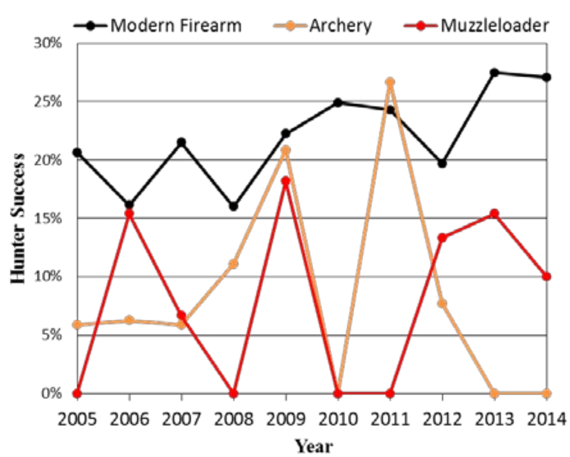

Figure 7. Hunter success by weapon type during the general season in GMU 602, from 2005–2014.

Pysht - GMU 603

General season deer harvest in GMU 603 was estimated to be 104 deer in 2014; 13% higher than 2013, but lower than the previous 10-year average of 128 (Figure 8). Fifteen antlerless permits were available in 2014; of these, 5 hunters reported harvesting 2 does. Modern firearm hunters comprise the largest user group in this GMU (Figure 9). Since 2005, general season success rates have averaged 18% for archery hunters, 24% for modern firearm hunters, and 15% for muzzleloader hunters (Figure 10). On average, tribal hunting accounts for 6% of the total deer taken in this GMU each year.

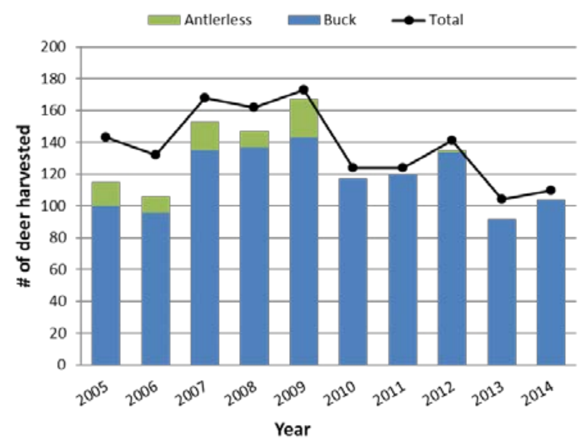

Figure 8. Total number of black-tailed deer harvested annually in GMU 603, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

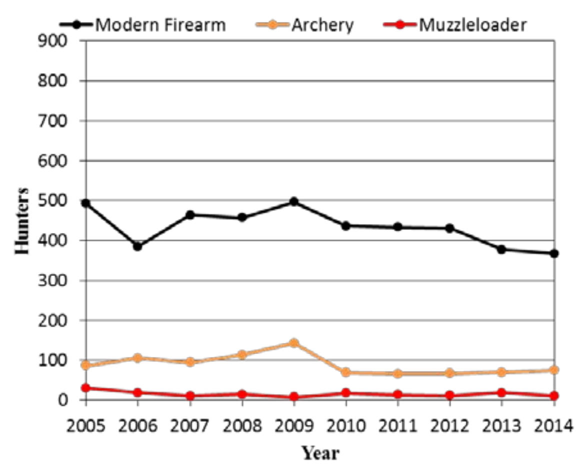

Figure 9. Number of general season deer hunters by weapon type in GMU 603, from 2005–2014.

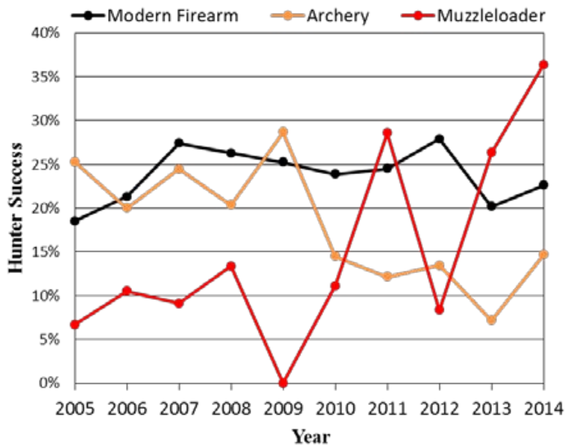

Figure 10. Hunter success by weapon type during the general season in GMU 603, from 2005–2014.

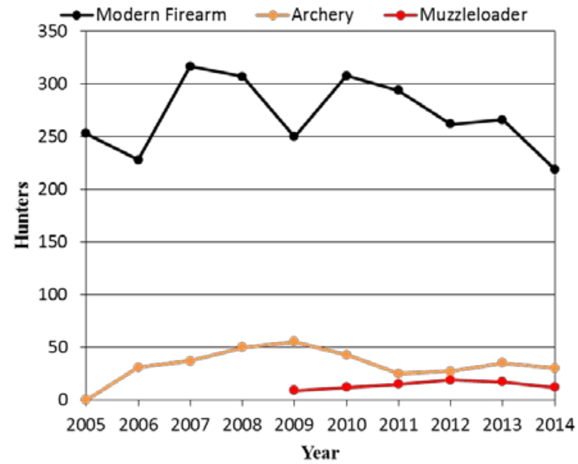

Figure 12. Number of general season deer hunters by weapon type in GMU 607, from 2005–2014.

Sol Duc - GMU 607

General season deer harvest in GMU 607 was estimated to be 37 deer in 2014; lower than 2013 and the previous 10-year average of 48 (Figure 11). Five Quality buck permits were available in 2014; of these 5 hunters reported hunting with no success. Modern firearm hunters comprise the largest user group in this GMU (Figure 12). Since 2005, general season success rates have averaged 7% for archery hunters and 16% for modern firearm hunters (Figure 13). Since 2009, general season muzzleloader success has averaged 5%. On average, tribal hunting accounts for 9% of the total deer taken in this GMU each year.

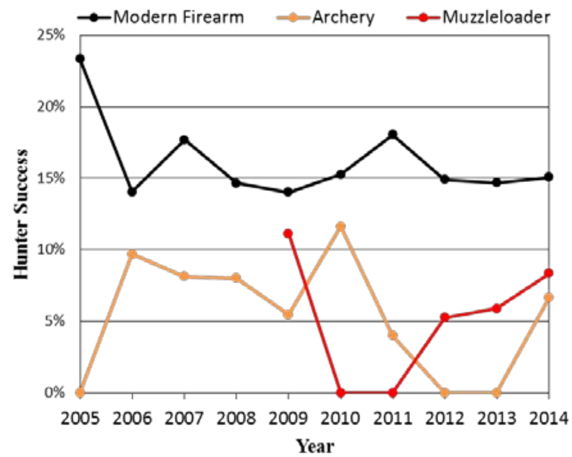

Figure 13. Hunter success by weapon type during the general season in GMU 607, from 2005–2014.

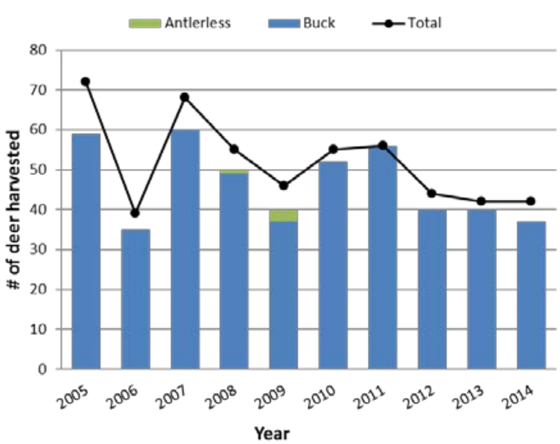

Figure 11. Total number of black-tailed deer harvested annually in GMU 607, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

Goodman - GMU 612

General season deer harvest in GMU 612 was estimated to be 21 deer in 2014; lower than 2013 and the same as the previous 10-year average of 21 (Figure 14). No special permits were available in 2014. Modern firearm hunters comprise the largest user group in this GMU (Figure 15). Since 2005, general season success rates have averaged 4% for archery hunters, 14% for modern firearm hunters, and 32% for muzzleloader hunters (Figure 16). On average, tribal hunting accounts for 24% of the total deer taken in this GMU each year.

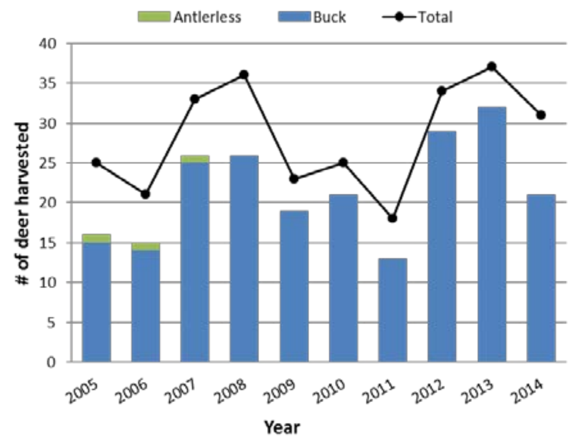

Figure 14. Total number of black-tailed deer harvested annually in GMU 612, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

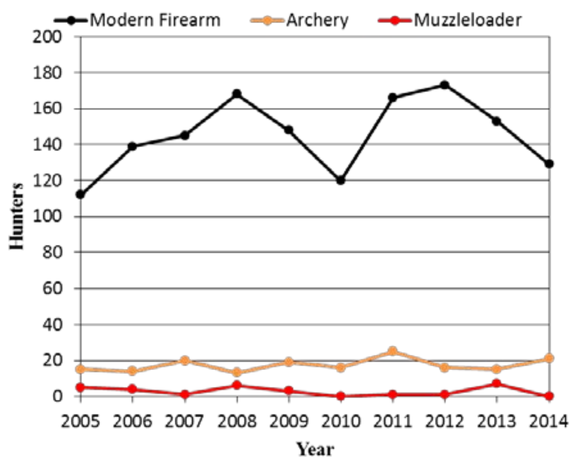

Figure 15. Number of general season deer hunters by weapon type in GMU 612, from 2005–2014.

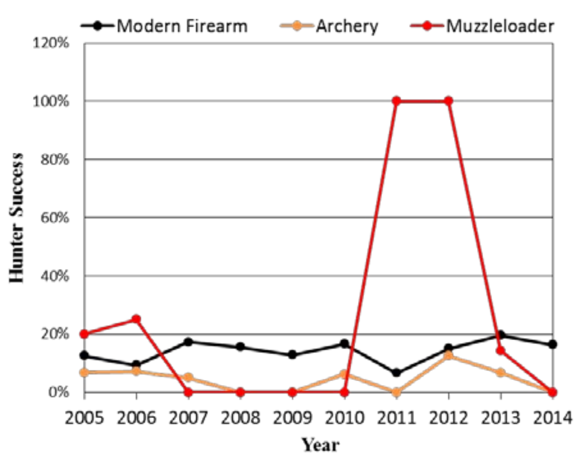

Figure 16. Hunter success by weapon type during the general season in GMU 612, from 2005–2014.

Clearwater - GMU 615

General season deer harvest in GMU 615 was estimated to be 49 deer in 2014; higher than 2013 and the previous 10-year average of 34 (Figure 17). No special permits were available in 2014. Modern firearm hunters comprise the largest user group in this GMU (Figure 18). Since 2005, general season success rates have averaged 5% for archery hunters and 15% for modern firearm hunters (Figure 19). Since 2009, this GMU has seen very little muzzleloader participation. On average, tribal hunting accounts for 21% of the total deer taken in this GMU each year.

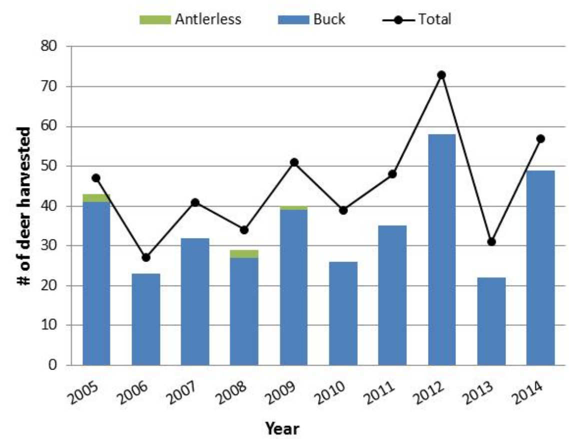

Figure 17. Total number of black-tailed deer harvested annually in GMU 615, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

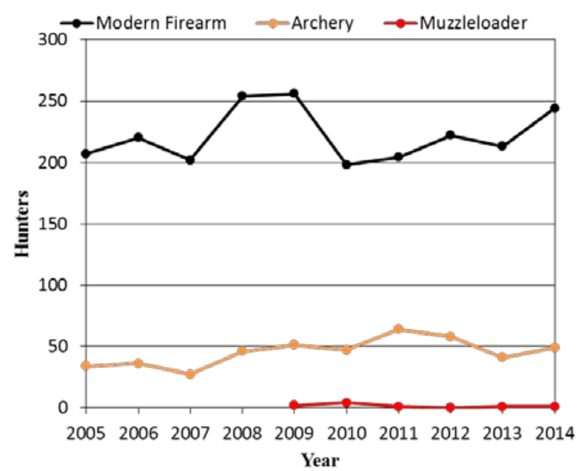

Figure 18. Number of general season deer hunters by weapon type in GMU 615, from 2005–2014.

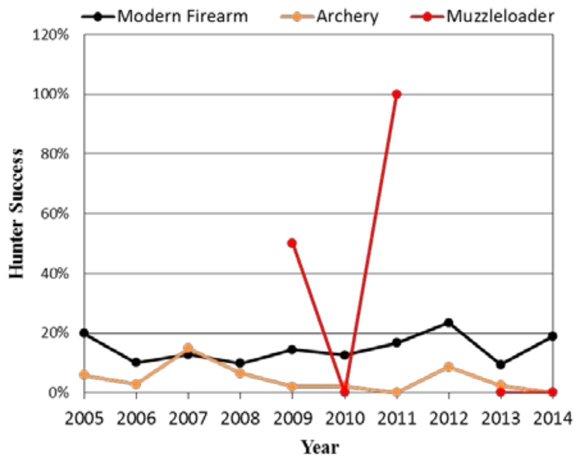

Figure 19. Hunter success by weapon type during the general season in GMU 615, from 2005–2014.

Matheny - GMU 618
General season deer harvest in GMU 618 was estimated to be 10 deer in 2014; higher than 2013 and the previous 10-year average of 4 (Figure 20). No special permits were available in 2014. Modern firearm hunters comprise the largest user group in this GMU (Figure 21). Since 2005, general season success rates have averaged 9% for archery hunters, and 13% for modern firearm hunters (Figure 22). There was no general season muzzleloader hunting in this GMU. On average, tribal hunting accounts for 15% of the total deer taken in this GMU each year.

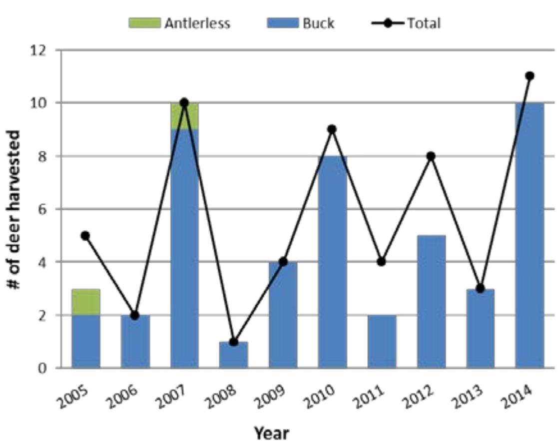

Figure 20. Total number of black-tailed deer harvested in GMU 618, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

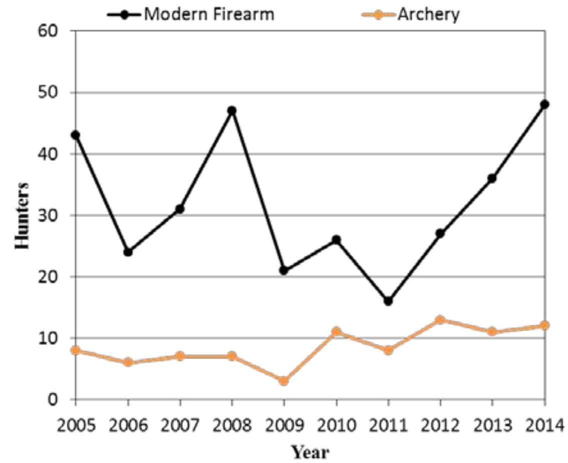

Figure 21. Number of general season deer hunters by weapon type in GMU 618, from 2005–2014.

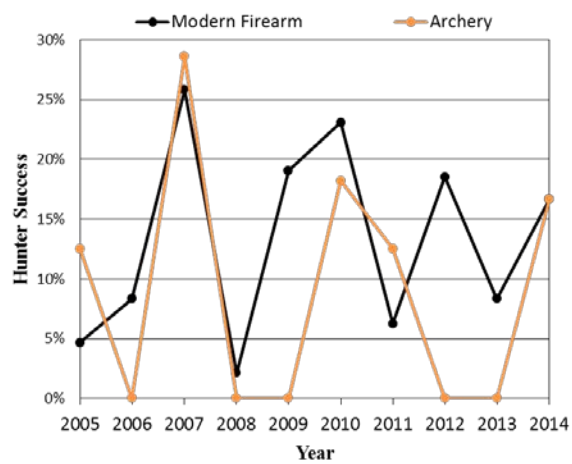

Figure 22. Hunter success by weapon type during the general season in GMU 618, from 2005–2014.

Olympic - GMU 621
General season deer harvest in GMU 621 was estimated to be 355 deer in 2014; a 22% increase compared to 2013 and higher than the previous 10-year average of 321 (Figure 23). Seventy special permits were available in 2014; of these, 37 hunters reported harvesting 17 deer. Modern firearm hunters comprise the largest user group in this GMU (Figure 24). Since 2005, general season success rates have averaged 26% for archery hunters, and 22% for modern firearm hunters (Figure 25). General season muzzleloader hunting was added in 2014; 8 hunters reported hunting in this GMU, but did not harvest any deer. On average, tribal hunting accounts for 10% of the total deer taken in this GMU each year.

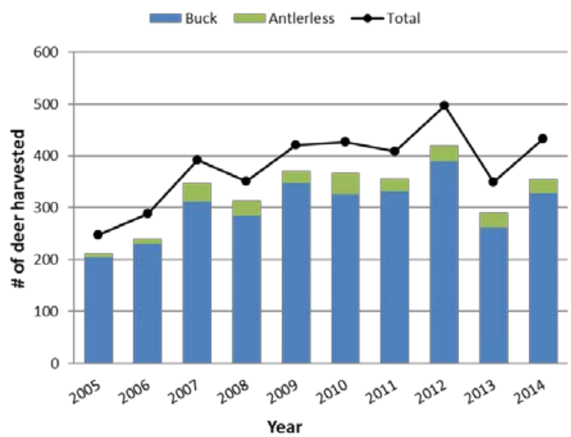

Figure 23. Total number of black-tailed deer harvested in GMU 621, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

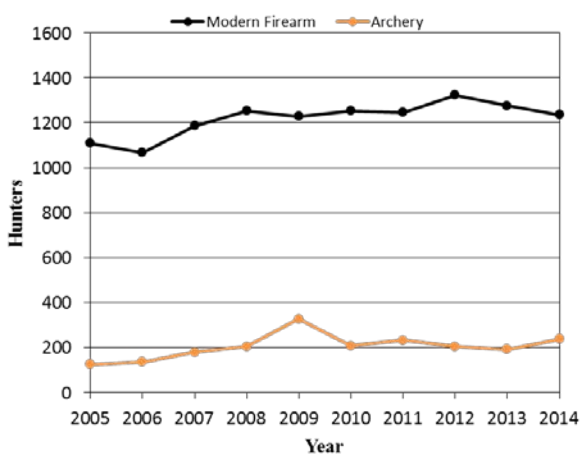

Figure 24. Number of general season deer hunters by weapon type in GMU 621, from 2005–2014.

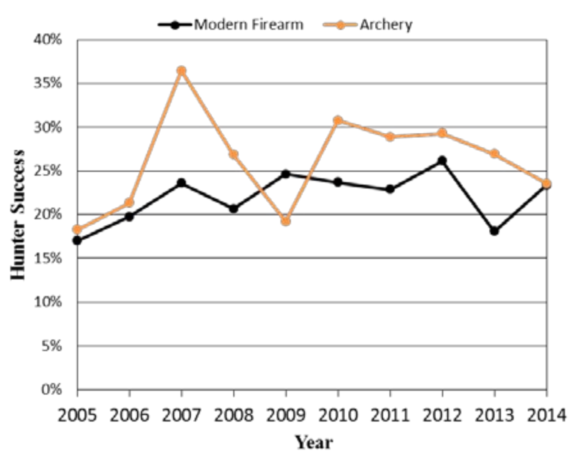

Figure 25. Hunter success by weapon type during the general season in GMU 621, from 2005–2014.

Coyle - GMU 624

General season deer harvest in GMU 624 was estimated to be 259 deer in 2014; an 11% increase compared to 2013 and higher than the previous 10-year average of 235 (Figure 26). Forty special permits were available in 2014; of these, 8 hunters reported harvesting 3 deer. Modern firearm hunters comprise the largest user group in this GMU (Figure 27). Since 2005, general season success rates have averaged 26% for archery hunters, 24% for modern firearm, and 14% for muzzleloader hunters (Figure 28). On average, tribal hunting accounts for 12% of the total deer taken in this GMU each year.

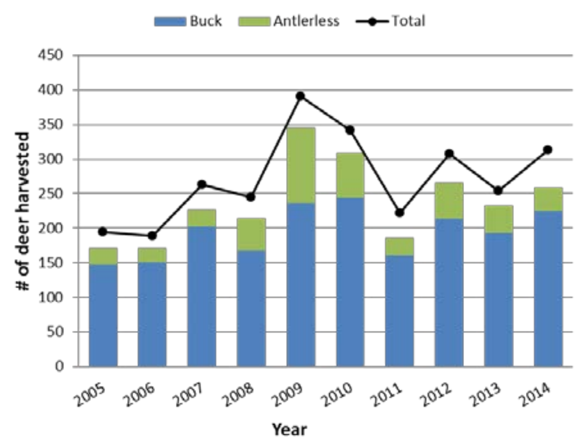

Figure 26. Total number of black-tailed deer harvested annually in GMU 624, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

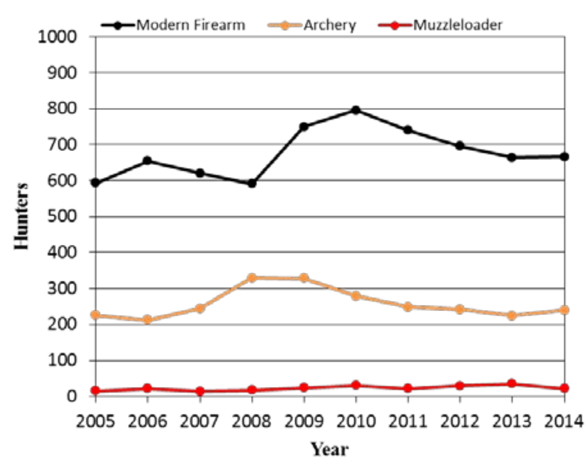

Figure 27. Number of general season deer hunters by weapon type in GMU 624, from 2005–2014.

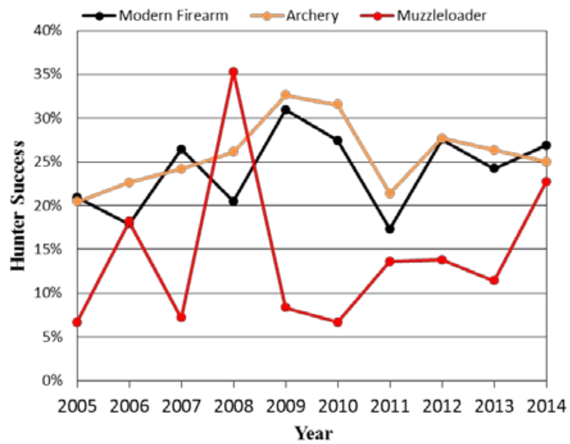

Figure 28. Hunter success by weapon type during the general season in GMU 624, from 2005–2014.

Kitsap - GMU 627

General season deer harvest in GMU 627 was estimated to be 248 deer in 2014; a 7% increase compared to 2013 and higher than the previous 10-year average of 194 (Figure 29). Thirty special permits were available in 2014; of these, 13 hunters reported harvesting 6 deer. Modern firearm hunters comprise the largest user group in this GMU (Figure 30). Since 2005, general season success rates have averaged 18% for archery hunters, 22% for modern firearm, and 14% for muzzleloader hunters (Figure 31). On average, tribal hunting accounts for 2% of the total deer taken in this GMU each year.

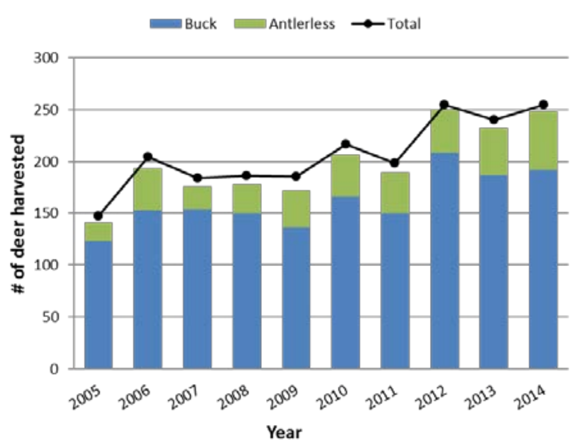

Figure 29. Total number of black-tailed deer harvested annually in GMU 627, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

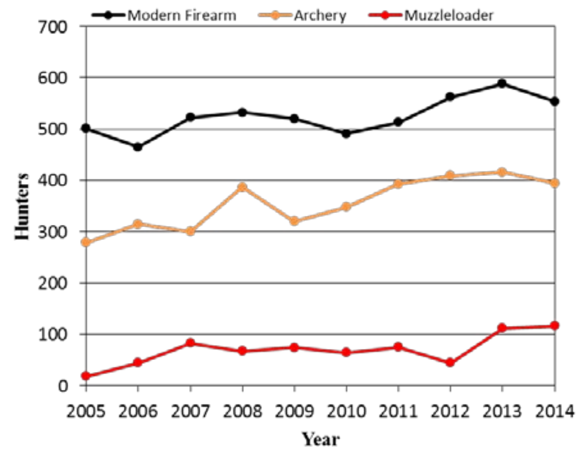

Figure 30. Number of general season deer hunters by weapon type in GMU 627, from 2005–2014.

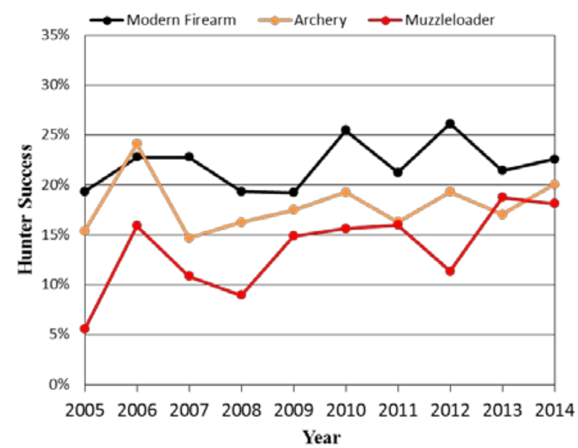

Figure 31. Hunter success by weapon type during the general season in GMU 627, from 2005–2014.

Mason - GMU 633

General season deer harvest in GMU 633 was estimated to be 304 deer in 2014; a 13% increase compared to 2013 and higher than the previous 10-year average of 285 (Figure 32). Modern firearm hunters comprise the largest user group in this GMU (Figure 33). Since 2005, general season success rates have averaged 14% for archery hunters, 20% for modern firearm, and 16% for muzzleloader hunters (Figure 34). On average, tribal hunting accounts for 1% of the total deer taken in this GMU each year.

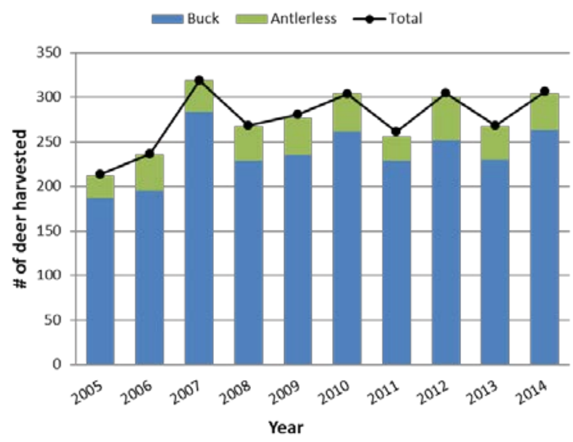

Figure 32. Total number of black-tailed deer harvested annually in GMU 633, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

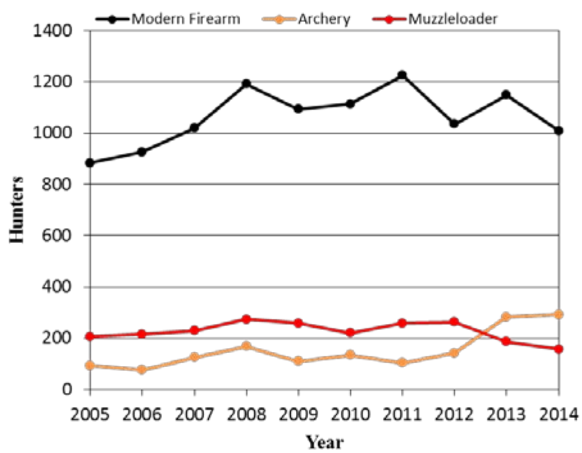

Figure 33. Number of general season deer hunters by weapon type in GMU 633, from 2005–2014.

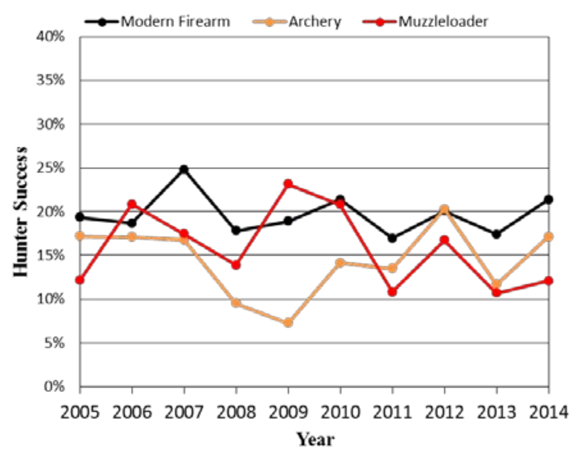

Figure 34. Hunter success by weapon type during the general season in GMU 633, from 2005–2014.

Skokomish - GMU 636

General season deer harvest in GMU 636 was estimated to be 124 deer in 2014; a 1% increase compared to 2013 and lower than the previous 10-year average of 149 (Figure 35). Thirty-five special permits were available in 2014; of these, 24 hunters reported harvesting 11 deer. Modern firearm hunters comprise the largest user group in this GMU (Figure 36). Since 2005, general season success rates have averaged 14% for archery hunters and modern firearm hunters. Since 2009, average success among muzzleloader hunters has been 5% (Figure 37). On average, tribal hunting accounts for 20% of the total deer taken in this GMU each year.

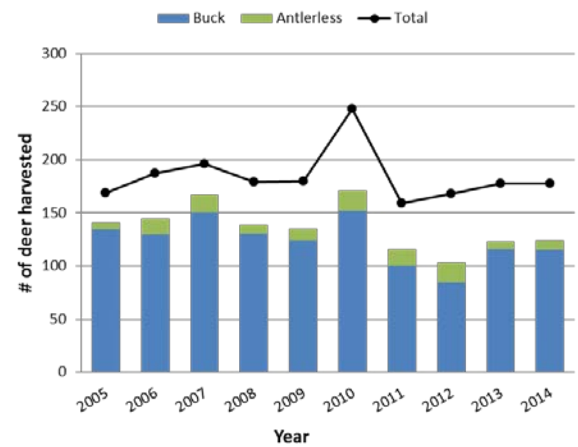

Figure 35. Total number of black-tailed deer harvested annually in GMU 636, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

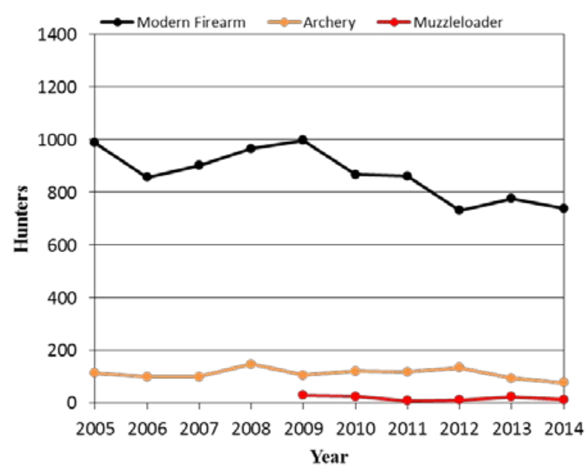

Figure 36. Number of general season deer hunters by weapon type in GMU 636, from 2005–2014.

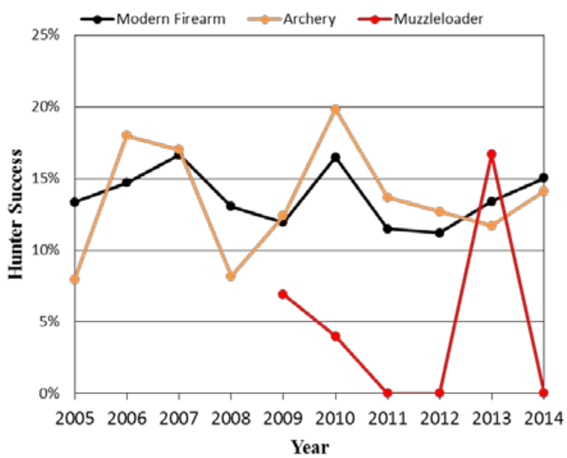

Figure 37. Hunter success by weapon type during the general season in GMU 636, from 2005–2014.

Quinault Ridge - GMU 638

General season deer harvest in GMU 638 was estimated to be 20 deer in 2014; a 26% increase compared to 2013 and lower than the previous 10-year average of 23 (Figure 38). No special permits were available in 2014. Modern firearm hunters comprise the largest user group in this GMU (Figure 39). Since 2005, general season success rates have averaged 14% for archery hunters, 16% for modern firearm hunters, and 0% for muzzleloaders (Figure 40). On average, tribal hunting accounts for 11% of the total deer taken in this GMU each year.

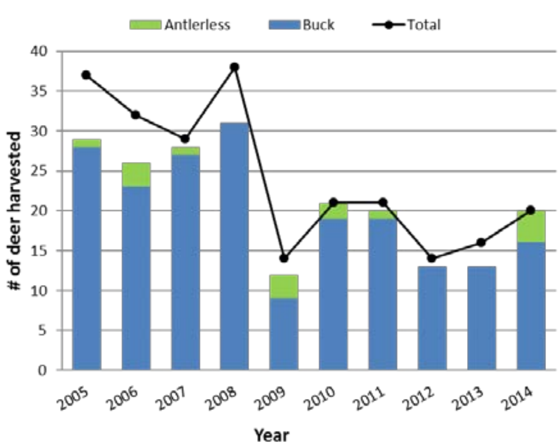

Figure 38. Total number of black-tailed deer harvested annually in GMU 638, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

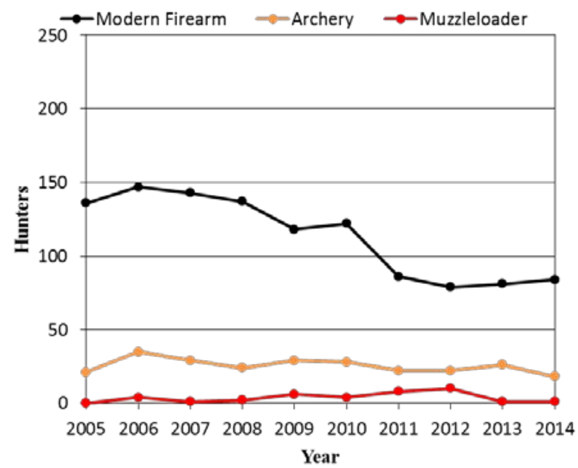

Figure 39. Number of general season deer hunters by weapon type in GMU 638, from 2005–2014.

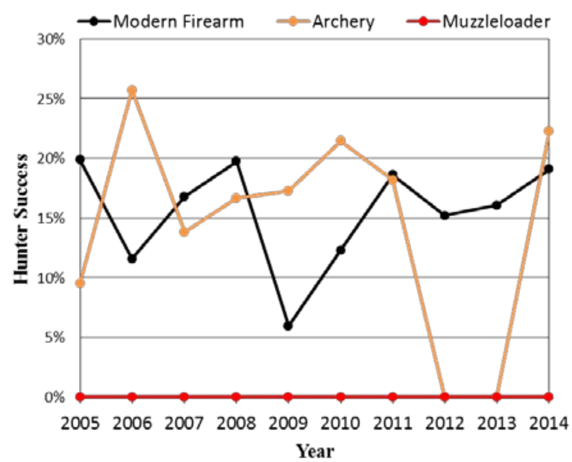

Figure 40. Hunter success by weapon type during the general season in GMU 638, from 2005–2014.

Copalis - GMU 642

General season deer harvest in GMU 642 was estimated to be 95 deer in 2014; a 58% increase compared to 2013 and higher than the previous 10-year average of 88 (Figure 41). Twenty special permits were available in 2014; of these, 15 hunters reported harvesting 4 deer. Modern firearm hunters comprise the largest user group in this GMU (Figure 42). Since 2005, general season success rates have averaged 24% for archery hunters, 25% for modern firearm hunters, and 8% for muzzleloaders (Figure 43). On average, tribal hunting accounts for 6% of the total deer taken in this GMU each year.

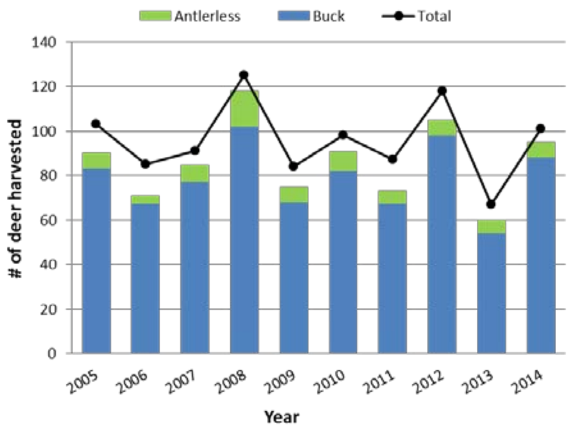

Figure 41. Total number of black-tailed deer harvested annually in GMU 642, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

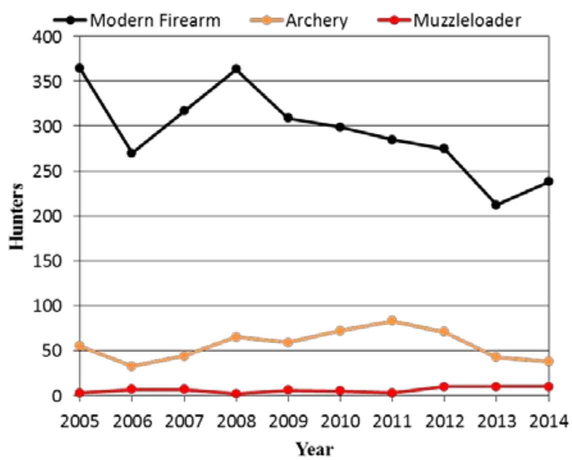

Figure 42. Number of general season deer hunters by weapon type in GMU 642, from 2005–2014.

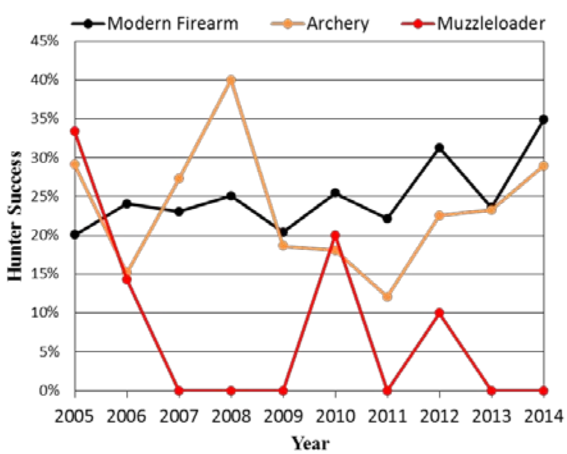

Figure 43. Hunter success by weapon type during the general season in GMU 642, from 2005–2014.

Wynoochee - GMU 648

General season deer harvest in GMU 648 was estimated to be 217 deer in 2014; a 12% increase compared to 2013 and lower than the previous 10-year average of 360 (Figure 44). Thirty-five special permits were available in 2014; of these, 22 hunters reported harvesting 11 deer. Modern firearm hunters comprise the largest user group in this GMU (Figure 45). Since 2005, general season success rates have averaged 17% for archery hunters, 19% for modern firearm hunters, and 22% for muzzleloaders (Figure 46). On average, tribal hunting accounts for 5% of the total deer taken in this GMU each year.

Recent declines in deer harvested and modern firearm hunters in this unit may be, in part, related to increased access restrictions imposed on private forestlands in this GMU.

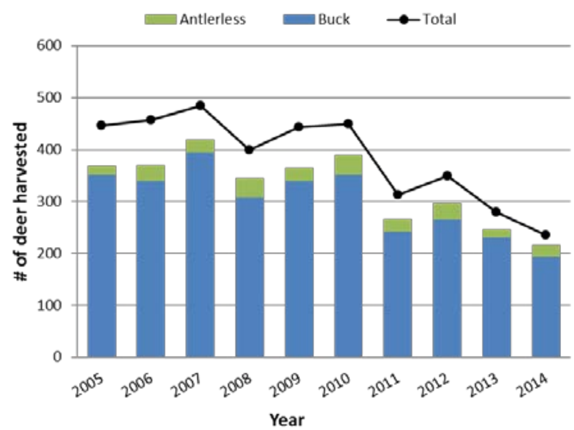

Figure 44. Total number of black-tailed deer harvested annually in GMU 648, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

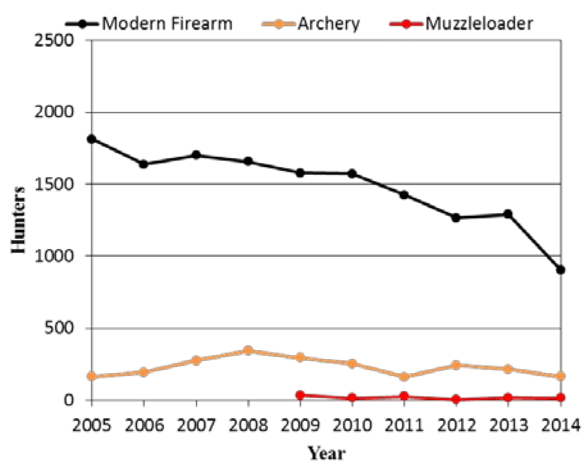

Figure 45. Number of general season deer hunters by weapon type in GMU 648, from 2005–2014.

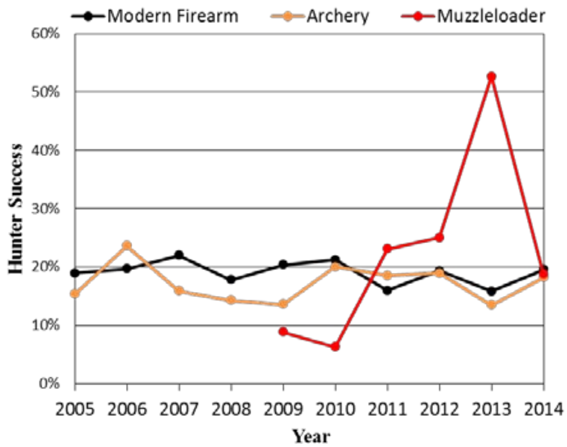

Figure 46. Hunter success by weapon type during the general season in GMU 648, from 2005–2014.

Satsop - GMU 651

General season deer harvest in GMU 651 was estimated to be 309 deer in 2014; a 6% decrease compared to 2013 and lower than the previous 10-year average of 442 (Figure 47). One hundred and twenty special permits were available in 2014; of these, 54 hunters reported harvesting 23 deer. Modern firearm hunters comprise the largest user group in this GMU (Figure 48). Since 2005, general season success rates have averaged 17% for archery hunters, 21% for modern firearm, and 17% for muzzleloader hunters (Figure 49). On average, tribal hunting accounts for 11% of the total deer taken in this GMU each year.

Recent declines in deer harvested and modern firearm hunters in this unit may be, in part, related to increased access restrictions imposed on private forestlands in this GMU.

The decline in general season success among the muzzleloader group in 2011 was likely due to a regulation change affecting antlerless harvest. In 2005, the legal deer in the general late-muzzle loader season was changed to any buck until the last 9 days of the season, when any deer was legal. In 2011, all antlerless harvest during the late muzzleloader season was changed to permit only; data suggesting low fawn recruitment and higher than expected doe mortality prompted this regulation change.

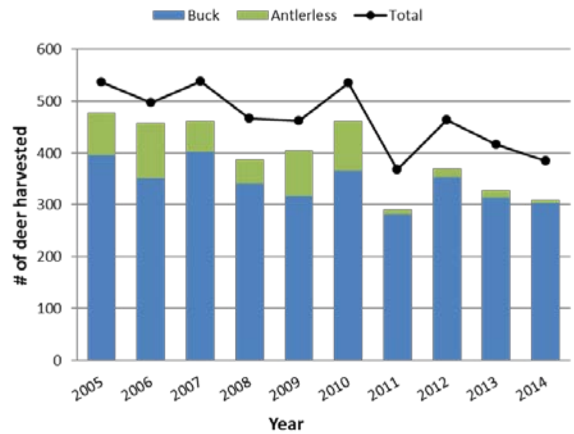

Figure 47. Total number of black-tailed deer harvested annually in GMU 651, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

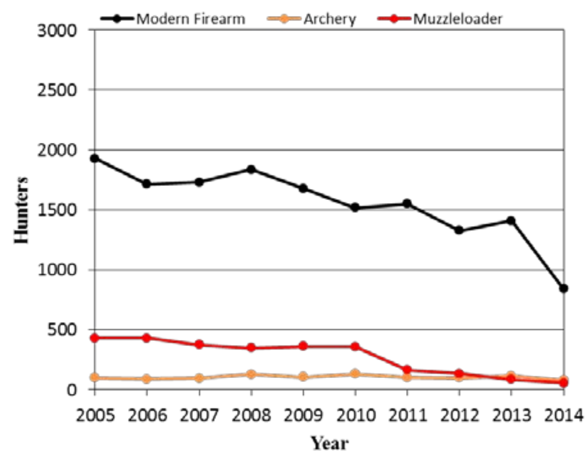

Figure 48. Number of general season deer hunters by weapon type in GMU 651, from 2005–2014.

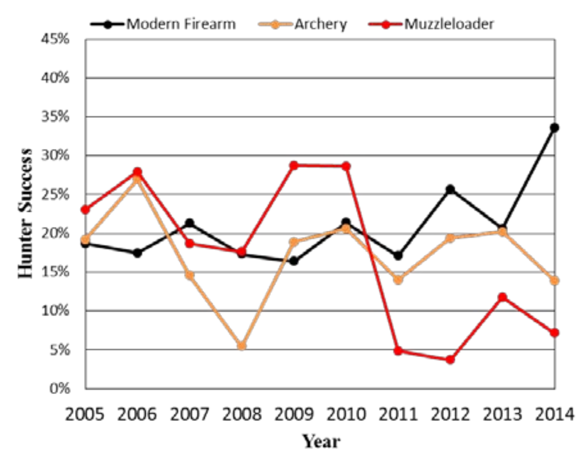

Figure 49. Hunter success by weapon type during the general season in GMU 651, from 2005–2014.

Puyallup - GMU 652

General season deer harvest in GMU 652 was estimated to be 145 deer in 2014; a 17% decrease compared to 2013 and lower than the previous 10-year average of 172 (Figure 50). There were no special permits available in this GMU in 2014. Modern firearm hunters comprise the largest user group in this GMU (Figure 51). Since 2005, general season success rates have averaged 15% for archery hunters, 19% for modern firearm hunters, and 13% for muzzleloader hunters (Figure 52). On average, tribal hunting accounts for 3% of the total deer taken in this GMU each year.

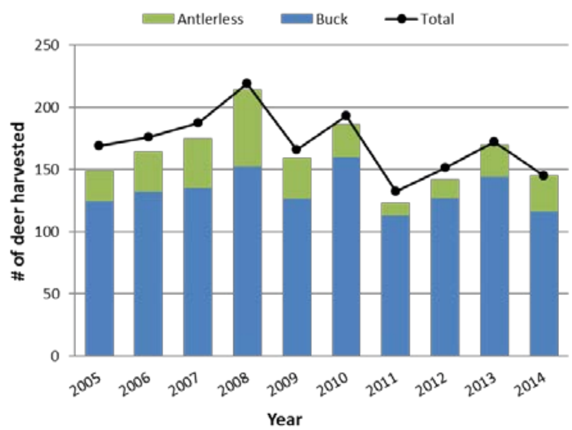

Figure 50. Total number of black-tailed deer harvested in GMU 652, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

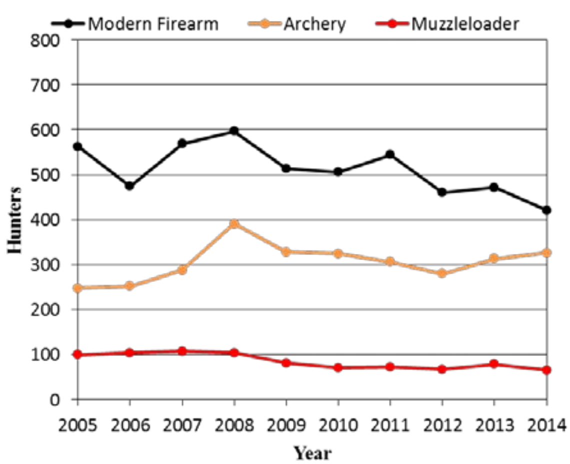

Figure 51. Number of general season deer hunters by weapon type in GMU 652, from 2005–2014.

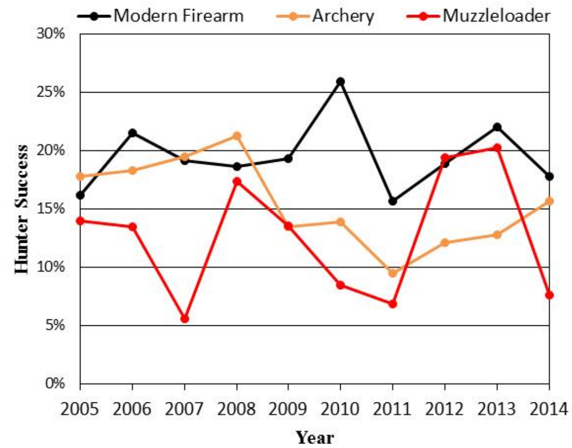

Figure 52. Hunter success by weapon type during the general season in GMU 652, from 2005–2014.

White River - GMU 653

General season deer harvest in GMU 653 was estimated to be 81 deer in 2014; a 3% increase compared to 2013 and lower than the previous 10-year average of 113 (Figure 53). There were no special permits available in this GMU in 2014. Modern firearm hunters comprise the largest user group in this GMU (Figure 54). Since 2005, general season success rates have averaged 15% for archery hunters and 14% for modern firearm hunters; there is no general muzzleloader season in this GMU (Figure 55). On average, tribal hunting accounts for 30% of the total deer taken in this GMU each year.

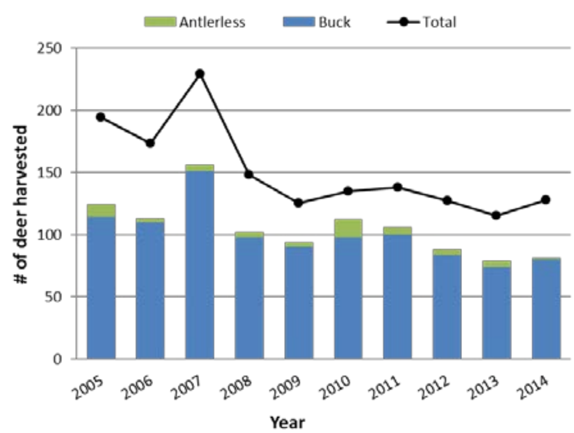

Figure 53. Total number of black-tailed deer harvested annually in GMU 653, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

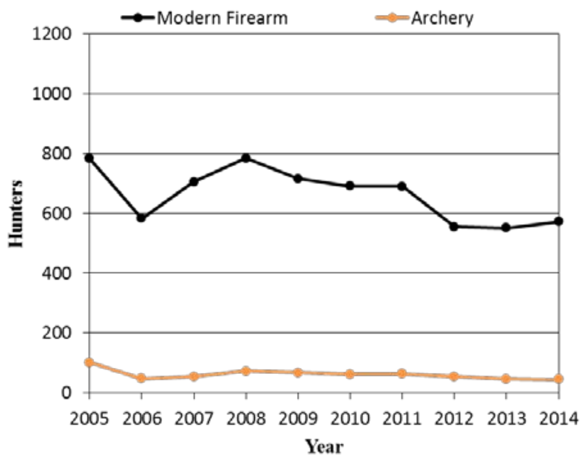

Figure 54. Number of general season deer hunters by weapon type in GMU 653, from 2005–2014.

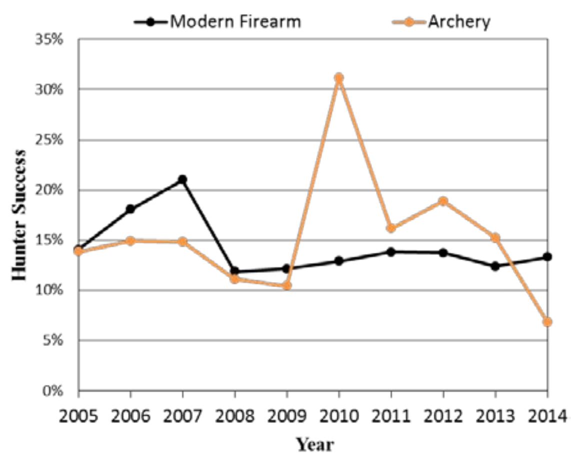

Figure 55. Hunter success by weapon type during the general season in GMU 653, from 2005–2014.

Mashel - GMU 654

General season deer harvest in GMU 654 was estimated to be 242 deer in 2014; a 16% decrease compared to 2013 and lower than the previous 10-year average of 332 (Figure 56). There were 140 special permits available in the 2014 season; of these, 74 hunters reported harvesting 27 deer. Modern firearm hunters comprise the largest user group in this GMU (Figure 57). Since 2005, general season success rates have averaged 15% for archery hunters, 18% for modern firearm, and 12% for muzzleloader hunters (Figure 58). On average, tribal hunting accounts for 2% of the total deer taken in this GMU each year.

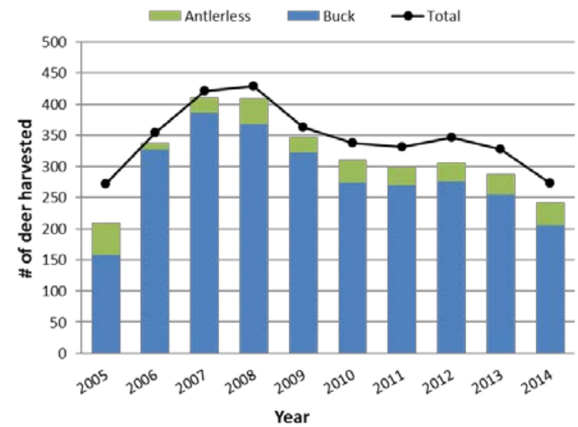

Figure 56. Total number of black-tailed deer harvested annually in GMU 654, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

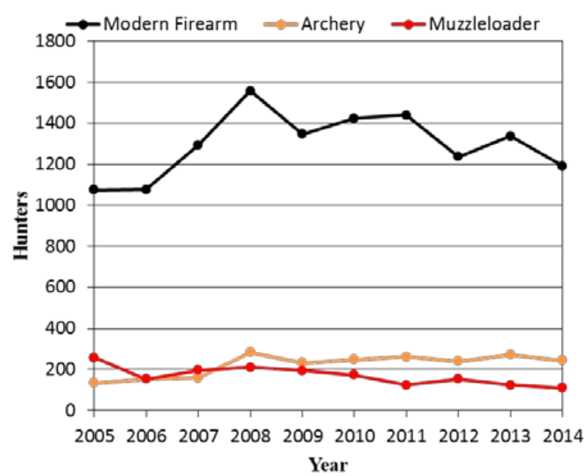

Figure 57. Number of general season deer hunters by weapon type in GMU 654, from 2005–2014.

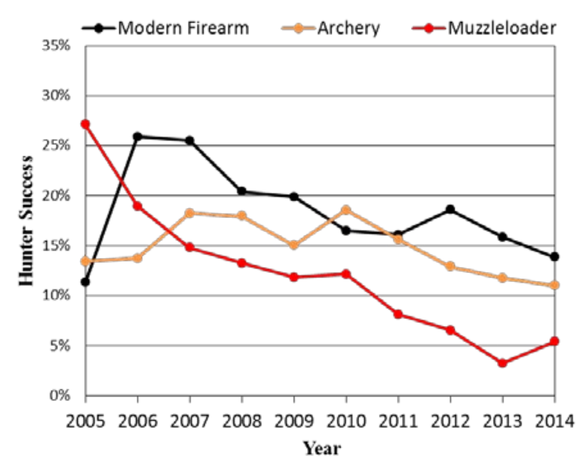

Figure 58. Hunter success by weapon type during the general season in GMU 654, from 2005–2014.

Anderson Island - GMU 655
2014 was the first year harvest data was reported for GMU 655. Combined general and permit season deer harvest in GMU 655 was estimated to be 21 deer in 2014. The proportion of deer harvested by user group was estimated to be 57% modern firearm, 24% archery, and 5% by multi-season permit hunters. General season success rates were 71% for archery hunters, 30% for modern firearm, and no muzzleloader hunters reported hunting in this GMU.

North River - GMU 658
General season deer harvest in GMU 658 was estimated to be 120 deer in 2014; a 26% increase compared to 2013 and lower than the previous 10-year average of 128 (Figure 59). Eighty-five special permits were available in 2014; of these, 37 hunters reported harvesting 17 deer. Modern firearm hunters comprise the largest user group in this GMU (Figure 60). Since 2005, general season success rates have averaged 12% for archery hunters, 17% for modern firearm hunters, and 5% for muzzleloaders (Figure 61). No tribal deer harvest has been reported for this unit since 2001.

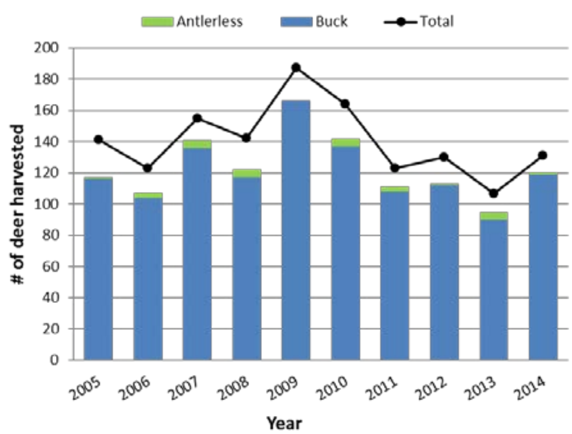

Figure 59. Total number of black-tailed deer harvested annually in GMU 658, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

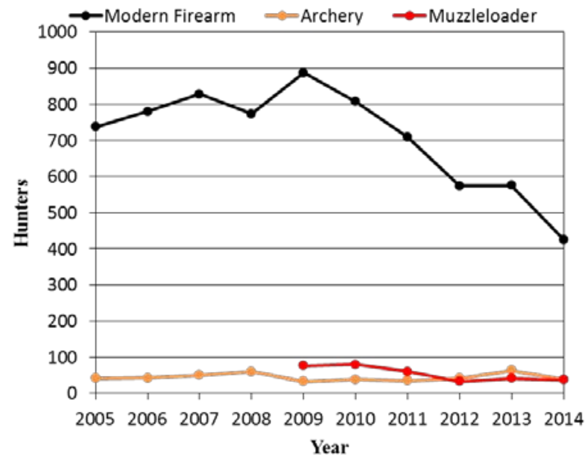

Figure 60. Number of general season deer hunters by weapon type in GMU 658, from 2005–2014.

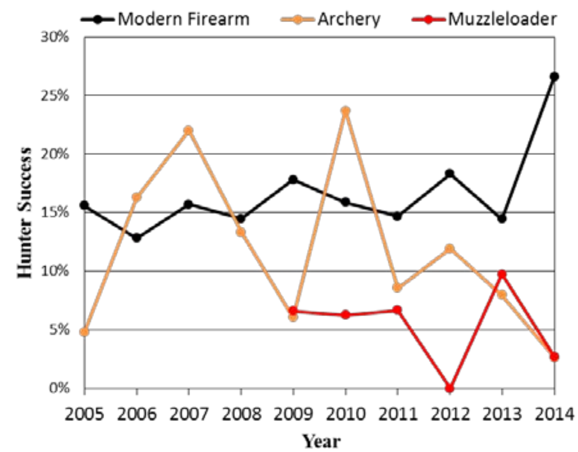

Figure 61. Hunter success by weapon type during the general season in GMU 658, from 2005–2014.

Minot Peak - GMU 660
General season deer harvest in GMU 660 was estimated to be 208 deer in 2014; an 11% increase compared to 2013 and similar to the previous 10-year average of 207 (Figure 62). Twenty special permits were available in 2014; of these, 10 hunters reported harvesting 2 deer. Modern firearm hunters comprise the largest user group in this GMU (Figure 63). Since 2005, general season success rates have averaged 18% for archery hunters, 21% for modern firearm hunters, and 7% for muzzleloaders (Figure 64). Very little tribal deer hunting occurs in this GMU.

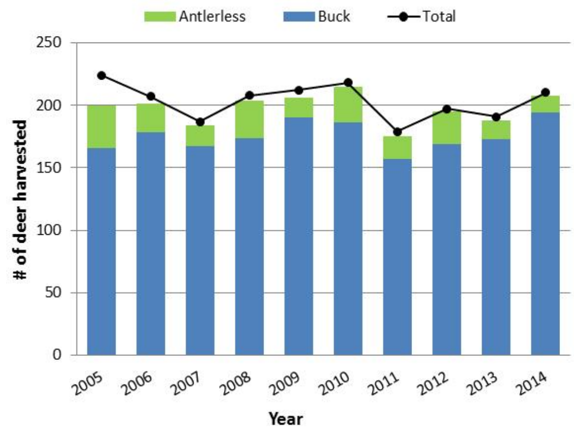

Figure 62. Total number of black-tailed deer harvested annually in GMU 660, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

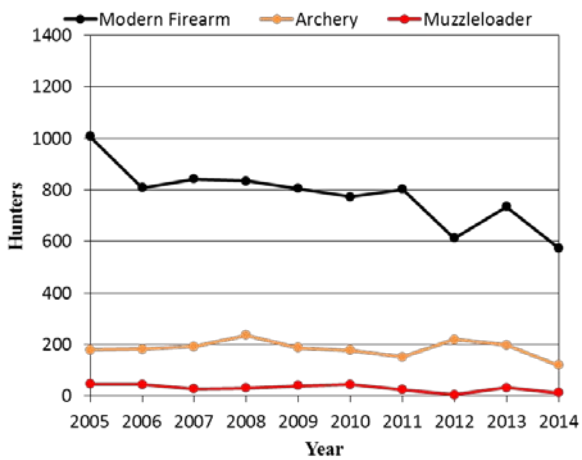

Figure 63. Number of general season deer hunters by weapon type in GMU 660, from 2005–2014.

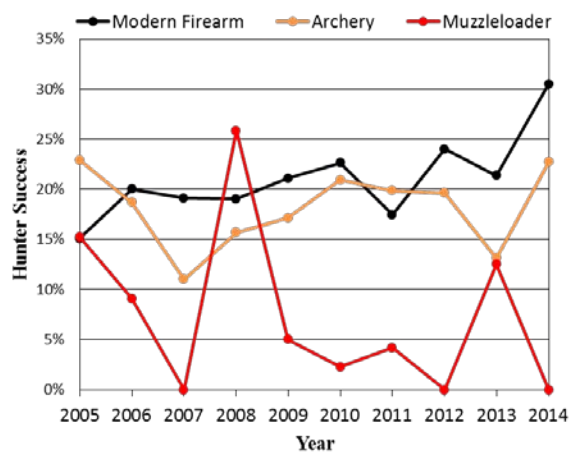

Figure 64. Hunter success by weapon type during the general season in GMU 660, from 2005–2014.

Capitol Peak - GMU 663

General season deer harvest in GMU 663 was estimated to be 415 deer in 2014; a 6% increase compared to 2013 and higher than the previous 10-year average of 332 (Figure 65). Forty special permits were available in 2014; of these, 25 hunters reported harvesting 10 deer. Modern firearm hunters comprise the largest user group in this GMU (Figure 66). Since 2005, general season success rates have averaged 23% for archery hunters, 19% for modern firearm hunters, and 14% for muzzleloaders (Figure 67). On average, tribal hunting accounts for 3% of the total deer taken in this GMU each year.

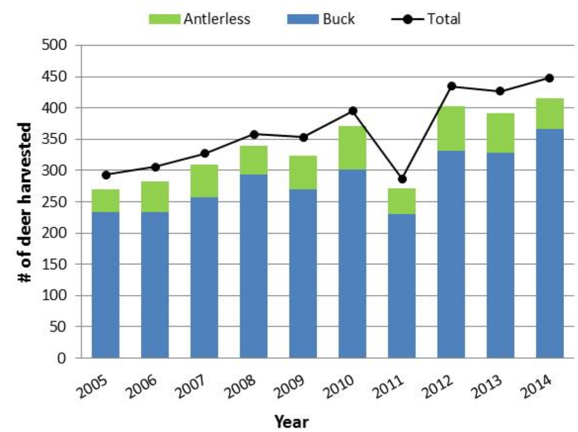

Figure 65. Total number of black-tailed deer harvested annually in GMU 663, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

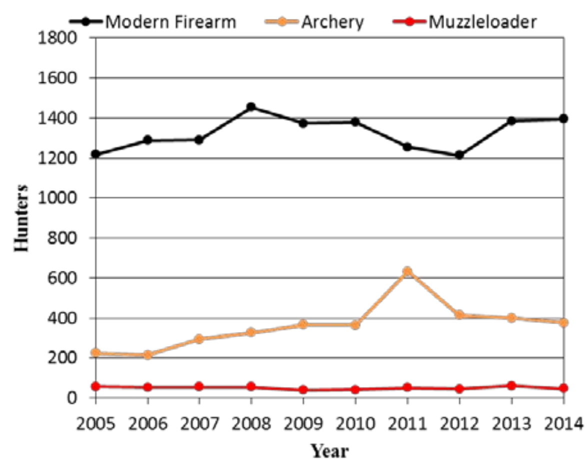

Figure 66. Number of general season deer hunters by weapon type in GMU 663, from 2005–2014.

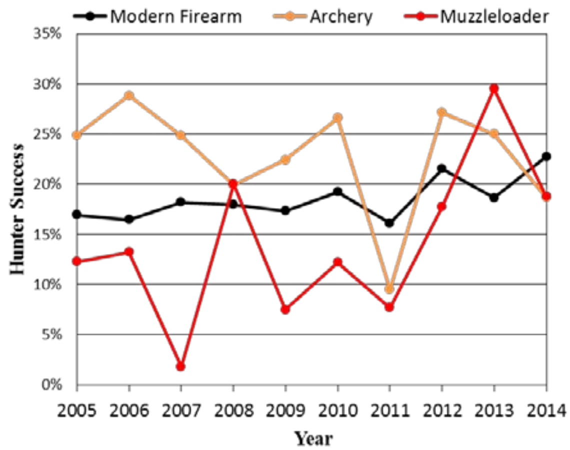

Figure 67. Hunter success by weapon type during the general season in GMU 663, from 2005–2014.

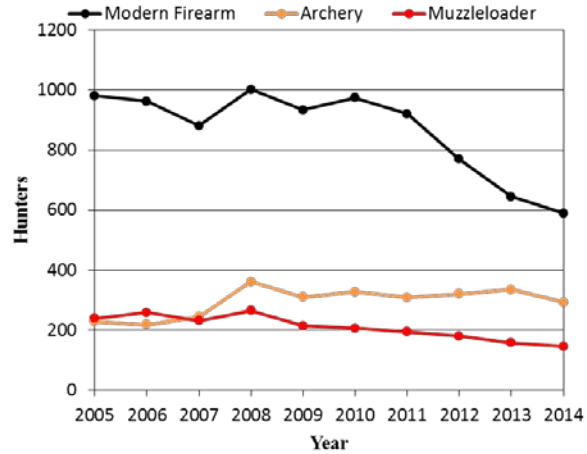

Figure 69. Number of general season deer hunters by weapon type in GMU 666, from 2005–2014.

Deschutes - GMU 666

General season deer harvest in GMU 666 was estimated to be 244 deer in 2014; a 4% increase compared to 2013 and lower than the 10-year average of 260 (Figure 68). There were 40 special permits available in the 2014 season; of these, 9 hunters reported harvesting 3 deer. Modern firearm hunters comprise the largest user group in this GMU (Figure 69). Since 2005, general season success rates have averaged 17% for archery hunters, 18% for modern firearm, and 18% for muzzleloader hunters (Figure 70). On average, tribal hunting accounts for 2% of the total deer taken in this GMU each year.

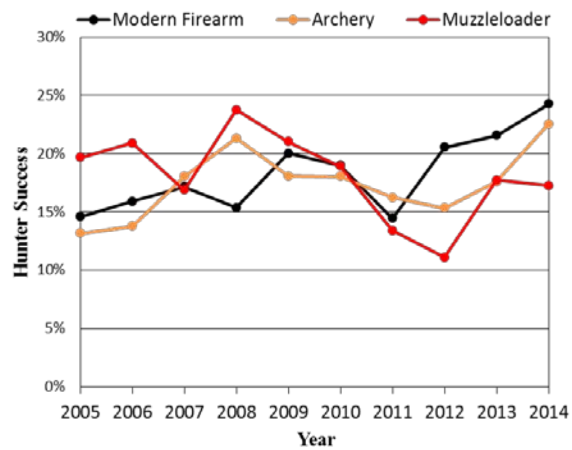

Figure 70. Hunter success by weapon type during the general season in GMU 666, from 2005–2014.

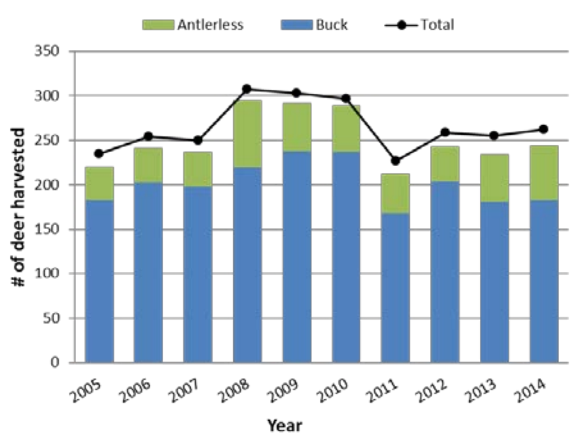

Figure 68. Total number of black-tailed deer harvested annually in GMU 666, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

Skookumchuck - GMU 667

General season deer harvest in GMU 667 was estimated to be 795 deer in 2014; a 15% increase compared to 2013 and similar to the 10-year average of 798 (Figure 71). There were 90 special permits available in the 2014 season; of these, 58 hunters reported harvesting 27 deer. Modern firearm hunters comprise the largest user group in this GMU (Figure 72). Since 2005, general season success rates have averaged 21% for archery hunters and 24% for modern firearm hunters (Figure 73). Muzzleloader hunter success has averaged 10%, since a general season was added to this GMU in 2009. On average, tribal hunting accounts for less than 1% of the total deer taken in this GMU each year.

The decline in modern firearm hunters in this unit is related to increased access restrictions imposed on private forestlands; however, hunter success increased following the closure and deer harvest has remained similar to previous years.

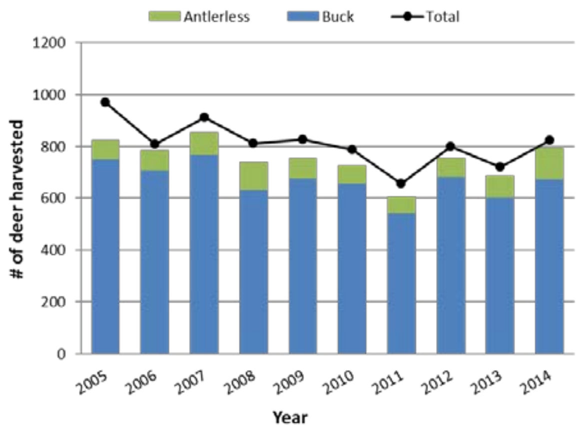

Figure 71. Total number of black-tailed deer harvested annually in GMU 667, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

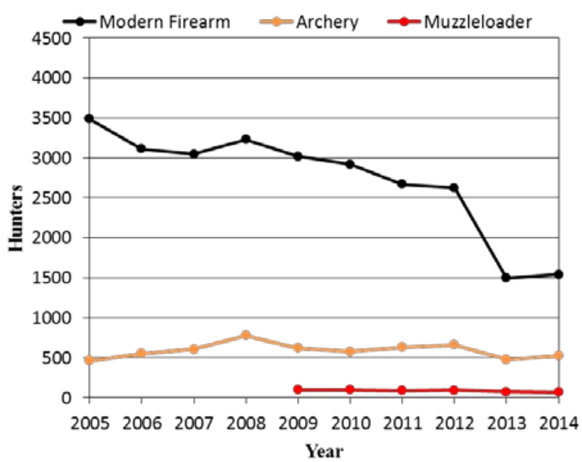

Figure 72. Number of general season deer hunters by weapon type in GMU 667, from 2005–2014.

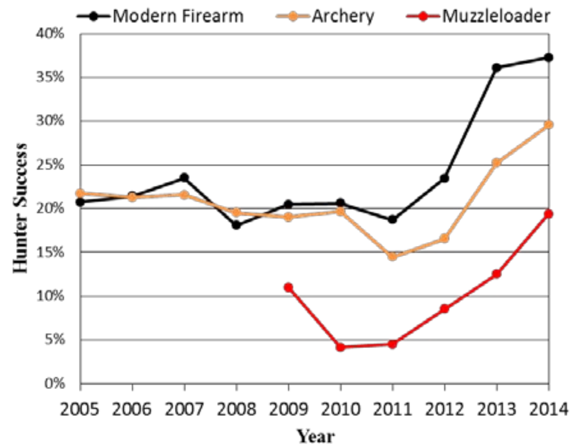

Figure 73. Hunter success by weapon type during the general season in GMU 667, from 2005–2014.

Fall River - GMU 672

General season deer harvest in GMU 672 was estimated to be 229 deer in 2014; an 8% increase compared to 2013 and similar to the previous 10-year average of 232 (Figure 74). There were no special permits available in this GMU in 2014. Modern firearm hunters comprise the largest user group in this GMU (Figure 75). Since 2005, general season success rates have averaged 17% for archery hunters, 22% for modern firearm hunters, and 7% for muzzleloaders (Figure 76). On average, tribal hunting accounts for less than 1% of the total deer taken in this GMU each year.

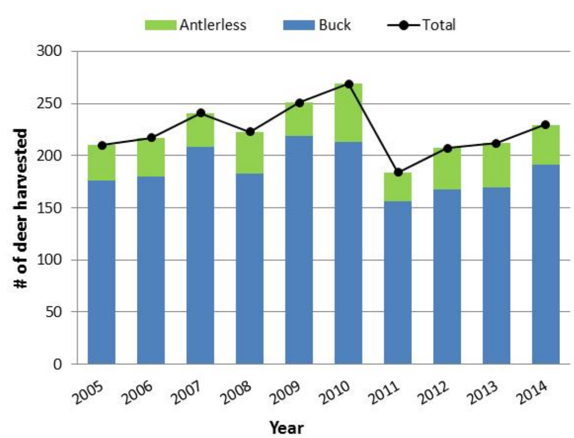

Figure 74. Total number of black-tailed deer harvested annually in GMU 672, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

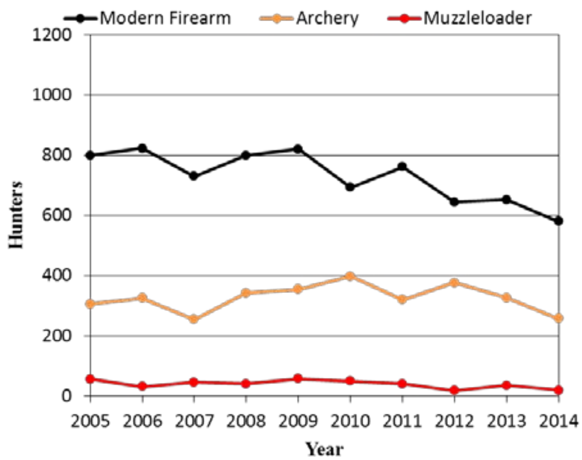

Figure 75. Number of general season deer hunters by weapon type in GMU 672, from 2005–2014.

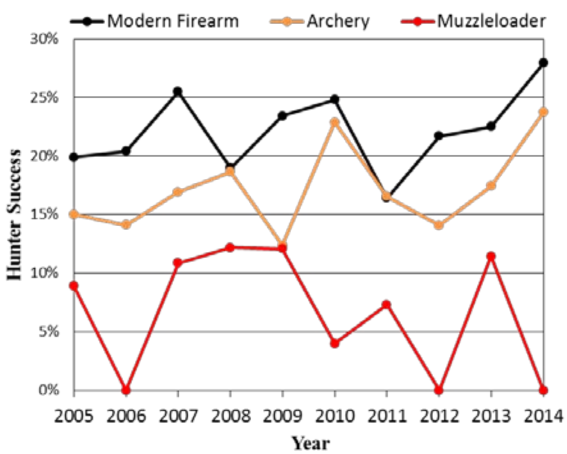

Figure 76. Hunter success by weapon type during the general season in GMU 672, from 2005–2014.

Williams Creek - GMU 673

General season deer harvest in GMU 673 was estimated to be 208 deer in 2014; a 4% decrease compared to 2013 and higher than the previous 10-year average of 170 (Figure 77). Ten special permits were available in 2014; of these, 7 hunters reported harvesting 3 deer. Modern firearm hunters comprise the largest user group in this GMU (Figure 78). Since 2005, general season success rates have averaged 3% for archery hunters, 21% for modern firearm hunters, and 33% for muzzleloaders (Figure 79). No tribal hunting has been reported in this GMU recently.

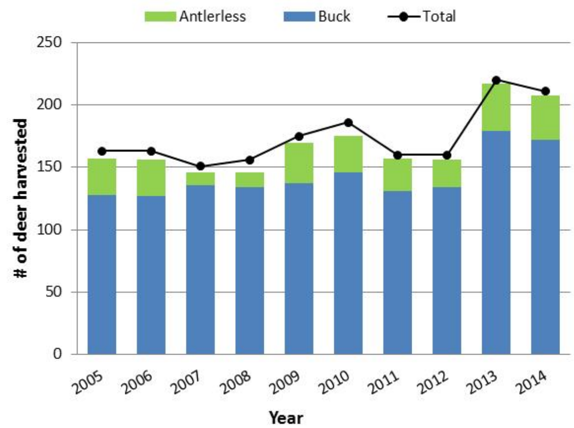

Figure 77. Total number of black-tailed deer harvested annually in GMU 673, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

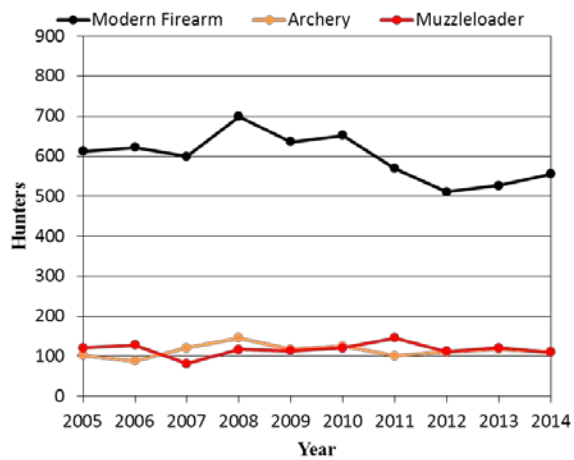

Figure 78. Number of general season deer hunters by weapon type in GMU 673, from 2005–2014.

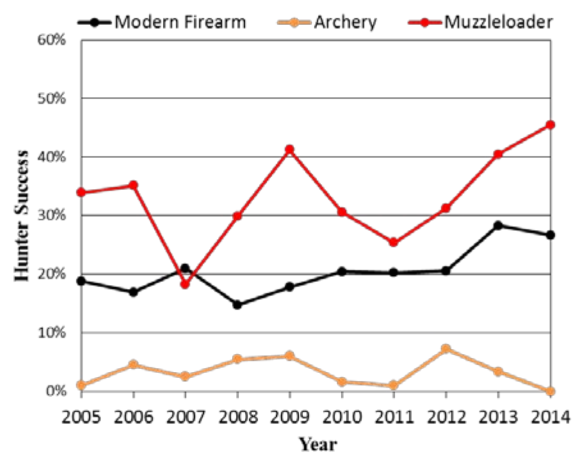

Figure 79. Hunter success by weapon type during the general season in GMU 673, from 2005–2014.

Bear River - GMU 681

General season deer harvest in GMU 681 was estimated to be 52 deer in 2014; an 86% increase compared to 2013 and higher than the previous 10-year average of 33 (Figure 80). There were no special permits available in this GMU in 2014. Modern firearm hunters comprise the largest user group in this GMU (Figure 81). Since 2005, general season success rates have averaged 8% for archery hunters and 14% for modern firearm hunters; there hasn't been a muzzleloader season in this GMU recently (Figure 82). No tribal hunting has been reported in this GMU recently.

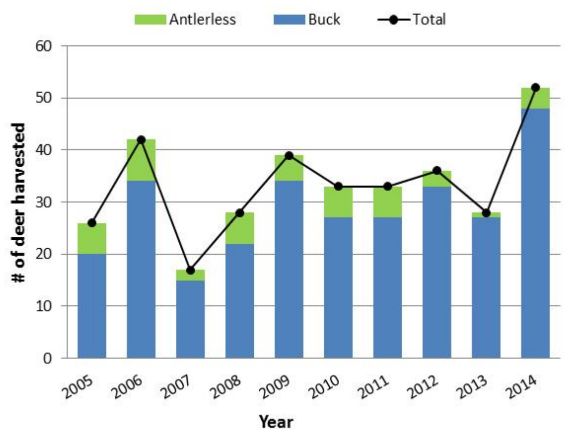

Figure 80. Total number of black-tailed deer harvested annually in GMU 681, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

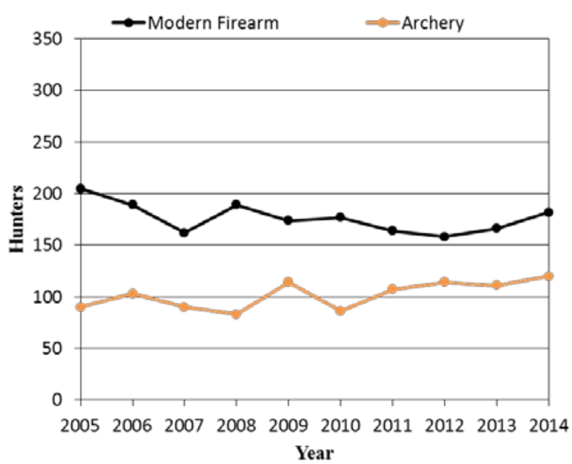

Figure 81. Number of general season deer hunters by weapon type in GMU 681, from 2005–2014.

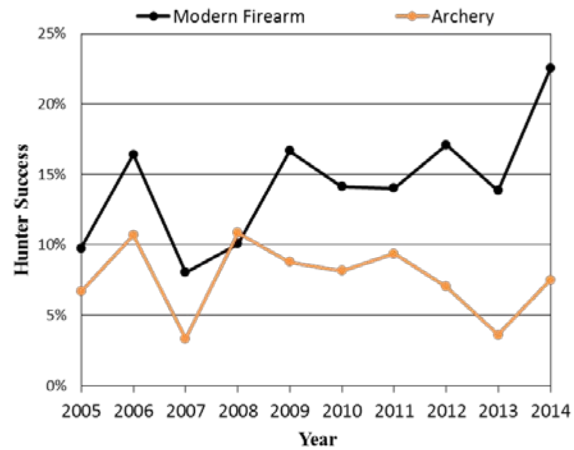

Figure 82. Hunter success by weapon type during the general season in GMU 681, from 2005–2014.

Long Beach - GMU 684

General season deer harvest in GMU 684 was estimated to be 25 deer in 2014; a 31% decrease compared to 2013 and lower than the previous 10-year average of 30 (Figure 83). There were no special permits available in this GMU in 2014. Modern firearm hunters comprise the largest user group in this GMU (Figure 84). Since 2005, general season success rates have averaged 33% for archery hunters, 29% for modern firearm hunters, and 15% for muzzleloaders (Figure 85). No tribal hunting has been reported in this GMU recently.

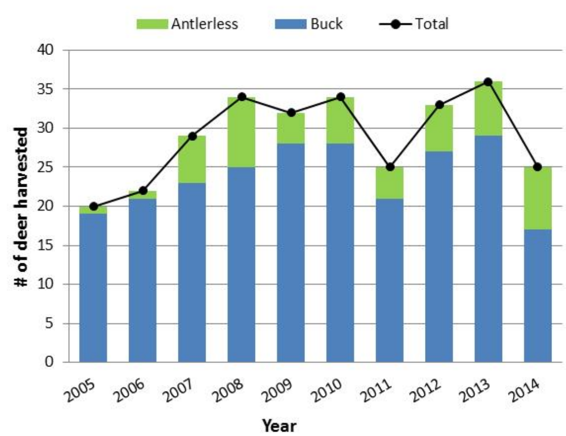

Figure 83. Total number of black-tailed deer harvested annually in GMU 684, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

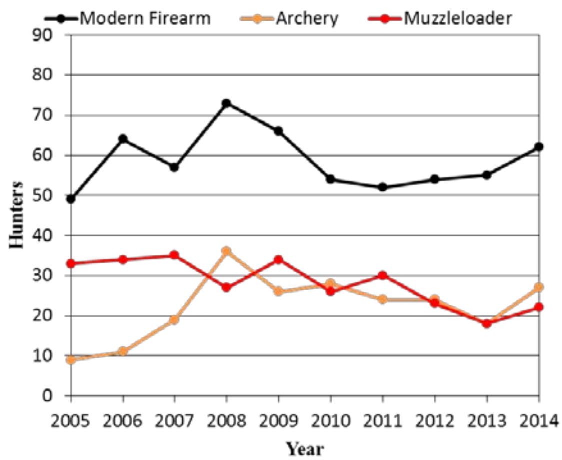

Figure 84. Number of general season deer hunters by weapon type in GMU 684, from 2005–2014.

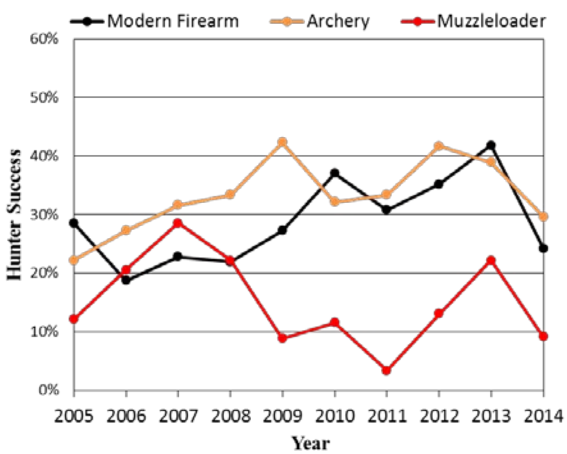

Figure 85. Hunter success by weapon type during the general season in GMU 684, from 2005–2014.

Long Island - GMU 699

Very few deer are taken in this GMU each year (Figure 86). In 2014, 2 bucks and 1 doe were harvested by archery hunters. There were no special permits available in this GMU in 2014. Archery hunters comprise the largest user group in this GMU, averaging 1% success rate since 2005. A late-modern firearm season has seen some participation, but the number of hunters reporting in this GMU has averaged only 2 and only one deer was harvested since 2005. No tribal hunting has been reported in this GMU recently.

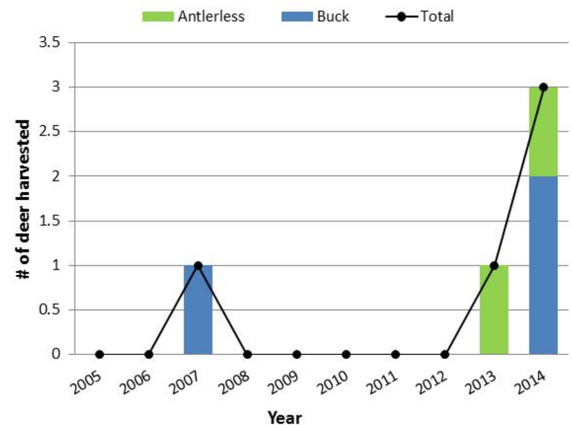

Figure 86. Total number of black-tailed deer harvested annually in GMU 699, from 2005–2014. Total includes deer harvested in general, permit, and tribal seasons; while, buck and antlerless totals are from the general state season only.

Monitoring

Monitoring is primarily achieved via mandatory hunter reporting and, when funding is available, through composition surveys or more targeted projects related to specific GMUs or study areas. Tribal game harvest reports are compiled and published annually by the Northwest Indian Fisheries Commission (for data referred to in this document, see the NWIFC Big Game Harvest Reports for Western Washington Treaty Tribes; 2005-2014/5). Tribal research also provides valuable information on black-tailed deer in Region 6, through work conducted independently and in cooperation with WDFW.

WDFW has established post-season buck to doe ratio targets as a means to assess varying levels of harvest intensity (WDFW Game Management Plan 2015). In this context, GMUs in Region 6 are managed to allow a liberal level of hunting intensity; indexed by post-season buck: doe ratio objectives ranging from 15-19 bucks per 100 does. In Region 6, composition surveys of black-tailed deer, when conducted, are usually flown in late-August or early-September to assess pre-season buck to doe ratios, a time when both age and sex classes are more readily distinguished and anecdotally bucks are more likely to occupy open habitats prior to antler hardening; nonetheless, it is likely that buck to doe ratios are minimum estimates due to the reclusive nature of the black-tail buck. Although pre-season buck: doe ratio targets have not been identified for Region 6 GMUs, inferences can be made about the level of harvest intensity assuming average buck mortality.

In Washington, annual survival of black-tailed bucks averages around 50% in forested landscapes with hunting identified as the primary source of mortality (McCorquodale 1999, Bender et al. 2004[1]). In more urbanized habitat, annual buck survival was estimated to be 86% with causes of mortality other than hunting being most common (Bender et al. 2004[2]).

Funding for composition surveys in Region 6 has been periodic and limited. The most consistently surveyed GMU was Skookumchuck (667), which was surveyed annually from 1995-2009 (Figure 87); pre-season buck to doe ratios averaged 22:100. Sampling has been periodic in the Willapa Hills portion of Region 6, but on average there were 16 bucks per 100 does in fall surveys conducted in these GMUs (Figure 88). Sampling has also been inconsistent and periodic in GMUs in the southern and eastern portion of the Olympic Peninsula, often conducted in cooperation with the Skokomish Tribe. On average there were 31 bucks per 100 does in fall surveys conducted in these GMUs (Figure 89). The Makah Tribe has reported pre-season buck to doe ratios ranging from 20 to 39 per 100 does in the Hoko (601) (McCoy, pers. comm.) and the Elwha Tribe conducted a composition survey in the Pysht (603) in 2014, reporting 29 bucks per 100 does (Sager-Fradkin, pers. comm.) (Figure 90). No composition flights were flown in 2014 by WDFW in Region 6.

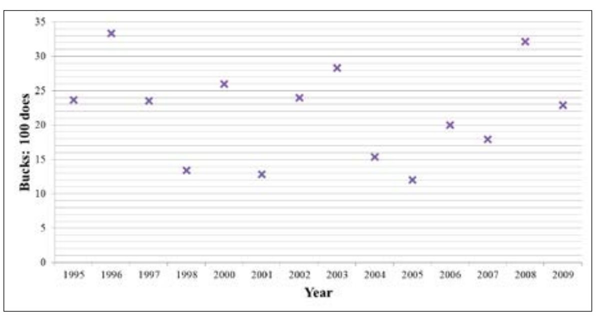

Figure 87. Fall buck to doe ratios derived from composition surveys conducted in GMU 667 from 1995-2009.

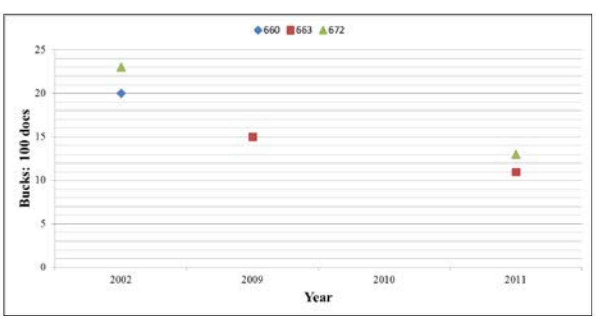

Figure 88. Southwest Region 6 GMUs, fall composition of bucks per 100 does, periodic sampling from 2002 to 2011.

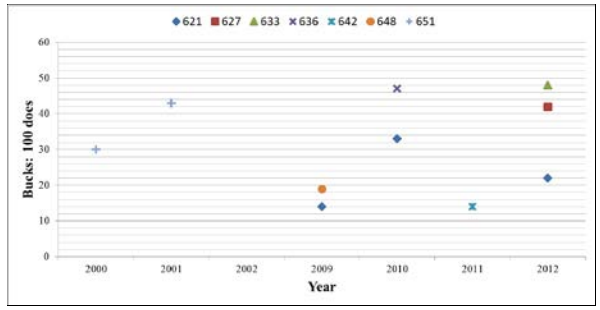

Figure 89. Fall buck per 100 doe composition among Game Management Units in the southern and eastern portions of the Olympic Peninsula, periodic sampling from 2000 to 2012.

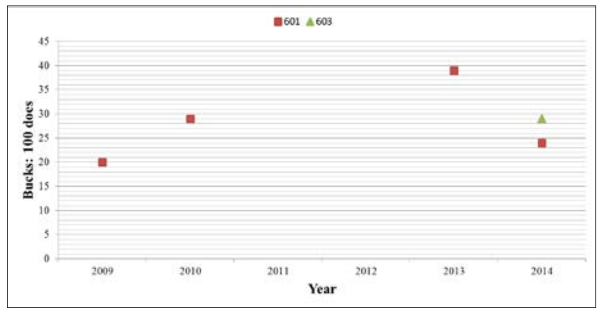

Figure 90. Fall buck per 100 doe composition in GMUs 601 and 60, periodic sampling from 2009 to 2014.

The Muckleshoot Tribe began studying doe survival in the White River (653) in 2004. A preliminary analysis in 2013 indicated annual survival averaged 85% and ranged from 78-91% (D. Vales, pers. communication). In January and February of 2015, they increased their marked deer sample to 44 by radio marking 29 does with Vertex survey GPS Globalstar collars, which better track movements and acquire more timely mortality information and deployed radio-transmitting ear tags on 7 male fawns/yearlings that were incidentally captured (D. Vales, pers. communication). The Muckleshoot Tribe plans to conduct aerial surveys in December to estimate the number of deer using a mark-resight estimator based on the collared deer (D. Vales, pers. communication).

The Makah Tribe found similar adult doe survival rates in the Hoko (601) where annual survival rates ranged from 79-87% (McCoy et al. 2014). McCoy et al. (2014) estimated that predation accounted for 74% of all fawn mortality in the Hoko (601) and annual fawn survival averaged 33% (95% CI = 24-43). In this study, fawn survival was strongly influenced by the presence of hair-loss syndrome (HLS), fawns with HLS had an over-winter survival probability of 57% (95% CI=41-72), while fawns without HLS had an over-winter survival probability of 80% (95% CI=65-89) (McCoy et al. 2014). The health of HLS afflicted deer is compromised directly by the loss of hair and their ability to maintain body temperature. And, indirectly through an alteration of behavior, where in response to irritation caused by the non-native biting lice, afflicted deer will spend less time feeding and more time scratching or grooming (S. Murphie, 2010). Modeling black-tail population trends with and assuming without HLS present indicated that HLS, coupled with predation, was likely limiting the deer population in the Hoko (601) (McCoy et al. 2014). This was the first study to illustrate how HLS may be negatively influencing black-tailed deer populations, particularly in the coastal habitats on the Olympic Peninsula of Washington.

In 2014, the Elwha Tribe initiated studies of fawn and buck survival and causes of mortality in the Pysht (603). Their projects are anticipated to last until 2017. Preliminary results indicate predation is a predominant cause of mortality among fawns, while hunting is the leading cause of mortality among bucks (Sager-Fradkin, personal communication).

Population status

Currently, WDFW does not use formal estimates or indices of population size to monitor black-tail deer populations. Instead, trends in harvest, hunter success, and catch per unit effort are used as surrogates to a formal index or estimate of population size. Provided harvest and participation are robust, these statistics can provide a reasonable indicator of population trend. However, deer harvest can be influenced by factors other than density. Changes to hunting regulations and the fairly recent trend of timber companies restricting or limiting access to hunt, make it difficult to compare harvest estimates across years. WDFW is currently evaluating new approaches to monitor black-tailed deer populations that are independent of harvest data.

Habitat

Black-tailed deer consume a variety of browse including woody shrubs, forbs, lichens, and some grasses and have a selective foraging strategy, preferring to consume the most nutritious plants, rather than consuming more low quality forage (Nelson et al. 2008). Woody shrubs and forbs are typically more abundant in younger, more recently disturbed sites (<20 years old) with less canopy cover than sites in mid- to late-seral stages; age-classes created predominately through active logging. GMUs heavily logged years ago will likely contain vast areas of single-aged stands in the mid- to late-seral stage of forest succession; the least productive for ungulate forage. While in other units, active timber harvest continues to create early seral habitat. Those units or portions of units that include a diverse mix of stand-ages and types are likely to provide the most benefit to black-tailed deer and higher deer abundance.

The effects of forest management strategies, particularly the use of herbicides and decreased burning are poorly understood, but may negatively influence ungulate forage and ultimately deer abundance. Two studies were recently initiated to examine these effects, as they relate to black-tailed deer.

In 2009, WDFW began a study examining the effects of forest management practices on black-tailed deer reproduction and survival. One hundred and eighty one does and 257 fawns have been fitted with either GPS or standard VHF collars at 8 sites in Regions 5 and 6 (C. Rice, pers. communication). The project is expected to continue through 2017.

In 2012, WSU with funding provided by WDFW, the Muckleshoot Tribe, National Council for Air and Steam Improvement, and Weyerhaeuser, initiated a project studying the nutritional ecology of black-tailed deer and how timber management practices influence the availability and quality of forage for black-tailed deer. Data from this project are currently being analyzed with a report expected in late 2015.

Hunter access

WDFW actively works with timber companies to maintain hunting access, as the vast majority of deer hunting opportunities in Region 6 occur on private industrial forestlands. There is an increasing trend among timber companies to restrict public access or require an access permit to hunt or recreate on their lands. This is impacting hunting opportunities in Region 6, as the number of access permits issued can be lower than previous hunter participation rates and the cost of the permit is an added burden hunters must bear to hunt in some units. Although the addition of access permits has caused the number of hunters to decline in some GMUs, hunter success has increased, as fewer hunters are afield. Satsop (651) and Skookumchuck (667) are two examples where changes in access have decreased hunter participation, but hunter success has improved. Access may also be restricted due to the risk of fire; this predominately affects early season archery and muzzleloader hunters.

The following rating system was developed for GMUs to give hunters a general idea of what type of access is available in the GMU they are thinking of hunting. Access ratings are specific to the level of motorized access that is allowed and does not refer to the level of access in general. Several GMU's have some type of fee access areas that grant the permit or lease holders a higher level of access. The following ratings are based on a hunter not having a lease or permit and are meant to provide a general and broad overview of access conditions. Each GMU was given a rating of excellent, good, or poor (Table 2) with the level of access associated with each rating as follows:

- **Excellent**---most if not all of the main logging roads are open, as well as, most of the spur roads.
- **Good**---There is a mix of open and closed roads with most main logging roads open, but many of the spur roads are closed to motorized access.
- **Poor**---Most of the GMU is closed to motorized access, but is open to non-motorized access. Private timberlands may require an access permit.

Information provided is a brief description of major landowners and the level of motorized access a hunter can expect. Access rules change through the seasons and vary by year. Information is updated when available.

Table 2. Anticipated motorized access rating for Region 6 Game Management Units (GMUs) in 2015.

GMU	Access Rating		
	Excellent	Good	Poor
Hoko (601)			X
Dickey (602)			X
Pysht (603)			X
Sol Duc (607)		X	
Goodman (612)		X	
Clearwater (615)		X	
Matheny (618)		X	
Olympic (621)		X	
Coyle (624)			X
Kitsap (627)			X
Mason (633)			X
Skokomish (636)		X	
Quinault Ridge (638)		X	
Copalis (642)			X
Wynoochee (648)			X
Satsop (651)			X
Puyallup (652)		X	
White River (653)[1]		X	
Mashel (654)[1]		X	
Anderson Island (655)			X
North River (658)		X	
Minot Peak (660)			X
Capitol Peak (663)	X		
Deschutes (666)			X
Skookumchuck (667)			X
Fall River (672)		X	
Williams Creek (673)			X
Bear River (681)		X	
Long Beach (684)			X
Long Island (699)			X

[1]Access to land owned by Hancock Timber Resources in these GMUs requires an access permit.

Wildlife conflict

In Region 6, deer conflict management is predominately directed at reducing urban deer issues commonly associated with expanding urban development into deer habitat or expanding deer populations within existing urban landscapes. Agricultural deer damage is mostly limited to nurseries and smaller farming operations such as cranberries, blue berries, and small vegetable gardens where produce is grown for local farmer's markets. For 2014, 21 Damage Prevention Cooperative Agreements involving deer were active in Region 6. Seven of these agreements were specifically for deer damage with the remaining addressing both deer and elk damage. These agreements focus on nonlethal actions and working with producers to allow public hunting access to address the damage problems. Nonlethal methods include pyrotechnics, noise making devices, and other means to deter deer from damaging crops. In many cases landowners are encouraged to install deer proof fencing, when feasible, to reduce use.

Most of the deer conflict issues occur in areas where natural mortality is considered low thus management actions generally revolve around liberalizing hunting seasons or legal deer restrictions, as well as, adding second deer permits in attempt to increase harvest. However, these efforts often have limited value, as local shooting or hunting ordinances can reduce deer hunting activity despite reduced restrictions. Master Hunter permits are also issued for areas in Region 6 designated by conflict staff to address damage issues.

In response to damage/conflict issues, liberal deer hunting seasons have been established in GMUs 624, 627, 633, 655, 666, and 684. One hundred and seventy second deer permits were available in Region 6 in 2014, but participation and success were quite low; 36 hunters reported harvesting 18 does. Twenty Master Hunter permits were available in 2014, but only 2 hunters reported hunting with this permit; both harvested a doe.

Acknowledgments
District Wildlife Biologist A. Novack, Wildlife Biologist T. Schmidt, Wildlife Conflict Specialist S. Harris, and RPM B. Calkins provided valuable reviews and comments on this report.

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Elk

ELK STATUS AND TREND REPORT: REGION 1
SELKIRK HERD
GMUs 101, 105, 108, 111, 113, 117, 121

DANA L. BASE, District Wildlife Biologist
ANNEMARIE PRINCE, Assistant District Wildlife Biologist

Population objectives and guidelines
The primary goal of elk management in the Colville District is to provide for sustainable annual hunter harvest while maintaining a viable and productive elk population (WDFW 2014a). Management objectives for the Selkirk Elk Herd are outlined in the Selkirk Elk Herd Plan (WDFW 2014b) and are as follows:

- Develop and implement a formal survey protocol to generate an elk population estimate or index for the Selkirk elk herd.
- Expand the Pend Oreille sub-herd population numbers from today's current level (about 1,500) to an upper limit of 2,500.
- Manage for bull ratio estimates of 12 to 20 bulls per 100 cows post-hunt and/or 15 to 35 bulls per 100 cows pre-hunt.
- Encourage the conservation of elk habitat on private lands within the Selkirk Herd area.
- Minimize the number of elk caused damage claims.
- Cooperate and collaborate with the Kalispel Tribe of Indians, Confederated Tribes of the Colville Indian Reservation, the Spokane Tribe of Indians, and the Coeur d'Alene Tribe to implement the Selkirk Elk Herd Plan, including development of hunting season packages conducted on a 3-year cycle.
- Cooperate and collaborate with County Governments to implement the Selkirk Elk Herd Plan especially in discussions of problems and solutions associated with elk damage and conflict.

Hunting seasons and harvest trends
Elk are widely scattered in small groups throughout the densely forested region of northeastern Washington. As a consequence, elk in northeastern Washington are difficult both to survey and to hunt.

Since 2003, there were multiple shifts in the seasons and opportunities for archery and muzzleloader elk hunters. In the 2003 – 2005 season package, the early archery season opened later than in the past (Sept. 8) and spanned 14 days. In 2009, the opener was shifted to the Tuesday after Labor Day and season length was reduced to 13 days and remained so through 2014. In 2003, muzzleloaders gained the opportunity to hunt elk in the Selkirk GMU (113). Also in 2003, the muzzleloader season in GMUs 101, 105, 108, and 121 was separated from the modern firearm season and placed in a muzzleloader only hunt in early October. In 2006, GMU 117 was added to the muzzleloader season making all GMUs open to all hunt methods during their respective seasons. Season timings and increased opportunities for archers and muzzleloaders resulted in a significant increase in harvest for those groups. While hunter numbers for archers and muzzleloaders have held steady since 2008, the number of modern firearm hunters has been variable (Figures 1). However, this hasn't had a large effect on total harvest (Table 1 and Figure 2).

The "multiple season" elk tag was introduced in 2006 and has resulted in variable harvest. Hunter success is generally higher for multi-season tag holders and was at approximately 26% in 2014 compared to general methods at about 5%.

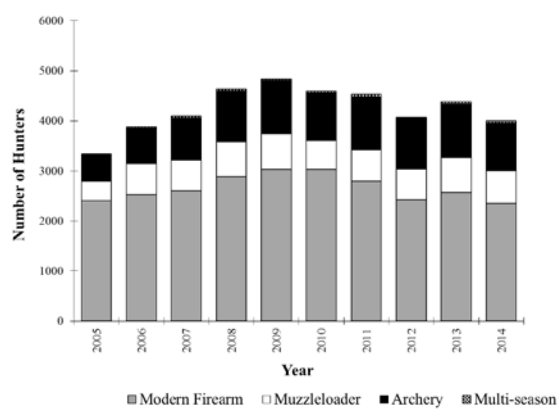

Figure 1. Number of elk hunters by hunt method for GMUs 101-121, 2005 – 2014.

As a result of development of the Selkirk Elk Herd Management Plan (2014), hunting opportunity for any elk within GMUs 101, 105, 108, and 121 changed to antlered bull only in 2012. From 2005 – 2014, the proportions of bulls harvested by antler point category have remained fairly stable (Table 3).With the exception of the early archery season, antlerless elk may still be taken within these GMUs, but may now be taken only by special permit. For the 2014 season, 170 special permits were available in District 1 (Table 2).

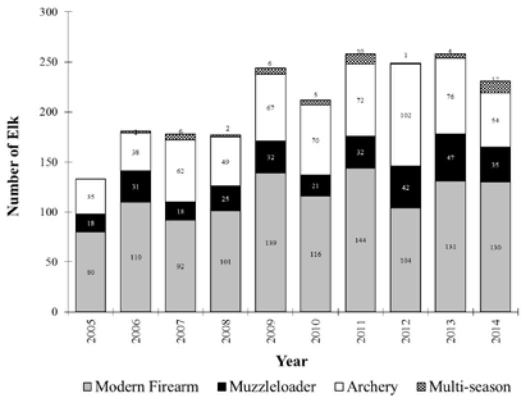

Figure 2. Number of elk harvested by hunt method for GMUs 101 – 121, 2005 – 2014.

Special permit antlerless hunts are designed to provide added hunter opportunity for antlerless elk and address landowner conflict where it occurs. In District 1, special permits for antlerless elk provide enhanced recreational opportunity for hunters, but the harvest is modest and of limited utility in addressing elk damage concerns. The special permit harvest in 2014 was 34 elk and hunters had a success rate of 20% (Table 2).

Surveys

Devoting substantial resources for surveying elk has not been a high priority in District 1 because harvest levels are relatively low for the northern Selkirk Herd compared with other regions of the state. In addition, surveys in the Selkirk Herd area are hampered by extensive forested habitat. For management decisions, we primarily rely on trends in harvest (Table 3).

No aerial surveys focusing exclusively on elk have been accomplished for several years. The best opportunity to observe elk for ground-based surveys is in the early spring from mid-March to early May. Qualified volunteers have been enlisted when available to help survey elk. During early mornings or early evenings before dark, observations of elk concentrating on "green-up" fields or within forest openings are recorded. Calf:cow ratios and trends in total elk observed is the most reliable information gathered in early spring surveys in District 1. Survey effort and coverage has varied considerably since 1998and in 2014 no spring surveys were conducted.

Population status and trend analysis

The Selkirk elk herd is likely increasing in numbers and distribution based on harvest data and observations made by WDFW staff. The limiting factor for this herd is probably the amount of habitat created by active timber management and wildlife damage issues occurring on agricultural lands adjacent to elk habitat. While this elk population appears to be within the range of the current population objective, better estimates are needed. Precise estimates of the total population, post hunting season bull:cow ratios, and bull age structure cannot be calculated using current data and methods. Population data are limited, but there is currently no indication that bull: cow ratios or opportunities for quality bull hunting are declining. In fact, stable hunter harvest and anecdotal information indicate that elk populations are increasing.

Habitat condition and trend

Habitat conditions for elk in the Pend Oreille sub-herd are changing both positively and negatively. Road closures by federal, state, and private land managers were aggressive in recent years, and are highly beneficial for elk security. Logging continues on federal and state forest lands and even more intensively on private lands. The high rate of logging during the 1990s in central Pend Oreille County produced early successional forest and the accompanying forage that elk select. Recently, large tracts of private industrial timberlands were treated with herbicides to control hardwood shrubs that compete with regenerating conifer trees. Elk may be affected by this broad-scale herbicide application because forage could be reduced in sprayed areas. However, there have been no research projects in Washington east of the Cascades to examine this potential negative effect on elk forage.

Wildlife damage

Elk damage to standing hay, baled hay, and stored hay continues in the Cottonwood Creek drainage (GMU 117) southeast of Chewelah and periodically within the Skookum Flats area of GMU 113. To help alleviate elk damage, antlerless permit opportunity increased substantially within GMU 117 beginning in 2008 with a permit season that included December 16-31. In addition, all user groups currently have general seasons within both GMUs 117 and 113, which puts pressure on elk that frequent agricultural land there. A total of 13 Damage Prevention Cooperative Agreements (DPCA) were made between the Department and private landowners since last year. WDFW may issue Landowner Damage Prevention Permits when and where circumstances are appropriate as another means of addressing damage to lands open to hunting.

Habitat enhancement

The Colville National Forest, with grant money from the Rocky Mountain Elk Foundation (RMEF), implemented many projects designed to benefit elk. As of 2014, completed projects amounted to an enhancement of 58,169 acres. Most of the projects involved prescribed burning to enhance winter forage production, but there were also projects to restore aspen stands and reclaim roadbeds for improved habitat. The majority of these projects were in the prime elk areas of Pend Oreille County (J. McGowan and M. Borysewicz, USFS, pers. comms. 2010 - 2014).

Management conclusions

The management objective for elk in the Colville District is being met with a sustained annual harvest of a viable and productive elk population with desirable population characteristics. While there are unreliable post-season survey data on bull:cow ratios, the prime bull (6 point +) percentage in the 2014 bull harvest was 28% which is indicative of desirable population characteristics for elk productivity and quality bull hunting opportunities (Table 3).

In recent years, WDFW provided increased opportunity or changed season timing to improve equity among the three hunting method groups. Hunter participation and harvest is now well dispersed across the Colville District for all three hunting methods. Discounting multi-season permit holders, in 2014, modern firearm hunters accounted for 59% of the participation and 59% of the kill. Archers accounted for 24% of the hunters and 29% of the kill and muzzleloaders accounted for 17% of the hunters and 13% of the kill.

The number of special permits issued for antlerless elk was 110 in 2014 for the three primary elk GMUs, 111, 113, and 117. While there was considerable interest in these special permits, the resulting harvest was modest. In 2014, the success rate of permit holders for GMUs 111, 113, and 117 was 29%.

In April of 2012, the Fish and Wildlife Commission adopted hunting seasons allowing only antlered bulls rather than any elk to be harvested for most general seasons within GMUs 101, 105, 108, and 121. This change was recommended in the draft Selkirk Elk Herd Management Plan as a means to moderately increase the elk population and its distribution throughout the Colville District. In June of 2014, the Selkirk Elk Herd Management Plan was finalized.

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Washington Department of Fish and Wildlife. 2014a. Game Management Plan. Washington Dept. of Fish and Wildlife, Olympia, WA. 162 pp.

Washington Department of Fish and Wildlife. 2014b. Selkirk Elk Herd Plan. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA. 70pp.

Table 1. General season and special permit season elk harvest, Colville District, GMUs 101-121, 2005 – 2014.

Year	Antlered Harvest	Antlerless Harvest	Total Harvest
2005	102	31	133
2006	136	45	181
2007	120	58	178
2008	119	68	187
2009	187	89	276
2010	147	85	232
2011	158	100	258
2012	201	51	252
2013	205	58	263
2014	184	50	234

Table 2. Special permit allocations and harvest, Colville District, GMUs 101-121, 2005 – 2014.

Year	Permits Issued	Antlered Killed	Antlerless Killed	Success Rate
2005	75	1	5	8%
2006	95	2	6	8%
2007	120	1	10	9 %
2008	120	1	20	18%
2009	120	0	16	14%
2010	120	0	25	21%
2011	135	0	24	18%
2012	160	1	27	18%
2013	160	0	34	21%
2014	170	0	34	20%

Table 3. Antler point distribution (high side) from general season hunter harvested elk, Colville District, GMUs 101-121, 2005 – 2014.

Year	1-2 points	3-5 points	6+ points	Total
2005	42 (42%)	34 (34%)	26 (26%)	102
2006	60 (44%)	31 (23%)	45 (33%)	136
2007	29 (24%)	52 (44%)	38 (32%)	119
2008	37 (31%)	44 (38%)	37 (31%)	118
2009	66 (36%)	68 (38%)	47 (26%)	181
2010	35 (24%)	51 (35%)	61 (41%)	147
2011	43 (27%)	66 (42%)	49 (31%)	158
2012	60 (30%)	75 (37%)	66 (33%)	201
2013	88 (43%)	63 (31%)	54 (26%)	205
2014	77 (42%)	55 (30%)	52 (28%)	184

ELK STATUS AND TREND REPORT: REGION 1

SPOKANE SUBHERD OF SELKIRK ELK HERD
GMUS 124, 127, 130, 133, 136, 139, 142

MICHAEL T. ATAMIAN, District Wildlife Biologist
CARRIE L. LOWE, Wildlife Biologist

Population objectives and guidelines

The goal for this elk (*Cervus elaphus*) subherd is to manage the population for a sustained yield at levels compatible with agriculture production and within tolerance levels of landowners occupying the rural-urban interface. Consequently "any elk" seasons are offered in these GMUs (WDFW 2014*a*).

These harvest strategies are mainly directed to control populations where agricultural damage and nuisance problems have persisted or increased. For the past few years, however, many local landowners have recognized the economic benefits of providing fee access for elk hunting, which has resulted in fewer damage complaints, increased hunter access, and subsequently, increased harvest.

Hunting seasons and harvest trends

The 2014 general elk hunting seasons for Game Management Units (GMUs) 124-142 did not change from the previous year. All units allowed the harvest of <u>Any Elk.</u>

Hunter numbers were down slightly this year relative to the previous two years, but above the 10 year average (Table 1). This may be a leveling off of the growth in hunter participation seen over the past ten years (Table 1). The decline in hunter numbers occurred for all weapon types but was proportionally greater for archers, at 11%. The decline in hunter numbers was not seen across all GMUs, but occurred most strongly in GMUs 124 and 130, the most popular units (Fig. 2)

This year's overall hunter success was 12%, back up to 2010-2012 levels after last year's drop to 9% (Table 1). Hunters experienced increased success with less effort (days hunted per kill) this year in all GMUs except for 136 & 139 (Fig. 3 & 4). By weapon, muzzleloaders harvested 71 animals at an 11% success rate, about the same as last year. Archers harvested 30 animals–the same as last year–, this combined with the decline in hunters resulted in a slight increase in success (Table 2). Modern firearm hunters harvested 212 animals– success was at a 10-year high of 14% (Table 2).

Total elk harvested during the general season was 319, up from last year's 272, but in line with 2010-2012 harvest (Table 1). When looking at harvest by GMU (Fig. 1), the increase was driven predominantly by greater harvest in GMUs 127 and 130. GMUs 124, 133, & 136 were stable, while 139 & 142 saw a decline in harvest. The decline in 139 and 142 is likely tied to the transient nature of the elk groups in these GMUs and private land access.

After dropping considerably in 2012 and 2013, bull harvest was back on the rise this year (Table 1). As usual, GMUs 124, 127 & 130 provided the majority (78%) of the district's 140 bulls harvested, GMU 130 reported the greatest bull harvest, with 41 animals.

After a decrease in last year's general season antlerless harvest, antlerless harvest was back up this year to 179, just above the 5-year average of 171 (Table 1). As with bulls, the great majority of antlerless harvest occurred in GMUs 124, 127 & 130 (Table 4). The variability in the general antlerless harvest is driven primarily by access to private land and presence of elk on these lands during the hunting seasons. The presence of elk is a function of weather, snow depth, hunter pressure, and forage availability.

The Turnbull National Wildlife Refuge (TNWR) permit hunts were offered again this year. The same number of permits was offered as in 2014 – 1 bull and 62 antlerless. This permit hunt coincides with the general seasons off the refuge, thus creating the potential for permit hunters to push the elk off of TNWR, where they have a higher likelihood of being harvested by general season hunters. A total of 20 cow elk were harvested during these hunts compared to only 8 taken last year (Table 5). Notably, the entire early season muzzleloader permit hunt and a significant portion of the disabled permit hunt in TNWR was cancelled last year due to the Federal government shutdown, resulting in lost opportunity and reduced harvest. No bull was harvested this year, a first for this permit.

Antler point classes (1-2, 3-5, and 6+ points) reported in the harvest have varied considerably from year to year. Proportions of the harvest in each antler point class were comparable to the 10-year averages in each category (Table 3).

Surveys

Composition counts have been conducted primarily in GMU 130 on and around TNWR due to limited WDFW survey funds, the lack of success in earlier attempts of aerial surveys in the more forested area of GMU 124 and 127, GMU 130 comprises on average 40% of the harvest, ongoing studies on TNWR, and TNWR has been able to provide survey costs.

In 2014 a total of 207 elk were counted, relative to the previous nine years of surveys the number of elk counted this year was well below the 322 observed on average (Table 6). The decrease in observation was across all sex and age classes, resulting in calf to cow and bull to cow ratios being approximately the same as last year (Table 6). Additionally, the 90% Confidence Intervals for this year's calf to 100 cow ratio (± 13) and bull to 100 cow ratio (± 7.5) indicate no difference from the long term average for both metrics (Table 6).

Though, some of the decline may be due to the increased pressure put on the herd with the Turnbull antlerless permit hunts initiated in 2010 and changing the late master hunter season to antlerless only in 2012. The majority is likely due instead to the limited area covered by the survey and thus increased likelihood of a group of elk being outside of the survey area. For example in 2009, the previous low count, a group of ~100 elk were known by WDFW enforcement to be just outside of the survey area. We have not heard from any sources that any significant elk groups were out of the survey area this year. However, the extent of private rural lands to the south and west of the study area would allow for a substantial number of elk to move outside of the survey area unbeknownst to anyone.

Composition count data from the aerial surveys in GMU 130 (Table 6) show that since 2004, the bull:cow ratio has been at or above the 15 to 35 bulls:100 cows pre-hunt management objective (WDFW 2014*b*).

Population status and trend analysis

From 2001, when mandatory reporting began, through 2011 harvest reports show an increasing trend in elk harvested in District 2, since 2011 harvest has been relatively stable (Table 1). The increase in harvest combined with a relatively stable hunter numbers, success, and effort expended per kill (days/kill)suggests this is due to a population increase and potentially elk expanding into new areas. The latter is corroborated by increases in harvest in traditionally low harvest units (GMUs 139 & 142, Fig. 1), and by numerous sightings of elk in new areas by WDFW staff and local landowners, as well as more damage complaints from landowners in GMU 133, 139, & 142.

Habitat condition and trend

The greatest concern for these elk herds in the past has been the agricultural conversion of native habitat, thereby reducing available elk habitat. Now, elk habitat degradation due to urban expansion, increased roads, and human disturbance has become the highest concern. Habitat loss due to development continues to occur, especially in GMUs 124, 127, and 130 around the main Spokane metropolitan area, with the redistribution of urban populations outward into rural settings impacting the elk population in these GMUs.

There has been a concern for habitat damage to aspen and other vegetation from high elk numbers on TNWR. This concern resulted in the limited entry hunt being offered on the refuge, as well as an Eastern Washington University research project studying the movements of collared elk in and around TNWR and the vegetation on the refuge. TNWR will be re-evaluating habitat conditions this year.

Elk Damage

There are currently 14 Damage Prevention Cooperative Agreement for elk in District 2, two each in GMUs 124-130, three in 133, one in 139, and four occur in GMU 142. A variety of non-lethal tools are offered to landowners to deploy against offending elk. These include herding dogs, pyrotechnics, barriers for hay stacks, and the use of hazing equipment and increased human presence by Department Conflict Specialists and Master Hunters. Damage permits and Master Hunters have also been effective tools, and it is important that an adequate number of these permits continue to be made available to address landowner concerns.

While the core herd area is in GMUs 124–130, there are indications of increasing elk numbers in GMUs 139 and 142 which are dominated by agriculture (wheat and lentils). Consequently, we have begun receiving more damage complaints from these GMUs. Many of these elk migrate back and forth from Washington to Idaho. Elk in these areas are in scattered groups, occupying habitats wherever they can find relative seclusion and safety, frequently being found in Conservation Reserve Program (CRP) plots.

Management conclusions

Harvest data from the last 5 years indicates the elk population in District may be stabilizing after several years of growth and expansion; however damage complaints are still on the rise. Given the extensive agricultural lands in the district and the increase/expansion of elk, harvest strategies in all GMUs will remain “any elk”. Considering that both the aerial surveys and the number of mature bull elk harvested indicate a potentially low number of mature bulls in the population, bull numbers will continue to be closely watched to determine if bull hunting restrictions need to be implemented.

The overall increase in harvest (particularly of antlerless elk) will hopefully result in reduced damage on TNWR and complaints from local landowners. However, we will maintain aerial surveys in this area to insure that herd numbers or ratios do not drop below management objectives (WDFW 2014*b*).

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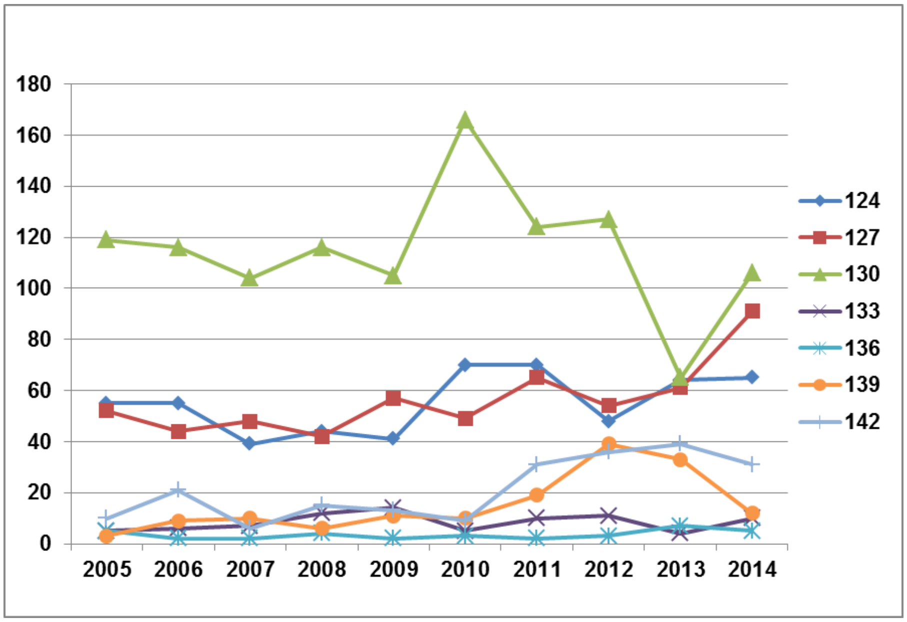

Figure 1. General season total elk harvest by GMU, all weapon types combined.

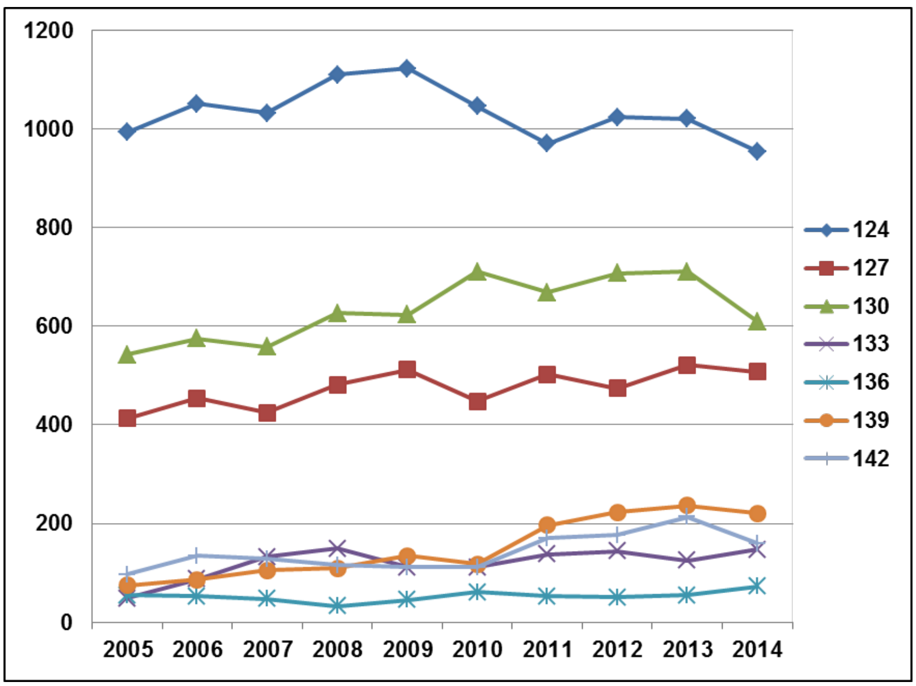

Figure 2. General season elk hunter numbers by GMU, all weapon types combined.

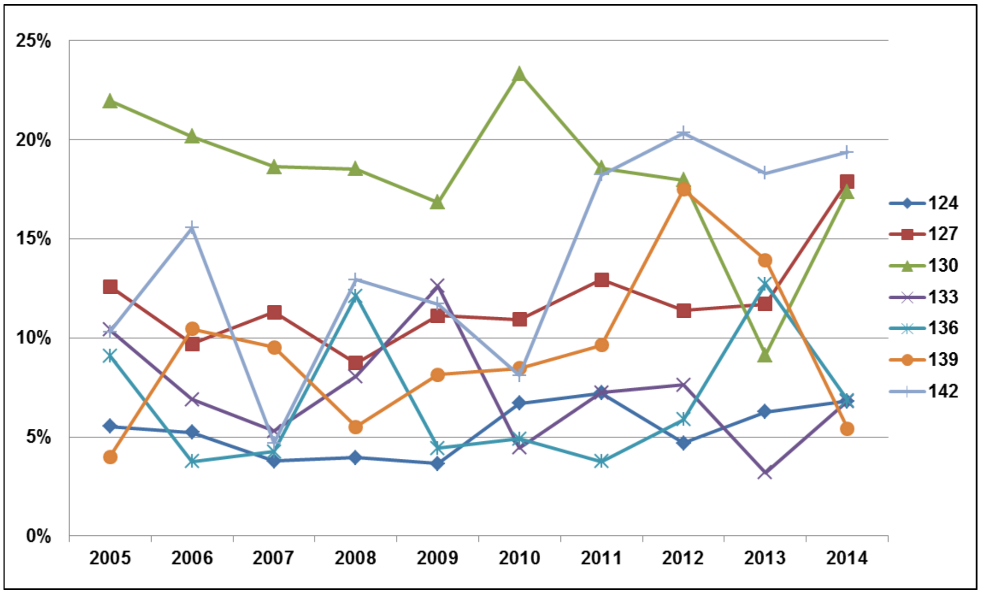

Figure 3. General season hunter success by GMU, all weapon types combined.

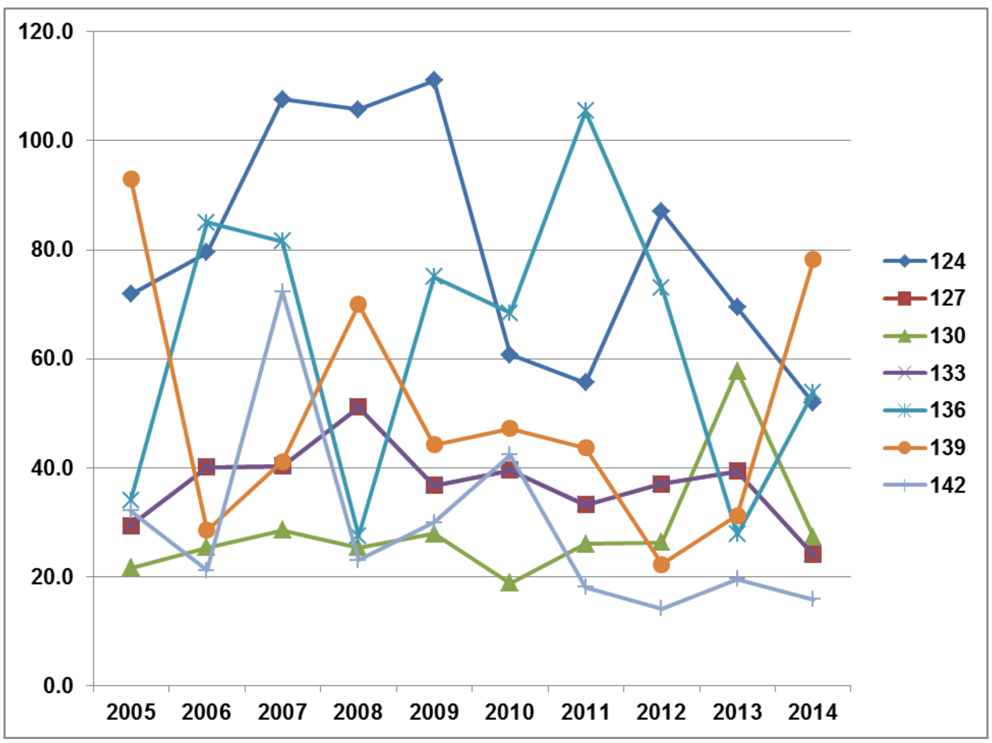

Figure 4. General season elk hunter effort expended per kill (days/kill) by GMU, all weapon types combined.

Table 1. Elk general season harvest, hunters, and hunter days for GMUs 124-142., all weapon types combined.

Year	Antlered	Antlerless	Total	Hunters	Hunter Days	Hunter Success
2005	92	157	249	2,223	8,992	11.20%
2006	128	125	253	2,441	10,323	10.36%
2007	114	102	216	2,427	10,663	8.90%
2008	138	101	239	2,624	11,134	9.11%
2009	121	122	243	2,659	10,955	9.14%
2010	136	176	312	2,607	10,807	11.97%
2011	168	154	322	2,698	11,394	11.93%
2012	125	193	318	2,800	11,646	11.36%
2013	120	152	272	2,891	13,153	9.41%
2014	140	179	319	2,673	11,143	11.93%
Average	**128**	**146**	**274**	**2,604**	**11,021**	**10.53%**

Table 2. Hunter success in general season by weapon type for GMUs 124-142.

Year	Archery	Modern	Muzzle	Multi	All
2005	4%	12%	14%	0%	11%
2006	6%	10%	15%	36%	10%
2007	6%	10%	7%	33%	9%
2008	7%	9%	12%	17%	9%
2009	4%	10%	12%	12%	9%
2010	6%	13%	15%	40%	12%
2011	8%	13%	11%	24%	12%
2012	5%	11%	16%	29%	11%
2013	6%	10%	10%	21%	9%
2014	7%	14%	11%	26%	12%
Average	**6%**	**11%**	**12%**	**24%**	**11%**

Table 3. Antler point proportion for general season elk harvest in GMUs 124-142.

Year	1-2 Pt	3-5 Pt	6+ Pt
2005	49%	41%	9%
2006	39%	39%	23%
2007	45%	34%	21%
2008	32%	40%	28%
2009	42%	45%	13%
2010	41%	40%	19%
2011	38%	43%	20%
2012	46%	41%	13%
2013	45%	32%	23%
2014	43%	36%	21%
Average	**42%**	**39%**	**19%**

Table 4. 2014 General season antlered and antlerless elk harvest by GMU.

GMU	Antlered	Antlerless
124	37	28
127	31	60
130	41	65
133	8	2
136	3	1
139	6	6
142	14	17
Total	**140**	**179**

Table 5. Turnbull National Wildlife Refuge Elk Permit Hunt Summary.

Year	Applicants	Permits Issued	Actual Hunters	Total Harvest	% Hunter Success (of Actual Hunters)	% Success excluding Bull	Antlerless Harvest	Antlered Harvest
2010	4363	63	44	25	57%	56%	24	1
2011	3168	63	49	24	49%	48%	23	1
2012	2317	63	50	20	40%	39%	19	1
2013	2463	63	35	9	26%	24%	8	1
2014	2387	63	47	20	43%	44%	20	0

Table 6. Summary of Turnbull National Wildlife Refuge Composition Surveys (±90%CI)

Year	Bulls	Cows	Calves	Total	Bull to 100 Cow	Calf to 100 Cow
2004	36	211	106	353	17 ±5.1	50 ±9.8
2005	No Survey Flown					
2006	49	207	113	369	23 ±6.2	54 ±10.5
2007	50	140	78	268	35 ±9.7	55 ±12.9
2008	61	145	111	317	42 ±10.6	76 ±15.9
2009	35	146	79	260	23 ±7.4	54 ±12.4
2010	66	248	146	460	26 ±6.1	58 ±10.1
2011	41	193	106	340	21 ±6.0	54 ±10.9
2012	28	166	102	296	16 ±5.7	61 ±12.7
2013	39	207	103	349	18 ±5.4	49 ± 9.9
2014	25	121	61	207	20 ±7.5	50 ±13.0

ELK STATUS AND TREND REPORT: REGION 1

GMUS 145 - 186

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MARK VEKASY, Assistant District Wildlife Biologist

Population objectives and guidelines

Elk (*Cervus elaphus*) populations in the Blue Mountains are at or near population management objectives. The Wenaha GMU comprised a majority of the elk in the Washington Blue Mountains until the late 1980s, but declined during the 1990s to less than 500 elk. Elk numbers in the Wenaha are still struggling, likely requiring substantial habitat improvement to increase the herd. A number of elk groups residing along the Stateline with Oregon have been growing recently, causing uncertainty to the number of elk that are available to Washington hunters. Most of these groups are residing on private land, where they also can contribute to damage complaints received by WDFW. The Blue Mountains Elk Management Plan is currently being revised, and will include an updated population objective.

Hunting seasons and harvest trends

The general season bull harvest was restricted to spike-only in 1989 in order to increase bull survival and post-hunt bull:cow ratios, and improve breeding efficiency. Prior to spike-only management, bull:cow ratios historically ranged from 2-5 bulls:100 cows, and few bulls older than 2.5 years of age were observed during post-hunt surveys. After implementation of the program, bull:cow ratios increased to management objective (>12 bulls:100 cows) within 3 years. Currently, a diverse age structure is observed in the post-hunt bull population with a bull ratio of 32:100 cows (90% CI +/- 8.3) observed in 2015.

Total bull harvest in the Blue Mountains has been stable for the past 6 years, averaging 269 bulls. Hunters harvested a total of 265 bulls in 2014 (Table 1), which is 12% above the 10-year average. The elk population has remained stable over this time period, as has recruitment. Surveys in early 2015 showed a small increase in bull ratios and a stable calf ratio at 31.5:100 cows (90% CI +/- 2.3).

Branched-antlered bulls are harvested under special permits in all GMUs (Table 2). In 2014, 228 “any bull” special permits, targeting a harvest of 119 bulls, were issued in one “permit-only” entry unit and eleven “spike-only” units for rifle, muzzleloader, and archery hunters, excluding auction, raffle, and incentive permits. Branched-antlered bull special permit hunters averaged 58% success with 187 (18% failed to report) permit holders harvesting 112 bulls. Six point or larger bulls comprised 96% of the harvest. Large, mature bulls continue to be harvested in the Blue Mountains, and generate much public interest for both hunting and viewing.

The Mill Creek Watershed (GMU 157) is a limited entry unit managed in cooperation with the City of Walla Walla (City water supply), U.S. Forest Service, WDFW, and Oregon Dept. of Fish & Wildlife. Washington issued 35 Watershed permits in 2014. Normally, some Watershed permit holders do not hunt because they fail to research the area before applying, and are not aware of the rugged terrain. In 2014, of the 29 harvest reports returned, 24 hunted, harvesting 8 bulls and 0 cows. Bulls harvested in the Watershed consisted of 100% six point or better.

Antlerless elk hunting is by special permit for modern firearm (MF) and muzzleloader (ML) hunters in GMUs 149, 154, 162, 163, 172, 175, 178, and 181. General season archery hunters are allowed to hunt antlerless elk on private lands in GMU 162 and 172, and unit wide in GMUs 149, 154, 163, 175, 178, and 181. A total of 472 antlerless elk permits were issued in 2014 for 3 weapon types, excluding landowner damage control permits: MF 346, ML 111, Archery 15. Hunters harvested a total of 151 antlerless elk from eight GMUs. MF hunters harvested 91 antlerless elk, ML harvested 26, and archers 2. Archers harvested an additional 32 antlerless elk during the general archery seasons.

The antlerless harvest is generally focused on sub-populations on private land to alleviate agricultural damage. 2014 permit levels were increased slightly to address increasing or stable counts in private land zones. The strategy of targeting antlerless elk on private land has been successful in reducing agricultural damage complaints, while allowing elk populations on public land to increase and maintain the overall elk population near management objective.

Poaching of adult bulls appears to have remained at low levels compared to the high levels experienced between 2000 and 2002 when more than 50 bulls were investigated as illegal harvests. The current ability to track elk poaching cases and changes in trends is proving difficult for the Department. Numerous changes in the enforcement program's reporting requirements has taken away the ability to compare years, but local officers reported that they investigated 22-25 cases of reported illegal elk kills. This would be a significant increase from previous years based on the opinion of the enforcement personnel.

Surveys

Post-season surveys are conducted to determine population estimates and herd composition in late winter. The 2015 survey was conducted from March 2 through 7th. The 2015 Blue Mountains elk population is estimated to be 5,307 (90% CI +/- 298, Table 3). Some surveys are conducted on winter range in Oregon north of the Wenaha River and an unknown percentage of those elk likely do not return to summer range within Washington.

Population status and trend analysis

Winter calf ratios in 2015 were estimated at 31.6 calves:100 cows (*90% CI* +/- 2.3), a small decrease compared to last year's 34.7 ratio and the third highest in the last 20 years. Post-hunt bull/cow ratios in 2015 were estimated at 32.5 bulls:100 cows (*90% CI* +/- 8.3, Table 3). Surveys conducted along the Oregon border (GMUs 157, 169, 172, and 186) include survey zones within Oregon. It is thought that a majority of elk in these zones winter in Oregon north of the Wenaha River, and migrate into Washington later in the spring, but little data is available to confirm this. Some historic data (Mace 1967) described movement patterns of wintering elk at 2 feeding sites on Bartlett and Eden Benches (south of the Wenaha River) in Oregon, and approximately 35% of the these elk summered in Washington.

Research

There is no ongoing elk research being conducted within the Washington portion of the Blue Mountains at this time.

Habitat condition and trend

The Pomeroy Ranger District has made progress in closing old roads and reducing road densities in GMU-175. WDFW biologists are working with the USFS to address elk habitat and security needs with a new forest management proposal called Sunrise Vegetation Management.

The Pomeroy Ranger District is also struggling to find funds to replace broken gates and patrol for gates incorrectly left open. This has increased the vulnerability of elk in large areas of summer range within GMUs 166 and 175. WDFW will need to continue working with the USFS on this issue for the foreseeable future.

The road closure program on the Walla Walla Ranger District is complete, although some maintenance needs are anticipated for the future.

Habitat conditions on 163,000 acres of National Forest and private land will continue to improve over the next 10 years due to extensive wildfires that occurred in 2005 and 2006 (School Fire-2005, Columbia Complex Fire-2006), however, large areas of the Wenaha-Tucannon Wilderness that have not been allowed to burn continue to have poor habitat conditions for elk.

The Umatilla National Forest Access Management and Fire Management Plans should improve habitat conditions over time, and prescribed burns are being implemented throughout the forest to reduce fuel loads and improve stand conditions. The WDFW will work closely with the USFS to reduce road densities and improve habitat effectiveness in areas of high value elk habitat.

Habitat enhancement

Projects to control weeds on WDFW Wildlife Areas and elk winter range on private land were implemented in 2009-2011. Long-term habitat improvement projects will be developed in conjunction with the Blue Mountains Elk Initiative (BMEI), Rocky Mountain Elk Foundation (RMEF), U.S. Forest Service, and county weed boards.

Elk Damage

While actual elk damage claims are low, complaints from farmers are very common and elk damage continues to be a problem in some units and is largely being addressed by lure crop payments and issuance of landowner depredation permits. The largest damage issues occur in GMU-154 Blue Creek, GMU-162 Dayton, and GMU-178 Peola. Damage tags are valid from July 1 – March 31, with restrictions on the harvest of antlered elk.

In 2011, the Department implemented a new program to address wildlife caused agricultural damage called the Damage Prevention Cooperative Agreement (DPCA). This program allows the Department to issue permits to landowners, which they may use to focus hunting pressure on damage-causing elk on their land through much of the year. It does require the landowner to provide reasonable access to public hunters during hunting seasons. Department records indicate that in 2014, of the 153 elk permits that were issued, 54 were filled. The Department strives to focus antlerless elk removal on GMUs where elk suppression is the goal.

The sub-population that inhabits the wind power project lands in the Marengo unit (GMU 163) appears to have stabilized in recent years and has been kept in check with antlerless harvest opportunities and damage prevention permits given to landowners.

Damage issues in GMU-181 have decreased from a high of 10-years ago after issuing landowners preference permits for antlerless elk in lieu of damage. Periodically, high numbers of elk move into the western portion of the unit, with this trend increasing over the past two years. Additional effort will be needed to stop this pattern of behavior.

An unknown number of elk (50 -200) are periodically located in the Peola unit (GMU 178) and are herded through the elk fence when opportunities arise. Efforts will continue to herd these elk back inside the elk fence and onto public land in GMUs 166 and 175 during 2015- 2016.

Management conclusions

Bull ratios and age structure are currently healthy in the Blue Mountains. The bull ratio is at the upper end of the range prescribed in the Draft Blue Mountains Elk Management Plan. A small increase in antlered opportunity will likely be offered for the 2016 season, attempting to move the bull ratio closer to the desired range.

Winter calf ratios remained relatively stable during the past 2 years (Table 3). Low calf survival has had negative impact on hunting opportunity through reduced recruitment from the mid-1980s through mid-2000s. Low calf recruitment is thought to be the major factor still preventing Wenaha elk from increasing in numbers.

Shed antler hunting activity continues to be a concern for elk on the winter range. Shed antler hunting activity in GMUs 154, 162, 166, 169, 172, and 175 can be extremely intense during March and April. Elk use patterns in GMUs 154, 166, 169, 172, and 175 have changed over the last decade due to disturbance caused by shed antler hunting activity. Bull groups are broken and scattered into the upper elevation timber and snow, while cow/calf groups can be redistributed onto agricultural lands. Shed antler hunting and other activities on winter range are putting elk under increased stress at a critical time of year.

Recommendations were developed in 2009 to reduce harassment and control human activities on elk winter range, especially shed antler hunting. In July 2013, WDFW staff met with USFS and ODFW staff to discuss the issue and propose possible management recommendations to address the level of disturbance.

Agricultural damage continues to occur in traditional locations in GMUs 154, 162, 163, 172, 178, and 181 resulting in damage control hunts being implemented by the Department. The current damage control strategy to target specific groups of elk on private land for damage control has reduced damage claims on a majority of private lands.

Habitat values have declined in some areas due to roads (GMUs 154, 175), development (154), and noxious weeds (154, 169, 175, & 186), although extensive wildfires in 2005 and 2006 have improved habitat conditions on a majority of the 163,000 acres burned in GMUs 154, 162, 166, 175, and 178.

Literature Cited

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Table 1. 2014 Blue Mountains elk general season and permit harvest combined, and prior 10-year history.

	Bulls					Antlerless Harvest
Year	Spikes	Adult	Total	Antlerless	Total	Cows:Bulls
2004	193	32	225	194	419	86
2005	146	45	191	251	442	131
2006	163	47	210	203	413	97
2007	137	47	180	160	331	88
2008	90	88	175	124	300	71
2009	174	95	261	103	364	39
2010	130	131	250	150	406	62
2011	157	111	277	145	413	52
2012	142	150	302	149	442	49
2013	151	112	249	146	386	58
2014	154	112	266	151	417	57

Table 2. 2014 Special Permit Bull Elk Harvest-All Weapons, Blue Mountains, WA, and prior 10-year history.

Year	Bull		Hunter Success	Percent 6 Point+
	Permits	Harvest		
2004	73	20	27%	95%
2005	82	26	32%	78%
2006	100	35	35%	86%
2007	119	33	28%	94%
2008	107	65	61%	85%
2009	141	95	67%	95%
2010	183	131	72%	98%
2011	236	111	47%	100%
2012	289	150	52%	96%
2013	236	112	47%	84%
2014	228	112	49%	96%

Table 3. Elk population estimates for the Blue Mountains generated by the Idaho Sightability Model.

	Population	90%	Antlerless		Bulls			Total		Ratios:100 Cows	
Year	**Estimate**	**CI**	**Cows**	**Calves**	**Yearlings**	**Raghorns**	**Adult**	**Bulls**	**Unclass**	**Bulls**	**Calves**
2006	4,341	193	2,817	847	157	184	335	676	0	24.0	30.1
2007	4,328	233	2,753	674	213	254	420	887	13	32.2	24.5
2008	4,748	102	2,987	842	190	191	403	783	136	26.2	28.2
2009	4,925	355	3,089	905	184	193	504	881	51	28.5	29.3
2010	4,921	97	2,951	835	202	251	521	972	162	33.0	28.3
2011	5,638	356	3,392	1,257	259	182	520	961	30	28.3	37.0
2012	4,900	610	3,090	945	196	110	540	847	16	27.4	30.6
2013	5,102	124	3,420	894	224	122	429	774	14	22.6	26.1
2014	5,774	490	3,364	1,166	280	161	551	992	250	29.6	34.7
2015	5,307	298	3,227	1,016	212	216	622	1050	16	32.5	31.5

ELK STATUS AND TREND REPORT: REGION 3

COLOCKUM HERD– GMUS 328-335
YAKIMA HERD– GMUS 336 – 368
RATTLESNAKE HILLS HERD– GMUS 372-381

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Population objectives and guidelines

The post-season population objectives for the Yakima and Colockum elk (*Cervus elaphus*) herds are 9,025-9,975 and 4,275-4,725, respectively. A goal of <350 animals has been set for the Rattlesnake Hills sub-herd. The postseason bull ratio goal is within the range of 12- 20 bulls per 100 cows for all herds.

Hunting seasons and harvest trends

Elk hunting seasons in Region 3 have changed frequently over the years. The major changes in recent years have been:
1994: All branched antler bull hunting became permit only in all except Rattlesnake Hills.
2000: Entire region came under one eastern elk tag by weapon.
2003: Early archery general season changed from September 1-15 to September 8-21. The late Archery season was set at November 20-December 8. Damage hunts changed from muzzleloader to any Advanced Hunter.
2004: Antlerless elk were no longer legal for Archery general season in Colockum.
2009: Colockum became true-spike only for general seasons.
In 2014, the general seasons outside of Rattlesnake Hills were:

Archery: Early season September 2-14, true-spike only in Colockum, spike or antlerless in Yakima. Late season: November 26-December 8, Colockum true-spike or antlerless; Yakima spike or antlerless.

Muzzleloader: October 4-10, Colockum true-spike; Yakima spike-only.

***Modern Firearm*:** October 25- November 2, Colockum true-spike only; Yakima spike-only.

Rattlesnake Hills elk have been managed separately from the remainder of the region with an array of liberal seasons allowing the harvest of antlerless and any bull elk. A substantial number of damage permits have been issued to landowners to target problem elk and to reduce the size of the Rattlesnake Hills sub-herd. In addition, in 2014, a modern firearm general season for antlerless elk occurred in the Blackrock Elk Area (private land west of Hanford, Elk Area 3722) September 6-21. To further reduce the Rattlesnake sub-herd, a general modern firearm season for any elk occurred in GMU 372 during October 25-November 2, 2014.

Harvest of any elk also occurred in and GMU 373, 379, & 381 during a modern firearm general season during October 25-November 15, 2014. There were also archery and muzzleloader general seasons for any elk in GMU 373, 379, & 381 during 2014. Early archery occurred September 2-14. Late archery in GMU 379 & 381 was held October 25-November 15 and in GMU 373 during November 25-December 8. Opportunity for muzzleloader hunters occurred during a late season hunt in GMU 373, 379, & 381 during October 25-November 15.

In 2014, the reported number of elk hunters in Region 3 increased 16% (Table 1) and was 5% below the 10-year average. Elk tag sales have been stable during the previous period of decline. Hunters are apparently purchasing tags to apply for special draw permits. If not drawn, many don't hunt. Permits increased in 2014, which might account for some of the gain in hunter numbers.

Reported harvest was near average for the Colockum and Yakima herds. The increase in antlerless harvest off-set below average bull harvest. Total success in the region was slightly above average.

The "true-spike" regulation in Colockum was designed to increase yearling bull escapement. Bull harvest in the Colockum has been below average since the change in 2009. Harvest data for the Rattlesnake Hills sub-herd has been variable (Table 4). Harvest has typically ranged between 43 and 101 since 1999. The exceptions were 2000 (harvest =212) and 2007 (harvest = 137) when wildfires displaced large numbers of elk from Hanford and the Arid Lands Ecology Reserve (ALE) site. In 2014, field personnel documented a harvest of 126 elk (61 bulls, 65 antlerless).

The majority of elk were harvested in GMU 372. No elk were reported harvested in GMU 373 in 2014. In GMU 381, 2 antlerless elk were harvested. One bull was also harvested in GMU 379. Elk numbers are low in these units and are managed liberally to reduce crop damage risk.

Surveys

A post-hunt aerial survey was conducted over 100% of the Colockum winter range in March 2015 (Table 2). The Yakima herd was not surveyed due to lack of snow and elk on winter range/feed sites.

GMU 372 was surveyed by helicopter as a separate area in February 2015. This recurring annual winter survey is completed by WDFW in partnership with USFWS. All survey units on the Hanford ALE site and a randomly selected subset of units on Central Hanford and surrounding private land to the south and west of ALE were also surveyed.

Population status and trend analysis

In March 2014, the Colockum herd was estimated at 6,103 ± 24 (Table 2). The Yakima herd was 1,800 elk over objective in 2013 (Table 3). Both herds are above population objectives. The Colockum herd is probably much higher than the estimated 6,103 as a large group (>700) has been observed outside the surveyed winter range. Recent studies have also found a connection between elk south of I-90 on the Yakima Training Center (YTC) and the Colockum herd. YTC is not surveyed. Estimated calf recruitment in the Colockum has been at recorded highs the last 4 years (Table 2). The observed Colockum bull ratio is below objective, but an ongoing bull study indicates there are significant numbers of bulls outside the surveyed winter range. The trend has been increasing yearling bull recruitment.

The Rattlesnake Hills sub-herd grew from less than 100 elk in the early 1980s to over 1,000 by 2013 (Figure 1). In 2000, a trapping effort and high harvest following a large wildfire, reduced the herd by several hundred, but it has since rebounded. Surveys in February 2015 yielded an estimate of 1,109 elk. Ratios per 100 cows were 40 bulls and 21 calves. The high bull ratio is typical for this herd because they can seek refuge from hunting on the federal Hanford and ALE lands most of the year. No surveys were conducted in GMU 373, 379 or 381.

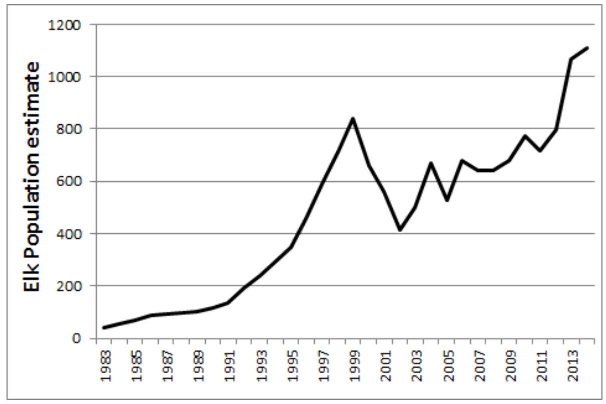

Figure 1. Winter population estimate of Rattlesnake Hills elk sub-herd since 1983.

Habitat condition and trend

The overall acreage of summer range for the Colockum herd is increasing due to timber harvest and wildfire effects, but much of the area is also heavily grazed by livestock. Large areas now lack hiding cover, and when human activity increases in late summer, many elk concentrate in and around the Coffin Reserve. A large fire on the westside of the core Colockum range removed much of the cover in fall 2012. Eventually, forage should increase on summer range, but hiding cover will be reduced. In 2013, a large fire burned about 72,000 acres of elk winter range. There was some fall re-growth, but there was an obvious short-term reduction in available forage. The past 2 winters have been mild and no significant overwinter elk mortality occurred.

The U.S. Forest Service (USFS), Washington Department of Natural Resources (DNR), and WDFW manage the majority of summer range for the Yakima herd. Habitat quality for elk varies across these ownerships depending on management emphasis and underlying land cover types. The USFS shifted toward a late seral stage management emphasis over 20 years ago. The lack of recent timber harvest has reduced forage production on a portion of summer range. Insect outbreaks have recently killed conifers over a substantial area. Prescribed burns and wildfires are starting to improve forage quantity and quality where they have occurred.

In the range of both Colockum and Yakima elk, human use is high. Activity on winter and spring range has increased drastically with increased bull numbers and the resultant increased number of shed antlers in the spring. Many people now participate in shed antler hunting in the spring on these elk ranges.

The major change to habitat for the Rattlesnake Hills elk was a fire that consumed most winter range in June 2000. In August 2007, approximately 67,000 acres burned, mostly on ALE and some private land west of ALE. The short-term effect of these fires was to reduce herd productivity and push elk onto private land. Today, the herd seems to have recovered from these disturbances. The population has grown to the highest levels ever observed, and calf numbers indicate high recruitment of additional elk. Elk continue to move onto the properties surrounding ALE.

Crop damage

Most of the problem areas within the Yakima elk herd area have been fenced. No fence is elk "proof", as some elk go around ends or find holes in fence. An extended Master Hunter season (August 1- Jan. 20) was enacted in 2003 below the fence in an attempt to reduce crop damage. There are a few crop fields above the fence that are chronic problem areas. Most of those landowners have Damage Prevention Cooperative Agreement (DPCA's) with WDFW and receive permits to help keep elk out of the crops. When available, some fencing is provided to landowners to protect high value crops. Annually, there are 15-20 DCPA's within theYakima Herd area.

The Colockum herd is not fenced, and damage is being managed by hunting and hazing. The boundaries of the hunts are adjusted frequently, depending on where damage is occurring. In 2004, the damage season was extended to August 1 – February 28th. In recent years the general damage season has closed in mid-December. Additional problem elk are being managed through hazing, DPCA's and Master Hunter Permits. The goal is to eliminate/displace elk that have developed a habit of foraging on private agricultural lands. In the past year, an additional person was put on contract to help haze elk out of fields, mostly outside hunting seasons. There were approximately 60 DCPA's within the Colockum herd area in the past year.

Historically, the Rattlesnake Hills elk caused the most significant damage in Region 3. Crop damage claims, payable by the state, have largely been for damage to dryland wheat fields south of ALE. Typically, elk enter the fields from ALE after sunset and return to ALE prior to sunrise. Landowners in this area work closely with WDFW Conflict Specialists to find ways to reduce crop losses. In 2014, Damage Prevention Cooperative Agreements with 22 landowners in Benton County were in effect. Activities used to reduce damage impacts include herding and hazing elk from crops. Other non-lethal strategies include LP gas cannons, acoustic deterrents, commercial wildlife deterrent chemicals, and fencing. If damage persists, landowners may be issued permits to lethally remove a limited number of bull, spike, or cow elk, depending on the time of year. The proximity of these elk to valuable perennial crops further increases the risk. Several orchard and vineyard managers west of ALE have fenced their crops or have elected to waive damage payments in return for damage prevention permits. These farms are relatively small and surrounded by rangeland. In contrast, the area south of ALE near Prosser and Benton City contains large acreages of orchards and vineyards. The number of elk complaints in this area has increased since the August 2007 fire. Controlling the herd size is problematic, as the core use area is on ALE, where hunting is currently prohibited by the federal government.

In 2005, WDFW worked with USFWS to draft an elk control plan that included strictly controlled hunting on ALE, but the Department of Energy (DOE), which owns the land, objected to public hunting on this site at the time. In 2011, WDFW, the Yakama Nation, and USFWS drafted another hunt plan for the ALE. The plan was supported by DOE and was published on the Federal Register for public review. All indications were that a hunt was going to occur in the fall of 2012. Unfortunately, two other northwest tribes objected to the hunt, and the USFWS backed off plans for the 2012 hunt.

Management conclusions

The Colockum and Yakima herds are over objective, and antlerless opportunity is being increased to reduce the populations. The historic low bull recruitment in the Colockum has reversed with "true-spike". It is likely that the Colockum bull population is actually at objective, but is under reperesented in surveys. An ongoing study on adult bull movements and survival should allow for a better estimate of Colockum bulls in the near future.

Extensive permit seasons may have slowed the Rattlesnake Hills sub-herd growth, but has not stabilized elk numbers. Hazing and targeting problem elk has reduced, but not eliminated damage. Landowner tolerance and WDFW's ability to pay for damage are finite. The Rattlesnake Hills sub-herd should be reduced to <350. Landowners and hunters have not been able to harvest enough antlerless elk to reverse population growth. Bulls have averaged 53% of the total harvest the last 5-years (Table 4). A controlled hunting program on ALE will probably be needed to reduce the sub-herd and reduce the risk of crop damage and ecological resource degradation on ALE, such as at springs that the elk population is damaging.

Table 1 Region 3 Elk Hunter Success, 1992-2014.

	Colockum harvest		Yakima harvest		Regional hunter numbers				
Year	Bull	Cow	Bull	Cow	Modern	Muzz	Archery	Total	Success (%)
1992	611	652	1,348	1,246	26,928	4,086	5,865	36,879	10
1993	801	613	1,513	1,020	26,513	4,618	5,989	37,120	11
1994	550	433	782	770	26,328	5,503	6,114	37,945	7
1995	542	731	970	2,418	21,341	5,517	5,622	32,480	15
1996	469	660	631	892	20,288	6,190	4,819	31,297	8
1997	449	593	911	1,069	21,237	5,490	5,558	32,285	9
1998	335	255	717	426	18,253	3,918	3,701	25,872	7
1999	492	239	975	889	20,128	4,705	4,362	29,195	9
2000	392	214	1,140	1,058	25,383	4,554	5,549	35,486	8
2001	385	245	1,450	1,549	23,278	4,305	5,363	32,959	11
2002	379	358	1,184	1,442	22,204	4,791	6,177	33,172	10
2003	513	591	1,017	1,157	21,926	6,119	5,914	33,959	10
2004	424	393	1,083	1,373	20,888	3,342	6,521	30,751	11
2005	449	218	1,013	772	23,291	3,789	6,760	33,840	6.5
2006	418	302	927	1,093	20,654	3,497	5,972	30,123	9
2007	381	241	802	695	19,045	2,743	5,618	27,406	8
2008	327	282	799	826	18,552	2,898	5,578	27,028	8
2009	250	160	1,019	787	17,160	2,474	5,141	24,775	9
2010	182	121	694	440	16,320	2,400	4,942	23,662	7
2011	188	119	658	761	15,047	2,262	4,651	*22,371	7
2012	333	226	975	1,095	14,974	2,707	5,146	*22,924	11
2013	252	303	639	782	15,002	2,983	4,923	*23,145	8
2014	229	410	671	1,023	16,772	3,884	6,054	*26,960	9
10 YR AVG	340	237	861	862	18,093	2,910	5,525	*28,226	8

*Includes multi-weapon tags

Table 2. Colockum elk winter survey results, 1999-2014.

	Antlerless		Bulls		Total	Ratios (per 100 cows)	
Year	Cow	Calves	Spike	Branched	Elk	Calves	Bulls
1999	3,871	1,061	84	242	5,258 ± 2,048	27	8
2000	2,697	570	60	130	3,457 ± 940	21	7
2001	3,464	719	100	170	4,453 ± 543	21	8
2002	2,800	829	119	391	4,172 ± 566	30	18
2003	3,060	526	96	238	3,920 ± 445	17	11
2004	2,388	782	63	209	3,442 ± 168	33	11
2005	3,084	770	46	86	3,986 ± 391	25	4
2006	2,244	873	73	116	3,306 ± 160	39	8
2007	2,829	843	118	104	3,918	30	9
2008	2,859	917	43	77	3890±20	32	4
2009	3,723	732	80	85	4,621 ± 21	20	4
2010	3,549	839	69	137	4,594	24	6
2011	3,695	995	121	68	4,880±15	27	5
2012	3,924	1,121	153	107	5,305±11	29	7
2013	4,057	1,265	164	227	5,712±35	31	10
2014	4,517	1,226	154	121	6,018±24	27	6
2015	4,275	1,344	221	264	6,103±28	33	11

Table 3. Yakima elk winter survey results, 1999-2013.

	Antlerless		Bulls		Total	Ratios (per 100 cows)	
Year	Cow	Calves	Spike	Branched	Elk	Calves	Bulls
1999	10,399	3,479	442	716	15,036 ± 4,334	33	11
2000	8,125	2,528	421	703	11,777 ± 1,242	31	14
2001	6,896	2,652	464	698	10,710 ± 830	38	17
2002	6,611	2,337	356	970	10,274 ± 609	35	20
2003	6,815	2,007	413	599	9,834 ± 983	29	15
2004	6,217	2,806	357	688	10,068 ± 457	45	17
2005	6,242	2,013	253	343	8,851 ± 843	32	10
2006	5,717	2,926	273	673	9,589 ± 270	51	17
2007	6,167	2,000	518	674	9,359	35	18
2008	6,001	2,368	290	820	9,478 ± 389	39	18
2009	6,076	1,816	267	737	9,133	30	17
2010	5,834	1,890	150	715	8,589	32	15
2011	6,902	2,534	442	678	10,556±161	37	16
2012	7,847	2,963	472	766	12,048±1110	38	16
2013	7,454	2,730	369	757	11,308±169	37	15

Table 4. Rattlesnake Hills Elk Harvest 1985-2014. Data derived through landowner and hunter interviews.

Year	Bulls	Antlerless	Unk	Total	% Bull
1985	2	1	0	3	67%
1986	10	2	1	13	77%
1987	6	8	0	14	43%
1988	4	9	0	13	31%
1989	8	3	0	11	73%
1990	3	0	0	3	100%
1991	14	0	0	14	100%
1992	8	0	0	8	100%
1993	9	5	0	14	64%
1994	18	15	0	33	55%
1995	17	3	0	20	85%
1996	17	2	0	19	89%
1997	17	3	0	20	85%
1998	18	15	0	33	55%
1999	22	41	38	101	22%
2000	95	104	13	212	45%
2001	17	58	0	75	23%
2002	45	8	0	53	85%
2003	46	33	0	79	58%
2004	17	47	0	64	27%
2005	29	27	0	56	52%
2006	36	59	0	95	38%
2007	59	78	0	137	43%
2008	24	19	0	43	56%
2009	28	22	0	50	56%
2010	50	32	0	82	61%
2011	47	48	0	95	49%
2012	53	32	0	85	62%
2013	47	49	0	96	49%
2014	61	65	0	126	48%
28-yr avg	28	26	2	56	60%
last 5 yrs avg	51	45	0	97	54%

ELK STATUS AND TREND REPORT: REGION 4

GMUS 407, 418, 437, 448, 450

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Population Objectives and Guidelines

Proposed management objectives are outlined in the draft North Cascade Elk Herd Plan (WDFW 2014). The draft plan is currently being reviewed by the co-managers and others and is not final. Proposed objectives in the plan include the following:

- Increase elk population numbers to current population objective of 1,950 animals throughout the managed range of the North Cascades elk herd. .
- Manage hunted elk units for minimum post-season bull ratios of 12 - 25 bulls:100 cows, with overall bull mortality rates of less than or equal to 50 percent, consistent with the statewide Game Management Plan (WDFW 2014).
- Address public safety by reducing elk/vehicle collision rate on State Route 20 between Sedro Woolley – Concrete.
- Minimize elk damage complaints on private property.
- Promote elk herd expansion and hunter access to areas with reduced potential for elk-related agricultural impacts.
- Increase public awareness of the elk resource and promote viewing and photographic opportunities.

Hunting season and harvest trends

Conservation closures were established in both GMUs 418 and 437 in 1997 until 2007 when a limited-entry bull only permit hunt was initiated in GMU 418. In 2014, the total number of permits in 418 was 50 (25 spike only, 25 any bull), which were divided equally among state and tribal hunters. The 25 state permits were allocated as 6 archery (3 spike only, 3 any bull), 6 muzzleloader (3spike only, 3 any bull), 11 modern firearm (6 spike only5 any bull), with the contingency for the westside raffle tag and auction tag (any bull) holder potentially being used in GMU 418. Of the 24 state permit holders who drew GMU 418 bull elk permits, 19 harvested bulls. Tribal hunters harvested 21 bulls using GMU 418 permits from their allocation of 25 tags. 2014 general season state harvest outside of GMU 418 included 5 branched bulls, three taken with modern firearms and 2 taken with muzzleloaders, and 7 antlerless all taken with muzzleloaders in GMU 407. Tribal hunters harvested two cows in GMU 407, and 3 bulls and 9 cows in GMU 437.

Elk-related Agricultural Damage Hunts

In the Skagit Valley (portions of GMUs 418 and 437) 16 cows were harvested on permits issued by the WDFW Conflict Specialist. In the Acme area (GMUs 407 & 418), 1 cow was harvested with damage permits issued by the conflict specialist.

Other Mortality

Other reported sources of human-related mortality include 26 reported elk-vehicle collisions that resulted in dead elk along State Route 20 between Sedro Woolley and Concrete in 2014-2015.

Surveys

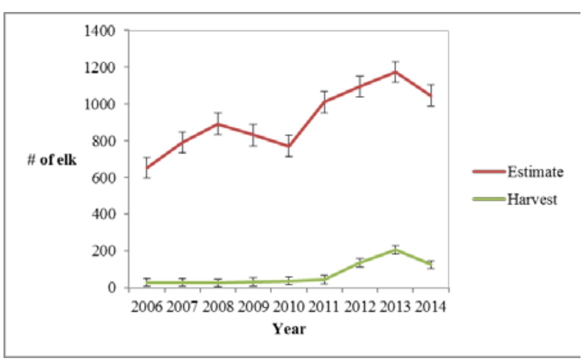
In 2005, biologists from WDFW and the Point Elliott Treaty Tribes initiated a study to assess the size of the North Cascades elk herd and develop a practical monitoring strategy (McCorquodale et al. 2013). This study evaluated two monitoring approaches: sightability-correction modeling and mark-resight modeling, taking advantage of existing radio-marked elk from the 2003-2005 Mount St. Helens translocations. Additional capture and radio collaring of bull elk was required since bulls were underrepresented in the marked sub-population. Between 2005 and 2011, 40 bull elk were captured and radio tagged. The culmination of this work supports the ongoing use of radio collared elk in a mark-resight modeling approach to estimate population parameters. This involves two post-hunt aerial surveys conducted in late winter when elk sightability is maximized. As of June 2014, 36 animals in the North Cascades herd had functioning radio collars. Future population monitoring requires ongoing capture and radio collaring of elk to maintain an adequate sub-population of marked animals. Beginning in 2011, biologists from WDFW and the Point Elliott Tribes began using modified collapsible clover traps to trap and collar elk. Although somewhat labor intensive, live trapping avoids the need to chemically immobilize the animal and eliminates the cost and danger associated with aerial darting. A total of 44 elk were trapped from 2011 to 2015. Of these, 11 elk were outfitted with GPS collars and the remaining elk were outfitted with VHF collars.

Population status and trends

The North Cascade elk herd steadily increased in size following successful reintroduction efforts in 1946 to an estimated peak of 1,700 animals in 1984 (WDFW 2002). Overharvest, poaching, and habitat-related impacts lead to a major population decline in the 1990s. By the late 1990s, the entire population had decreased to an estimated 425 animals. Efforts to rebuild the herd (including herd augmentations in 2003 and 2005, forest road access management, forage enhancement, and a moratorium on hunting) have contributed to population recovery and the population is approaching the current objective of 1,950 elk.

Based on 2014 survey data, the estimate for the surveyed portion of the North Cascades elk herd was 1057 animals (Figure 1). The estimated number of cow elk in this area was 607, while the estimated number of bulls was 390. The surveyed portion of the range of the North Cascades elk herd includes core habitat in the Nooksack and Skagit River drainages. Peripheral areas support small numbers of elk but are not surveyed due to practical, logistical and financial considerations.

Figure 1. Post-hunt, mark-resight population estimate and harvest results (recreational, damage, and roadkill) for surveyed portion of population of the North Cascades elk herd from 2006-2014.



Estimates of bull:cow and calf:cow ratios illustrate that this growing herd is meeting most of its population management objectives. Overall, these estimates suggest that the ongoing limited-entry bull harvest is successfully providing quality harvest opportunities without adversely affecting population growth or age stricture within the bull cohort.

Recent aerial surveys and ground observations also indicate that the herd expanding into previously vacant historical range. A pattern of population expansion from the population core to peripheral areas (including agricultural lands) has occurred over the past several years.

Habitat condition and trends

Comprehensive habitat assessment using modern spatial analysis techniques remains one of the highest priorities. Location data from 15 elk that were outfitted with GPS collars between 2008 and 2009 was used to validate summer forage habitat models developed by the US Forest Service Pacific Northwest Research Station.

The primary objectives of these projects are to: 1) develop habitat enhancement projects to encourage herd expansion into areas with reduced potential for future elk-related agricultural conflicts; 2) develop alternatives for managing elk in agricultural environments; and, 3) address the escalating public safety issues associated with increasing numbers of elk-vehicle collisions.

Problems limiting the effectiveness of the current elk range include the loss of habitat associated with forest land conversion, residential development, mortalities from elk-vehicle collisions, and disturbance from multiple recreational uses on the land (e.g. hiking, horses, snowmobiles, and ORVs).

A cooperative project to reduce elk/vehicle collisions on highway 20 between Concrete and Sedro Woolley was initiated in 2013. Biologists from WDFW, WSDOT, Western Washington University and some of the Point Elliot Tribes are studying elk crossing behavior and investigating remedial measures. Solar powered warning signs have been installed by WSDOT in areas with histories of collisions and seem to have reduced the number of incidents. GPS enabled collars have been placed on elk in the vicinity of the highway and are providing insight into the problem.

The core management area of the North Cascade herd within the South Fork Nooksack River has gone through a series of ownership changes. In 2005, Sierra Pacific Industries purchased much of the core range. Sierra Pacific has continued to limit vehicular access on most of their road network. Other than standard timber operations and permitted elk and bear hunters, access is limited to foot traffic only. Any increase in public access would likely have a negative effect on the herd.

Elk-Related Agricultural Conflicts

Current annual spring surveys are likely inadequate for estimating the total number of elk that utilize agricultural lands throughout the year. Based on those surveys, anecdotal observations from natural resource personnel from various entities, and reports from landowners, it is likely that 300 or more elk currently utilize agricultural lands at least some portion of the year. WDFW intends to work with members of a new stakeholder group to involve landowners in developing an estimate in the agricultural landscape. Data from this effort will complement data from annual mark-resight surveys.

The majority of damage occurs in the Highway 20 corridor between Sedro-Woolley and Concrete in Skagit County and the Acme area in Whatcom County. Issuing damage permits to harvest elk in problem areas appears to reduce crop damage to some degree, but has not appreciably reduced the number of animals in the agricultural landscape. In addition to continuing to lethally remove elk using damage permits and limited master hunters, WDFW is expanding efforts to address this issue by implementing other targeted hunting opportunities. As outlined in the draft herd management plan (WDFW 2012), additional strategies for address elk-related agricultural damage include fencing, herding and hazing, and enhancing forage on forestlands away from agricultural conflict areas.

Recreational Use

An elk public viewing area, developed in cooperation with the Skagit Land Trust and Skagit County, has been established along Highway 20 west of Concrete. This site (locally referred to as Hurns Field) provides a year-round opportunity for public elk viewing. Establishing a similar site in Whatcom County has the potential to provide additional public viewing opportunities. However, it is critical that such a site be located in place that would not exacerbate or create new elk-related agricultural damage or public safety issues.

The limited-entry bull permit hunt in unit 418 was expanded for 2014 to include a total of 50 tags (26 any bull, 24 spike only) divided equally between state and tribal hunters. The allocation to state hunters was 11 modern firearm tags (5 any bull, 6 spike only), 6 muzzleloader (3 any bull, 3 spike only) and 6 archery (3 any bull, 3 spike only), and the contingency for the western Washington raffle tag and auction tag holder potentially being used in GMU 418. Few elk reside in in GMUs 407 and 448. Due to the potential for agricultural conflicts and higher residential housing densities, WFDW is managing for low elk densities in these units and offers over the counter tags for all firearm types with liberal season lengths and antler restrictions. Special damage control hunts will continue to be adapted to address elk-related agricultural conflicts while providing harvest opportunities – particularly for those enrolled in WDFW's master hunter program.

Management Goals

The goals for the North Cascades elk herd are to:

- Manage the North Cascades herd for a sustained yield;
- Manage elk for a variety of recreational, educational and aesthetic purposes including hunting, wildlife viewing, photography, cultural and ceremonial uses by Native Americans, and scientific study; and,
- Manage and enhance elk and their habitats to ensure healthy and productive populations.

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ELK STATUS AND TREND REPORT: REGION 4

GMUS 454, 460, 466, 485

CHRIS ANDERSON, District 12 Wildlife Biologist

Population objectives and guidelines

Precise population estimates for elk (*Cervus elaphus*) in Game Management Units (GMUs) 454 and 460 are unavailable. Current estimates for elk numbers in these areas are based on limited surveys and knowledge of herd and sub-herd sizes. Current numbers have been reported as 200-250 elk in GMU 454 and 400-500 elk in GMU 460 (WDFW). Elk occurring in GMU 454 are generally restricted to the eastern portions of the GMU. These areas are typically near core area elk herd refugia. This largely includes adjacent industrial timber and municipal watersheds away from the suburban growth and sprawl. However, habituated, small satellite herds do occur in suburban and rural areas of GMU 454. Population estimates for this game unit are likely low as they are based on older data. Current harvest levels (e.g. 2013 total harvest of 112 animals; Fig. 1) would indicate a plausibly larger population. This is given anecdotal elk presence observed by staff recently in comparison to overall relatively similar total annual harvest reported over a number of past years. Future surveys to update population estimates are needed as funding and survey opportunities become available.

Elk in GMU 460 are scattered throughout the potential range in small, somewhat isolated groups that normally range in size from 8-12, but occasionally approach >75 elk. The North Bend-Snoqualmie herd (Elk Area 4601) has grown to an estimated >400 animals (Upper Snoqualmie Elk Management Group, unpublished data). This data is based on repeated years of mark-recapture data; albeit small numbers of captures. That said it provides a general index of animal numbers within that portion of the valley. Occurrence varies on the extremes, with elk found from isolated wilderness areas and managed timberlands to suburban/urban populations.

The Green River elk herd in GMU 485 is a sub-population of the North Rainier Elk Herd that exhibited a decline during the 1990s. Elk historically occurred in the Green River watershed, 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 about 800-900 elk between 1988 and 1991.

Elk population estimates for GMU 485 indicate a continuing increase since 2000 (Table 1) (WDFW unpubl. data 2001, Muckleshoot Indian Tribe unpubl. data 2014).

Table 1. GMU 485 Post-hunt elk herd composition, 1984-2013 (ratios per 100 cows). Year is the year flight occurred, not biological year.

Year	Bulls	Calves	Pop Est ± 95%
1984	9	21	
1985	10	30	
1986	13	23	
1987	10	15	
1988	19	22	
1989	18	21	
1990	27	15	
1991	30	14	
1992	20	21	
1993	22	12	
1994	20	13	
1995	13.5	10	
1996	8.4	11.5	
1997[a]	6.3	14.8	
1998[a]	27	7	
1999[a]	14.7	6.4	161 ± 27
2000[a]	22.8	9.9	147 ± 14
2001[a]	7.9	23.7	124 ± 45
2002[a]	16.1	32.3	174 ± 55
2003[a]	30.3[b]	15.2	204 ± 34
2004[a]	23	27	190 ± 25
2005[a]	27	54	265 ± 62
2006[a]	36	47	298 ± 62
2007[a]	25	43	297 ± 37
2008[a]	19	41	387 ± 103
2009[a]	26	30	408 ± 90
2010[a]	20	32	389 ± 51
2011[a]	17	30	443 ± 108
2012[a]	14	24	476 ± 152
2013[a]	18	24	548 ± 105
2014[a]	21	38	511 ± 117
2015[a]	16	36	629 ± 138

[a] Flight data provided by D. Vales, Muckleshoot Indian Tribe Biologist
[b] Ratios include bulls not classified

In 1984, GMU 485 became a unique management unit where access is limited by the City of Tacoma to protect water quality and eliminate unauthorized access. That same year GMU 485 became established as a quality bull area with additional high success antlerless hunts. This continued through 1996. Harvest levels had dropped over this period and reassessment of this permit hunt occurred. It is currently a very limited quality bull hunt with high harvest success.

GMU 466, also part of the Green River watershed, consists of multiple ownerships including U.S. Forest Service lands. GMU 466 retains public access and hunting opportunities for bull elk with a 3-point minimum.

Hunting seasons and harvest trends

Management strategies vary for the different GMUs. GMU 454 has liberal seasons set for all weapon types. This is intended to maintain the population at a level that curbs damage complaints while providing for harvest and watchable wildlife opportunity where land use conflict is minimal. Harvest for years 1995-2014 in GMU 454 are presented in Fig. 1.

Hunting seasons in GMU 460 include a 3-point minimum for all weapon types. This is designed to allow the population to grow at a slow rate and for elk to expand their range. Antlerless harvest was eliminated since the 2000 season to enhance herd growth. Harvest for years 1995-2014 in GMU 460 is presented in Fig. 2. In 2014, a 3-point minimum or antlerless season (late archery and early muzzleloader) was instituted for Elk Area 4601(within GMU 460) to aid in reduction of damage in and around North Bend and Snoqualmie. This antlerless harvest is contained within the GMU 460 reports below.

GMU 466 continues to be included in the general season (no muzzleloader) with 1998 being the last year an antlerless elk could be taken. GMU 466 elk intermix with GMU 485 elk, and a small number of collared elk have been shown to move to winter range down the east side of the Cascades on Manastash Ridge to the L.T. Murray Wildlife Area (D. Vales, Muckleshoot Indian Tribe, pers. comm.). In part due to the bull only hunt, total elk harvest in GMU 466 dropped substantially (Fig. 3).

State and tribal co-management is an important relationship in providing for desired herd composition, harvest levels, and overall herd management goals. More information regarding tribal harvest can be found at the Northwest Indian Fisheries Commission (NWIFC) website (see http://nwifc.org/publications/big-game-harvest-reports/). In District 12 tribal-state co-management has provided for herd health and hunt opportunity. A good example of this collaborative management can be found in GMU 485, Green River Unit. Beginning in 1992 the Muckleshoot Tribe began exercising treaty hunting rights in the Green River Watershed. Subsequently, permit allocation changed to include the Tribe as follows: 1992 and 1993 - 15 elk (6 spike, 9 antlerless); 1994 - 31 elk (6 spike, 19 antlerless, 6 branch-antlered bulls); 1995 and 1996 - 43 elk (6 spike, 35 antlerless, 2 branch-antlered bulls). No permits were issued from 1997-2003 because of the continued population decline.

In GMU 485 the hunter success rate was initially high, averaging 91% (range 78-100%) between 1984 and 1991. Between 1992 and 1995 the success rate declined, averaging 67% (range 44-83%). The 1996 success rate of 27% was a notable exception to the past and the lowest recorded since 1984.

Currently, the Muckleshoot Tribe collects age and reproductive data as part of continuing research efforts. The tribe and Tacoma Water also contribute flight dollars for herd composition flights. Management decisions, permit levels, and allocation result from annual meetings between the WDFW, Muckleshoot Tribe and Tacoma Water. Since 2000 herd composition surveys have shown an average bull:cow ratio of 23:100.

After 3 consecutive years of high bull:cow ratios and an increasing population trend, in consultation with the Muckleshoot Tribe, a 1 special permit any bull hunt for all citizens and 1 any bull tag for the tribe was instituted for the 2004 season by special permit. This was a successful hunt with the tribe and the state each taking one bull. Subsequent survey flights indicated no change in the bull:cow ratio and the permit allocation of 1 elk each for the tribe and the state was instituted for the 2005 season. It was further agreed that the limited hunt would be biologically acceptable and not affect the future growth of the herd, while at the same time allowing hunter opportunity; the first since 1997.

During the 2005-2009 seasons a limited entry 3 bull permit each for the state and the Muckleshoot Tribe has occurred. Since 2010, the State and Muckleshoot Tribe have increased harvest to 6 “any bull” permits each. Hunter success thus far has averaged 96% (range 83-100%). This co-management harvest level will continue in 2015.

Surveys

Currently no surveys are conducted in GMU 454, 466 and 490. Limited surveys provided by local NGO efforts occur in 460. Lack of survey is a result of limited funds and difficulty in surveying elk within the suburban/rural interface found in District 12.

Prior to 1986, elk composition surveys for GMU 485 were primarily from the ground; by foot or vehicle. Helicopter survey has been utilized since that time (see Table 1).

Since the late nineties the Muckleshoot Tribe has taken lead in post-hunt herd composition helicopter survey; flown late March through mid-April. These surveys are in collaboration with Tacoma Water and WDFW. This spring survey estimates the population size and sex-age ratio based on previous year's harvest and natural mortality factors. The flight also affords a yearling calf count to provide for a measure of annual survivability.

Population status and trend analysis

Based on limited, primarily anecdotal information, the elk population in GMU 454 is very likely increasing. Landscape conversion and resulting built-natural matrix changes still provide for elk use but reduce or eliminate hunt opportunity and plausibly some natural predator pressure. A small number of elk from adjacent GMU 490 may use eastern portions of GMU 454 and southern portions of GMU 460. The elk population in GMU 460 is likely increasing slowly, with concentrated growth occurring in and around the city limits of North Bend and Snoqualmie.

In GMUs 485 and 466 there are no historic population estimates for comparison, but the long history and experience with this elk herd from field observations and sub-herd location suggests this herd declined from about 1992 to 2001. Also, the total number of elk counted during post-hunt helicopter composition flights in spring has shown a decline in the mid-to-late nineties. However, the population in GMU 485 has generally been increasing since the turn of the 21st century.

Factors that may be affecting this herd are:
1.) A density dependent decline associated with landscape forestry management changes to less preferred seral forest stages. Forest structure and age, if not managed to provide for elk limiting needs, may result in less productive habitat. In turn this may reduce winter range carrying capacity resulting in elk numbers exceeding carrying capacity. This can have a negative effect on recruitment.
2.) Predation may affect recruitment. GMU 485 was closed to bear and mountain lion harvest until 2000. It must be kept in mind that a combination of forestry management techniques, predator-prey interactions, as well as other factors such as seasonal range connectivity and overall forage quality affect herd population dynamics. These and other factors must continue to be considered in herd management planning at the local and landscape levels.

Calf mortality study

A calf mortality study was initiated in May of 1998 to determine the sources of elk calf mortality in GMUs 466 and 485. This was a cooperative study involving the Muckleshoot Indian Tribe, Tacoma Water, Weyerhaeuser and Plum Creek Timber Companies, the Army Corp of Engineers, and WDFW. The Muckleshoot Indian Tribe and WDFW continued with the study in 1999. The Muckleshoot Indian Tribe continued with the study through 2004.

Results suggested that predation, predominantly mountain lion, is the primary source of death to radio-equipped calves.

It has been noted that elk herds on the west side of the Cascade Mountains tend to have poor nutritional condition in general. Further research to distill differences in calf survival and both proximate and ultimate causes is necessary to understand these relationships (WDFW 2002, D.Vales, pers. comm. 2003).

Habitat condition and trend

In general, quality and quantity of typically preferred elk habitat in GMU 454 is declining, primarily as a result of habitat conversion. Elk have largely switched to use of agricultural areas, rural fringe hobby timber plantings (such as Christmas tree farms or smaller timber lots), and natural spaces often managed more so for non-consumptive human recreational use. The shift in landscape composition in 454 has created refuge for elk. Elk now utilize private lands that are generally near the borders of municipal urban growth areas and often either difficult to hunt due to no access or not able to be hunted due to management regime, local laws, and safety concerns. As a result, it is likely that the suburban-rural to exurban interface land matrix that GMU 454 encompasses provides atypical, but generally good, forage and habitat. Adaptations by elk in this landscape, both spatially and temporally, are resulting in quite healthy looking individuals with little hunt pressure and opportunity available.

Habitat trends in GMU 460 are more favorable to typical management efforts and harvest of elk; where several thousand acres of timberlands managed for wood fiber, fish, recreation, and wildlife can support an increasing elk population. There is strong community support for elk sub-herds occupying farmland, open space, parks, and conservation areas in the rural and suburban fringes of GMU 460.

The Green River Watershed (GMU 485) has interspersed ownership of private, state, and federal timberlands. Most of the timberlands are intensively managed and create a mosaic of seral stages, which means a mosaic of clearings mixed with different age stands of trees. Average rotation between successive harvests is about 60 years on private and state lands. These managed lands also contain remnant old growth forest, primarily in federal ownership, at higher elevations (> 2500 feet).

Habitat enhancement activities

Past and present work in GMU 485 has included cooperative projects with the U.S. Army Corp of Engineers, Tacoma Water, and the Muckleshoot Tribe to create open meadow grass habitat plots for elk. These mitigation measures were enacted to compensate for the anticipated loss of habitat from raising the Howard Hanson Dam and subsequent loss of habitat due to additional water storage.

In August 2000, a 250 acre forage enhancement project with the Rocky Mountain Elk Foundation, Tacoma Water, and the Bonneville Power Administration was completed. The project was highly successful and involved spraying and mowing of scotch broom along power line corridors to stimulate elk forage. The work and collaboration has continued with consecutive projects occurring through 2008. In summer of 2005, $30,000 from the combined sources of the Rocky Mountain Elk Foundation, the Muckleshoot Indian Tribe, BPA, and Tacoma Water was used to continue efforts on reducing scotch broom cover and improve forage quality. Over 550 acres have been treated mechanically and/or chemically to improve forage conditions on the range.

In addition, Tacoma Water implemented habitat improvement work and elk pasture creation to mitigate the effects of raising the water level of the Howard Hanson Reservoir. These projects, in the form of seeded fields and timber thinning, cover over 300 acres and provide valuable winter and summer forage for elk.

Wildlife damage and nuisance problems

In GMU 454, elk damage to ornamental shrubs, gardens, crops and pastures is a problem and numerous complaints are received every year. A combination of fencing, hazing and hunting pressure (where appropriate) has been used to address these situations. Two landowners entered into Damage Prevention Cooperative Agreements (DPCA) in 2014 to address ongoing elk damage issues in GMU 454. In addition, five landowners in GMU 652 (bordering GMU 454) entered into DPCAs with Region 4 staff.

In GMU 460, elk damage is a notable problem in some golf courses, Christmas tree farms, nurseries, blueberry farms and other agricultural crops. Vehicle-elk collisions have increased as well. GMU 460 has good elk habitat, primarily on managed forestlands and the potential to support about 450-550 elk without damage concerns. However, damage complaints within the city limits of North Bend and Snoqualmie and vehicle-elk collisions on I-90 are raising concerns. As a result, the Upper Snoqualmie Valley Elk Management Group was formed in 2008. The group is made up of citizens, WDFW wildlife and enforcement division personnel, city and county staff. The primary role of the group is to address the problems associated with the rapidly increasing herd.

Further, Washington Department of Transportation has initiated monitoring and collaborative academic studies to examine vehicle-elk collisions along I-90. These are examining use of corridors and patterns related to this use.

All of these groups in GMU 460 are working together to address these concerns with human-elk conflict, while continuing to provide for the herd and recreational opportunities. As noted above, additional elk hunting opportunities were initiated in 2014 within Elk Area 4601. In addition, three landowners entered into DPCAs in 2014 to address ongoing elk damage issues in GMU 460. A combination of fencing, hazing and hunting pressure (where appropriate) has been used to address these situations, as well as on additional properties where DPCAs were not formalized.

Elk in GMUs 485 and 466 have not largely been a problem to private property with little nuisance complaints received. However, continued monitoring of herd growth and opportunities to track any herd outmigration from these GMUs will be valuable as surrounding communities continue to expand and develop adjacent to core herd use areas.

Management conclusions

Elk in GMU 454 should continue to be managed with liberal seasons designed to keep damage issues at acceptable levels in developing areas. Isolated sub-herds, generally on the eastern boundary of the GMU should continue to offer hunting and recreational viewing opportunity.

Currently the most important concern in GMU 460 is to get an accurate assessment of the population size and distribution of elk. Survey information would facilitate management, habitat protection, and the setting of population objectives.

Several small sub-herds occur within and immediately adjacent to the urban boundaries of the cities of North Bend and Snoqualmie. Strong community interest suggests these elk represent a "quality of life" indicator consistent with a rural lifestyle and characterized by open space consisting of greenbelts, local parks, and conservation areas. Encounters of elk and humans along the urban interface present an opportunity for building and expanding public interest in wildlife conservation.

Management goals for the Green River sub-herd include maintaining the population at a minimum 500 elk, maintaining high bull to cow ratios and ensuring a majority of bulls reach the prime age class (5-10 years).

The GMU 485 permit hunt is one of Washington's most popular because of the opportunity to harvest and view quality bulls coupled with the high success rates.

Cooperative efforts between Tacoma Water, the Muckleshoot Tribe, and WDFW will continue to assess herd composition and population numbers while enhancing habitat in order to achieve population objectives and improve forage conditions in GMU 485.

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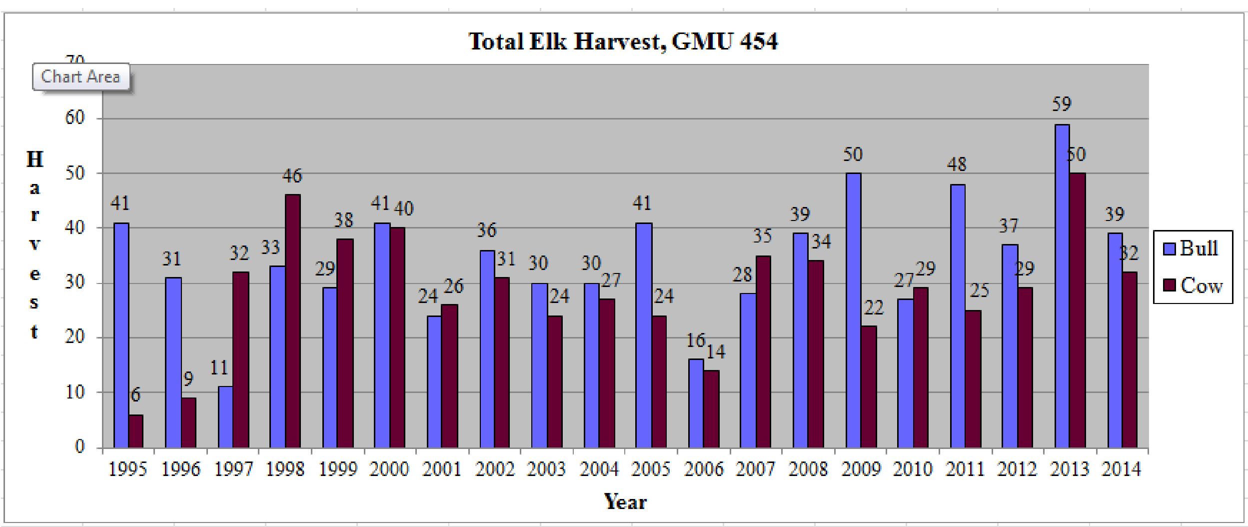

Figure 1. Annual elk harvest, GMU 454, 1995-2014 (all weapon types combined)

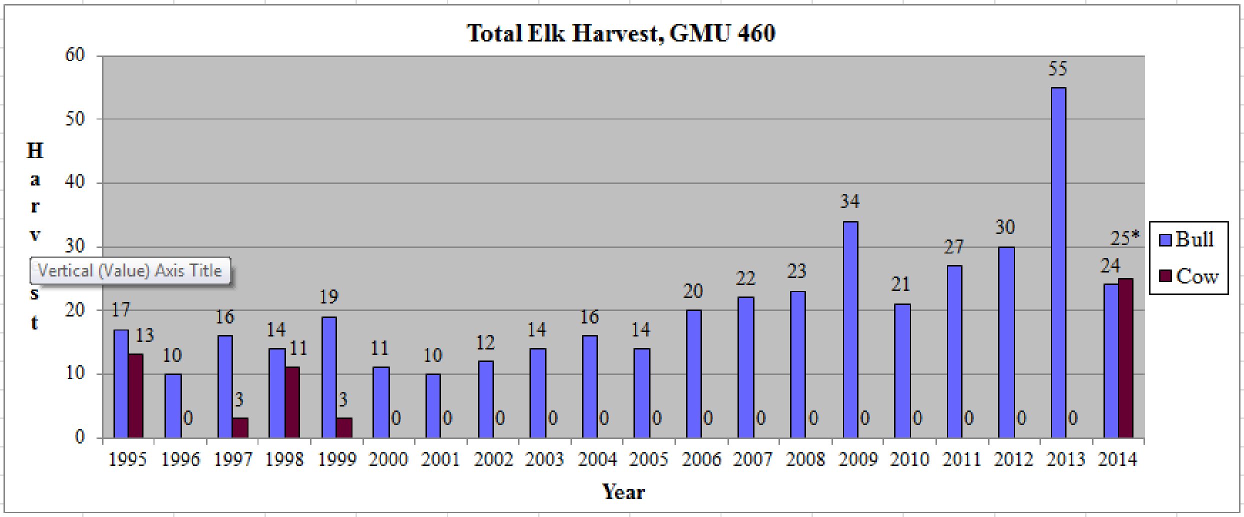

Figure 2. Annual elk harvest, GMU 460, 1995-2014 (all weapon types combined). Antlerless harvest (25*) in 2014 within Elk Area 4601.

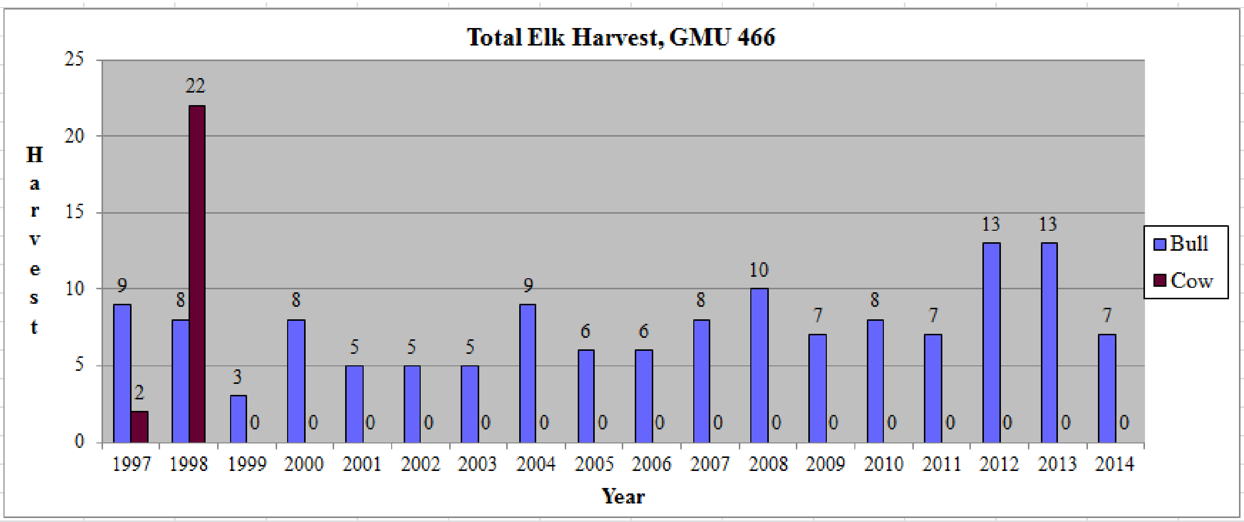

Figure 3. Annual elk harvest, GMU 466, 1997-2014 (all weapon types combined)
*2004 harvest reflects uncorrected raw data reported from hunter reports

ELK STATUS AND TREND REPORT: REGION 5
GMUS ALL

ERIC HOLMAN, District Wildlife Biologist
STEFANIE BERGH, Wildlife Biologist

Population Objectives/Guidelines
Region 5 contains all or part of three elk herds. The largest in the Region and the state is the Mount Saint Helens (MSH) herd followed by the Willapa Hills herd, and the South Rainier elk herd. The Game Management Units (GMUs) comprising each herd are listed in Table 1.

Table 1. Region 5 elk herds and associated GMUs

Herd	GMUs
Mount Saint Helens	578, 388, 564, 568, 574, 522, 524, 554, 556, 560, 572, 505, 520, 550, 503
South Rainier	510, 513, 516, 667
Willapa Hills	506, 530, 501, 504, 684, 681, 673, 658, 672, 660, 663

The MSH elk herd plan was adopted in November of 2006. Many factors, which include increased human population and development, damage complaints, winter mortality events, and declining habitat on United States Forest Service (USFS) and other timberlands, suggested that a reduction of elk was needed to bring the herd into balance with the amount of available habitat (WDFW 2006). Other objectives specified in the MSH elk herd plan are to continue post-season bull ratio and mortality rate goals for open-entry, three-point, and permit-entry units that are consistent with Department goals (WDFW2015). The plan also outlines objectives to continue efforts to monitor and improve winter habitat and wintering elk populations in the Toutle River valley. In addition, plan goals address minimizing damage conflicts, increasing public appreciation of the elk resource, and using sound science to monitor the herd.

The South Rainier elk herd plan was adopted in 2002 and is on a list of plans to be reviewed (WDFW 2002). Specific goals of the South Rainier herd plan are to increase the estimated elk population in the eastern half of the herd's range in keeping with habitat limitations and landowner tolerances, to minimize elk damage to private property, to encourage/maintain the current habitat availability on USFS lands, and to maintain current elk winter range. Other goals include managing the herd with the best available science and developing private/public partnerships to improve habitat and management of elk in the South Rainier herd.

The herd plan for the Willapa Hills was completed in 2014 (WDFW 2014). The main goals of the plan include: implement a standardized and statistically valid survey protocol that will generate reliable estimates or indices of population size and herd composition; keep the Willapa Hills elk herd at its current level by maintaining harvest levels during general hunting seasons; continue to mitigate elk damage and minimize the number of elk damage complaints; work cooperatively with timber companies to maintain hunter access; increase public awareness of the elk resource by creating an informative brochure on elk viewing; cooperate and collaborate with treaty tribes to implement the Plan; and coordinate season setting and herd management in traditional hunting areas.

General Hunting Seasons and Harvest Trends
In Region 5 elk are managed under four principal harvest strategies. From year to year, these strategies and/or what GMUs are in each of the categories can be modified to promote healthy elk populations or restrict elk numbers if needed where they are not tolerated by the public, while offering a variety of hunting opportunities. These strategies are summarized for the modern firearm general season in Table 2. General hunting seasons for archers and those choosing to hunt with muzzleloading firearms may differ from the listed strategies.

Table 2. Summary of modern firearm general season harvest strategies in Region 5	
Antler Restriction	GMU (s)
3 Point Mimimum	503, 505, 506, 510, 513, 516, 520, 530, 550, 560, 568, 572, 574, 578
3 Point Minimum or Antlerless	501, 504
Any Elk	564, 388, 382
Special Permit Only	522, 524, 556

During 2014, a total of 20,435 general season elk hunters spent 114,008 days afield in Region 5 (Figure 1).

Region 5 general season harvest was 1,636 elk and is broken down by user group as follows: 484/30% in archery, 232/14% in muzzleloader and 856/52% in the modern firearm season; the other 64 elk were killed by multi-season permit holders. Overall, hunter success during the general season was 8.0%, which is below the 10 year average of 8.7%. The 2014 general season elk harvest of 1,636 was down 29% from the most current 10 year average (2005-14) and is down 12% from the 2013 harvest. Table 3 lists a summary of the 2014 general season elk harvest in all Region 5 GMUs.

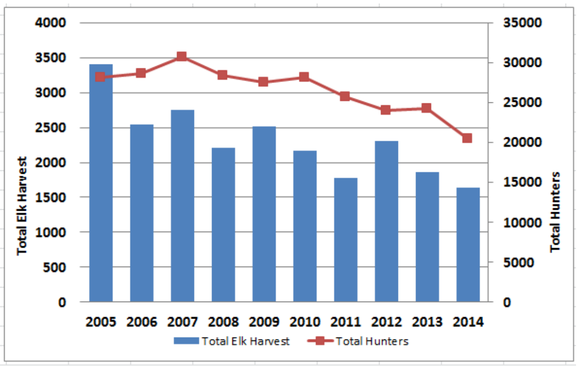

Figure 1: General season elk harvest and hunter numbers for all user groups, 2005-14, Region 5.

Table 3. Summary of General Season elk harvest, all weapons combined, for 2014 in Region 5.

GMU	Antlerless Harvest	Antlered Harvest	Total Harvest
382	3	0	3
388	2	3	5
501	15	21	36
503	9	22	31
504	21	18	39
505	16	33	49
506	57	193	250
510	0	12	12
513	0	68	68
516	0	64	64
520	39	130	169
524	0	0	0
530	43	169	212
550	7	131	138
554	6	15	21
556	0	0	0
560	57	202	259
564	24	25	49
568	5	43	48
572	17	80	97
574	4	34	38
578	1	47	48
TOTAL	326	1310	1636

Special Permit Hunting Seasons and Harvest Trends

Harvest of elk by special permit in Region 5 is designed to provide higher quality hunting opportunities for those fortunate enough to be drawn. These opportunities include chances to hunt bull elk in less crowded conditions, near the breeding season, and in favorable locations. The opportunity to harvest antlerless elk is primarily offered through this process as well.

Beginning in 2007, permit levels increased for modern firearm, muzzleloader, and archery (both bull and antlerless permits) throughout the Region. This was a purposeful increase associated with the Mt. St. Helens Elk Herd Plan goal of reducing the elk population (WDFW 2006). In 2013, these permit levels leveled out and/or decreased in parts of the Region and this trend continued downward in 2014.

A total of 2,276 special permits were distributed within 99 hunts in the Region for the 2014 season. Of this total number of permits, 1,914 were antlerless permits (851 fewer permits than in 2013). The total permit harvest in 2014 for the Region was 577.

Table 4 and Figure 2 depict the number of antlerless elk permits and antlerless harvest for all user groups combined in Region 5 during 2014. The antlerless harvest in the table below is made up of animals that were taken in both GMU and Elk Area permit hunts.

Table 4. Antlerless permit levels and antlerless harvest for all user groups combined in Region 5, 2014

GMU	Antlerless Permits	Antlerless Harvest
504	75	5
505	68	9
506	105	52
520	181	28
522	61	12
524	150	17
530	270	67
550	185	43
554	75	15
556	220	55
560	120	46
568	85	20
572	35	9
574	100	16
578	184	42
TOTAL	**1914**	**436**

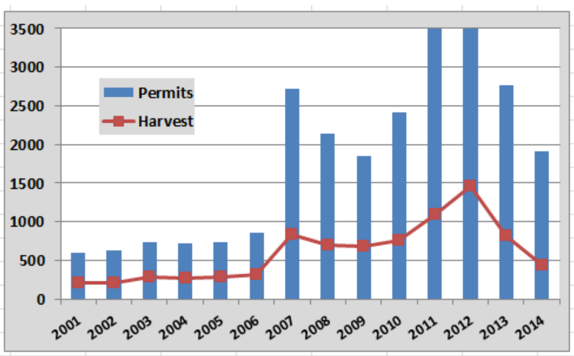

Figure 2: Antlerless elk permit numbers and harvest, 2001-14, Region 5

Three GMUs (522, 524, 556) within Region 5 are permit-entry only units for all elk hunting. Bull elk permits are available to all user groups (modern firearm, muzzleloader and archery). Tag numbers, harvest, and success rates are listed in Table 5.

Table 5. Bull elk permits and associated harvest for all weapons combined, permit-only GMUs, Region 5, 2014

GMU	Number of Bull Elk Permits	Bull Elk Harvest	Success Rate
522	30	16	53%
524	150	60	40%
556	141	40	28%

Tribal Harvest

Members of the western Washington treaty tribes have hunting rights within portions of the South Rainier elk herd area. GMUs where tribal harvest occurs include 503, 510, 513 and 516. See Table 6 for a summary of tribal elk harvest in the south Rainier herd (Northwest Indian Fisheries Commission 2014).

Table 6. Elk Harvest Reported by Western WA Treaty Tribes, South Rainier elk herd area, 2014

GMU	Bull Harvest	Antlerless Harvest	Total Harvest
503	4	5	9
510	0	0	0
513	2	6	8
516	17	52	69

Surveys

A research project in the Region to develop a more robust method of population estimation has been completed (McCorquodale et al. 2014). Using the Sightability based method of population estimation, a site specific model was developed during this research. Portions of selected GMUs in the Mt. St. Helens and Willapa Hills herd area were surveyed in the spring of 2015. The resulting population estimates for these surveyed areas are presented in the Population Status and Trend section below.

In addition to the surveys discussed above, an annual winter elk mortality survey is conducted on the Mount St. Helens Wildlife Area in the spring. Additionally, once a month throughout the winter, elk counts are performed from a fixed point overlooking the Wildlife Area to determine elk use and winter severity. Figure 3 shows the winter elk mortality for the past 17 years and the peak winter elk counts for the past 10 years on the mudflow portion of the Wildlife Area. Just 13 mortalities were found in the 2015 survey, substantially below the long-term average of 39. Winter conditions during 2014-15 were very mild and there were never large groups of elk concentrated on the Wildlife Area.

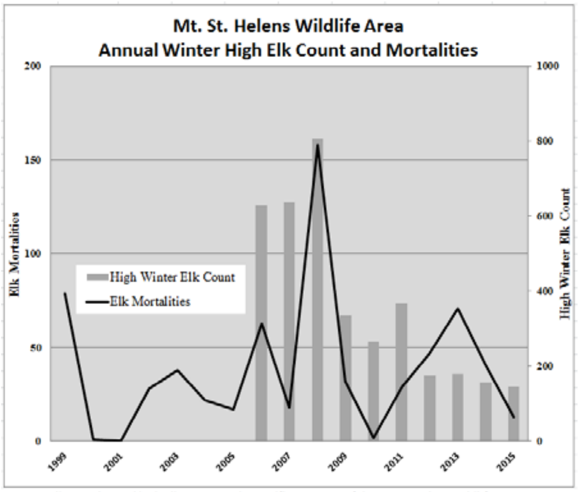

Figure 3: Elk mortality and high elk counts on the Mudflow portion of the Mt. St. Helens Wildlife Area 1999-2015

Population Status and Trend

In the past, several sources of information were used to assess elk herd size and composition. Most of these data came from harvest reports and annual aerial surveys. These are discussed below.

Mount St. Helens Herd

Because of the need for essential information about the size, composition, and dynamics of the MSH elk herd, in 2007 Region 5 began planning for a new population monitoring strategy. This strategy was implemented in 2009 in a cooperative venture of the Olympia Deer and Elk Section and Region 5 staff biologists. In support of the development of a new monitoring strategy and with the intent to produce more reliable estimates promptly, WDFW biologists radiomarked elk in the winters of 2009-2012 across a northwestern core area of the MSH elk herd (GMUs 520, 522, 524, 550, and 556). In March and April 2009-2012 project staff conducted 2 weeks of intensive aerial surveys across the 5-GMU study area. These resighting flights were used to generate statistically robust estimates of elk numbers in the survey area using mark-resight models. The data collected was also used to derive sightability-correction models for aerial surveys of the MSH elk herd. The data collection phase of this effort was completed in the spring of 2013 and the analysis was completed in 2014 (McCorquodale et al. 2014) . The mark-resight method was found to be more effective at accounting for undetected elk while the sightability model appeared to underestimate true abundance. The trend estimates were found to be similar and the yearly estimates highly correlated, so the sightability model was seen as useful despite its underestimation. The sightability model is also more cost effective since no marked animals are required and only one flight repetition per spring is needed.

Estimates of elk abundance during this period indicate approximately a 30% decline in the overall population within the core study area. For a detailed discussion of elk population trends in the core GMUs of the MSH herd area, see McCorquodale et al. 2014. During these years of work in the core GMUs, no population monitoring occurred in the southern or eastern portion of the MSH herd area.

In 2015, post-season surveys were conducted in the core GMUs. The sightability model was used to estimate abundance while composition was also calculated. This effort resulted in a total elk population estimate of 2,856 (2548-3541 95% CI) for the core portion of the MSH herd (GMUs 520, 522, 524, 550, and 556). This estimate represents a 21% increase over the 2014 estimate of 2,368. However, the 95% confidence intervals surrounding these figures overlap. It is anticipated that this method will continue to be used in the core area of the MSH herd to monitor the population on an ongoing basis.

The post-season surveys conducted in selected GMUs within the Mt. St. Helens herd area provide an evaluation of current elk management strategies in meeting the sex ratio goals outlined in the Game Management Plan (GMP) (WDFW 2015). Specifically, the GMP calls for post-season bull to cow ratios of 12-20 bulls per 100 cows, and 2-10% mature bulls within the bull segment of the population. Table 7 shows the post-season sex and age ratios for the selected GMUs within the MSH herd area during surveys conducted in the spring of 2015. The unusually high bull to cow ratios reflect the combined effects of extremely limited hunting opportunity in GMU 522, permit-only bull elk hunting in GMU 524 and 556, and the liberal allotment of antlerless elk tags among many of the MSH herd GMUs in recent years. The survey results indicate that current management strategies are exceeding the minimum post-season goal of 12-20 bulls per 100 cows. The calf to cow ratios for the survey portion of the MSH herd area are typical for elk in Western Washington and Oregon.

Table 7: sex and age ratios, 2015 post-season elk surveys, Region 5		
GMU	Bull:Cow	Calf:Cow
520	76:100	36:100
522	68:100	29:100
524	69:100	39:100
550	29:100	29:100
556	61:100	31:100

Willapa Hills Herd

Since habitat, land management, and elk behavior in the Willapa Hills and MSH herds are similar, the sightability model developed for the MSH herd was used in the Willapa Hills herd starting in 2014. Post-season surveys were conducted in the spring of 2014 within GMUs 506 (Willapa Hills) and 530 (Ryderwood) using the same protocol developed in the MSH herd. The same WDFW staff conducted both MSH and Willapa Hills surveys lending some consistency to the evaluation of the sightability model's use in Willapa Hills.

This effort resulted in a total elk population estimate of 1,538 (1,413-1,844 95% CI) for GMU 530 (Ryderwood) and GMU 506 (Willapa Hills) combined. In 2015, a similar effort was conducted in GMUs that make-up the Region 6 portion of the Willapa Hills herd. The results of this work will be presented in the Region 6 elk status and trend report. The rotation of survey effort among the GMUs comprising the Willapa Hills elk herd area will be continued in future years.

South Rainier Herd

The Puyallup Tribe of Indians developed a sightability model for estimating elk abundance (Gilbert and Moeller 2008). To facilitate development of the model, the Tribe used radio-marked cow elk that were collared as part of research being conducted by the Tribe. Estimates of elk numbers in the areas surveyed are based on spring helicopter surveys, where the data collected is entered into the sightability model. The measure of the visibility bias or correction factor is then used to adjust raw counts of animals observed to an unbiased estimate of population size and structure. WDFW did not participate in developing or reviewing this model or analyzing the data collected during survey efforts. The information provided by the Puyallup Tribe provides estimates for wintering elk in the upper Cowlitz River basin within portions of GMUs 513, 516, 510, and 503 and is presented in Table 8 (Moeller 2015).

Table 8: Spring population estimates for elk in portions of GMUs 503, 510, 513 and 516, Puyallup Tribe of Indians, 2006-15	
Year	Population Estimate
2006	938
2007	964
2008	815
2009	1084
2010	1282
2011	1618
2012	1495
2013	1562
2014	1430
2015	1424

Additionally, in the South Rainier elk herd area and specifically within Mt. Rainier National Park, a cooperative effort lead by the U.S. Geological Survey (USGS), and partnering with Mt. Rainier National Park, WDFW, Muckleshoot Tribe of Indians, and the Puyallup Tribe of Indians began in 2008 and is aimed at producing a better estimate of elk in the Park in the fall months. Fall surveys are flown within the southern and northern portions of the Park, with each partnering entity contributing one flight. A hybrid double-observer and sightability model is being used to adjust raw counts and compositional data in order to develop a robust population estimate of elk within the sub-alpine zone of the Park.

The south Rainier portion of this survey resulted in an average annual estimate of 503 elk during 2008-2011 (Jenkins et. al. 2015). Sex and age ratios were also recorded during this work. From 2008-2011 the calf to cow ratio in the Mount Rainier National Park portion of the south Rainier herd area was 34:100 and the bull to cow ratio was 39:100. Survey results during 2012-14 indicate a slight rise in the population. The results of this survey work spanning the years 2012-2015 will be included in a forthcoming project summary from the participating partners.

Habitat Condition and Trend

Region 5 continues to face loss of elk habitat through: (1) establishment of extensive Late Successional Reserves (LSR) on USFS lands that reduce forage habitat, (2) increased residential development along the three hydroelectric reservoirs (Merwin, Swift, and Yale Reservoirs), (3) intensive forest management that limits forage production on industrial forest land, and (4) general increases in development and human encroachment throughout the lowlands of Region 5, which can result in a lower tolerance by landowners to the presence of elk.

Some mitigation for the loss of winter range along the North Fork Lewis River watershed has been addressed in the Lewis River Wildlife Habitat Management Plan (Pacificorps Energy 2008). The Plan is a cooperative management agreement between Pacificorps, the utility company managing Merwin, Swift, and Yale Reservoirs; the Rocky Mountain Elk Foundation (RMEF); the Cowlitz Tribe of Indians; the USFS; the surrounding Counties; and WDFW. The plan is currently in year 6 of 50 and emphasizes elk as a primary species. These mitigation efforts benefit the southern portion of the MSH elk herd.

Many of the management issues for the northern part of the MSH elk herd stem from the natural and management-induced changes on the landscape since the 1980 eruption of Mount St. Helens. During the early post-eruption phase, the recovering landscape was dominated by early seral habitats. Such habitat provided excellent foraging opportunities for elk. However, as much of the affected landscape is industrial timberland, the forest landowners undertook a massive reforestation effort to restore the timber assets they lost in 1980. In the 3 decades since, these second-growth forests have grown up and the canopy has closed, reducing the amount of quality elk foraging habitat. Renewed logging has created a current mosaic of clear cuts, relatively open young regeneration stands, and low forage-potential closed canopy forests. Post-logging treatments on industrial timberland (*i.e*., herbicide application) often reduce/delay the forage values produced by logging for the first 2-3 years relative to what would naturally occur (*e.g*., what occurred on the early post-eruption landscape) (Geary et al. 2012). Limited timber harvest on federal forests in the last 3 decades has led to a generally declining trend in habitat quality for elk. Finally, a large tract of land within the Mount St. Helens Monument has retained its dramatically altered, largely non-vegetated state and is generally poor elk habitat.

Two of the biggest factors affecting the habitat of the South Rainier herd are the extensive development of LSRs within the Gifford Pinchot National Forest and the continual development of the herd's winter range along the Cowlitz River Valley. Elk numbers remain too high in the valley for public tolerance; however it is the prime winter range for the herd.

Commercial forest owners in two Willapa Hills units (530 and 506) have increased timber harvest activity in the past 5 years. Large amounts of acreage are now in early successional stages.

Habitat Enhancement

WDFW Managed Lands

WDFW continues to take steps to enhance forage quality on the North Toutle mudflow through plantings and fertilization on the Mt. St. Helens Wildlife Area. Lime and/or fertilizer treatments were applied to over 200 acres to maintain and enhance forage production. Portions of these sites were also harrowed to break up and control moss and thatch that can inhibit the growth of forage plants. All of the enhancement sites that were rehabilitated over the past several years are beginning to make significant contributions to the forage base, and on average provide 30-40% more forage than areas that have not been enhanced. WDFW will continue to collect clip plot samples to monitor and compare productivity between sites.

WDFW mowed Wildlife Area pastures in the Hoffstadt Unit to maintain plant vigor and palatability until the winter period and sprayed the perimeter of the pastures to control non-native blackberries that were encroaching into the openings. Approximately 10,000 trees were planted in the upland areas and riverbank of the North Fork Toutle River to help reduce bank erosion and reestablish tree cover in areas where scotch broom had been removed.

Scotch broom control efforts included hand spraying individual plants on approximately 200 acres and aerial spraying of 70 acres. WDFW staff also surveyed and treated all yellow and mouse-ear hawkweed encountered on approximately 800 acres of the Mudflow Unit of the Wildlife Area.

Pacificorps Mitigation Lands

Elk forage enhancements are a primary focus of the mitigation efforts relative to the North Fork Lewis River discussed earlier. Activities on the mitigation lands managed by Pacificorps include forest canopy removal, fertilization, establishment of forage plots, treatment of invasive plants, maintenance of farmlands and meadows for elk habitat, and creation of meadows and openings within the forested landscape. These activities are conducted on approximately 13,000 acres surrounding the reservoirs.

Federally Managed Lands

Habitat improvements have also occurred on the federally managed lands in GMUs 560 and 572 within the MSH elk herd area, as well as GMUs 513 and 516 in the South Rainier herd area. These projects have primarily consisted of thinning forest stands to foster development of older-age forests with a robust understory component. The projects have totaled several hundred acres in the past several years. Additional projects including road abandonment and meadow enhancement have been implemented as well. For a review of projects on U.S. Forest Service lands see the Gifford Pinchot National Forest website at: www.fs.usda.gov/projects/giffordpinchot/landmanagement/projects Funding for these habitat improvement activities has been provided by U.S. Fish and Wildlife Service Tribal Wildlife Grants, the Puyallup Tribe of Indians, the Rocky Mountain Elk Foundation, as well as the U.S. Forest Service. These projects have and will continue to provide valuable year round forage for elk. Additional funding has been secured to thin 400 acres during 2015-16 (Moeller 2015).

Elk Conflict

Complaints of damage to crops occur throughout Region 5 with the most severe damage concentrated in the valleys; the historical winter range areas for elk within the Region. Elk damage complaints in the St. Helens GMUs have decreased with the reduction of the Mt. St. Helens Elk Herd in these GMUs. A variety of crops are impacted by elk damage including: alfalfa, peas, Christmas trees, oats, barley, and orchards but most of the damage in Region 5 is on hay fields. Wildlife Conflict specialists work closely with producers by developing Damage Prevention Cooperative Agreements (DPCAs) which identify a plan to reduce the amount of damage incurred to agricultural crops using non-lethal and lethal methods. Non-lethal methods of discouraging elk use are a very important component to reducing elk damage and are generally attempted prior to the use of lethal response. Region 5 conflict specialists and landowners use a variety of non-lethal means to discourage elk including: electrified fladry fencing, noisemakers (birdbangers, critter gitters, propane cannons), hazing and herding on foot, with a vehicle or with a dog, scarecrow-like electronic devices, and odor-based repellents such as Plantskyyd. Details including the number of DPCA contracts and the types of non-lethal methods employed, by GMU are presented in Table 9.

Table 9: types of non-lethal deterrents used, and number of DPCAs, by GMU, 2014, Region 5

GMU	Types of Non-Lethal Methods Used	# DPCAs
503	herding, hazing, electric fladry fencing	3
505	bird bangers, herding, critter gitter, hazing, dogs	9
506	herding, dogs, bird bangers, mylar	8
513	critter gitter, herding, bird bangers, electric fladry	7
516	herding, electric fladry fencing	1
520	herding, mylar, hazing, cannon, lure crop	3
530	herding, critter gitter, bird bangers	3
578	electric fladry fencing, cannon	10

Lethal methods of deterring elk are also used in Region 5. These efforts include special late and early season damage hunts within specified elk areas, a region-wide pool of Master Hunters for immediate response to damage issues, and landowner damage permits. A summary of the elk hunts designed to address agricultural damage, the number of permits issued and the number of elk harvested, by GMU, are presented in Table 10. A tabulation of elk specifically removed under landowner damage permits will be compiled on a statewide basis and presented by the Wildlife Conflict Section of WDFW's Wildlife Management Division. Collectively, these hunts are designed to decrease the herd size of elk causing the damage and/or to haze elk from the area.

Table 10: Elk hunts implemented to address agricultural damage by GMU, 2014, Region 5

GMU	Hunt Name	Total Permits	Total Kill
505	Mossyrock	18	4
506	Grays River	50	24
520	Toledo	101	15
530	Boistfort	150	23
530	Wildwood	40	18
550	Green Mountain	20	4
578	Trout Lake	9	7
Region 5	Designated Areas	40	6

Hoof Disease

Occasional reports of hoof deformities began in the Boistfort Valley in the mid-1990s. By 2008, the number of reports of elk with abnormal hooves and lameness, and the geographic scope, had increased significantly. WDFW initiated a scientific investigation into these reports in March of 2009.

Since the initial investigation, 43 elk have been collected and extensively analyzed by veterinary experts in the field of Microbiology, Pathology and Immunology. Sampled elk ranged from 3 to 4 months up to many years in age from areas that were both affected and unaffected by hoof disease.

Collections of elk took place outside of hunting seasons from 2009 through 2013 within five counties in Southwest Washington and two control counties east of the Cascade Range. The samples from these elk were sent to five independent labs in the United States and Europe.

In 2012, the WDFW established a Technical Advisory Group (HDTAG) with members from several universities, government agencies, and research and diagnostic laboratories in the field of veterinary medicine. A Public Working Group

(HDPWG), consisting of local constituents representing multiple entities including County Commissioners, local landowners and businesses, sportsman groups, tribes, government agencies, and universities was also established in 2012. The role of both groups is to collaboratively discuss research and management questions and options, share information, and communicate with the public. To date, the groups have assisted with the ongoing development of a management approach and have participated in discussions to address further hoof disease research needs.

The HDPWG is currently scheduled to meet as needed when results from studies evolve or in response to developments. All results of these meetings, updated study results, available presentations, and public comments can all be found on the hoof disease webpage:
http://wdfw.wa.gov/conservation/health/hoof_disease/

In 2014, the HDTAG released a consensus statement relaying that all evidence to date indicates the disease is caused by infectious treponeme bacteria and appears to be very similar to a disease complex known as digital dermatitis, the most common infectious hoof disease of cattle, and in some parts of the world, sheep and goats. Treponeme-associated hoof disease (TAHD) of elk results in abnormal hoof growth, cavitating sole ulcers, and in severe cases, eventual sloughing of the hoof capsule. TAHD of elk most closely resembles contagious ovine digital dermatitis in sheep. It is likely that environmental factors are important in disease initiation and propagation as the bacteria are suspected to persist in wet soil conditions and spread to new areas on the hooves of infected animals. Since the release of a consensus statement, diagnostic results have been peer reviewed and published in both the *Journal of Wildlife Diseases* (Han and Mansfield 2014) and the *Journal of Clinical Microbiology* (Celgg, et al. 2015).

WDFW, with continued input from HDTAG and the HDPWG, is addressing hoof disease in the following manner:

- Distribution: Continued monitoring of unconfirmed public observations of limping elk through an online reporting tool in an effort to determine the geographic scope and extent of hoof disease. http://wdfw.wa.gov/conservation/health/hoof_disease
- WAC 232-12-286: Hunters are required to remove the hooves of any elk taken in specific GMUs within Southwest WA and leave them on site as a precautionary measure in an attempt to minimize the spread of the TAHD in elk.
- Initiation of research projects: Studies designed to ascertain the prevalence of the disease and the effects on survival of infected animals have been started in southwest Washington. Details regarding these research undertakings are discussed in Research Projects below.

Research Projects

Two research projects are currently underway in southwest Washington both of which are focused on treponeme associated hoof disease. The first study is designed to ascertain the prevalence of the condition. The effort consisted of a citizen science based survey of elk conducted during March and April of 2015. Over 300 volunteers surveyed expansive areas throughout southwest Washington, and approximately 250 groups of elk were observed during the undertaking. Survey results will be compiled and the effort will likely be continued during the spring of 2016.

Additionally, WDFW has initiated an effort to learn more about the effects of treponeme associated hoof disease on both individual elk and the overall population. Seventy-eight female elk > 2 years of age were captured and outfitted with satellite GPS collars in February of 2015. The study is designed to determine the survival, reproductive fitness, and nutritional condition of affected elk relative to their unaffected counterparts. The study also allows for the opportunity to collect biological samples from both affected and healthy elk and generally learn more about the disease. The study is designed to continue through 2019.

Management Conclusions

The new survey effort in the Willapa Hills herd and continuing efforts in the MSH and South Rainier herds have helped inform management decisions. The general season elk harvest and success in the Region have both declined since peaking in 2005. The population reduction goal outlined in the MSH elk herd plan has been achieved and the herd is being managed to achieve stabilization. Continued monitoring efforts planned throughout the Region should provide useful estimates of the elk population. Additionally, significant efforts will continue in order to understand the management implications for the Region's elk affected with hoof disease.

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ELK STATUS AND TREND REPORT: REGION 6
ALL 600 SERIES GMUS

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Population Objectives and Guidelines
In general, the Department primarily manages elk (*Cervus elaphus spp*.) to promote viable and productive elk populations. Secondary management goals include:

- Provide recreational opportunity and sustainable annual harvests
- Provide a variety of recreational, aesthetic, and educational purposes
- Minimize, mitigate, and manage wildlife conflict.

General guidelines for managing elk are outlined in the Department's Game Management Plan (WDFW 2015). This plan directs that the goal of sustainable harvest can be fulfilled by managing the population for:

1. Pre-hunt Bull:Cow Ratio: 15-35 bulls per 100 cows.
2. Post-hunt Bull:Cow Ratio: 12-20 bulls per 100 cows.
3. Total bull mortality rate of 50% or less

The Department developed management plans that outline objectives and strategies to manage each of Washington's 10 elk herds. Region 6 completely envelopes the Olympic elk herd and contains portions of three others; the Willapa Hills herd, South Rainier herd, and North Rainier herd (Table 1). Specific population objectives and guidelines for each herd vary in accordance with the individual herd plan. Each plan is available for review and can be accessed through the Department's website.

Thirteen treaty tribes retain off-reservation hunting rights inside portions of region six. Thus, effective management of elk herds in Region 6 requires a cooperative effort between the Department and those treaty tribes with a vested interest in a particular herd. In several Game Management Units (GMUs), treaty tribes have taken the lead in collecting information used to better manage local elk herds (e.g., survey data, population estimates, research, etc.). In their commitment to work cooperatively, they have shared that information with the Department. Some data provided in this report was obtained from tribal counterparts. Credit is given accordingly where information is presented.

Table 1. Elk herd and associated GMUs contained within Region 6

Herd	GMU(s)
Olympic	601-603, 607, 612, 615, 618, 621, 624, 633, 636, 638, 642, 648, 651
Willapa Hills	658, 660, 663, 672, 673, 681, 684, 699. also 501, 504, 506, 530,
North Rainier	652, 653, 654 also 454, 460, 466, 485 & 490
South Rainier	667. also, 510, 513 and 516

- GMU's 627, 666 are not identified as part of any herd area

Hunting Seasons and Harvest Trends
The Department implements a variety of harvest strategies to achieve its management goals for elk in Region 6 (Table 2). When (season timing and length) and where (GMU and/or Elk Area) these strategies are implemented depends on the population objectives for a specific area. For example, permit opportunities for antlerless elk are primarily restricted to agricultural areas that experience chronic elk damage. The objective of these permits is to limit elk numbers in a localized area.

Table 2. Summary of general hunting seasons and antler restrictions by GMU in Region 6.

Season	Antler Restriction	GMUs
Modern Firearm	3 pt. min	601-618, 624, 627-633, 638-652, 654-684
	Any Elk	666
Early Archery	3 pt. min.	601-603, 607, 612-618, 627, 633, 638-648, 651, 658, 663
	3 pt. min. or antlerless	624, 654, 660, 667-673, 681, 684, 699
	Any Elk	652, 666
Late Archery	3 pt. min or antlerless	667, 672, 681, 699
	3 pt. min	603, 612, 615, 638, 648
	Any elk	666
Early Muzzleloader	3 pt. min	602-603, 607, 627, 633, 638, 642, 660, 663, 672
	3 pt. min. or antlerless	652, 654, 667
	Any elk	666, 684
Late Muzzleloader	3 pt. min.	601, 618, 651, 667
	3 pt. min. or antlerless	652, 654, 667
	Any elk	666, 684

Olympic Elk Herd (GMUs 601-603, 607, 612, 615, 618, 621, 624, 627, 633, 636, 638, 642, 648, 651)

An estimated 358 bulls and 57 antlerless elk were harvested in all GMU's included within the Olympic Elk herd area during the 2014 season (Table 3).

Table 3. General Season Elk Harvest by GMU in Olympic herd area for 2014.

GMU	Bull	Antlerless	Total
601	5	9	14
602	21	0	21
603	10	0	10
607	22	0	22
612	15	0	15
615	37	0	37
618	18	0	18
621	0	0	0
624	1	0	1
633	0	0	0
636	0	0	0
638	26	4	30
642	16	0	16
648	27	0	27
651	17	0	17
Total	**215**	**13**	**228**

Compared to the 2013 general season, bull harvest decreased by 4%, but was almost equal to the 10 yr average of 376 bulls (374 bulls in 2013). Antlerless harvest decreased by 8% compared to 2013 and was 27% lower than the 10 yr average. Total harvest has been declining since 2010 (Figure 1). Tribal Harvest represented 38% of the total, or 34% of the bull and 61% of the antlerless harvest. Special permits represent 9% of the total harvest

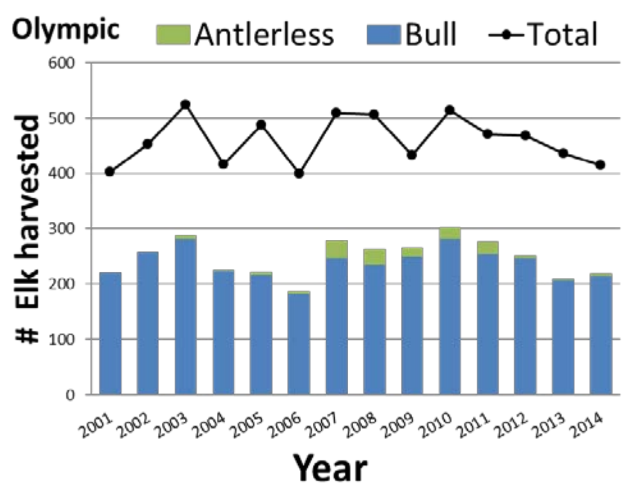

***Figure 1**. Total elk harvest in the Olympic herd area including tribal and special permits. Bar graph shows general season bull and antlerless harvest.*

A total of 3,160 hunters participated during the general modern firearm, archery, and muzzleloader seasons combined and spent a total of 17,528 days pursuing elk in the Olympic herd area during the 2014 season. The number of modern firearm and muzzleloader hunters declined in 2014, while the number of archery hunters remained stable (Figure 2).

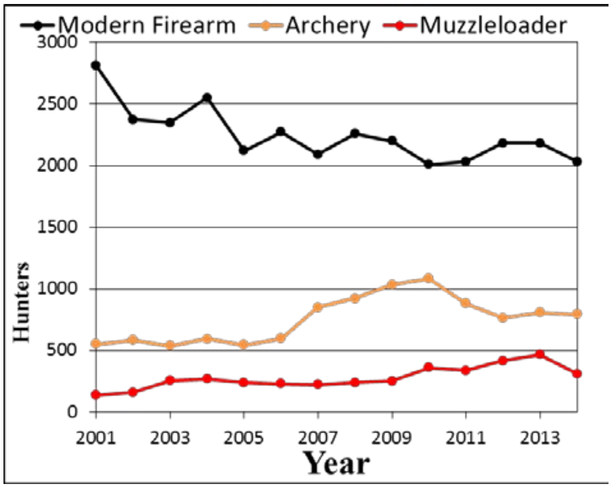

Figure 2. Annual trends in for total hunters by weapon type in Olympic herd area.

Hunter success rates were 6%, 7%, and 11% during the 2014 general modern firearm, archery, and muzzleloader seasons, respectively. Muzzleloader hunters have historically experienced the greatest success among general season user groups. Archery hunter success has declined slightly the past two years while 2014 saw a slight increase in modern firearm success (Figure 3).

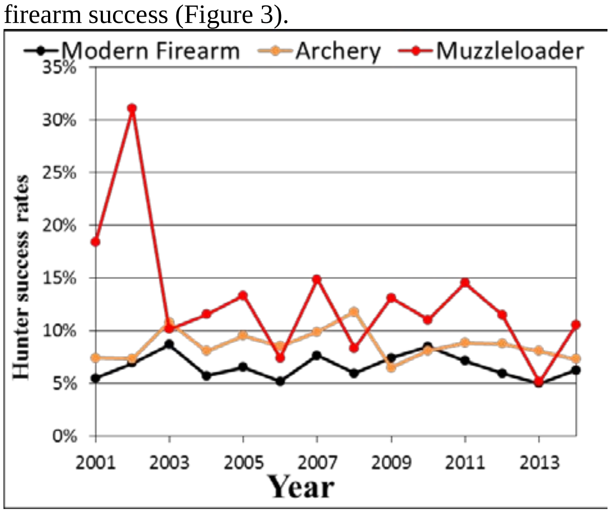

Figure 3. Annual trends in hunter success by weapon type within Olympic herd area.

Willapa Hills Herd (GMUs 658, 660, 663, 672, 672, 681, 684, 699)

Region 6 overlaps a portion of the Willapa Hills Elk Herd Area. An estimated 441 bulls and 120 antlerless elk were harvested during 2014 in these GMU's that comprise a portion of the Willapa Hills Elk herd area (Table 4).

Table 4. General Season bull and antlerless elk Harvest by GMU in Region 6, Willapa Hills herd area.

GMU	Bull	Antlerless	Total
658	100	0	100
660	41	3	44
663	3	0	3
672	58	34	92
673	156	43	199
681	63	31	94
684	13	3	16
699	7	6	13
Total	**441**	**120**	**561**

Compared to the 2013 season, bull harvest increased by 2% and was 11% over the 10 yr average of 399 bulls. Antlerless harvest decreased by 10% compared to 2013 but was 4% above the 10 yr average of 116 animals. Total harvest has been stable since 2009 (Figure 4). Tribal harvest represented 1% of the total elk harvest in these units and special permits were 9%.

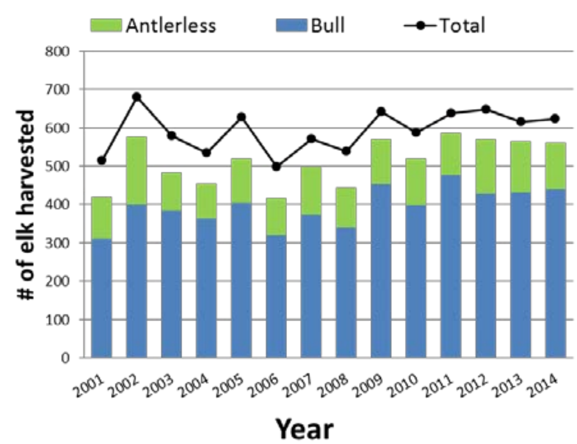

Figure 4. Total elk harvest within the Willapa Hills Herd Area including tribal and special permits. Bar graph shows general season bull and antlerless harvest.

A total of 4,310 hunters participated during the general modern firearm, archery, and muzzleloader seasons combined and spent a total of 25,469 days pursuing elk in the Willapa Hills herd area during the 2014 season. The number of hunters from each weapon class declined in 2014, (Figure 5).

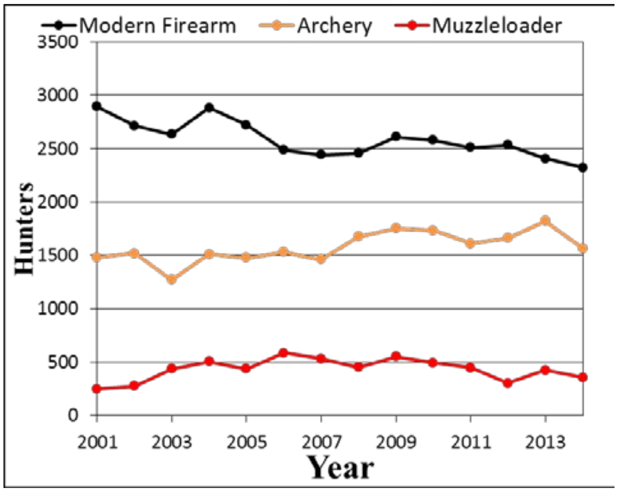

Figure 5. Annual trends in total hunters by weapon type in Willapa Hills herd area

Hunter success rates for the Willapa Hills herd area were 12%, 14%, and 13% during the 2014 general modern firearm, archery, and muzzleloader seasons respectively. Both modern firearm and archery hunter success increased over the previous year, while 2014 saw a slight decrease in muzzleloader success (Figure 6).

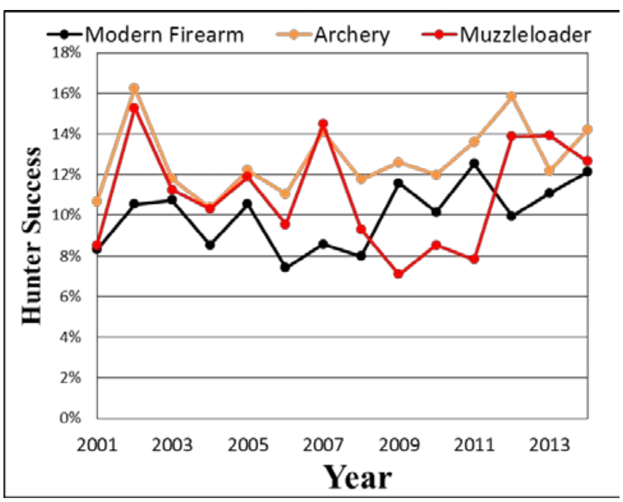

Figure 6. ***Annual trends in for hunter success by weapon type in Willapa Hills herd area***

North Rainier Herd (GMUs 652, 653 & 654)
Region 6 contains 3 GMUs that overlap a portion of the North Rainier Herd Area. An estimated 148 bulls and 96 antlerless elk were harvested during 2014 in these GMU's that are a portion of the North Rainier herd area (Table 5).

Table 5. General Season bull and antlerless elk harvest by GMU in Region 6 portions of North Rainier herd area.

GMU	Bull	Antlerless	Total
652	87	68	155
653*	0	0	0
654	61	28	89
Total	148	96	244

- No general season opportunities available in GMU 653

Bull harvest decreased by 15% from 2013 but was still 21% over the 10 yr average of 51 bulls. Antlerless harvest decreased by 18% compared to 2013 but was still 75% above the 10 yr average of 16 animals. Total harvest has been trending upward since 2004 (Figure 7). Tribal Harvest represented 18% of the total elk harvest in these units while special permits made up 10% of the total.

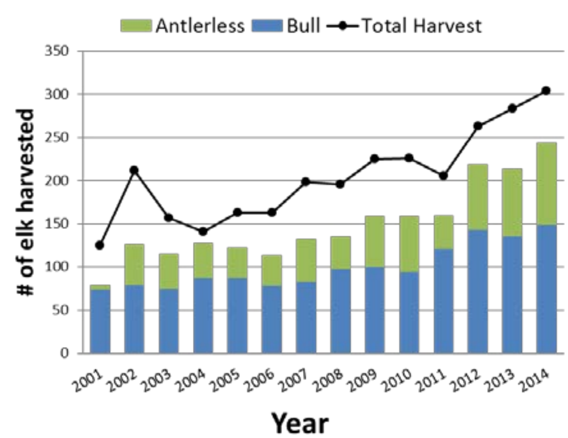

Figure 7. Total ***elk harvest within Region 6 portions of North Rainier Area including tribal and special permits. Bar graph shows general season bull and antlerless harvest.***

A total of 1,584 hunters participated during the general modern firearm, archery, and muzzleloader seasons combined and spent a total of 8,141 days pursuing elk in this portion of the North Rainier herd area during the 2014 season. The number of hunters from each weapon class has remained stable, (Figure 8).

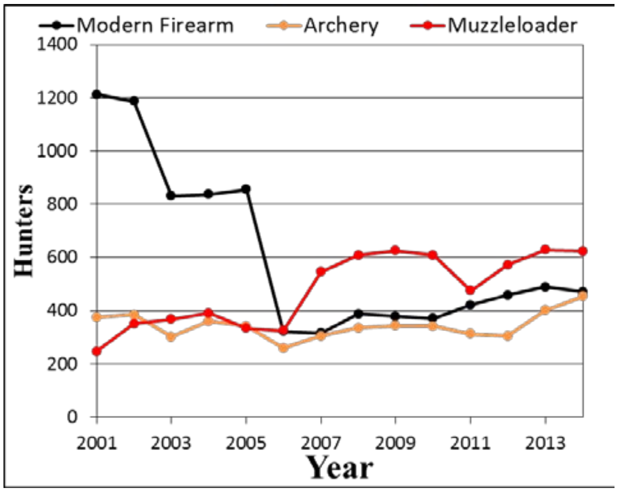

Figure 8. Annual trends in total hunters by weapon type in Region 6 portions of North Rainier herd area

Hunter success rates for this portion of the North Rainier herd area were 10%, 16%, and 18% during the 2014 general modern firearm, archery, and muzzleloader seasons respectively. Both archery and muzzleloader hunter success notably increased last year while 2014 saw a slight decrease in modern firearm success (Figure 9).

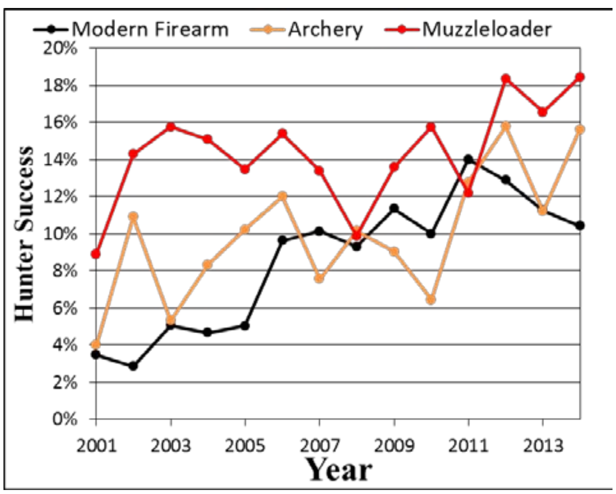

Figure 9. Annual trends in hunter success by weapon type in region 6 portions of North Rainier herd area

South Rainier Herd (GMU 667)

Region 6 contains one GMU within the South Rainier herd area. The other three GMUs that comprise the herd are in Region 5. An estimated 48 bulls and 37 antlerless elk were harvested during 2014 in this GMU. Bull harvest decreased by 13% from 2013 but was still 14% over the 10 yr average of 42 bulls. Antlerless harvest decreased by 26% compared to 2013 but was still 15% above the 10 yr average of 32 animals. Although harvest decreased last year, total harvest has been trending upward since 2004 (Figure 10). Tribal Harvest was not reported in these units while special permits contributed to 25% of the total.

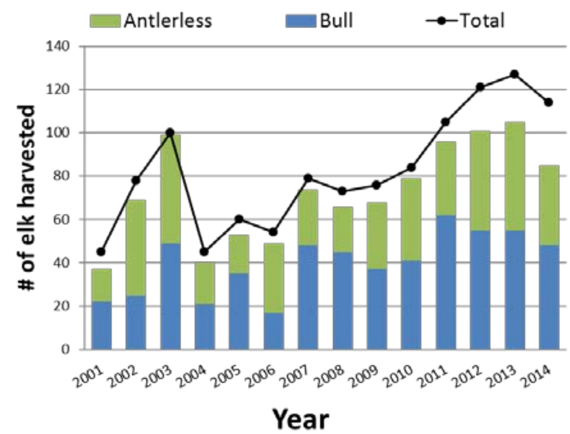

Figure 10. Total elk harvest within Region 6 portions of the South Rainier herd area including tribal and special permits. Bar graph shows general season bull and antlerless harvest

A total of 1,075 hunters participated during the general modern firearm, archery, and muzzleloader seasons combined and spent a total of 6,650 days pursuing elk in this portion of the South Rainier herd during 2014. The number of hunters from each weapon class remains stable (Figure 11).

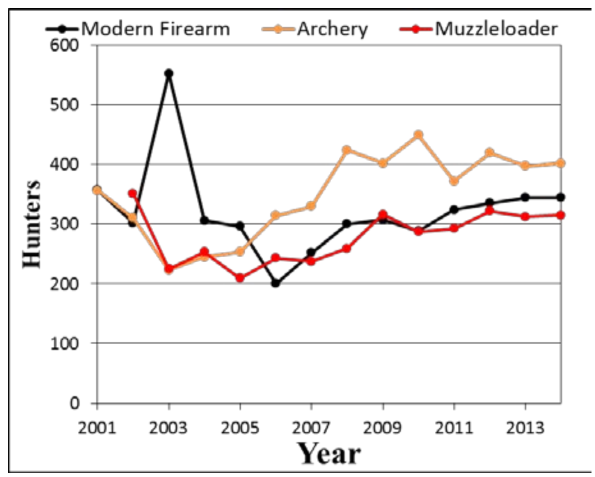

Figure 11. Annual trends in total hunters by weapon type in Region 6 portions of South Rainier herd area

Hunter success rates for this portion of the South Rainier herd area were 7%, 7%, and 9% during the 2014 general modern firearm, archery, and muzzleloader seasons respectively. Both modern firearm and muzzleloader hunter success notably decreased last year while archery success remained stable (Figure 12).

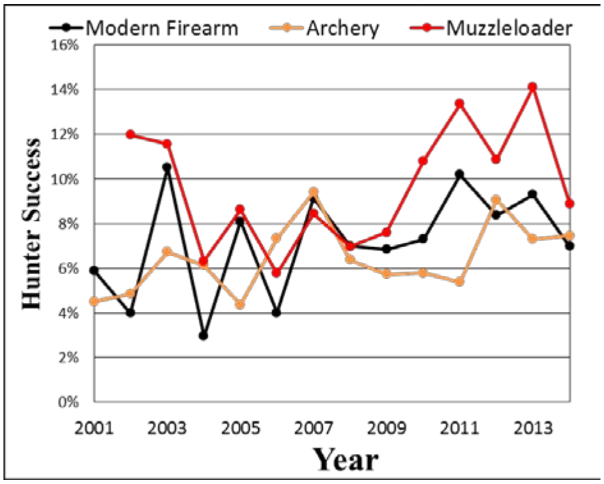

Figure 12. Annual trends in hunter success by weapon type in Region 6 portions of South Rainier herd area

GMU's 627 and 666

GMUs 627 and 666 are outside of any herd area, and have low to nonexistent elk populations. Elk expansion into these areas is discouraged.
No elk were harvested in GMU 627 during 2014 and, the 10 year average is zero. In GMU 666, an estimated 19 bulls and 12 antlerless elk were killed during the 2014 season. Total elk harvest has been relatively stable since 2009 (Figure 13). Tribal Harvest was 3% of the total. Special permit harvest was 3% of the total.

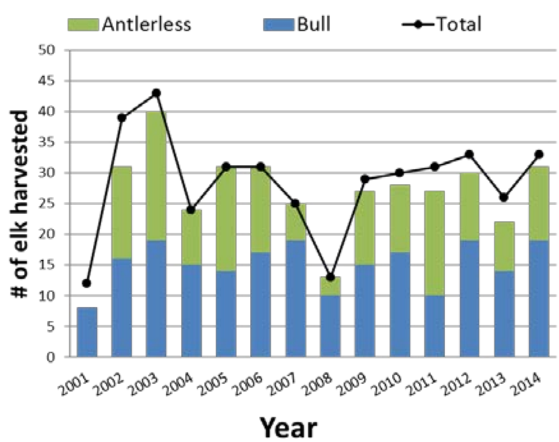

Figure 13. Total Elk Harvest within GMU 666 including tribal and special permits. Bar graph shows general season bull and antlerless harvest

Only 9 hunters participated in GMU 627 in 2014. In GMU 666, a total of 314 hunters spent 1,676 days pursuing elk during the combined general modern firearm, archery, and muzzleloader seasons. The number of archery and modern firearm hunters increased while muzzleloader hunters decreased (Figure 14)

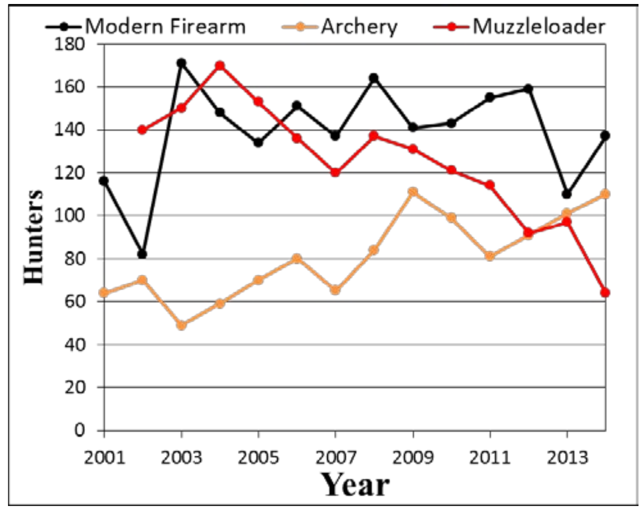

Figure 14. Annual trends in total hunters by weapon type in GMU 666

Hunter success rates for GMU 666 were 9%, 5%, and 17% during the 2014 general modern firearm, muzzleloader and archery seasons respectively. Muzzleloader hunter success notably increased last year while modern firearm success remained stable and archery success decreased (Figure 15).

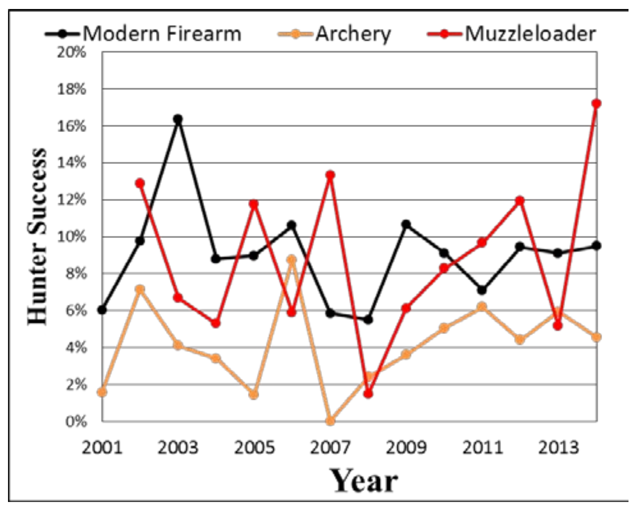

Figure 15*. *Annual trends in hunter success by weapon type in GMU 666

Surveys

In general, the Department conducts preseason or postseason surveys, but rarely conducts both in the same biological year. Preseason (August–September) surveys evaluate population productivity (calves:100 cows) and estimate the preseason bull:cow ratio. Postseason (March–April) surveys assess calf recruitment rates and the postseason bull:cow ratio. Postseason bull:cow ratios are used as an index of bull escapement. Due to logistical or financial constraints, timing of preseason and postseason surveys may diverge from the typical survey months of August–September and March–April.

Estimated bull:cow ratios are viewed as minimum, or conservative estimates because they are most likely biased low. This negative bias occurs because mature bulls tend to segregate themselves from cow-calf groups and occur in smaller bachelor groups, which decreases the probability of their detection during surveys. Although this bias is most prevalent during postseason surveys, it occurs to a presumed lesser degree during preseason surveys as well.

The majority of the survey data presented for Region 6 is the result of collaborative efforts between the Department and several treaty tribes.

Olympic Herd

Preseason and postseason composition surveys have been completed in various segments of the Olympic herd area since the late-1980s. Survey focus areas include GMUS 601, 602, 607, 612, 621, 648, 651. Intermittent surveys have occurred in 603, 618, and 636.

Through these years, elk surveys have been implemented by WDFW and many of the Olympic Peninsula tribes. The Makah Tribe, Quinault Tribe, Quileute Tribe, Point No Point Treaty Council, Skokomish Tribe, and Lower Elwha S'Klallam Tribe have all contributed to aerial and ground survey efforts. From 2004-2012, Average preseason elk composition was 39 calves and 21 bulls per 100 cows. Average postseason composition from 2005-2014 was 30 calves and 14 bulls per 100 cows (Table 5).

Table 5. Average elk calf to cow and bull to cow ratios in the Olympic Herd area 2004-2012.

Timeframe	Season	Calf:Cow	Bull:Cow
2004-2012	Preseason June/Sept	39:100	21:100
2005-2014	Postseason Dec/May	30:100	14:100

Three GMUs were surveyed by the Quileute tribe in the western portion of the herd area. A single 2014 postseason survey was conducted in the eastern portion of the herd area in GMU 651 (Table 6)

Table 6. ***Elk sex and age ratios by GMU from postseason surveys in Olympic herd area during spring 2015.***

GMU	Total Elk	Calf:Cow	Bull:Cow
602	237	32:100	10:100
607	203	27:100	11:100
612	252	31:100	6:100
651	176	25:100	15:100

The Olympic Herd is also surveyed within Olympic National Park by the National Park Service. These pre-hunt surveys are conducted at higher altitudes with high visibility where bulls may be overrepresented. Although hunting within park boundaries is not allowed, the elk residing within the park contribute to the overall population and may be subject to harvest when they migrate outside the park. Details of their survey methodology can be found elsewhere (Happe, 2015). The estimated total number of elk and sex/age composition was determined for three park units; Core, Elwha, and Quinault. For 2014, the estimated number of elk for these units was 174, 143 and 246 respectively. Sex and age ratios are reported in Table 7. Calf ratios in the core area have remained stable since 2011 (Happe 2015)

Table 7. Elk sex and age ratios within Olympic National Park from preseason surveys during spring 2014.

Unit	Total Elk	Calf:Cow	Bull:Cow
Core	174	31:100	92:100
Elwha	143	3:100	72:100
Quinault	246	48:100	34:100

Willapa Hills Herd

The Department has intermittently completed preseason and postseason surveys in the Willapa Hills since 2000. The majority of those survey efforts have occurred in GMU 673. A sightability model, developed for the Mount Saint Helens herd, was applied to the Willapa Hills herd starting in 2014. This 2014 effort was conducted in GMUs located in Region 5 and results can be found in that section of the status and trends report.

In 2015, postseason surveys were conducted in GMUs 658, 660, 672 & 673. The resulting population estimate for those combined units were 2,076 elk (range 1653-3,859). Individual GMU estimates were obtained for GMU 658 (1,047 elk, range 723-2955), and GMU 672 (394 elk, range 357–560) (Table 8). The estimated sex age ratios for this population was 21 bulls per 100 cows and 37 calves per 100 cows.

Table 8. 2015 Elk sex and age class population estimates with ranges for portions of Willapa Hills elk herd

		Total Population		Cows		Calves		Bulls	
Year	Units	ñ	Range	ñ	Range	ñ	Range	ñ	Range
2015	All	2,076	1,653-3,859	1,245	1,028-2,083	465	344-1,168	258	204-445
	658	1,047	723-2,955	577	423-1,418	275	169-1,043	132	100-293
	672	394	357-560	238	219-323	62	58-105	56	42-150

North Rainier Herd

WDFW cooperates with the U.S. Geological Survey, Mount Rainier National Park (MNRP), the Muckleshoot Indian Tribe, and the Puyallup Tribe of Indians to conduct late summer aerial elk surveys on subalpine summer range in Mount Rainier National Park (Happe et al. 2015). Estimating abundance for this portion of the North Rainier herd is relevant for the Department because some of those elk migrate out of MNRP and are available for harvest during seasons established by the Department and treaty tribes. Because surveys only occur in subalpine habitats, resulting estimates are intended to be an index of sub-population size rather than a formal estimate of the entire population.

The MNRP effort was used to develop a double-observer sightability model that was published in the Journal of Wildlife Management in 2013. Survey protocol, annual reports, and 4-year analysis reports are available at http://science.nature.nps.gov/im/reports/index.cfm.

Surveys have been completed since 2008, with estimates ranging from 294 elk in 2008 to 424 elk in 2009 (Happe et al. 2015). Overall, indices show this sub-population has been stable or slightly increasing.

Preseason data for 2014 revealed a bull:cow ratio of 32 bulls per 100 cows and a calf:cow ratio of 50 calves per 100 cows (Table 9).

Table 9. Elk sex and age ratios within the northern portion of Mt. Rainier National Park from preseason surveys during spring 2014.

Cow	Calf	Bull	Total	Bull:Cow	Calf:Cow
244	123	78	445	32:100	50:100

Additionally, the Muckleshoot Tribe continues to monitor radio-collared adult cows and calves in GMU 653. The Tribe conducts annual elk surveys in spring, occasionally cooperatively with WDFW and Hancock Forest Management, using radio-marked adult elk to facilitate estimating elk numbers. After a precipitous decline in the late 1990's and early 2000's the GMU 653 White River Elk Herd has steadily increased at roughly 10% per year (Muckleshoot Indian Tribe, unpublished data).

South Rainier Herd - GMU 667

As noted, surveys in the South Rainier herd area are completed as part of a collaborative effort among the National Park Service, U.S. Geological Survey, Muckleshoot Indian Tribe, Puyallup Tribe of Indians, and the Department. Further details can be seen in the Region 5 portion of the elk status and trend report.

GMUs 627 and 666

No surveys are conducted in these GMUs

Population Status and Trend

Formal estimates or indices of population size at the herd level do not exist for any elk herd in Region 6. Occasionally, estimates exist at the GMU level and those data are presented when available. In the absence of formal estimates, the Department relies on harvest data as indices of population trend.

Bull:cow ratios are used to determine if the Department is meeting its management objective of maintaining populations with a range of 15 to 35 bulls:100 cows in the preseason population and a range of 12 to 20 bulls:100 cows in the postseason population.

Preseason calf:cow ratios are used to index long-term trends in population productivity and postseason calf:cow ratios are used to provide a relative index of the potential for populations to increase, decrease, or remain stable.

Olympic Herd

Trends in total harvest (decline), and hunter success rates (stable) all indicate the elk population in the Olympic herd has, in general, been stable since 2001. The area covered by this herd is very large so subregions, such as those previously identified as Population Management Units (PMU) or individual GMUs, may have diverging trends.

Overall trends in calf:cow ratios cannot be readily assessed. Preseason ratios in Olympic National Park have been stable. The 2015 postseason ratios from three GMUs in the northeast ranged from 27 to 31 calves per 100 cows while those within GMU 651 were low (13 calves per 100 cows) but, no inference can readily be made to the larger herd area.

In contrast, the bull to cow ratios in the northeast were 6-11 bulls per 100 cows, which is lower than the agency minimum objective of 12 bulls per 100 cows. The ratio within GMU 651 was within the range of the objective at 15 Bulls per 100 cows.

Willapa Hills Herd

Trends in total harvest (stable) and hunter success rates (stable) indicate that the elk population in the Region 6 portion of the Willapa Hills has been stable since 2001. Postseason calf:cow ratios for 2015 indicate calf recruitment at levels that would promote stable or increasing elk populations. Postseason bull:cow ratios are largely within the recommended range objective of 12 to 20 bulls per 100 cows.

North Rainier Herd

Preseason surveys within Mount Rainier National Park in 2014 revealed comparable sex and age ratios to the prior year. Calf to cow ratios have been trending higher since 2010 while bull ratios have been more variable.

However, surveys conducted in MRNP represent only a small portion of the elk available for harvest in this portion of the North Rainier herd area therefore, harvest data is still the strongest indicator of population trend.

Long-term trends in total harvest have been steadily increasing since 2004. Hunter success has been highly variable since 2001 but trending upwards.

South Rainier Herd

Trends in total harvest (decreasing), and hunter success rates (decreasing), both indicate elk populations in GMU 667 may have declined in 2014. However, spring population surveys conducted by the Puyallup tribe in the remaining units (GMUs 503, 510, 513, 516) indicate a stable or slightly increasing herd. See the Region 5 portion of the elk status and trends report for more detail.

Research

Hoof Disease

An increasing incidence of Treponeme Associated Hoof Disease (TAHD) in elk has been reported in southwest Washington. Severely affected elk show significantly overgrown and deformed claws, and often marked emaciation. Although reports of deformed hooves in elk have occurred sporadically in southwest Washington for over a decade, the number and geographical distribution of these reports increased dramatically.

Currently, the Department is collaborating with the Washington State University College of Veterinary Medicine and other specialists from around the world to identify treponeme bacteria as the cause of TAHD in southwest Washington elk herds. With guidance from this technical team of specialists, the Department collected samples from affected (Regions 5 and 6) and non-affected areas (Regions 3 and 6) during three separate sampling periods (February-March 2013, July-August 2013, and January 2014). A consensus of the Hoof Disease Technical Advisory Group was that all evidence indicated this disease was caused by infectious treponeme bacteria. The Department has initiated investigations into survival, prevalence, distribution, and management strategies for this hoof disease in both Regions 5 and 6.

One research project underway is a citizen science project developed to assess the prevalence of TAHD in elk. The effort involved volunteers conducting road surveys to locate elk and identifying the number of animals affected (limping) and the geographic location. Survey results are being compiled and the effort will likely continue during spring 2016.

Telemetry Studies- North Rainier Herd Area

The Muckleshoot Tribe has radio-collared adult cow elk on and around the Muckleshoot Indian Tribe reservation in GMU 652. Data from these collared animals has helped refine a special elk hunt area to target removal of non-collared animals causing damage to commercial agriculture. Movement data has revealed the sedentary nature of these low-elevation dwelling elk

Telemetry Studies- Olympic Herd Area

The Quinault tribe has radio-collared 10 elk located primarily on the reservation. Data from these collars will be used to develop road and habitat management plans.

The Skokomish tribe has collared 16 elk in GMUs 651 and 636. The effort is part of an integrated study of predator-prey relationships between elk and mountain lion.

The Point No Point Treaty Council was monitoring 4 gps collared elk in GMU 621 as part of a cooperative elk foraging study with Oregon State University. Eight additional elk have been collared for a variety of management purposes.

Habitat Studies

Timber management practices that include shorter stand rotations and the use of herbicides may affect the availability and quality of elk forage in Region 6. However, changes in understory composition and structure following the use of herbicides is not simply an effect of the herbicide, but rather an interaction between the management treatment and herbivory by deer and elk (Riggs et al. 2005). Little is understood about that interaction in coastal regions of western Washington, but it has been the focus of research in Region 6 by Washington State University. The primary intent of the project is to determine the effect of current timber management practices on the quantity and quality of forage available to black-tailed deer (*Odocoileus hemionus columbianus*). However, it is anticipated their findings will have implications for elk as well. A report is expected in 2016.

Habitat Condition and Trend

Elk habitat in Region 6 is dominated by second-growth forests and clearcuts, which are different in structure and composition than old-growth forests that once dominated the landscape (Edmonds 1979). This change in forest structure and composition has influenced elk by altering forage quantity and quality as well as the juxtaposition of foraging habitats to security cover.

Industrial timber management practices have also resulted in a high density road system that has increased human access to remote areas. A few large industrial timber company landowners have begun restricting access to their lands. These restrictions can be attributed to land leasing and fee permit requirements which may limit the total number of permittees.

Recently, there have been no major changes in the status of elk habitat in Region 6. At a more localized scale (e.g., GMU) habitat trends are directly related to the proportion of timber stands that are in early seral stages. In recent years, logging has increased in several GMUs, which has resulted in an increase of foraging habitats.

Habitat Enhancement

The Department actively manages < 1% of the land base in Region 6, which limits its ability to implement habitat management actions that would benefit elk at the landscape level. Therefore, the Department must work cooperatively with other land management agencies (e.g., U.S. Forest Service, Department of Natural Resources) to effectively manage habitat on public lands. In addition, the Department is working to encourage private timber companies and other private landowners to manage their lands in a way that promotes long-term benefits to elk.

The U.S. Forest Service has variable density thinning projects and native forage seeding in several areas on the Olympic peninsula that should result in better forage conditions in some areas of the Olympic National Forest.

The Department currently manages over 500 acres of high quality elk forage in Region 6. In addition to the elk forage plantings, several hundred more acres are managed for waterfowl and other species that also benefit elk.

The Makah Tribe developed elk forage plots on the reservation starting in 2009. They reported success from the effort. Elk routinely spend the winter in and around the forage plots. Previously, elk were seldom seen on the reservation. The project includes a road closure/management program

Elk Conflict

Elk damage complaints continue to be a substantial management concern in Region 6. Chronic damage persists in several GMUs across all elk herds. Some focal GMUs include GMU 621 (Dosewallips, Duckabush, and Hamma Hamma river valleys), GMU 638 (Quinault river valley), GMU 652 (Buckley/Enumclaw area), GMU 660 (Chehalis River valley), GMU 667 (Hanaford) and GMUs 672 and 673 (Willapa River valley).

Elk damage occurs on Christmas tree farms, hay and silage fields, cranberries, corn, peas, pumpkins, and other agricultural crops. Elk can also damage agricultural infrastructure such as fences or irrigation systems. Overall reports of elk conflicts to agriculture for 2014 were similar to past years although damage complaints from residential and small non-commercial farms increased. Some portions of the region have seen conflicts reduced as special permits and seasons are utilized to alleviate those conflicts.

Wildlife Conflict Specialists work closely with producers by developing Damage Prevention Cooperative Agreements (DPCAs). These agreements involve nonlethal measures to prevent elk damage and increased hunter access to modify elk behavior and control group size. Nonlethal measures include herding and hazing by Master Hunters, producers, and WDFW staff, pyrotechnics, and electric fladry fencing. All DPCA's include a public hunting component to increase pressure on groups of elk causing problems. In 2014, Region 6 Wildlife Conflict Specialists managed 61 active DPCA's and worked with many additional landowners without a DPCA. Management actions generally increase hunting activity on focal damage zones. These damage zones can cover an entire GMU or, be organized into a special Elk Area.

In some cases, general season regulations may be liberalized to address elk conflicts within specific areas. Additionally, special permit seasons can be created to address elk conflicts within Elk Areas or GMUs. A regional pool of permit hunters, who have achieved certification as master hunters, is also utilized. Master hunters who draw these permits are deployed directly by WDFW staff to address localized conflicts. A total of seven special permit seasons are established to address elk conflicts in Region 6. Fifty-five elk were harvested by those permittees (Table 10.)

Table 10. Elk hunts implemented to address agricultural damage by GMU and Elk Area in Region 6.

GMU	Elk Area	Hunt Name	Permits	Harvest
	6013	Puyallup	10	4
666		Deschutes	10	1
	6069	Hanaford	15	8
	6010	Mallis	20	12
	*	Willapa NWR	10	0
658		North River	10	3
Region Wide		Region 6	60	27

• Designated areas within the Willapa NWR

Management Conclusions

Trends in harvest data indicate that elk populations in the Olympic and Willapa Hills herd areas are stable. Detailed survey data from the Willapa Hills corroborates the stability of the sampled portion of that herd. Surveys from the Olympic herd area are less thorough with more variable results. Current bag limits and season lengths appear to be appropriate for these populations. Hunter numbers have trended slightly downward during the past year. This downward trend may be a consequence of policy changes by large timber landholders to lease their grounds or, charge fees for access.

Harvest and survey data in the North Rainier portion of Region 6 indicates an increasing population. As a consequence, longer and more liberalized seasons were implemented for elk conflict zones in GMU 652. Continued efforts will be directed toward managing a reduction in localized elk conflicts via harvest, throughout the region.

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Mountain Goat

MOUNTAIN GOAT STATUS AND TREND REPORT
STATEWIDE

RICHARD B. HARRIS, Special Species Section Manager

Population objectives and guidelines
The population monitoring objective for mountain goats is to be able to detect i) substantial declines in population size reliably within a 4-year period, and ii) increases sufficient to justify an increase in harvest opportunity within a 4-year period. The harvest objective is to provide recreational hunting opportunities in individual mountain goat herds that have been documented as large and robust enough to support it, while at the same time goat population size remains stable or increasing. Specific guidelines for managing harvest within sustainable limits are discussed in WDFW (2014). The harvest guidelines are to limit harvest opportunity to 4% or less of the total population (excepting kids) in contiguous areas containing 100 or more mountain goats, and limit harvest of nannies (females) to 30% or less. In a refinement of the “4% , 30%” guidelines, WDFW will begin revising permit limits every 3-years, with reference to whether or not the previous 3-years’ harvest of females has exceeded 1.2% of the total estimated local population (excepting kids). Mandatory carcass inspection, instituted in 2015, will increase the accuracy of our knowledge of female harvest.

Hunting seasons and harvest trends
Mountain goat hunting opportunity in Washington is limited by permit. Permit availability (and therefore hunter opportunity) decreased substantially beginning in the late 1990s (Figure 1), and is currently considerably lower than during the 1980s (which, in turn, was a reduction from the peak years of permit availability during the 1960s and 1970s, Rice and Gay 2010). Twenty-four permits (22 general permits, 1 raffle permits, and 1 auction permit) were available in 13 goat management units in 2014. The 2014 mountain goat season provided 47 days of mountain goat hunting (September 15 to October 31; except that archery hunters, auction, and raffle permit hunters’ seasons began September 1). Hunters were able to use any legal weapon and harvest any adult goat with horns greater than 4 inches (although hunters were encouraged to select billies (males).

Of the 24 permits available in 2013, 23 were reported used by hunters. These hunters reported harvesting a total of 17 goats. Estimated success (including raffle and auction hunts) was thus 74%.

Given the sensitive nature of mountain goat populations (Rice and Gay 2010) and their generally small sizes (see Population status and trend analysis, below), only goat populations that are surveyed annually, and meet or exceed population guidelines described in WDFW 2008 are considered for recreational hunting.

Surveys
With one exception, surveys were conducted using a helicopter and generally occurred between July and late August. (Surveys in the Lake Chelan area have recently been using winter-time boat-based surveys). For most surveys, the total number of goats on an area-wide basis was estimated using a sightability correction model (Rice et al. 2009) developed specifically for use in Washington State. Because the funding level was not sufficient to survey all goat units, priority was given to hunted units.

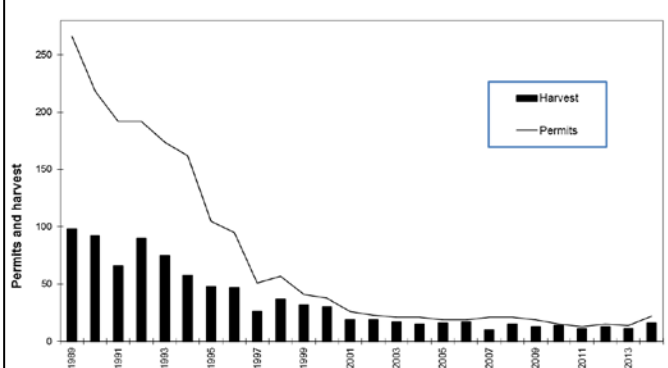

Figure 1. Special permits (line) and mountain goat harvests (vertical bars) in Washington, 1989-2014.

Population status and trend analysis
Mountain goat populations have declined in Washington relative to estimated historical levels. Goat populations within the state were considered by Johnson (1983) to have exceeded 10,000 animals (including those within federally-managed areas; within state-managed areas, the guesstimate was 8,555)) as recently as 1961 (although documentation for these numbers is weak). Rice (2012) estimated 2,815 (with lower and upper estimates of 2,401 and 3,184 respectively) within Washington during the

period 2004-07, of which about 800 were in areas not managed by WDFW. As of 2014, our best estimate is that mountain goats within Washington numbered approximately 3,590 (lower and upper bounds of 2,840 and 3,340). Of these, about 750 live primarily within National Parks. Hunting opportunity has responded accordingly, and current permit levels represent 4% or less of estimated population in herds that are stable or increasing, and which have been surveyed routinely. Despite the overall declining trend in goat numbers and range, a few populations are doing well. Goat populations around Mt. Baker, along the lower Cascade crest, in Goat Rocks, and along the north shore of Lake Chelan appear to be stable, and populations in the Naches Pass and Bumping Units may be increasing. Goat populations south of Darrington in the Boulder River Wilderness have increased to the level where a modest hunting season was initiated in 2015. There are suggestions that goats are recovering southeast of the Boulder River Wilderness, as well as on Glacier Peak. Mountain goats have recently been documented as increasing (from essentially none to approximately 70) in and around Mt. St. Helens.

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. Climate change may pose challenges of an uncertain nature for mountain goat populations in the future.

Management conclusions

The largest obstacles to effective mountain goat management are i) a consistent funding base to assess the status of goats, ii) difficulty of estimating the size and defining biologically-meaningful boundaries of individual herds, and iii) the existence of large areas of suitable goat habitat where goats are absent. Management activities are now being directed toward a goat translocation project to begin rebuilding goat populations in areas of vacant suitable habitat within the Cascade Mountains.

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MOUNTAIN GOAT STATUS AND TREND REPORT: REGION 2
GOAT UNIT: METHOW

SCOTT FITKIN, District Wildlife Biologist
JEFF HEINLEN, Wildlife Biologist

Population objectives/guidelines
The Methow unit (Goat Unit 2-2) is currently being managed for population growth and increased distribution. We encourage the public to take advantage of watchable wildlife opportunities at the salt lick along the Hart's Pass Road and on Grandview Mountain just northwest of Palmer Lake.

Hunting seasons and harvest trends
Over the long-term mountain goat populations have declined significantly in some portions of the North Cascades. Research findings suggest historical hunting levels may have been unsustainably high for goats. As a result, statewide mountain goat management guidelines do not recommend harvest permits until surveys indicate a population size of at least 100 goats in a population management unit. Limited resources caused a gap in survey data over a five year period and resulted in the suspension of harvest in the unit for 3 years (2009-2011) (Table 1).

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

Year	Permits	Hunters	Harvest	Success	Goats seen/hunter
1995	8	8	8	100%	31
1996	8	8	5	63%	8
1997	5	5	4	80%	20
1998	5	5	3	60%	22
1999	5	5	4	80%	32
2000	5	5	5	100%	23
2001	2	2	0	0%	11
2002	2	2	1	50%	26
2003	2	2	2	100%	31
2004	2	2	1	50%	26
2005	2	2	1	50%	48
2006	2	1	1	100%	23
2007	2	1	1	50%	4
2008	2	2	2	100%	38
2009	--	--	--	--	--
2010	--	--	--	--	--
2011	--	--	--	--	--
2012	1	1	1	100%	11
2013	1	1	1	100%	16
2014	--	--	--	--	--

Anecdotal reports during this time suggested a total Methow Unit population of over 100 animals, and possibly some limited range expansion. As a result, a single annual harvest permit was offered in both the 2012 and 2013 seasons. Due to the 2013 survey yielding detections of only 26 goats within the unit boundary, harvest was suspended in 2014.

Table 2. Population composition counts from the Methow Unit.

Year	Kids	Yearling	Adults	Minimum Population	Kids:100 Adults
1995	--	--	--	--	--
1996	16	--	41	57	39
1997	20	--	49	69	41
1998	--	--	--	--	44
1999	--	--	--	--	--
2000	11	--	36	47	31
2001	10	--	50	60	20
2002	19	--	61	80	31
2003	8	--	45	53	18
2004	13	17	52	82	*25
2005	18	13	65	96	*28
2006	7	5	31	43	*23
2007	18	5	38	61	*47
2008	--	--	--	--	--
2009	5	--	13	18	*38
2010	--	--	--	--	--
2011	--	--	--	--	--
2012	--	--	--	--	--
2013	6	5	15	26	*40
2014	--	--	--	--	--
2015	--	--	--	--	--

*Starting in 2004 adults and yearlings were classified separately. Prior to 2004 yearlings were classified as adults. Therefore, the ratio K:100 has changed to exclude yearlings starting in 2004.

Surveys
As resources allow, we conduct annual surveys to determine minimum population size and herd productivity. These data are used to generate hunting permit allocations in accordance with statewide management guidelines. Poor survey conditions and timing produced a small sample size in 2009. Similarly, weather forced the 2013 survey outside of the preferred seasonal window and resulted in the classification of only 26 animals with a ratio of 40 kids per 100 adults. Limited resources precluded surveys in 2014 and 2015 (Table 2).

Population status and trend analysis
This unit had been monitored closely from 2000-2007 with a stable population being observed. The 2009 and 2013 surveys suggest a decline in the population size; however, to what extent this decline is real or the result of a sampling artifact is unclear given the unavoidable suboptimal timing of the recent survey efforts. Continued annual aerial counts in very early summer will be needed to adequately document the status and trend in this population. Incidental observations outside of the traditional hunting unit verify that small numbers of goats are persisting in pockets scattered throughout suitable habitat in the Okanogan District. Little survey work has been done in these areas due to lack of resources. Population size and trend are unknown for these animals.

Habitat condition and trend
Goats in the Okanogan District contended with a mild snow pack during the 2014/2015 winter.

Goat habitat is almost entirely within secured areas and habitat availability remains stable. Habitat quality varies noticeably throughout goat range in the Okanogan District due to past wildfires of varying ages. For instance, regenerating burns in the Handcock Ridge area are improving forage conditions in this portion of the Methow Unit. Conversely, the fire in the Mt Gardner area is now over 25 years old and forage conditions may have passed the peak post-fire conditions. Overall, the unit is currently characterized by a mosaic of successional stages. Much of the district's goat habitat is in wilderness areas. As a result, changes in habitat quality will occur primarily through natural, unpredictable events such as wildfires and avalanches, rather than human intervention.

Management conclusions
Management objectives should continue to focus on population growth and distribution expansion. Resources are needed to allow for a consistent and methodical survey effort annually in late June to better determine population size and trend.

Significant differences in productivity between the north and south portions of the unit may be developing. Limited data from telemetry and survey flights suggests fairly minimal interchange occurs between the two herd segments. In addition, suitable goat habitat adjacent to this unit is sparsely populated and could likely support more animals than exist currently. Consideration should be given to augmenting the Methow Unit and surrounding areas to potentially boost genetic diversity and improve overall population numbers.

Also, the Handcock Ridge band spends significant time west of the Cascade Crest to the northwest of the Methow Unit boundary, and occupied goat range extends beyond the unit boundary to the south. As a result, redrawing and/or splitting the Methow into two units extending across administrative district boundaries should be explored.

MOUNTAIN GOAT STATUS AND TREND REPORT: REGION 2
CHELAN COUNTY

DAVID P. VOLSEN, District Wildlife Biologist
JON GALLIE, Wildlife Biologist

Population objectives and guidelines
The statewide management goals for mountain goats are to ensure healthy productive populations and native habitats, to provide opportunities for a wide range of non-consumptive uses, and to enhance populations to provide sustained recreational hunting opportunities. Statewide mountain goat strategies recommend that prior to a population being hunted, that it be surveyed to determine its population size and trend, and that the population numbers a minimum 100 goats within the management unit. For stable or increasing goat populations meeting these guidelines, harvest is limited to no more than 4% of the total population, with harvest of females maintained at <30% of the total (WDFW 2008).

Hunting Seasons and Harvest Trends
Until 2001, no goat harvest had occurred in Chelan County in over 20 years. In 2001, 2 permits were authorized for North Lake Chelan, and 2 male goats were harvested (Table 1). Only one permit was issued each year from 2002-2008, with permits again increased to two in 2009. Hunter success has increased recently with eight goats taken in the last three years. Rugged terrain and remote wilderness with restricted access limits hunter success and makes finding adult males difficult. Of the 16 goats harvested since 2001, five have been nannies (31%).

A single permit will continue to be issued for the South Lake Chelan unit. The unit has only been open for hunting for three years. Hunters have only harvested one goat in 3 years so far on this unit. Difficult access to areas with goats is the main factor in the low success rate.

Mountain goat populations within the East-central Cascades (Chiwawa, East Stevens Pass, North Wenatchee Mtns, and Stehekin) are not surveyed intensively enough to confidently estimate their population size, and are currently closed to hunting. Surveys conducted since 2008 via driving and hiking routes suggest that goat numbers in the North Wenatchee Mountains Unit are increasing, and warrant formal helicopter sightability surveys to develop a population estimate.

Surveys
As part of a hydropower license agreement, the Chelan Public Utility District (PUD) annually completes 12 winter wildlife surveys by boat on Lake Chelan along both north and south shores. For Lake Chelan, the total number of known goats is the result of comparing results from all surveys completed during each winter. This is the only annually collected, long-term data for Chelan County mountain goats (Pope and Cordell-Stine, 2015). However, the varied and rugged terrain as viewed from the lake makes sighting and correctly classifying mountain goat age and sex difficult, and contributes to high variability in the composition data. Kid numbers and ratios might also be biased high due to the large number of unclassified mountain goats recorded in the surveys.

Low snowfalls in recent years have created difficult conditions in which to survey. Without adequate snowfall, goats do not move down to lower elevations where observation increases. Surveys during mild winters, such as 2014-15, return low counts that will bias population estimates downward if not accounted for. As a comparison to ongoing boat-based survey methods, we conducted a helicopter-based aerial survey using sightability correction to estimate goat numbers in a subsection of habitat on the North Shore Lake Chelan. Although this winter’s survey was not exhaustive, results showed that large numbers of goats occupying habitat in the survey units were not available for observation from a boat-based survey platform. Aerial sightability surveys also allow managers to develop formal population estimates with confidence intervals based on the more rigorous survey method.

Winter counts conducted along driven survey routes in mountain goat areas in other sections of Chelan County returned increasing numbers over time, which suggests that the population is increasing. Additionally, a volunteer led survey effort, using hiking routes, sought to determine presence of goats in portions of the Alpine Lakes Wilderness for which we have no data. Results were promising, finding goats in several areas where their presence and numbers were unknown. This effort has helped document the current mountain goat distribution and will aid in the design of future helicopter based surveys. Priority should be given to acquiring population data using helicopter sightability protocols on goat populations within the East-central Cascades zone as its population, once verified, will likely support harvest opportunities (Table 2).

Population Status and Trend Analysis

Mountain goat populations in Chelan County remain below historic levels of the 1960s. Observational data suggest that numbers are increasing from historical low numbers of 30 years ago. The Lake Chelan population (which the Chelan PUD has monitored for the last 30 years) appears, very roughly, to be stable (Table 3). Kid: adult ratios appear adequate for population growth, averaging 27 kids:100 adults over the last decade. This most recent winter saw unusually dry conditions, with very little snowfall, and as a result, surveys found few goats because most remained up at higher elevations. This produced lower counts than previous years, but it is unlikely it reflects a population decline, rather a limitation in survey capability. The North Lake Chelan boat-based surveys averaged 56 goats (range: 43-78), with 29 kids:100 adults (range: 22-32) over the last three years. Goat counts for the North Lake Chelan population have decreased over the last 4 years, although it is unknown if this is a true population decline or a problem with boat-based visibility, which causes high sighting variability. In the helicopter-based survey, a total of 76 goats were observed, with a sightability-corrected point estimate of 91 (90% CI = 73-109 goats, see Rice et al. 2009). In comparison, the maximum count from boat-based surveys along the north shore was 44 (Pope and Cordell-Stein 2015). These results provide justification for our understanding that the population is probably larger than the boat-based surveys is indicating. As well, the substantial variability of counts obtained during repeated boat-based counts reveals their limitations.

The South Lake Chelan surveys over the last three years averaged 67 goats (range: 45-105), with 21 kids:100 adults (range: 10-29). This population has consistently had higher observed production than the North Shore over the last ten years. A minimum count of more than100 goats on the South Shore has been documented in three of the previous five years. Although herd productivity and habitat conditions are good, it is unknown if there are additional bands of goats from other populations utilizing the South Lake Chelan unit as winter range, or whether they are all resident herds.

Research

A statewide mountain goat research project was initiated to determine habitat use, seasonal range, population status, methods of survey, and population limiting factors in 2002. There were 3 adult nannies fitted with GPS collars during 2004 in District 7. One was collared on Nason Ridge, and one each on the North and South Lake Chelan Units. In 2005-2006, all goats were found to concentrate their activity in 4-5 mi^2 areas near their capture locations.

Insight was also gained on gene flow and interaction between populations. This was highlighted by two nannies collared on Gamma Ridge on Glacier Peak who traveled 10-12 miles east to the south shore of Lake Chelan. Any potential hunting opportunity offered in South Lake Chelan would have to take into account the potential harvest of goats from Region 4 as well. In addition, in fall 2006, 3 goats collared on Gamma Ridge were found in the Chiwawa region of Chelan County.

Habitat Condition and Trend

Fire suppression during the last 50 years has decreased habitat for mountain goats in Chelan County. Most mountain goat habitat is within wilderness areas and is managed by Okanogan-Wenatchee National Forest. Wilderness designation precludes most forms of habitat alteration, with changes in habitat condition occurring from forest fires. Fires are anticipated to reduce habitat initially, but increased forage post-fire will be beneficial to mountain goats. Over the last decade, several major fires in the Lake Chelan Basin (both shores), and North Wenatchee Mountains (Icicle and Tumwater Canyons) have burned substantial mountain goat habitat and range. The subsequent increase in early seral stage vegetation and forage may have contributed to the increase in mountain goat counts during the same time period (both in terms of increased production and visibility). The fires of summer 2015 may provide an additional opportunity to test this hypothesis.

Management Conclusions

Mountain goat populations in Chelan County are below historic levels, thus the most of their populations are not hunted. Population trends in areas outside the Lake Chelan area cannot be effectively monitored without additional survey resources. Based on Chelan PUD survey data, average kid production is gradually increasing in both the north and south shore populations. Resources should be directed to formalize helicopter sightability surveys Lake Chelan to produce a sightability-corrected abundance estimate (Rice et al. 2009) and compare that with boat survey data. Additional emphasis should be placed on new surveys in different section of District 7's mountain goat habitat, particularly those in the East-central Cascades to better understand trends in mountain goat populations and their distribution.

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Table 1A: Summary of Mountain Goat Harvest for North Lake Chelan, 2001-2014

Year	Permits	Hunters	Harvest	Male	Female	Success	Goats Seen/Hunter	Days Hunted
2001	2	2	2	2	0	100	24	6
2002	1	1	0	0	0	0	0	20
2003	1	1	0	0	0	0	12	8
2004	1	1	1	1	0	100	3	3
2005	1	1	0	0	0	0	25	15
2006	1	1	0	0	0	0	0	1
2007	1	1	0	0	0	0	27	12
2008	1	1	1	0	1	100	25	8
2009	2	2	2	2	0	100	17	8
2010	2	2	2	2	0	100	35	5
2011	2	2	2	0	2	100	35	9
2012	2	3*	3*	2	1	100	52	7
2013	2	3*	1*	1	0	0	60	0
2014	2	2	2	1	1	100	1	12

Table 1B: Summary of Mountain Goat Harvest for South Lake Chelan, 2012-2014

Year	Permits	Hunters	Harvest	Male	Female	Success	Goats Seen/Hunter	Days Hunted
2012	1	0	0	0	0	0	0	0
2013	1	1	1	1	0	100	20	6
2014	1	1	0	0	0	0	11	0

*Includes Raffle/Auction hunter harvest

Table 2. Mountain Goat counts in Chelan County, 200-2015.

Area	North Lake Chelan	South Lake Chelan	Stehekin	Chiwawa	North Wenatchee Mtns	East Stevens Pass	Total
2000-01	68	31	6		35		140
2001-02	44	28	2	12		1	87
2002-03	71	39		19		18	147
2003-04	72	56					128
2004-05	118	49					167
2005-06	91	57	4				152
2006-07	75	102					177
2007-08	104	76					180
2008-09	95	66		15	23	20	219
2009-10	81	128		9	69	22	309
2010-11	78	94		8	38	10	228
2011-12	43	116			71	12	242
2012-13	74	103			56		233
2013-14	45	50			78		173
2014-15	76	45			117		238

Numbers for North and South Lake Chelan are best estimates from Chelan County PUD boat-based surveys.

Table 3. Mountain goat population composition for Lake Chelan, Chelan County, 2001-2014.

Year	Adults	Kids	Total Count	Kids:100 adults
2001	60	14	74	23
2002	89	21	110	24
2003	103	25	128	24
2004	138	29	167	21
2005	120	29	149	24
2006	129	48	177	37
2007	113	26	139	23
2008	92	24	116	26
2009	133	39	172	29
2010	92	39	131	42
2011	116	33	149	28
2012	111	31	142	28
2013	42	7	49	17
2014	81	20	101	25
Average	101	28	129	27

Data from Pope and Cordell-Stine 2015

MOUNTAIN GOAT STATUS AND TREND REPORT: REGION 3
BLAZED RIDGE, BUMPING RIVER, NACHES PASS

JEFFREY A. BERNATOWICZ, District Wildlife Biologist

Population objectives/guidelines
The statewide goals for mountain goats are:

1. Preserve, protect, perpetuate, and manage mountain goats and their habitats to ensure healthy, productive populations.

2. Manage mountain goats for a variety of recreational, educational, and aesthetic purposes including hunting, scientific study, cultural and ceremonial uses by Native Americans, wildlife viewing and photography.

3. Enhance mountain goat populations and manage for sustained yield.

4. For populations to be hunted, a minimum of 100 goats and 25 kids: 100 non-kids.

5. Harvest should not exceed 4% of a stable population (defined as animals older than kids), with no more than 30% of the harvest being females.

Hunting seasons and harvest trends
Mountain goat seasons are open only to hunters drawing a special permit. In 2014, there were 5 permits spread over 3 units (Tables 1-3) in Region 3 and 3 goats were taken. All 3 were reported as billies.

Surveys
Tables 1-4 show annual survey results for mountain goat units. No surveys were conducted in 2014.

Population status and trend analysis
The status of mountain goat populations is assessed using aerial surveys (Rice et al. 2009) and, as an ancillary data source, interviews with hunters, guides, and other people knowledgeable about local mountain goats.

All goat populations in the Region probably declined from historic levels due to over-harvest. WDFW planning calls for harvests being no more than approximately 4% of the adult (older-than-kid) population. Goats were historically managed with more liberal permit numbers and with harvest rates often over 10%. Since 1996, harvest has been more conservative and populations appear to be increasing in the area of the Bumping River as well as Naches/ Corral Pass. Goat populations in the Blazed Ridge area have been somewhat more difficult to assess. Tallies from ground observers often exceed those of the aerial survey results. Blazed Ridge is more forested than others and bands of goats may be easily missed. The trend for Kachess Ridge is unknown, as no surveys have been conducted since 2005.

Habitat condition and trend
The majority of goats in the Bumping, Tieton, and Naches Pass areas spend summers in wilderness areas where short- term, habitat is mostly influenced by weather cycles. However, fire suppression has reduced open meadow habitat in wilderness areas. Recent insect outbreaks have killed timber, making these areas prime for a large fire. Recreational use could also be influencing use of available habitat. There is no comprehensive documentation of where these goats winter. Outside the wilderness, timber harvest and road building may impact habitat.

The Blazed Ridge and Kachess Units are mostly outside wilderness areas. Timber harvest continues in both units. The north portion of the Blazed Ridge unit has been particularly heavily logged. The timber cutting has probably improved summer habitat, but may have removed winter cover. Road and trail densities have also increased. There are often roads at the top and bottom of every ridge. Off-road vehicle use and general recreation is heavy in the Blazed Ridge unit.

It is unknown how goats react to roads and human activity, which have increased with Washington's population. Major highways (e.g., I-90) have probably limited movements among herds over time. Smaller highways and developments (e.g., ski areas) could also limit movement and use of some areas. This may limit re-colonization and recovery of some areas and may have long-term implications for genetic diversity.

Management conclusions

Goat populations in Region 3 have declined over historic levels, probably due to over-harvest. Harvest rates have been reduced and populations appear to now be recovering. Harvest guideline #4 has not always been followed closely. Until 2013 (Naches/Corral Pass) the three-year average has never exceeded 100 adults in any unit. However, unit boundaries may not correspond to biological populations. It is likely that gene flow occurs among all goats south of I-90. Hunting units have changed over time. Previously, Blazed Ridge was lumped with Naches Pass. Lines have arbitrarily been drawn in the past, using little knowledge of population structure or movements. This has led to a conservative harvest. Following decades of overharvest, it was prudent to be very conservative. Now that populations are recovering, it may be time to review populations and harvest. For units within the region, there were an estimated 265 adult goats in 2013. A 4% offtake quota would thus have suggested issuing 10 permits instead of 3. The estimate of 265 goats likely remains biased low. The visibility correction model (Rice et al. 2009) can only adjust for groups of goats seen, and not all groups are seen within a unit on a given survey. Surveys do not cover all habitats. The northwest 1/3 of the Bumping unit is not surveyed, and the unit abuts Mount Rainer National Park. Groups of goats are known to cross the boundary. North of I-90, the Kachess unit was probably the smallest in the state and has limited habitat. It is unlikely the unit ever had 100 adult goats. A meaningful subdivision of the population would probably stretch between I-90 and Hwy 2. The entire area has never been surveyed, but observations suggest there are well over 100 adult goats between these highways. If surveyed, there may be justification for additional hunting opportunity.

Guideline #5 (4%) may be overly general. Game populations are much more impacted by female harvest than male harvest. Other states use a point system, where harvest of females is accounted for differently than harvest of males. The initiation of mandatory carcass inspection following harvest has allowed WDFW to begin using a point system that accounts for the demographic distinction between harvesting billies and nannies.

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Table 1. Harvest and surveys for Bumping River (Mountain goat Unit 3-7)

Harvest Information				Survey Data (for 2009 and later, figures represent points estimates from sightability-corrected model; Rice et al. 2009)			
Year	**Permits**	**Hunters**	**Harvest**	**Kids**	**Adults**	**Total**	**K:100**
1990	15	14	11				
1991	10	9	7	5	12	17	42
1992	10	10	9	12	66	78	18
1993	6	6	5	7	43	50	16
1994	6	5	4	5	35	40	14
1995	2	2	2	3	30	35[a]	17
1996	6	5	5	20	39	59	51
1997	1	1	1	12	49	61	25
1998	2	2	2				
1999	2	2	2				
2000	2	1	1	7	22	39	32
2001	2	2	2	14	46	60	30
2002	2	2	2	25	52	77	48
2003	2	2	2	24	59	83	41
2004	2	1	1	16	39	55	41
2005	2	2	2	32	66	98	48
2006	2	2	2	15	39	54	38
2007	2	2	1	9	40	71[a]	22
2008	2	3*	3*	15	53	68	28
2009	2	2	2	17	46	63	27
2010	1	1	1				
2011	1	1	1	28	75	103	37
2012	1	1	1	39	103	142	38
2013	1	1	1	43	108	151	39
2014	2	2	1	No	Survey		

* Includes auction/raffle

[a] Includes unclassified

Table 2. Harvest and surveys for Naches/Corral Pass (Mountain goat Unit 3-6 and 4-38)

Harvest Information				Survey Data (for 2009 and later, figures represent points estimates from sightability-corrected model; Rice et al. 2009)			
Year	**Permits**	**Hunters**	**Harvest**	**Kids**	**Adults**	**Total**	**K:100**
1990	12	>7	>7				
1991	12	8	6	10	42	52	24
1992	12	10	9	11	86	97	13
1993	14	12	11	5	18	23	28
1994	14	11	9	13	27	40	48
1995	5	3	2	9	78	87	12
1996	14	11	9	23	58	81	40
1997	5	5	5	10	55	65	18
1998	7	7	7				
1999	5	5	5				
2000	5	5	5	21	48	69	44
2001	5	5	4	3	18	21	17
2002	4	3	4	18	41	59	44
2003	3	3	3	18	62	80	29
2004	2	2	1	21	61	82	34
2005	2	2	2	40	55	95	73
2006	2	2	2	18	73	91	25
2007	2	1	1	25	67	107	37
2008	2	3*	3*	37	79	116	47
2009	1	1	1	41	106	147	39
2010	1	1	1	29	74	103	39
2011	1	1	1	37	96	133	38
2012	1	1	1	34	112	147	32
2013	1	1	1	45	104	169[a]	43
2014	2	2	1		No	Survey	

* Includes auction/raffle

[a] Includes unclassified

Table 3. Harvest and surveys for Blazed Ridge (Mountain goat Unit 3-10)

Harvest Information				Survey Data (for 2009 and later, figures represent points estimates from sightability-corrected model; Rice et al. 2009)			
Year	Permits	Hunters	Harvest	Kids	Adults	Total	K:100
1991				9	22	31	41
1996	3	2	1	27	57	79	47
1997	1	1	1	40	99	139	40
1998	6	6	6				
1999	6	6	6				
2000	6	6	5	18	43	61	42
2001	2	3*	2*	13	40	53	32
2002	1	1	1	15	40	55	37
2003	1	2*	2*	27	66	93	29
2004	2	3*	3*	17	63	80	27
2005	2	2	2				
2006	2	2	2	30[a]	83[a]	113[a]	36
2007	2	1	1	22	56	78	39
2008	2	2	1	22	50	72	44
2009	1	1	0	15	52	67	22
2010	1	1	1				
2011	1	1	1	14	32	46	44
2012	1	1	1	26	78	104	33
2013	1	1	1	14	53	67	27
2014	1	1	1	No	Survey		

* Includes auction/raffle

[a] Probable double count of ~15 animals

Table 4. Harvest and surveys for Kachess Ridge (Mountain goat Unit 3-11)

Harvest Information				Survey Data			
Year	Permits	Hunters	Harvest	Kids	Adults	Total	K:100
1991				21	39	60	54
1992				7	18	25	39
1993				14	44	58	32
1994-5		NO DATA					
1996	1	1	1	11	25	36	44
1997	1	1	1	1	5	6	20
1998	1	1	1				
1999	1	1	1				
2000	1	1	1	5	32	37	16
2001	1	1	1	6	22	28	27
2002	1	1	1	6	18	24	33
2003	0			No	Survey		
2004	0			8	18	26	44
2005	0			13	23	36	57
2006-14	0			No	Survey		

MOUNTAIN GOAT STATUS AND TREND REPORT: REGION 4
MT. BAKER AREA

PAUL DEBRUYN, Wildlife Biologist

Population Objectives/Guidelines
The management objective for mountain goat units in northern Region 4 is to maintain stable populations in all units for public viewing and harvest opportunities. Specific guidelines for managing harvest within sustainable limits are discussed in WDFW's Game Management Plan (2014). The harvest guidelines are to limit harvest to 4% or less of the total estimated population (excluding kids), only allow harvest in goat populations meeting or exceeding 100 total animals, and limit nanny harvest to 30%.

Hunting Seasons and Harvest Trends
A rebounding mountain goat population in the Mount Baker area has recently facilitated renewed hunting opportunities in this area. In 2007, Mount Baker units 4-3 Chowder Ridge and 4-7 Avalanche Gorge were reopened with one permit issued per unit. This hunt opportunity has been conservatively managed since then, with a maximum annual allocation of 5 permits in 2010, 2011 and 2014 (Table 1). Because two tags have been issued in at least one hunt unit over the past four years, there has also been the potential that the statewide auction and raffle permit holders could also hunt in this area. This system of allocation auction and raffle permits will become more flexible beginning in 2015.

Table 4. Raw counts of mountain goats counted in Mt Baker* surveys 2004-2014

Year	Kids	Yearling	Adult	Unk.	Total	Kids:100 Adults
2004	56	26	136	3	222	41
2005	78	64	178	11	331	44
2006	79	53	189	3	324	42
2007	77	32	219	0	328	35
2008	72	32	196	8	308	37
2009	89	33	209	0	331	43
2010	71	39	195	7	312	29
2011	24	47	134	1	206	18
2012	85	34	184	0	303	46
2013	79	17	151	12	259	52
2014	136	10	329	0	475	41

*Mt. Baker includes the following survey blocks: Black Buttes, Heliotrope, Chowder Ridge, Sholes Glacier, Coleman Pinnacle, Lava Divide, Lake Ann, and Loomis Mountain. Raw counts are shown because sightability correction was not applied in earlier years.

Surveys in 2013 showed similar numbers of goats to the past few years, and the number of permits was set at five for 2014, two in Avalanche Gorge two in Chowder Ridge and one in Lincoln Peak. All five tags were filled in the area as well as the auction and raffle tags. Of the seven goats harvested (including auction and raffle hunts), five were males. There were no reports of goats harvested by tribal members in the Mount Baker area in 2014.

The survey in 2014 suggested a substantial increase in goat numbers.

Surveys
In July 2014, an aerial mountain goat survey was conducted in the Mt. Baker/Loomis Mountain areas of Whatcom and Skagit Counties. A Bell Jet Ranger helicopter was used to fly the survey area. The survey routes were similar to previous years but varied slightly (as occurs in most years) in response to weather and habitat changes. A total of 475 goats were observed within the Mt. Baker and Lake Ann, and Loomis Mountain survey blocks (Tables 2, 3). As in previous years, we estimated the number of goats in each survey block, accounting for imperfect detectability using the method of Rice et al. (2009).

Table 2. Raw counts of mountain goats obtained during helicopter survey by survey blocks, Mount Baker Area, July 28, 2014.

Survey Block	Total	Adults	Yearlings	Kids
Black Buttes	29	18	1	10
Heliotrope	40	32	0	8
Chowder Ridge	95	67	1	27
Sholes Glacier	0	0	0	0
Coleman Pinnacle	178	117	5	56
Lava Divide	43	28	2	13
Lake Ann	79	60	1	18
Loomis Mountain	11	7	0	4
Total	**475**	**329**	**10**	**136**

Table 3. Estimated (90% CI in parenthesis) number of mountain goats on survey blocks during helicopter survey, Mount Baker Area, July 28, 2014. See Rice et al (2009).

Survey Block	Total	Adults and Yearlings	Kids
Black Buttes	31 (25-36)	20 (19-23)	11 (10-12)
Heliotrope	41 (40-44)	33 (32-36)	8
Chowder Ridge	99 (95-105)	71 (68-76)	28 (27-30)
Sholes Glacier	0	0	0
Coleman Pinnacle	185(178-196)	128 (117-135)	57 (57-61)
Lava Divide	43(43-52)	30(30-36)	13(13-16)
Lake Ann	79(79-99)	68(68-78)	18(18-22)
Loomis Mountain	12(11-16)	8(7-10)	4(3-6)
Total	**500(477-523)**	**360(359-375)**	**141**

Population Status and Trend Analysis

Historically, the majority of historical information regarding goat numbers and distribution has been derived from harvest report cards and questionnaires returned by permitted hunters. Historically, goat management units 4-2, 4-3, 4-4 and 4-5 collectively encompassed the Mt. Baker range in Whatcom and Skagit Counties. Harvest in these units during the period 1969-85 totaled 121 animals with an average harvest of 13 goats per season. For the period 1986-95, harvest totaled 26 animals with a 6 goat per season average. By 1996, all of the Mt. Baker GMUs were closed to hunting due to declines in harvest and goats reported by permit hunters.

The Lake Ann and Loomis Mountain survey blocks are largely beyond areas currently open to hunting. Current management direction (WDFW 2014) calls for limiting recreational harvest to no greater than 4% of the total estimated harvestable population, excluding kids. A further objective is that 30% or less of the harvest consists of females (nannies). As of 2014, the harvestable population in the Mt Baker area (estimated population size excluding kids) was estimated at 282.

Habitat Condition and Trend

The Mount Baker area mountain goat population has rebounded substantially since the low abundances in the 1980s and 1990s. It is currently unclear whether the increasing trend seen over the past few years can be sustained, or alternatively, if the population is reaching the capacity of the area to maintain goats. Conservative hunting, which was reestablished in 2007, appears to be having negligible effects on population size, age/sex structure, and population trend.

The majority of goats in the Mount Baker area are within the Mount Baker Wilderness area on the Mount Baker-Snoqualmie National Forest and the adjacent North Cascades National Park. Federal land management restrictions are protective of habitat qualities critical for the maintenance of a robust mountain goat population. However, this area has seen an increase of recreational uses including hiking, backcountry skiing, and snowmobiling. Discussions on goat management between WDFW and the Tribes are ongoing and remain a high priority.

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Table 1. Summary of harvest information for mountain goats in Mt. Baker Area (2008-2014)

Hunt Unit	Year	Permits	Hunters	Harvest	Success (%)	Days hunted
Chowder Ridge	2009	1	1	1	100	2
	2010	1	1	1	100	3
	2011	1	1	1	100	5
	2012	2	2	2	100	NA
	2013	1	1	1	100	0
	2014	2	2	2	100	5
Lincoln Peak	2009	1	1	1	100	8
	2010	2	2	2	100	5
	2011	2	2	2	100	19
	2012	1	1	0	0	0
	2013	1	0	0	0	0
	2014	1	1	1	100	4
Avalanche Gorge	2009	1	1	1	100	1
	2010	1	1	1	100	4
	2011	1	0	0	0	0
	2012	0	-	-	-	-
	2013	2	2	1	50	14
	2014	2	2	2	100	17
Dillard Creek	2009	1	0	0	0	-
	2010	1	1	1	100	12
	2011	1	1	1	100	9
	2012	0	-	-	-	-
	2013	0	-	-	-	-
	2014	0	-	-	-	-

MOUNTAIN GOAT STATUS AND TREND REPORT: REGION 5
GOAT ROCKS, SMITH CREEK, MT. ST. HELENS

ERIC HOLMAN, Wildlife Biologist
STEFANIE BERGH, Wildlife Biologist

Populations and Objectives
Region 5 of the Washington Department of Fish and Wildlife (WDFW) contains multiple areas inhabited by mountain goats. Two mountain goat population management units have been monitored aerially in recent years; Smith Creek (Goat Unit 5-3), and Goat Rocks/Tieton River (Goat Unit 5-4/3-9). The Goat Rocks/Tieton River Unit has historically contained one of the largest goat populations of any goat unit in the state of Washington (Rice 2012). This year, for the first time, mountain goats in the Mt. St. Helens area were the focus of an organized and rigorous ground-based survey. Additional areas supporting goats include Mt. Adams, the Dark Divide Wilderness, and the Tatoosh Mountains. Current population goals for all areas are to maintain or expand current population levels.

Hunting Seasons and Harvest Trends
Hunting opportunity for mountain goats in Washington is allowed only to those selected in the Special Permit Drawing. Those fortunate enough to draw a mountain goat tag may hunt only within a specified goat unit. During 2014, hunters were allowed to hunt only with archery equipment from September 1-14 and were allowed to use any legal weapon from September 15 through October 15. The bag limit is one goat of either sex, with horns longer than 4 inches, although hunters are encouraged to refrain from shooting nannies. Tag allocation for each unit is conservative in nature, with dual goals of providing a high-quality hunt for those successful in the permit draw and having little or no effect on the goat population.

Mountain goat studies completed by WDFW have led to a new population guideline to direct harvest management (WDFW 2015). A goat unit must have an estimated population of 100 or more to allow harvest. Furthermore, harvest levels are designed to remove 4% or less of the adult population (WDFW 2015). Within Region 5, only the Goat Rocks/Tieton River Unit is made up of a population large enough to support hunting under this guideline. Surveys of other areas supporting goats will be conducted periodically. Should populations surpass 100 individuals in these areas, hunts could be considered.

Three tags were offered in the Goat Rocks/Tieton River Goat Unit during 2014. All 3 of the permit holders reported killing a billy (Table 1). Information on harvest by Tribal hunters during 2014 is not yet available but typically results in the take of one additional billy from the Goat Rocks population (NWIFC 2013). Unlike in some past years, neither the auction nor the raffle goat permits were used in the Goat Rocks/Tieton River Unit.

Population Status and Trend Analysis
In 2013, the Goat Rocks/Tieton River Unit was surveyed aerially, yielding 308 animals observed (Table 2) and a sightability-corrected population estimate of 323 (Table 3) with a 95% confidence interval of 307 to 338. The Smith Creek Unit was most recently surveyed from the air in 2012, yielding a sightability corrected estimate of 64 goats (95% confidence interval: 48-79; Table 3). All aerial surveys were conducted using the sightability method developed by WDFW (Rice et. al. 2009).

Mountain goats were formally surveyed on Mt. St. Helens and the associated Mt. Margaret Backcountry in August of 2014. The ground-based effort involved simultaneous survey and documentation of all goat groups by multiple teams of observers at pre-arranged stations. The survey yielded a minimum goat population of 63 on Mt. St. Helens and in the Mt. Margaret Backcountry. The project was a cooperative effort among WDFW, the U.S. Forest Service, the Cowlitz Tribe of Indians, and volunteers associated with the Mt. St. Helens Institute. The cooperators regarded the survey as a success and a repeat effort is scheduled for 2015.

Additional areas in Region 5 known to be occupied by mountain goats were not surveyed due to lack of funding and because no hunting permits are currently offered for these smaller populations. Unsurveyed areas populated with mountain goats in Region 5 include the Tatoosh Mountains, Dark Divide Wilderness, and Mt. Adams. Finally, individual goats or very small groups of goats are sometimes observed or reported in additional areas within WDFW Region 5. Areas with such occurrences include Siouxon Peak, the Silverstar Mountain complex and Dead Canyon.

Sightability corrected aerial surveys conducted over the past several years suggest stability in the Goat Rocks and Smith Creek goat populations. Aerial surveys conducted in the mid-2000s by WDFW indicate that mountain goat populations in the Tatoosh unit have declined. None of the mountain goat populations in Region 5 were aerially surveyed during 2014.

Habitat Condition and Trend

High elevation openings characteristic of goat habitat are being lost in the Smith Creek Unit due to conifer encroachment. Alpine meadows are critical mountain goat foraging areas. Given the limited extent of suitable goat habitat in the Smith Creek Unit, the loss of habitat represents a threat to the sustained viability of this goat population. Results of the cooperative Cispus Adaptive Management Area 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 were lost in the period spanning 1959-1990 (Kogut 1996).

High alpine meadows are thought to be primarily created through disturbance such as avalanche, disease, wind-throw, and fire (Hemstrom 1979). Periodic fire is considered to be one of the most important factors in the creation and maintenance of alpine meadow (Olmsted 1979). U. S. Forest Service policy currently dictates the suppression of both man-made and naturally occurring fires. This policy has probably resulted in the losses of alpine meadow documented in the above study. In the years since the completion of this study, the loss of meadow has likely continued. Thus, the need for restoration and preservation of these areas is paramount to continued healthy goat populations.

Habitat Enhancement

Budgetary, logistical, safety, and other constraints in both the USFS and WDFW make the possibility of a prescribed burn program in the foreseeable future unlikely. However, naturally occurring high-elevation fires have occurred recently in areas associated with Mt. Adams and could occur elsewhere. Another possible avenue to address conifer encroachment is through the use of girdling and snag creation.

Management Conclusions

Mountain goats in Region 5 are valued for both viewing and hunting opportunities. Consequently, harvest quotas are kept at conservative levels to maximize both the consumptive and non-consumptive recreational attributes of these populations. Management direction dictates that two of the traditionally hunted units in Region 5 (Smith Creek and Tatoosh) remain closed until populations increase.

Raffle and auction permit holders sometimes select the Goat Rocks unit as it has one of the highest numbers of goats and has a long history of successful goat hunting. As such, harvest by raffle and auction permit holders must be factored into and considered when setting the permit level for Goat Rocks. A proposed system of multi-year quotas for each sex may address this issue and is prescribed for development in the most recent Game Management Plan (WDFW 2015). The continuation of annual aerial surveys is needed to document trends in population and productivity. In most cases, sightability-adjusted aerial surveys provide the least biased and most efficient method of population estimation, particularly considering the large expanse of area involved. However, the ground-based survey of goats associated with Mt. St. Helens and the Mt. Margaret Backcountry shows promise to become a useful method in those locations. Based upon the results of the cooperative Cispus AMA study, alpine meadow restoration in the Smith Creek Unit is recommended. Fire management in potential goat habitat will also play an important role in the expansion of goat populations outside of the Goat Rocks.

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Table 1: Hunter Survey Summary Goat Rocks 2005-2014

YEAR	Permits Issued	Harvest	% Success	Average # Goats Seen/Hunter	Average # Days/Harvest
2014	3	3	100	64	6
2013	3	3	100	9	5
2012	3	3	100	48	1
2011	3	4	100+	60	3
2010	5	4	80	51	3
2009	5	5	100	40	2
2008	5	5	100	46	4
2007	5	3	60	56	9
2006	5	5	100	65	3
2005	6	6	100	25	18

Note: Harvest exceeded permit numbers in 2011 due to huntng by Auction and Raffle Permit holders.

Table 2: Raw Survey Data from Mountain Goat Flights Region 5 (2005-2014)

Goat Unit	Year	Adult	Yearling	Kid	Unknown	Total	Kid:Adult
Goat Rocks/Tieton River	2014	No Survey in 2014					
	2013	234	2	72	0	308	30:100
	2012	146	22	33	0	231	23:100
	2011	205	17	31	0	253	15:100
	2010	181	14	36	0	231	20:100
	2009	170	33	73	0	276	43:100
	2008	178	23	60	7	268	34:100
	2007	No Survey in 2007					
	2006	203	14	71	0	290	35:100
	2005	188	47	66	0	303	35:100
Smith Creek							
	2014	No Survey in 2014					
	2013	No Survey in 2013					
	2012	32	4	14	0	50	44:100
	2011	No Survey in 2011					
	2010	28	6	8	0	42	29:100
	2009	No Survey in 2009					
	2008	9	2	4	2	17	44:100
	2007	28	0	6	0	34	21:100
	2006	16	6	5	0	27	31:100
	2005	15	6	11	0	32	73:100

Table 3: Sightability Corrected Mountain Goat Survey Results Region 5 (2005-2013)

Goat Unit	Year	Population Estimate (90% CI)
Goat Rocks/Tieton River	2013	323 (307-338)
	2012	246 (232-261)
	2011	259 (250-268)
	2010	224 (213-236)
	2009	285 (274-297)
	2008	282 (No CI)
	2006	308 (291-326)
	2005	341 (322-359)
Smith Creek	2012	64 (48-79)
	2010	41 (33-49)
	2008	32 (No CI)

Bighorn Sheep

BIGHORN SHEEP STATUS AND TREND REPORT
STATEWIDE

RICHARD B. HARRIS, Special Species Section Manager

Population objectives and guidelines

In 2014, biologists managing bighorn sheep herds in Washington convened to reconsider herd-specific population objectives that had existed for years, been enshrined in previous Game Management Plans (WDFW 2008), but not recently subjected to updated, rigorous consideration. We referenced updated bighorn herd boundary maps (most created using telemetry data), as well as USFS bighorn habitat model maps. We used pre-disease die-off densities of bighorn sheep in the Blue Mountains as a reference for potential densities, but deviated from this to account for differences in habitat productivity and land-use. Rather than articulate a single objective for each herd, the consensus view was that it made more sense to delineate short-term objectives and long-term potential population sizes (both, expressed in terms of upper and lower bounds). Short-term objectives were considered to coincide with the operational 6-year Game Management Plan (WDFW 2014), and thus used the year 2021 as a target. These objectives were developed in light of most recently-estimated herd sizes, as well as constraints that are unlikely to be overcome before the year 2021 (e.g., presence of persistent pneumonia, long-owner tolerance). Long-term potential herd sizes were envisioned as reflecting the capability of the local habitat to support bighorns, independent of current population sizes, and assuming that existing impediments to population growth might, at some point, be removed. Both short-term objectives and long-term potentials are shown in Table 1. In some cases, short-term objectives coincide with long-term population potentials.

Table 1. Herd-specific short-term objectives and long-term herd potentials, Washington bighorn sheep herds, as developed by district biologists in 2014. Shown are lower and upper bounds. No short-term objective was developed for the currently extirpated Tieton herd; 'nd' = not determined.

Herd	Short-term objective	Long-term potential
Hall Mountain	25-35	nd
Vulcan	70-90	80-110
Lincoln Cliffs	100-120	180-220
Asotin	130-170	240-240
Black Butte	60-100	585-585
Wenaha/Mtn View	130-170	375-375
Tucannon	40-80	160-160
Mt. Hull	80-100	80-100
Sinlahekin	50-80	100-150
Chelan Butte	150-170	150-170
Manson	100-120	200-200
Swakane	130-170	150-180
Cleman Mountain	170-220	170-220
Quilomene	150-170	150-170
Umtanum/Selah Butte	250-300	300-350
Tieton	*	200-250

Harvest objectives for bighorn sheep are to maintain a harvest success that averages >85% over a 3-year period, while at the same time bighorn population size remains stable or increasing. Strategies and harvest thresholds to obtain these objectives are described in the WDFW's Game Management Plan (2014).

Washington Department of Fish and Wildlife continues 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. Project activities included monitoring lamb production and mortality, sightability surveys, and disease investigations related to spillover of pathogens from domestic to bighorn sheep.

Hunting seasons and harvest trends

Bighorn sheep hunting opportunity in Washington is limited to permit-only hunting. Permit availability, and therefore hunter opportunity, has steadily increased in Washington (Figure 1). In 2014, 34 special season permits, 1 auction permit, and 4 raffle permit were available (including the potential from multi-species raffles) in 11 different sheep management units. Most 2014 bighorn sheep seasons were September 15 to October 10, (except 4 areas; either October 1-10 or November 5-30). Hunters had the choice of any legal weapon to harvest any bighorn ram (no curl restrictions). Of the 37 permits available in 2015 (including the auction and raffles), reports were received from 35l hunters, who killed 36 sheep (hunter success rate = 97%). One reporting ewe permit holder (in Selah Butte) did not harvest a bighorn.

Surveys

All bighorn sheep herds in Washington are surveyed annually. In 2014, both ground counts and aerial surveys were used to survey and classify sheep as lambs, ewes, or rams. In some herds, rams were further classified as yearling, less than 3/4 curl, or greater than 3/4 curl; in other herds, rams were classified according to the Class I-IV system. Surveys were conducted at differing times throughout the year, with a general pattern for most regions being to survey total herd composition in winter. Some herds were also surveyed post-lambing in early summer.

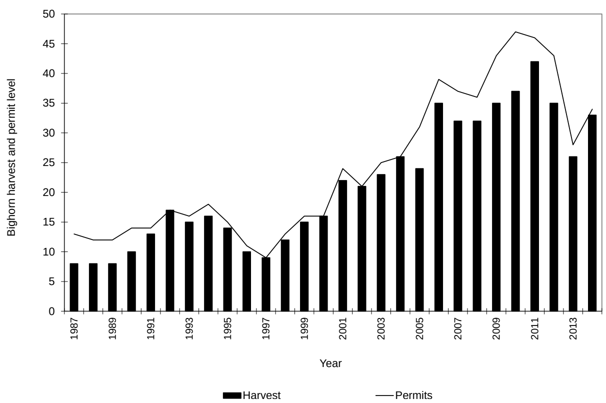

Figure 1. Regular draw permits (line) and harvest (bars) of bighorn sheep in Washington, 1990-2013.

Population status and trend analysis

Survey results indicate bighorn populations are stable in most areas (see regional reports), with some populations having increased since the 1990s, but others declined. Notable exceptions are the Hall Mountain bighorn herd, which has remained small (and is not currently hunted), and some of the Blue Mountain herds, most of which have recently experienced disease outbreaks. Two herds in the Yakima area (Region 3) have also recently experienced pneumonia-related die-offs: Umtanum/Selah in the Yakima Canyon (during winter 2009-10) and the Tieton Herd (in winter/spring 2013).

Rocky Mountain bighorns in the Blue Mountains continue to struggle as they recover from the 1995 pneumonia outbreak. Lamb mortality has remained high and ewe survival has declined in several herds; however, the total sheep population has remained fairly stable, with a sizable mature ram component.

Mycoplasma ovipneumoniae induced pneumonia continues to plague 4 of the 5 Blue Mountain bighorn populations; Asotin, Black Butte, Wenaha, and Mountain View. The Tucannon herd has not experienced pneumonia caused mortality, but do carry scabies (*Psoroptes ovis*). Bighorn populations in the Blue Mountains have not recovered from the pneumonia die-off as quickly as some herds, possibly from re-infection from domestic sheep and goats that exist within the range of multiple herds. The presence of domestic sheep and goats within and adjacent to bighorn sheep range presents a constant and substantial risk of another major epizootic. WDFW actively works with landowners near bighorn sheep herds to make sure accurate information is available and options to minimize contact are made available.

Other government agencies have encouraged landowners to use domestic goats for weed control. This type of weed control program presents a substantial risk to bighorn sheep populations in southeast Washington. WDFW has recently completed a study of the motivations, knowledge, and attitudes of owners of small domestic sheep or goat flocks in the in the vicinity of bighorn herds in Chelan, Yakima, Kittitas, and Asotin counties. Efforts to work with these small flock owners to reduce the risk of disease transmission are ongoing.

California bighorn populations remained stable in most herds (see individual herd reports). In December 2009, an outbreak of pneumonia was discovered at the north end of Umtanum. *Mycoplasma ovipnuemonia* was documented in the Umtanum/Selah Butte herd. Forty-four sheep are known to have died from December 2009-May 2010. Forty-two were found in the north portion of Umtanum and only 2 at the south end. No natural mortalities were found east of the river in Selah Butte. Recognizing the long-term effects of this disease in bighorn sheep, the Department initiated a culling action of bighorns with clinical signs of pneumonia in the Umtanum herd. Sixty-nine sheep were culled from the herd in an attempt to slow the spread of the disease, increase subsequent lamb recruitment, and better understand the disease distribution. All animals culled from west of the river tested positive for some degree of pneumonia or presence of *Mycoplasma ovipneumoniae.* East of the river, there did not appear to be significant signs of disease, but *Mycoplasma ovipnuemonia* could not be ruled out in a few individuals. By August 2010, lamb survival was very low on both sides of the river. Observations of coughing sheep and samples from hunter harvested rams in September confirmed that the disease had spread to Selah Butte. Two of 4 sheep sampled in Umtanum during September were clear of pneumonia, possibly because the disease outbreak was waning. No significant adult mortality has been observed on either side of the river since early 2010, and both lamb and adult survival appears to be high in both 2011 and 2012. While there may have been some double counting of ewes and lambs during aerial surveys in 2012, the herd had, by 2012 recovered to within objectives.

In early 2013, we captured and radio-collared 25 ewes and 5 rams from the Umtanum/Selah Butte herd, to monitor post-recovery lambing and survival. Although initial survival in summer 2013 was high, we documented poor survival in late summer, resulting in poor recruitment. Thus, it appears that the pneumonia has yet to completely clear from the Umtanum/Selah Butte herd. Preliminary results from lambing season 2014 suggest that recruitment remains poor.

In early 2013, the Tieton herd became the latest casualty of pneumonia. We began documenting an unusual number of road-killed animals in late winter 2013. By late March, it was clear that a major die-off had been underway for some weeks, and we surveyed the herd using a helicopter. Where we'd estimated approximately 150 sheep in this population in late 2011 (and as many as 200 or so earlier), we were able to account for only 35 live animals (with almost as many carcasses visible). Veterinary sampling confirmed that all animals had gross lesions consistent with pneumonia, and molecular testing confirmed the presence of *M. ovipneumoniae* in all animals. Because of the virulence of the disease (indicated by the rapid on-set and incidence of mortality), and the proximity to the uninfected Cleman Mountain herd, WDFW decided to remove all remaining animals in the Tieton Herd. As of late mid-September 2013, the combination of agency, USDA Wildlife Services, and independent contractors had removed all but 3 animals, and indications were that these had either died or dispersed far from the Tieton area.

Also in early 2013, the Sinlahekin herd experienced either a dramatic die-off, or an unexpected and unexplained range shift. From an estimated 90-95 animals in 2011 (from a count of 82), we were able to document only 26 animals during repeated counts in 2013. This herd had earlier been documented to have contracted scabies from the mite *Psoroptes ovis*, but large-scale mortality from this mange mite is usually considered rare. In early February 2014, we captured and tested 11 animals from the Sinlahekin herd; none tested positive for active infection or antibodies to *Mycoplasma ovipneumoniae*. These animals were also outfitted with GPS radio-collars, and their status will be monitored. The Sinlahekin herd has evidently begun to bounce back, as recent counts have been closer to the recent peak observed in 2011.

In 2014, WDFW obtained 2 young rams from the Oregon Department of Fish and Wildlife, both of which were placed in the Tucannon Herd, to increase genetic diversity. Further augmentations to support this struggling herd are planned in winter 2015-16.

Habitat condition and trend

Range conditions for bighorn sheep varied from poor to excellent. Recent fires in the vicinity of the Mt. Hull, Tucannon, Swakane, Manson, Umtanum, and Lake Chelan herds have rejuvenated vegetation and reduced conifer encroachment, improving habitat conditions generally for bighorns. Conversely, noxious weed invasion, primarily yellow-star thistle, continued to be a major concern for many bighorn sheep ranges (particularly in the Blue Mountains). Grazing also is a concern in several areas of the Blue Mountains and Yakima River basin.

Management conclusions

Bighorn sheep management in Washington centers on four main issues at this time: 1) minimizing the probability of new disease outbreaks, 2) helping herds infected with pneumonia-causing bacteria cope with, and ultimately recover from, persistent disease; 3) recovering depleted herds via augmentation; and 4) maintaining, and where possible increasing, habitat quantity and quality. WDFW continues to consider the possibility of establishing new self-sustaining herds in the few remaining areas of unoccupied habitat where land ownership might allow it, but implementation is currently a lower priority than maintaining existing herds.

Disease outbreaks associated with domestic-bighorn interactions is the primary concern for several herds. Disease has decimated or threatens at least 7 bighorn sheep herds at present. For those herds, eliminating the risk of disease transmission between domestic and bighorn sheep is the priority.

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).

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BIGHORN SHEEP STATUS AND TREND REPORT: REGION 1
HALL MOUNTAIN AND VULCAN MOUNTAIN

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Population objectives and guidelines

District 1 has two bighorn sheep populations, both resulting from reintroductions. Rocky Mountain bighorn sheep were introduced to Hall Mountain in Pend Oreille County, Washington from Alberta, Canada in 1972 (Johnson 1983). The founder herd included 5 rams and 13 ewes. In 1981, 2 additional ewes were translocated to Hall Mountain from Thompson Falls, Montana. California Bighorn Sheep were introduced to the Vulcan Mountain area of northern Ferry County, Washington in 1971. Eight bighorn sheep, consisting of 2 rams and 6 ewes, were translocated from the Colockum State Wildlife Area to U.S. Bureau of Land Management land near Little Vulcan Mountain.

For the Hall Mountain herd, the traditional objective has been to maintain a population of 40–70 Rocky Mountain bighorn sheep (WDFW 2014). In the past this population was used primarily as a source for Rocky Mountain bighorn sheep translocations into other areas of Washington State. The traditional population goal for the Vulcan Mountain bighorn sheep herd is to maintain 80-110 animals on the available range. Population objectives are currently being revised to reflect updated mapping of suitable habitat and literature-based estimates of desired population densities.

Surveys

From the early 1970s through 2002, ground surveys at the Noisy Creek winter feeding station were carried out to estimate the total number of sheep, sex ratio, and lamb production in the Hall Mountain herd (Table 1). In 2003, the winter feeding station was dismantled and feeding discontinued. With the loss of the ability to reliably survey sheep at the feeding site each winter, other survey techniques and protocols were used. Ground-based surveys are time intensive and generally require more than one visit to obtain a count. In addition, much of Hall Mountain is densely forested and seeing the sheep is difficult. As the sheep disperse over a larger range for forage, they are less likely to be surveyed with precision. Helicopter surveys are more productive than ground-based surveys at Hall Mountain, but are more expensive. If the Hall Mountain population increases to a level that facilitates area-specific permit hunting, more intensive monitoring of the Hall Mountain herd would be required. Because of limited WDFW funding for sheep surveys, no surveys were conducted by WDFW in the winter of 2014-15.

Since the introduction of the Vulcan Mountain Bighorn Sheep Herd in 1971 the population has been surveyed almost every year to determine composition and trend (Table 2). Beginning in 1990 this survey effort was largely standardized and carried out in the fall months, usually coinciding with rams in rut. The ground-based survey is conducted along an automobile route on county roads as well as from private, primitive roads. During the survey, we attempt to classify every detected bighorn sheep, but recognize this effort likely never results in a complete count and classification is not possible for animals at extreme distances. Poor results were obtained from 2 ground-based counts in the fall of 2011 and there was inadequate time to carry out a ground-based survey in 2012; hence the 2011 and 2012 surveys were accomplished by helicopter. In 2014, 2 ground-based surveys were conducted. The highest count recorded was 36 bighorn sheep observed including 6 rams, 19 ewes, 7 lambs, and 4 unclassified sheep.

Hunting seasons and harvest trends

The Hall Mountain herd was not hunted until 2009 when the population was made available for harvest to the Rocky Mountain bighorn sheep state raffle permit winner. On December 2, 2010, the winner of the Rocky Mountain bighorn sheep raffle permit harvested a full horn curl ram which was the first hunter-harvested bighorn sheep ever from this herd. The Hall Mountain herd remains open for the special raffle permit hunt, however, there have been no bighorn sheep harvested there since the one ram in 2010.

Both general public hunters (State) and members of the Colville Confederated Tribes (CCT) hunt bighorn sheep within the Vulcan Mountain Unit. Agency and Tribal biologists annually confer prior to developing their respective permit recommendations. From 1981, the first year of permit-only hunting of Vulcan sheep, through 1999 there were 49 bighorn sheep legally harvested from the Vulcan Unit including 48 rams and

1 ewe. Due to low population and recruitment levels, hunting was suspended by both the State and CCT from 2000 – 2004. In 2005 hunting resumed with 1 permit each issued by the State and the CCT. From 2005 – 2014 there were at least 26 bighorn sheep harvested including 15 rams and 11 ewes (Table 3). The state permit allocation for 2014 was 1 ram and the permittee was successful.

Herd health

The Hall Mountain bighorn herd is considered a clean herd by WDFW, meaning there are no documented cases of *M. ovipneumoniae* (Movi), a bacteria that causes deadly pneumonia in bighorn sheep, in this herd. Because this herd is considered clean, individuals may be used in the future to augment other failing Rocky Mountain herds in Washington.

The Vulcan bighorn sheep population declined dramatically in the late 1990s mainly as a result of complications from exceptionally high internal parasite loads. Domestic goats were known to share part of the Vulcan bighorn sheep range. Evidently the parasite *Muellerius capillaris* using slugs and snails as intermediate hosts was able to "jump" from domestic goats to the bighorn sheep. Native bighorn sheep, having less natural resistance than domestic goats to *Muellerius capillaris,* likely succumbed to pneumonia that this parasite brings about (Hall 2002). After 2001 the Vulcan herd appeared healthy and began producing lambs annually, suggesting that the overall health of the herd was acceptable. Nevertheless, we know of at least 1 flock of domestic sheep near the periphery of the Vulcan range, and are concerned about the potential for disease transmission from domestic sheep and goats to the Vulcan herd. In addition, in 2014, 3 bighorn sheep that wandered away from what we suspect was the Vulcan herd were euthanized after they began interacting with domestic sheep and we became concerned their disease risk was elevated.

Habitat condition and trend

Northeastern Washington is densely forested and the Hall Mountain bighorn sheep depend upon the steep terrain, open grasslands, and other scattered sub-alpine openings for forage and predator avoidance. Non-forested escape terrain is limited and fragmented within the range of the Hall Mountain herd including Sullivan Mountain, Crowell Ridge, Gypsy Ridge, and Hall Mountain. Sheep migrating between these and other peaks and ridges have to travel through valley bottoms and dense forest where vulnerability to predators may increase.

The U.S. Forest Service owns the vast majority of the land within the range of the Hall Mountain herd. Consequently, there are no immediate threats to habitat quality and quantity. The U.S. Forest Service plans to actively manage winter range habitat with prescribed burns subject to funding (Suarez 2001). There is no domestic livestock grazing within the portion of national forest used by the bighorn sheep.

Several projects to enhance habitat for the Vulcan Mountain Bighorn Sheep have been carried out. These include broad range weed control, selective logging, forage plant seeding, water source development, and temporary fencing at Moran Meadow to enhance controlled cattle grazing. Partners accomplishing these projects included several local private landowners, the Foundation for North America Wild Sheep (FNAWS), the Safari Club International (SCI), the Inland Northwest Wildlife Council (INWC), the USFS, the BLM, and the WDFW. One recent large-scale project was the completion of a BLM timber sale within the core sheep range in 2004. This helicopter-logging project was partially designed to improve predator avoidance for bighorn sheep by enhancing sight distances within the most densely forested portions of their range, as well as to increase forage production (Doloughan 2004). There are no domestic sheep grazing allotments within the Vulcan herd range.

Research

Between April of 2002 and March of 2004, six Vulcan bighorn sheep (3 rams, 3 ewes) were captured by helicopter net-gun and fitted with radio collars. Five bighorn sheep from Nevada including 1 ram and 4 ewes were radio collared and released at Vulcan in January of 2003. The purpose of this radio telemetry application was to document range use, especially use of timbered versus open habitats for the U. S. Bureau of Land Management (BLM) and U. S. Forest Service (USFS) habitat managers. Subsequent monitoring revealed little movement outside of the traditionally known bighorn sheep range (Doloughan 2004). In January 2012, the CCT translocated 4 bighorn sheep including 3 rams and 1 ewe from Cleman Mountain in Yakima County, WA to the Vulcan area to augment the population. One was outfitted with a Global Positioning System (GPS) radio collar to gain insights into bighorn sheep home range size and movements. Subsequent monitoring revealed similar results to those obtained from 2003 in which there was little movement outside of the traditionally known bighorn sheep range (Doloughan 2004, Krausz 2012). In February 2015, attempts were made to capture up to 6 animals from Vulcan to provide veterinary surveillance for disease presence, and to outfit with GPS collars, making it easier to survey this herd (which is difficult due to forest cover and land-ownership constraints). Poor weather hampered the attempt, but a single young ram was captured, tested, and released wearing a GPS collar. Plans for additional captures are scheduled for the near future. Future radio collared ewes will be used to locate lambs and assess recruitment into the population.

Management conclusions

The Hall Mountain bighorn sheep herd will continue to be limited by suitable habitat within the current herd range. More intensive monitoring and research would help the Department better understand the dynamics of this herd and determine the future potential of sustaining and/or increasing this herd.

The evident decline of the Vulcan herd in recent years is of considerable concern, but declines and disease issues in other herds within the state have taken priority, preventing the efforts required to provide a complete understanding of the dynamics of this herd. However, future efforts to radio collar animals and evaluate limiting factors for growth in this herd are in the works.

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Table 1. Counts of Hall Mountain bighorn sheep, 2001 – 2015. (Note that the last year of winter feeding was in 2003)

Year	Lambs	Ewes	Rams	Total Sheep*	Lambs: 100 Ewes: Rams
2001	4	11	8	23	36 : 100 : 73
2002	7	13	4	24	54 : 100 : 31
2003	-	-	-	No Data	No Data
2004	-	-	-	No Data	No Data
2005	7	14	6	27	50: 100: 43
2006	5	7	7	19	71: 100: 100
2007	4	11	7	22	36: 100: 64
2008	9	16	4	29	56: 100:25
2009	5	14	4	23	36: 100: 29
2010	9	11	0	24	82: 100: 0
2011	5	9	1	15	56 : 100 : 11 *
2012	2	6	4	12	33: 100: 67
2013	0	5	3	8	0: 100: 60
2014	3	7	11	21	43:100:157
2015	No surveys conducted				

* Total counts some years include unclassified bighorn sheep.

Table 2. Fall population composite counts of the Vulcan Mountain bighorn sheep, 2001 – 2014.

Year	Lambs	Ewes	Rams				Total Sheep	Lambs:100 Ewes: Rams
			Yearling	<3/4 curl	>3/4 curl	Total		
2001	5	8	0	2	2	4	17	63 : 100 : 50
2002	5	8	3	2	4	9	22	63 : 100 : 113
2003	9	17	3	4	3	10	36	53 : 100 : 59
2004	9	20	5	7	5	17	46	45 : 100 : 85
2005	21	32	4	11	7	22	75	66 : 100 : 69
2006	10	24	3	6	4	13	47	42 : 100 : 54
2007	21	39	5	4	6	15	75	54 : 100 : 38
2008	19	42	5	8	5	18	79	45 : 100 : 43
2009	15	43	2	14	7	23	81	35 : 100 : 53
2010	9	24	7	8	4	19	52	38 : 100 : 79
2011**	7	9	-	-	-	15	31	78 : 100 :167
2012**	4	9	1	3	9	13	26	44 : 100 :144
2013	6	15	1	2	7	10	31	40 : 100 : 67
2014	7	19	2	5	1	7	36	37 : 100 : 37

* Total counts some years include unclassified bighorn sheep.
*These counts were conducted by helicopter.

Table 3. Summary of State and Colville Confederated Tribes (CCT) permit numbers and State hunter harvest of bighorn sheep from the Vulcan Mountain Unit, 2005 – 2014.

	# Permits		
Year	State	CCT	State Hunter Harvest
2005	1	1	1 ram
2006	1	1	1 ram
2007	2	2	2 rams
2008	3	2	1 ram, 2 ewes
2009	4	4	1 ram, 3 ewes
2010	4	4	1 ram, 3 ewes
2011	2	4	1 ram
2012	1	1	1 ram
2013	1	1	None
2014	1	1	1 ram

BIGHORN SHEEP STATUS AND TREND REPORT: REGION 1
LINCOLN CLIFFS

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Population objectives and guidelines
The management objective for the Lincoln Cliffs (Sheep Unit 12) herd is to manage bighorn sheep numbers to a self-sustaining population capable of supporting both consumptive and non-consumptive recreation and remain within the local landowners' tolerance. The existing population objective for the Lincoln Cliffs herd is to reach a population size of 90-100 animals (WDFW 2014), but a revised set of population objectives is currently being finalized

Bighorn sheep distribution was historically centered on the original 1990 release site on the Lincoln Cliffs, a parcel owned by the Bureau of Land Management (BLM), just south of the town of Lincoln. This was an area jointly selected by WDFW and BLM as suitable habitat. Observations of bighorn sheep have been reported as far east as Porcupine Bay on the Spokane Arm of Lake Roosevelt and to the east side of Banks Lake in Grant County. The sheep now regularly occupy two main areas throughout the year: the original Lincoln Cliffs area and the cliffs around Whitestone Rock, about 7 miles downriver from Lincoln. Sheep have also been observed frequently using Whitestone Rock itself, as well as the cliffs above Sterling Valley, the area between Lincoln Cliffs and Whitestone. Bighorns were released during the springs of 2008-2010 into the Hells Gate area of the Colville Indian Reservation, on the north side of Lake Roosevelt, an area just north of the Lincoln Cliffs area.

Hunting seasons and harvest trends
The first hunting permit for this herd was issued in the 1997 hunting season. Since then, one ram permit was issued each year until 2014, when two permits were issued. Harvest success has remained at 100%. The number of applicants for the Lincoln Cliffs hunt has averaged 1,540 over the past five years. In addition to the annual permit, the statewide 2003 and 2005 auction winners and the 2004 raffle winner all selected Lincoln Cliffs to harvest their rams. In subsequent years, however, auction and raffle winners were not allowed to hunt at Lincoln Cliffs because of the requirement that 2 general draw permits be available for any unit hosting auction/raffle hunts. The Lincoln Cliffs herd became eligible but was not selected for these hunts in 2014.

Hunters have spent an average of 5 days hunting per kill. However, days hunted has varied widely from 1 to 14 days. The area is almost entirely composed of private property and days/kill often reflects how much time was spent prior to the hunt gathering permission to access the local properties.

Since 1997, 22 mature rams have been removed by hunting by either the regular permitees or the auction and raffle winners. The number of mature rams seen by hunters has been variable over the years (Table 1) and is highly dependent on hunter effort (time spent in the field) and selectivity (willingness to spend time searching for a ¾-curl ram vs. taking a ½-curl ram). On average hunters have reported seeing 7 mature (¾+ curl) rams/year; varying from 0 to 20**.**

Surveys
Aerial surveys are the preferred method for surveying this herd due to the habitat (cliffs) and lack of road access. Ground surveys have been used; however, these are often very limited due to the terrain of Lincoln Cliffs and the access to private property. Despite the problems, ground counts are conducted, whenever possible, to supplement the aerial surveys. Prior to 2002 aerial surveys were inconsistent due to funding and personnel. From 2002-2013 a concerted effort was made to conduct two aerial surveys per year, one in the spring to assess lamb production, and, one in late fall to assess ram numbers. Review of the past ten years data showed that the fall flight produced greater ram and ewe counts 90% of the years and greater lamb count 50% of the time. Therefore in 2014 it was decided to fly only the fall aerial survey.

Aerial surveys have resulted in variable ram to 100 ewe ratios over the past 13 years (average 70, range 39-178; Table 3). The lamb to 100 ewe ratio has remained relatively stable over the 12 years of spring flights (averaging 41 lambs per 100 ewes), although yearly 90% confidence intervals are large (Table 2). In 2014 concerns were raised when only 7 lambs were located during the fall aerial survey, all in the Whitestone area. This confirmed what had been reported from ground observations of the Lincoln Cliffs group. In February 2015, 10 sheep (8 ewes and 2 rams) were captured and fitted with GPS-enabled radio collars.

The new radio collars will allow for quicker location of sheep during aerial surveys and in, locating sheep that would have otherwise been missed, thus improving survey results and leading to more accurate lamb and ram to ewe ratios. In addition, GPS and radio telemetry have been valuable for ground counts, which have been conducted regularly during the spring and summer of 2015 to monitor lamb production and survival. Residents in Lincoln have also been very helpful in reporting counts and other observations of this group. Maximum ground counts during summer 2015 included 24 ewes with 15 lambs in the Lincoln group, and 20 ewes with 11 lambs in the Whitestone group. These lamb counts remained stable through the summer, indicating the recruitment failure of 2014 did not recur in this herd in 2015.

Population status and trend analysis

The Lincoln Cliffs population was started with an introduction of 11 California bighorns from Northwest Trek in December 1990. Three additional sheep from Vulcan Mountain were released in March 1991 and 5 from Kamloops, British Columbia in 1996.

Following this release, the population showed a steady increase and eventually tripled in numbers after 4 years. By 1996, the population objective level of 60 to 70 bighorns was reached with 65 animals observed during the fall ground survey. The population reportedly peaked at around 100 animals in June 1998 (ground survey, pers. comm. J.Hickman). This peak in population was further evidenced by hunter report of 60 animals seen in 1998 (Table 1). This remained the greatest number of sheep seen by hunters until 2012 when the permit holder saw 60 sheep as well. However, the hunter reports have been highly variable over the past 18 years, averaging 35 sheep with a range of 1 to 60. Much of this variability is tied to hunter effort; for example the three lowest years 2003, 2006, and 2007 the permit holder only hunted 1 day.

Some of the decline in hunter observation was also due to 27 ewes and 1 ram being removed to other populations in the state over the course of 3 years (1999-2001). In March 1999, 10 ewes and 1 ram lamb from the Lincoln Cliffs herd were captured and translocated to Lake Chelan. In February 2000, 6 additional ewes were captured and translocated to the Lake Chelan release site. In February 2001, 11 more ewes were captured and released on Cleman Mountain.

Following the last capture and translocation the number of sheep observed by the permit hunter in 2001 dropped significantly. Additionally the aerial and ground surveys in 2002 found on average only 40 sheep in the area. The population apparently was not able to recover from the removal of ewes for translocation to other areas. As a result, 15 sheep were translocated from Nevada to the Lincoln Cliffs and Whitestone areas in January 2003 (12 ewes, 1 ram, and 2 lambs). All were marked with numbered yellow ear tags and the adults were all equipped with VHF radio collars. Mortality rates for the radio collared sheep were approximately 10% each year, with a total of 7 mortalities post release (1 ram and 6 ewes). Cougar predation was the source of at least three of those deaths. The lambs were not found again after release, 2 ewes were never heard again after the November 2003 flight, and the remaining 4 ewes appear to have outlived their radio collars. No radio signals were picked up for these individuals after May of 2008, although yellow ear tags on at least two ewes were again seen in 2011. To date, no mortality has occurred for the 10 sheep that were radio-collared in the February 2015 capture.

Since 1997, 41 known sheep mortalities have been documented–22 from hunting, 2 from vehicle collisions, 5 from cougar, and 12 unknowns–a total of 33 rams and 8 ewes. The last reported non-hunting mortality occurred in 2013, with the cause unknown.

Minimum population estimates are based on maximum count of rams and ewes from all helicopter surveys in a given year (Fig. 1). They indicate the Lincoln Cliff population to be relatively stable through 2010, after which they have shown a positive growth trend (Fig. 1). There was a decline in ewes in 2005 followed by a decline of rams in 2006. The decline in rams also followed three consecutive years of 2 rams being removed due to the auction and raffle permit holders selecting the Lincoln herd to hunt. Since 2005 the ewe population has steadily increased. The ram population rebounded immediately after 2006 and had, until 2013, remained fairly stable at around 20 animals. In 2013, 32 rams were observed during aerial surveys, and 38 were observed in 2014. This is the greatest number since regular surveys began in 2002. In particular, the number of younger (¼-and ½-curl) age classes showed a considerable increase in the last two years. The total number of bighorns observed in the November 17, 2014 survey, including lambs, was 94.

Habitat condition and trend

A continuing threat to the sheep at Lincoln Cliffs is the increasing development of recreational and permanent housing in the Lincoln Cliffs area. In the past few years development has accelerated and brought more people and more roads to this sheep site. Habitat within the range of the Lincoln Cliffs herd is in good condition, but limited and decreasing. WDFW and the Bureau of Land Management should attempt to secure and protect the habitat base for this herd by acquiring, either by outright purchase or easements, more land in the immediate area.

Disease and parasites

During capture operations in 2000 and 2001 it was noted that these animals were in excellent physical condition. All of the animals captured were robust with excellent pelage and overall appearance. Disease testing showed low numbers of parasites and no harmful disease. Animals captured in 2015 were also in overall good condition, with moderate to good body fat levels, low parasite loads, and no scabies infestations. With concern over poor lamb recruitment in 2014, all animals were also tested for *Mycoplasma ovipneumoniae* exposure or infection. This is the respiratory pathogen that predisposes wild sheep to pneumonia, and is associated with domestic sheep or goat contact. All tested negative for *M. ovipneumoniae*.

There are no known large domestic sheep or goat operations in the area at the present time. However, with the current development there is an increased potential for contact with domestic sheep or goats via 4H and small scale operations. For example in 2006 three domestic sheep were discovered to have escaped in the area of Sterling Valley, but follow up observations indicate they did not survive. In the past, information pamphlets outlining the threats domestic sheep pose to bighorn sheep have been mailed to individuals known or believed to own sheep or goats. In the future, information pamphlets should also be made available to the many new residents around the Lincoln Cliffs area and mass outreach attempted through local newspapers and periodicals. GPS collar data will also allow WDFW to better delineate the herd's home range and movements, and thus where to target education and outreach efforts regarding these threats.

Wildlife damage

Damage complaints related to bighorns in both the Lincoln and Whitestone areas are on the rise. With the growth of this herd, increased agriculture in the area, and recent drought conditions, local producers are experiencing significant seasonal damage to crops such as winter wheat and alfalfa. WDFW staff and Master Hunters were used periodically in 2014 to haze sheep from fields with little success. Growth in the local human population and associated construction of new housing and splitting of parcels has not resulted in any damage complaints to date. However, the Lincoln group spends significant time near residences, which may become an issue in the future if landowner tolerance changes.

Management conclusions

The herd is now roughly estimated to be around 100-125 adult animals. This sets the Lincoln Cliff herd at or above the stated goal of 90-100 animals for this population (WDFW 2014). Given the apparent permanent expansion of this herd to Whitestone Rock, regular use of Sterling Valley, and the addition of GPS marked individuals, population goals and available habitat should be reviewed for this herd. Additionally, there is an increasing need to explore tools to address agricultural damage by bighorns.

Two ram permits have again been issued for the Lincoln Cliffs herd for the 2015 season. This qualifies the herd to be chosen by auction and raffle permit holders as well. With the increase in human population density in and around Lincoln Cliffs, extra effort will be taken to monitor herd numbers and sex ratios in the next few years.

Literature Cited

Washington Department of Fish and Wildlife (WDFW). 2014. 2015–2021Game Management Plan. Wildlife Program, Washington Department of Fish and Wildlife, Olympia. 159pp.

Table 1. Bighorn Sheep Harvest Data

Year	Applications Received	Seen by Permittee		
		Sheep	Lambs	¾ + Curl
1997	527	38	15	3
1998	451	60	23	8
1999	732	42	5	7
2000	1078	55	0	7
2001	1100	13	0	3
2002	1352	38	4	17
2003	1219	1	0	1
2004	1311	50	10	9
2005	1375	40	12	4
2006	1218	8	3	0
2007	1326	7	1	2
2008	1326	7	1	8
2009	1608	58	16	9
2010	1456	26	5	N/A
2011	1488	50	5	N/A
2012	1206	60	10	20
2013	1596	17	6	4
2014	1956	16	0	12

Table 2. Lincoln cliffs herd lamb ratios. *2014 data from November survey, prior to 2014 data from May surveys.

Year	Ewes	Lambs	Lambs: 100 Ewe	± 90% CI
2002	8	4	50	50
2003	27	13	48	27
2004	35	10	29	17
2005	21	10	48	30
2006	24	8	33	22
2007	18	9	50	34
2008	34	14	41	22
2009	33	11	33	19
2010	37	16	43	21
2011	34	11	32	18
2012	37	12	32	18
2013	34	18	53	25
2014*	49	7	14	9

Table 3. Lincoln cliffs herd ram ratios from November surveys.

Year	Ewes	Rams	Rams:100 Ewe	± 90% CI
2002	18	32	178	86
2003	32	18	56	27
2004	36	16	44	22
2005	21	22	105	53
2006	16	9	56	39
2007	25	20	80	39
2008	30	15	50	26
2009	31	18	58	28
2010	41	16	39	19
2011	42	26	62	25
2012	49	21	43	18
2013	55	32	58	21
2014	49	38	78	28

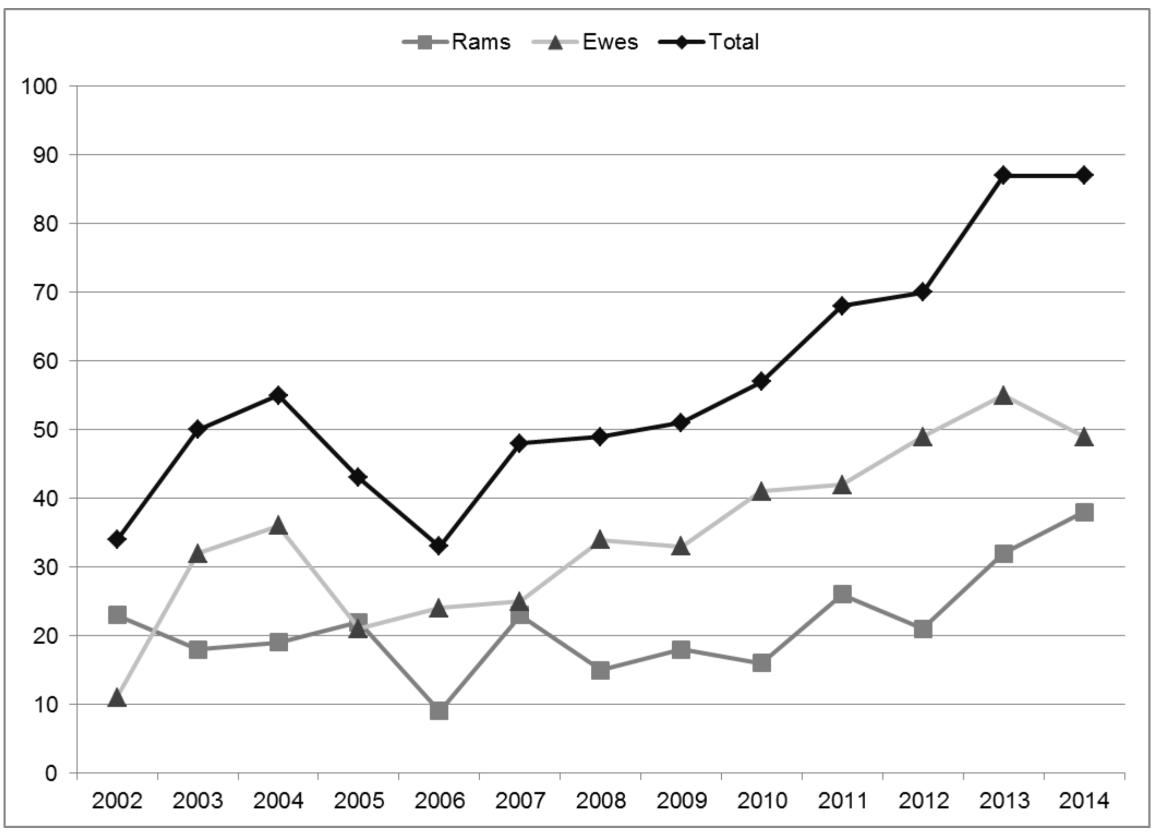

Figure 1. Lincoln Cliffs minimum population estimate by sex for 2002-2014. Estimated as the maximum count from all helicopter surveys conducted each year. Estimates are shown beginning in 2002, the year regular helicopter surveys were initiated.

BIGHORN SHEEP STATUS AND TREND REPORT: REGION 1
BLUE MOUNTAINS

PAUL WIK, District Wildlife Biologist
MARK VEKASY, Assistant District Wildlife Biologist

Population objectives and guidelines

The first bighorn sheep (*Ovis canadensis*) population in the Blue Mountains was established on the W.T. Wooten Wildlife Area (Tucannon River) during the early 1960s, and consisted of bighorns transplanted from the Sinlahekin Wildlife Area. Since that re-introduction, four additional herds of bighorn sheep have been established in the Blue Mountains; Asotin Creek, Black Butte, Mountain View (formerly known as the Cottonwood herd), and Wenaha.

Population management objectives for each herd are based on habitat conditions, habitat availability, and minimizing herd expansion into new habitats that may increase the risk of contact and disease transmission with domestic sheep or goats. The adult population management objective for the Blue Mountains is 500-550 bighorn sheep; Tucannon herd-60, Mountain View herd-60-70, Asotin Creek herd-75-100, Black Butte herd-150-200, and Wenaha herd >90 (WDFW 2008). These herd objectives were identified in 1995, prior to large scale disease die-offs. Updating our herd objectives is now complete, but has not yet been published.

The Hells Canyon Initiative (HCI) was established in 1996, with representatives from Washington Department of Fish & Wildlife, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, U.S. Forest Service, Bureau of Land Management, and the Wild Sheep Foundation formerly known as Foundation for North American Wild Sheep (FNAWS). HCI coordinates disease research, develops population survey methodology, conducts transplants, coordinates intergovernmental management activities, and implements projects designed to improve bighorn sheep habitat. All five of Washington's bighorn sheep populations are included in HCI; Black Butte, Mountain View, Wenaha, Tucannon, and Asotin Creek.

Hunting seasons and harvest trends

Permit-controlled hunting was terminated in most of the Blue Mountains after the pneumonia die-off of 1995-1996. Permits were terminated in the Tucannon in 1999, after this herd suffered a major population decline. Since 2008, permits for harvesting rams have been periodically implemented for the Asotin, Black Butte, and Mountain View sheep herds.

One raffle permit per year has been authorized by the Fish and Wildlife Commission since 2005 to fund bighorn sheep management and research in Southeast Washington. Biologists decide each year which units will be open for hunting by the permit holder. In 2014, the Asotin, Mountain View, and Hall Mountain herd in NE Washington, and a portion of the Black Butte herd were available. The harvest occurred in the Asotin herd. In 2015, the Asotin, Mountain View, and Hall Mountain herds will be available. Raffle permit holders have been successful in harvesting rams in all years since 2005.

Additional hunting permits will not be implemented in other herds until populations meet criteria established in the Bighorn Sheep Management Plan. Treaty hunting by the Nez Perce tribe (NPT) occurs annually but information on harvest is limited. WDFW documented 3 rams being harvested in 2014 by the NPT, with an additional wounding loss that was likely tribally related.

Since the NPT does not regulate or monitor harvest, WDFW considers these losses the minimum number taken by tribal members. In 2003, the NPT Wildlife Committee recommended closing the Washington portion of their treaty area to bighorn sheep hunting by tribal members. The current status of this closure is unknown.

Surveys

Aerial surveys have historically been conducted in February and March using a sightability model developed through the Hells Canyon Initiative. These surveys are conducted to determine population estimates, trend, and herd composition at the low point of the annual population cycle. Radio telemetry locations are obtained frequently throughout the year by foot and/or aircraft, supplementing the helicopter surveys.

Aerial surveys were not conducted in 2015 because ground counts have proven adequate for estimating population parameters. Ground counts were obtained for the five herds during March and April of 2015. The minimum population estimate for 2015(for all herds aggregated) was 206, considering of 113 ewes, 34 lambs, 57 rams for ratios of 50 (90% CI: 36-56) rams and 30 (90% CI: 20-40) lambs per 100 ewes (Table 1). A population estimate using the sightability correction has not been developed for 2015 at this time, but biologists estimate that there are approximately 210-230 bighorns in the 5 herds. Despite numerous removals for research and management, lamb survival and recruitment was adequate to maintain a stable population over the past year.

Population status and trend analysis

Lamb survival has been limiting population growth since the bronchopneumonia die-off in 1996, with lamb survival varying greatly between years. The 2014 lamb recruitment was again low for all Blue Mountains bighorn herds, except for Asotin; Black Butte (27* lambs:100 ewes), Tucannon (10:100), Wenaha (16:100), Asotin (52:100), and Mountain View (37:100). The Tucannon herd is the only herd that has not had lambs die from pneumonia during the past 16 years of intensive monitoring, but it is experiencing high lamb mortality, possibly due to predation. Despite the recent outbreak of *Mycoplasma ovipneumonia* (*M. ovi*.) induced bronchopneumonia in the Asotin herd, lamb recruitment was surprisingly good in 2014 with 13 lambs associated with 25 ewes in mid-winter. Historically, lamb recruitment rebounds for 1 – 3 years following an initial disease die-off, but rarely lasts. In the Asotin herd, we have been researching which animals within the herd are the "chronic" carriers of *M. ovi*., and removing identified animals within the year. It is still unclear if this research effort will result in continued improved lamb recruitment.

In February and March of 2015, 4 collared bighorn ewes were killed by a cougar in the Asotin Herd. This rate of mortality in a 4 week period amounted to 20% of the female population being lost. Following the fourth confirmed cougar depredation, WDFW removed one adult female cougar from the area where the last mortality occurred. No additional mortalities were detected in the following 3 months.

One 6-year old ram was removed from the Asotin herd range during the 2014-2015 reporting period because of the disease risk to the herd. This ram was originally sighted within 100 yards of 100+ domestic goats that had tested positive for *M. ovi*. the previous year. The owner of the goats contacted WDFW, who responded and successfully captured the animal. The animal was transferred to a Washington State University holding facility, where it later died of undetermined causes. This animal tested positive for *M. ovi*. at the time of capture.

The Black Butte herd's estimate of 27 lambs:100 ewes is biased by the fact that 8 adult ewes, all of which had lost their lambs, were removed by WDFW to protect remaining animals of the herd from disease transmission (see below). Their presence would have produced a lamb ratio of 16:100. These ewes were removed from the Black Butte herd following the detection of a new strain of *M. ovi*, in addition to the original strain that caused chronic infection and nearly 100% lamb mortality. Spring and summer monitoring within the Black Butte herd during 2014 documented a 25% loss of adult ewes within less than 3 months due to pneumonia. These 8 ewes were removed in October 2014 (prior to the rut and expected increase in male movement) due to the risk that this new strain would generate a new pulse of all age die-offs among nearby Hells Canyon herds ,The 8 ewes were transferred to a captive research facility at South Dakota State University to aid in the ongoing research. Unfortunately, this same strain of *M. ovi*. was detected further up the Grande Ronde River in the Shumaker section of the Black Butte herd range during winter captures. We have not documented any mortalities in this group from the single animal that tested positive.

The number of mature rams in the meta- population has been declining for the past 5 years, and still remains substantially below the number that existed prior to the die-off (Table 1). Declines in ram numbers are attributed to poor lamb recruitment, disease, predation, research removals, risk management removals, and harvest by WDFW hunters and tribal members. There has been no documented poaching of bighorn rams in the past year, although one animal was wounded and lost by a modern firearm hunter that is thought to be tribally related (see above).

During the winter of 2014-2015, the Tucannon herd was augmented with 2 young rams from the Lookout herd in Oregon. Both rams were fitted with Vectronics GPS/Satellite collars to monitor their movements. Both rams are still alive and within the Tucannon herd range as of July 2015.

Habitat condition and trend

Habitat conditions are moderate to good in most areas. However, the spread of noxious weeds, mostly yellow star-thistle (*Centaurea solstitialis*), thistle (*Cirsium* spp.), and rush skeleton weed (*Chondrilla juncea*) are threatening ranges in the Blue Mountains. Although the School Fire (2005) had immediate negative effects on the Tucannon bighorn sheep population (direct mortality), it appears the range has recovered. Noxious weeds are not dominating the landscape in the core bighorn range and the grasses and forbs appear to be healthy.

Disease and parasites

M. ovi induced bronchopneumonia continues to plague 4 of the 5 bighorn populations; Asotin, Black Butte, Wenaha, and Mountain View. Bighorn populations in the Blue Mountains have not recovered from the bronchopneumonia die-off as quickly as some herds, possibly from re-infection from neighboring bighorn herds and domestic sheep and goats that exist within the range of multiple herds. The presence of domestic sheep and goats within and adjacent to bighorn sheep range presents a constant and substantial risk of another major epizootic. WDFW actively works with landowners near bighorn sheep herds to insure accurate disease information is available to stock owners and options to minimize contact between domestics and wild sheep are made available.

Other government agencies have encouraged landowners to use domestic goats for weed control. This type of weed control program when used near the range of bighorn sheep presents a substantial risk to bighorn sheep populations in southeast Washington.

As part of the Hells Canyon Restoration committee, WDFW is actively participating in research on *M. ovi*. induced pneumonia in bighorn sheep. For the past 2 years, WDFW and IDFG researchers have been capturing ewes and lambs in the Asotin and Black Butte herds to determine the bacterial "shedding" status of animals within those populations. Efforts have been made to remove the "chronic" shedders of *M. ovi*. in the Asotin herd, ideally increasing the survival and recruitment of lambs in the future. Work in the Mountain View herd began in 2015 and will continue through the next few years. In the 2014-2015 reporting period, WDFWand IDFG biologists captured and sampled 56 animals from these three herds. A combination of ground darting and helicopter net gunning was used to accomplish these captures.

Additional research is occurring by a Ph.D. student from Montana State University. That student is looking at fine scale group compositions within a herd over time, attempting to model contact rates within a population to better understand the spread of disease.

Lamb mortality continues to be high in most herds (as suggested by low number of lambs in mid-winter, Tables 2-6). Lambs that have recently died or are severely incapacitated and have been collected from these herds all indicate that pneumonia was the proximate cause of death for lambs from all herds except the Tucannon. WDFW continues to collaborate with Washington State University research into the factors related to pneumonia in Hells Canyon.

Management conclusions

Four of the five bighorn sheep herds in the Blue Mountains are struggling with *M. ovi* induced bronchopneumonia. The Black Butte, Wenaha, and Mountain View herds still experience periodic pneumonia outbreaks, which result in high lamb mortality and sporadic adult mortalities. It is unclear what path the Asotin herd will take with the recent disease infection and research "treatment" that occurred there. The Tucannon herd escaped contracting the pneumonia causing bacteria, but suffered a major die-off after being infected with scabies in 1999. This herd has experienced high lamb mortality (not bronchopneumonia related) for the past 2 years. It is suspected that either predation on this small herd or genetic issues related to its chronically small size are limiting its recovery, and that it is unlikely to recover without additional management action We are currently planning to introduce 5 – 10 bighorn ewes from Oregon into the Tucannon herd range during the winter of 2015-2016, attempting to overcome the effects of small population size.

Domestic sheep and goats continue to be a major threat for bighorn sheep in the Blue Mountains. Rural landowners continue to use domestic sheep and goats to control weeds, posing a severe threat to all herds in Hells Canyon. HCI research has shown that a large amount of inter-herd movement occurs (F. Cassirer, IDFG, pers. comm.). Numerous bighorn sheep have been removed, either lethally or transferred to captive research facilities, to minimize the possibility of transmitting diseases. In early 2008, District 3 wildlife management staff authored response guidelines to be implemented when bighorn sheep are located in "high risk" areas, or domestic sheep or goats are located within bighorn range. These guidelines were submitted in February 2008, but have not been formally adopted. However, the general practice has been to lethally remove bighorns that move to the lower reaches of Asotin Creek if a captive facility does not have the ability to house the animal.

Literature Cited

Washington Department of Fish and Wildlife. 2008. 2009-2015 Game Management Plan. Washington Department of Fish and Wildlife, Olympia, 223 pp.

			Rams						Population	Ratio (90% CI)	
Year	Lambs	Ewes	C I	C II	C III	CIIIB	C IV	Total	Total	Lambs	Rams
2006	41	104	7	13	6		3	53*	198	39 (27, 51)	51 (38, 64)
2007	50	106	13	16	31		7	66	223	47 (34, 60)	63 (47, 79)
2008	28	125	21	26	24	1	4	76	229	22 (15, 30)	61 (46, 75)
2009	29	131	2	34	23	2	6	67	229	22 (15, 30)	51 (39, 64)
2010	32	136	17	29	33	1	5	85	253	24 (16, 31)	63 (48, 77)
2011	37	129	9	18	37	5	8	77	241	29 (20, 38)	60 (46, 74)
2012	36	113	14	14	29	1	15	73	222	32 (22, 42)	65 (49, 81)
2013	24	114	9	18	37	2	5	71	209	21 (13, 29)	62 (47, 78)
2014	29	131	7	16	28	4	4	59	221	22 (15, 30)	45 (33, 57)
2015	34	113	13	14	21	7	2	57	206	30 (20, 40)	50 (36, 65)

Table 1. Bighorn sheep population trend and herd composition, Blue Mountains, Washington.

			Rams					Ram	Population	Ratio (90% CI)	
Year	Lambs	Ewes	CI	CII	CIII	CIIIB*	CIV	Total	Total	Lambs	Rams
2006	13	34	6	6	3		1	16	63	38 (18, 59)	47 (24, 71)
2007	10	30	2	8	6		3	19	59	33 (13, 53)	63 (33, 94)
2008	13	40	11	9	6	0	1	27	80	33 (15, 50)	68 (40, 95)
2009	18	48	1	9	6	0	1	17	84	38 (20, 55)	35 (19, 52)
2010	17	46	12	10	12	0	3	37	100	37 (20, 54)	80 (51, 110)
2011	23	40	6	12	16	0	4	38	101	57 (33, 82)	95 (60, 130)
2012	12	26	6	8	10	0	7	31	69	46 (20, 73)	119 (67, 171)
2013	2	22	4	6	15	1	1	27	51	9 (0, 20)	122 (65, 180)
2014	9	29	1	5	16	3	2	27	65	31 (12,50)	93 (52, 134)
2015	13	25	1	1	12	4	0	18	56	52 (23, 81)	72 (30, 114)

Table 2. Asotin herd 10-year survey history.

			Rams					Ram	Population	Ratios (90% CI)	
Year	Lambs	Ewes	CI	CII	CIII	CIIIB	CIV	Total	Total	Lambs	Rams
2006	3	19	1	2	5		1	9	31	16 (0, 32)	47 (16, 79)
2007	4	24	5	2	9		1	17	45	17 (2, 31)	71 (34, 108)
2008	1	27	2	3	4	0	0	9	37	4 (0, 10)	33 (11, 55)
2009	0	25	1	10	7	2	1	21	47	0 (0,0)	84 (43, 125)
2010	1	19	0	2	2	1	0	5	25	5 (0, 14)	26 (5, 48)
2011	1	25	1	1	5	2	0	9	35	4 (0, 11)	36 (13, 59)
2012	3	24	0	2	4	0	1	7	34	12 (0, 25)	29 (9, 50)
2013	7	26	1	3	5	0	1	10	43	27 (8, 46)	38 (15, 62)
2014	2	25	3	2	0	0	0	5	32	8 (0, 18)	20 (4, 36)
2015	3	11	0	1	2	0	0	3	17	27 (0, 56)	27 (0, 59)

Table 3. Black Butte herd 10-year survey history

Year	Lambs	Ewes	Rams						Population	Ratios (90% CI)	
			CI	CII	CIII	CIIIB	CIV	Total	Total	Lambs	Rams
2006	10	16	0	5	1		1	7	33	63 (21, 104)	44 (11, 76)
2007	12	19	4	0	3		0	7	38	63 (25, 101)	37 (10, 64)
2008	0	22	2	0	0		0	2	24	0	9 (0, 20)
2009	0	7	0	4	2	0	0	6	13	0	86 (7, 164)
2010	2	18	2	6	6	0	0	14	34	11 (0, 25)	66 (32, 123)
2011	2	21	1	1	3	0	3	8	31	10 (0, 21)	38 (12, 64)
2012	8	16	1	1	5	0	2	9	33	50 (14, 86)	56 (18, 95)
2013	6	23	0	5	3	0	1	9	38	26 (6, 46)	39 (14, 64)
2014	4	26	1	2	3	0	0	6	36	15 (2, 29)	23 (6, 40)
2015	11	30	9	1	2	1	0	13	54	37 (15, 58)	43 (17, 70)

Table 4. Mountain View herd 10-year survey history.

Year	Lambs	Ewes	Rams						Population	Ratios (90% CI)	
			CI	CII	CIII	CIIIB	CIV	Total	Total	Lambs	Rams
2006	.	.	.	.	.	.	.		7 - 9		
2007	2	2	1	0	0	0	0		5	100 (0, 265)	0
2008	3	3	1	0	1	0	1	3	9	100 (0, 234)	100 (0, 234)
2009	0	7	0	1	0	0	1	2	9	0	29 (0, 66)
2010	2	5	0	1	2	0	0	3	10	40 (0, 95)	60 (0, 132)
2011	3	6	1	1	1	0	0	3	12	50 (0, 108)	50 (0, 108)
2012	4	12	3	1	1	0	0	5	21	33 (2, 65)	42 (5, 78)
2013	3	12	3	1	2	0	0	6	21	25 (0, 52)	50 (9, 91)
2014	2	12	1	2	3	0	0	6	22	16 (0, 38)	50 (9, 91)
2015	1	10	1	5	2	1	0	9	22	10 (0, 27)	90 (17, 163)

Table 5. Tucannon herd 10-year survey history.

Year	Lambs	Ewes	Rams						Population	Ratios (90% CI)	
			CI	CII	CIII	CIIIB	CIV	Total	Total	Lambs	Rams
2006	15	35						21	71	43 (21, 65)	60 (33, 87)
2007	22	31	1	6	13		3	23	76	71 (38, 104)	74 (41, 108)
2008	11	33	5	14	13	1	2	35	79	33 (14, 52)	106 (64, 148)
2009	11	44	0	10	8	0	3	21	76	25 (11, 39)	48 (27, 69)
2010	8	32	3	8	4	1	1	17	57	25 (9, 41)	53 (27, 79)
2011	8	37	0	3	12	3	1	19	62	22 (8, 35)	51 (28, 75)
2012	9	35	4	2	9	1	5	21	65	26 (10, 42)	60 (33, 87)
2013	6	31	1	3	12	1	2	19	56	19 (5, 34)	61 (32, 91)
2014	12	39	1	5	6	1	2	15	66	31 (14, 47)	38 (19, 58)
2015	6	37	2	6	3	1	2	14	57	16 (4, 28)	38 (17, 58)

Table 6. Wenaha herd 10-year survey history

BIGHORN SHEEP STATUS AND TREND REPORT: REGION 2

MT. HULL

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Population objectives and guidelines

Mt. Hull Herd. The historical population objective for the Mt. Hull California bighorn sheep herd is 55-80 animals. Currently, the estimated herd size is above this level at 130-135 animals. The current management focus is to maintain or slightly reduce the current population level while minimizing the risk of disease and agricultural damage. This population supports a conservative, any ram permit harvest to the extent it is compatible with herd demographics. Starting in 2009 two ewe permits where offered to help achieve herd reduction goals.

Sinlahekin Herd. The population objective for the Sinlahekin California bighorn sheep herd is 50 animals. The population reached a high in 2011 at an estimated 90-95 animals, but has since declined. Current surveys indicate an estimated herd size of 50-55 animals. This decline occurred in association with the discovery of the ectoparasitic mite *Psoroptes ovis* in the herd, although it is unclear whether there is a causative relationship. The current objective for the Sinlahekin herd is to increase population size.

Hunting seasons and harvest trends

Mt. Hull Herd. One or two ram permits have been consistently offered since 2003 depending on herd size and ram demographics. Beginning in 2009, two adult only ewe permits were issued for this herd to help achieve herd reduction goals. Washington Department of Fish and Wildlife (WDFW) permit holders harvested five (2 regular permit, 2 raffle permit, and 1 auction permit) mature rams and two adult ewes in 2014. Colville Confederated Tribe (CCT) permit holders harvested two rams and one adult ewe (Table 1). WDFW issued one any ram and two adult ewe only permits for the 2015 season. The CCT issued 4 any ram permits and two ewe only permits. The difference in ram permits is to achieve balance in permit allocation after the 2014 harvest.

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

Year	WDFW Permits	WDFW Harvest	CCT[a] Permits	CCT Harvest
1995	1 ram	0	1 ewe	0
1996	1 ram	1 ram	1 ewe	0
1997	1 ram	1 ram	1 ewe	0
1998	1 ram	1 ram	1 ewe	1 ewe
1999	1 ram	1 ram	1 any	1 ram
2000	0	--	1 any	0
2001	0	--	1 any	0
2002	0	--	1 any	0
2003	1 ram	1 ram	1 any	1 ram
2004	1 ram	1 ram	1 any	0
2005	1 ram	1 ram	1 any	0
2006	2 rams	2 rams	2 any	1 ram
2007	2 rams	2 rams	1 any	1 ram
2008	2 rams	2 rams	1 any	1 ram
2009	1 ram 2 ewe	1 ram 1 ewe	1 any 2 ewe	1 ram 1 ewe
2010	1 ram 2 ewe	1 ram 2 ewe	1 any 2 ewe	0 ram 2 ewe
2011	1 ram 2 ewe	1 ram 1 ewe	1 any 2 ewe	1 ram 1 ewe
2012	1 ram 2 ewe	1 ram 2 ewe	1 any 2 ewe	0 ram 0/NR* ewe
2013	2 ram 2 ewe	2 ram 1 ewe	2 any 2 ewe	0 ram 1 ewe
2014	5 ram 2 ewe	5 ram 2 ewe	2 any 2 ewe	2 ram ewe

[a] CCT=Colville Confederated Tribes
* Not Reported

Sinlahekin herd. In the past herd demographics supported the issuance of one ram permit annually from 2010 through 2012, and hunters successfully filled all three permits. Since then surveys indicate the population is not meeting harvest guidelines, thus no permit has been offered since 2012. Permits will not be available until survey results verify substantial herd growth.

Surveys

Population surveys are generally conducted annually to determine composition and trend on both the Mt. Hull and Sinlahekin herds (Tables 2 & 3). The surveys are conducted in late fall or early winter and consist of helicopter and/or ground count efforts. An attempt is made to classify every bighorn sheep in each herd, and although a complete count is probably not achieved, the majority of animals are typically documented by observers. This result represents a minimum count from which a population estimate is generated.

Table 2. Population composition counts from the Mt Hull area. <3/4 = less than 3/4 curl rams, ≥3/4 = greater than or equal to 3/4 curl rams, and L:100:R is lambs (L) and rams (R) per 100 ewes (100).

				Rams			Count	Population	
Year	Lambs	Ewes	<3/4	≥3/4	Total	Unknown	Total	Estimate	L:100:R
1992	0	26	1	7	8	0	34	40-60	0-100-31
1993	0	17	2	7	9	0	26	40-50	0-100-53
1994	5	28	2	8	10	0	53	50-60	18-100-36
1995	11	16	6	11	17	0	44	55	69:100:106
1996	0	5	10	6	16	0	21	40-60	0:100:320
1997	8	25	--	--	8	0	41	55-65	32:100:32
1998	--	--	--	--	--	--	--	--	--
1999	19	24	15	8	23	0	66	70	80:100:96
2000	21	30	9	0	9	0	60	60-65	70:100:30
2001	10	30	15	4	19	0	59	60-70	33:100:63
2002	11	40	6	4	10	0	61	65-70	28:100:25
2003	20	39	9	12	21	0	80	80-90	51:100:54
2004	9	32	7	10	17	0	58	70-90	28:100:53
2005	16	48	16	10	16	0	90	90-100	60:100:33
2006	8	40	25	5	30	0	77	100+	20:100:75
2007	13	54	17	6	23	0	90	100+	24:100:43
2008	18	52	20	13	33	0	103	110-120	35:100:63
2009	17	58	11	10	21	0	96	100+	36:100:29
2010	19	43	6	3	9	0	71	80-100	44:100:21
2011	8	38	13	18	31	0	77	80-100	21:100:82
2012	8	38	26	17	43	0	89	90-100	21:100:113
2013	12	50	17	8	25	3	90	90-100	24:100:50
2014	28	52	27	12	39	9	128	130-135	54:100:75

Mt. Hull Herd. WDFW biologists conducted a ground survey of the Mt. Hull Unit in September 2014 classifying 128 sheep, including 39 rams, 12 of which were ≥ ¾ curl. Observed lamb recruitment was 54 lambs per 100 ewes (Table 2).

Sinlahekin herd. WDFW biologists conducted a ground survey of the Sinlahekin Unit in September 2014 classifying 27 sheep, including 4 rams and 7 lambs. This survey produced a minimum count as telemetry signals indicated one group of sheep was not observed. Combining other observations with this formal survey suggested the Sinlahekin herd likely contained upwards of 33 ewes, 9 lambs, and 8 rams during 2014. Observed lamb recruitment to early winter increased in 2014 at 54 lambs per 100 ewes (Table 3).

Population status and trend analysis

Mt. Hull Herd. Observational data suggests that the Mt. Hull herd grew fairly steadily following reintroduction in 1970. Numbers peaked at 80-90 animals around 1990 following several mild winters. The population declined noticeably in the 1990s, particularly following the severe winter of 1992-93. Herd numbers climbed gradually over the next 10 years until the Rocky Hull fire burned a significant portion of the range in 2000. Robust herd growth has prevailed since, likely due to fire's rejuvenating effect on preferred forage plants. The herd reached its highest observed abundance in 2014 at 128 animals. This is above population objectives. The ram cohort fluctuated significantly in the early 2000s in response to fire activity in the US and Canada, but is now quite robust.

In 2001, WDFW augmented the herd with 8 ewes and 3 rams from the Cleman Mountain herd. Additional augmentation occurred in 2003 with 5 animals from John Day, Oregon. Augmentation efforts are primarily designed to maintain genetic diversity. Population growth is achieved largely through natural production. Given the limited range and insular characteristic of the sheep range on Mt. Hull, current herd size is likely near the maximum the landscape can sustainably support.

As herd growth increased, by the mid-2000s the bighorn sheep where coming down in elevation to forage on irrigated agricultural lands and crossing state highway 97 in the process. These behaviors led to an increase in bighorn sheep road kills and agricultural damage complaints which spiked in 2006-2007. To reduce herd size, trapping and relocating animals was accomplished in 2009 and 2011 in cooperation with the Colville Confederated Tribes and helped establish the Hellsgate bighorn sheep herd on the Colville Reservation. In addition to these translocation efforts, ewe-only permits were issued starting in 2009 to help reduce herd size towards management objectives. These permits continue to the present. Changes in private land use during this time also lead to reduced complaints.

The number of road kills and agriculture damage complaints decreased substantially after these herd reduction efforts and private land changes were achieved. Adequate natural forage away from the highway and farmland may also play a role in reduced complaints and road kills.

Bighorn sheep continue to come down in elevation to forage on irrigated agriculture fields and orchards and cross State Highway 97 in the process. This behavior is most prevalent during the dryer months (July, August and September) of the year but is exacerbated during periods of drought. Agricultural damage complaints and the potential for roadkill increase during these times, but have not returned to the level seen in 2006-2007. Herd reduction efforts involving trapping and relocating bighorn sheep were accomplished in 2009-2011 but the effects are no longer apparent with the herd's current large size. The herd's large size in addition to changes in private land use back to agriculture may lead to increased conflict with sheep. If the Mt Hull population remains high and vehicle collisions and agriculture damage increase, further herd reduction efforts may be implemented including additional ewe permits and/or translocations.

Table 3. Population composition counts from the Sinlahekin area. <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 <3/4	Rams >3/4	Rams Total	Unknown	Count Total	Population Estimate	L:100:R
1990	--	--	--	--	--	--	--	--	--
1991	--	--	--	--	--	--	--	--	--
1992	6	30	--	--	15	0	41	--	20:100:50
1993	2	17	--	--	4	0	23	--	12:100:24
1994	1	21	--	--	1	0	23	--	5:100:5
1995	9	24	5	6	11	0	44	--	38:100:46
1996	2	20	7	0	7	0	29	30-45	10:100:35
1997	--	--	--	--	--	--	--	25-40	--
1998	--	--	--	--	--	--	--	25-40	--
1999	0	0	0	0	0	0	0	25-40	--
2000	--	--	--	--	--	--	14	20-30	--
2001	6	16	4	0	4	3	29	30-35	38:100:25
2002	8	20	6	0	6	0	34	35-40	40:100:30
2003	--	--	--	--	--	--	--	--	--
2004	--	--	--	--	--	--	--	--	--
2005	2	13	3	2	5	0	20	30-40	15:100:38
2006	3	24	2	3	5	0	32	35-40	12:100:21
2007	2	37	5	7	12	0	51	50-60	15:100:32
2008	7	21	2	3	5	0	33	35-40	33:100:24
2009	15	48	14	9	23	0	86	90-95	31:100:48
2010	15	31	9	5	14	7	67	70-90	48:100:45
2011	4	55	18	5	23	0	82	90-95	7:100:42
2012	2	15	2	0	9	0	26	30-35	13:100:60
2013	4	29	3	2	5	0	38	40-45	14:100:17
2014	7	16	2	2	4	0	27	30-35	44:100:25

Sinlahekin herd. Initially, the herd grew rapidly following reintroduction in 1957. High productivity and continued expansion allowed for translocation of sheep to other ranges in Washington. During the 1990s, the population declined, incurring particularly heavy losses during the winter of 1992-93. In 2003, WDFW augmented the Sinlahekin herd with 10 animals from Oregon to improve genetic diversity and bolster production. Herd demographics had improved with survey results showing an increasing population through 2011. This was likely a function of the herd expanding its range into previously unused habitat to the north, genetic mixing through augmentation, and improved survey accuracy. Since 2012 surveys show a dramatic decrease in the population which likely reflects an actual herd reduction rather than an artifact of survey timing. Causes of this decline are currently unknown; however, psoroptic mange may be a factor as discussed below. Continued annual monitoring will be critical for determining herd status and outlook.

In 2010, WDFW and Washington State University initiated a research project to gather data on herd range expansion, seasonal animal movements, and to evaluate the effectiveness of prescribed fire as a sheep habitat enhancement tool in the Sinlahekin Wildlife Area. Biologists fitted a total of 21 bighorn sheep with GPS radio collars in two separate captures, one in 2010 (10 ewes and 2 rams) and one in 2011 (4 ewes and 5 rams). All data has been collected and is being analyzed by a graduate student enrolled at Washington State University.

During the 2011 Sinlahekin bighorn sheep capture psoroptic mange was discovered within the herd. The reaction to this parasite in a bighorn herd can vary from no signs at all (a few mites in the ears) to fatal infections. We speculate (but do not know) that psoroptic mange may have contributed to the low observed population size and lamb production since 2012. In 2014, 11 bighorn sheep were captured in the Sinlahekin herd and tested for multiple potential pathogens and parasites. Nothing was found that would explain the reduction in the herd size. However, *Psoroptes* mites continued to persist within the herd. Eight of these sheep were fitted with GPS radio collars to increase survey accuracy. Monitoring of the herd will continue.

Habitat condition and trend

Mt. Hull Herd. The Mt. Hull range has generally remained in good shape, but this may be changing. The Rocky Hull fire in 2000 appeared to initially reinvigorate natural forage production, and sheep use became more concentrated in the portion of the range that burned. Since then, increased population and noxious weed invasions may have reduced range quality.

Cheatgrass has flourished in portions of the burn and other new invasive species, including white-top and Dalmatian toadflax, are present. In the past, programs such as the Forest Service’s aggressive weed control effort funded by the Foundation for North American Wild Sheep (now Wild Sheep Foundation), have been helpful, and similar efforts will likely be needed into the future. Recent radio collar data indicates that the current habitat still supports functional connectivity between the Mt. Hull herd and the bighorn sheep herd at Omak Lake on the CCT. Radio collar data showed that a 7 year-old ram left the Omak Lake herd on November 14, 2010, traveling approximately 46 miles before reaching Mt. Hull. This ram returned via the same route to the Omak Lake herd by Christmas day. DNA testing of the Omak Lake herd indicated all animals tested but one, are genetically linked to the Sinlahekin herd. The one remaining individual was genetically linked to the Mt. Hull herd. This connectivity may increase genetic mixing but may also increase the chances of disease transmission between these herds.

Sinlahekin herd. Since the early 2000s, the majority of the Sinlahekin herd has moved north out of its traditional use area on Aeneas Mountain with the exception of a small group that continues to use the area from Aeneas Mountain south to Blue Lake within the Sinlahekin Wildlife Area. Over the years the amount of available sheep habitat on Aeneas Mountain and in the Sinlahekin Wildlife Area had likely declined due to tree encroachment and forest succession. Management activities have been reversing this trend in recent years.

In 2005, an extensive timber thinning and prescribed fire program to reduce tree encroachment and increase forage conditions began on the Sinlahekin Wildlife Area. To date 1,900 acres within the Sinlahekin Wildlife Area has been treated with prescribed fire. Of that, approximately 950 acres were also thinned to reduce conifer stocking levels. The project's ultimate goal is to thin and/or conduct prescribed fire on 2,700 acres overall. This effort, combined with an aggressive weed control program should improve habitat conditions for sheep and other ungulates on the Sinlahekin Wildlife Area.

Much of the sheep foraging habitat for the Sinlahekin herd is not under WDFW control. The WADNR and US BLM maintain cattle grazing on their permits in sheep range, and most of the adjacent private land is intensively grazed. These pressures are likely to continue.

Road mortality has been a minor issue in the Sinlahekin herd. Vehicles collisions have killed four mature bighorn rams and one lamb in the last 10 years.

An additional threat to both the Mt. Hull and Sinlahekin herds is the presence of domestic sheep and goats within and adjacent to their range. Wild sheep are often in close proximity to these domestic herds. This interaction may lead to the transfer of disease into these bighorn sheep herds, especially *Mycoplasma ovipneumoniae* and *Mannheimia haemolytica*, two bacterial pathogens that cause bighorn die-offs. Domestic dogs have also been documented chasing bighorn sheep on Mt Hull and, in one case, causing injury to a lamb.

Management conclusions

Mt. Hull Herd. Generally, the Mt. Hull herd has thrived in recent years, aided by improved post-fire forage conditions, genetic mixing through augmentation, and probable immigration from British Columbia. Changes in sheep behavior over the last few years suggest that the habitat is being strained by the increase in herd size. This herd is currently exceeding the population management objectives of 55-80 animals. Efforts by WDFW to reduce the Mt. Hull population, changes in land use, and favorable weather over the last few years have helped increase range quality, at least in the short term. These factors have also reduced road mortalities and landowner conflicts. WDFW is continuing to work on improving habitat, reducing the factors associated with vehicle collisions, landowner conflicts, and separation of bighorn sheep from domestic sheep and goats.

S*inlahekin Herd*. Continued monitoring is needed to determine the extent and cause of the potentially dramatic herd reduction indicated by survey results. Extensive prescribed fire and thinning treatments in association with weed control strategies are producing improved habitat on the Sinlahekin Wildlife Area. Opportunities for habitat improvement should also be explored for Mt Hull.

In addition, disease prevention, and monitoring should also be a management priority. Maintaining separation between bighorn sheep and domestic sheep and goats is a current focal task.

BIGHORN SHEEP STATUS AND TREND REPORT: REGION 2

SWAKANE, CHELAN BUTTE, MANSON

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Population objectives and guidelines

Three herds of California bighorn sheep are found in Chelan County, the products of reintroductions into Swakane Canyon, the north shore of Lake Chelan and Chelan Butte. In addition, bighorn sheep from the Quilomene herd use areas in Chelan County along the Kittitas County border near Tarpiscan Creek, and along Jumpoff Ridge.

Management objectives for the Wenatchee District are: (1) increase the size and range of existing populations; (2) ensure genetic health by augmenting existing populations with bighorns from other areas; (3) minimize risk of disease by eliminating overlap with domestic sheep grazing allotments on public land, and provide information to the public about the importance of separating wild and domestics sheep; (4) reintroduce bighorn sheep into suitable unoccupied historic habitat within the District; and (5) provide recreational opportunities.

There were an estimated 130-150 bighorn sheep in the Swakane herd as of summer 2015. The existing population objective for Swakane is 50-60 adult sheep (WDFW 2008), although we believe that the herd demonstrated that available habitat can sustain considerably more animals. The north shore of Lake Chelan (Manson) population was estimated at 113-130, with the current population objective for the herd is 100-150 adult sheep (WDFW 2008). The Chelan Butte herd has expanded from an original release of 35 in 2004, to a current estimate of nearly 200 bighorns. Habitat analysis (Musser and Dauer 2003) suggests sufficient habitat exists for a population of 195-390 sheep.

Hunting seasons and harvest trends

In 1999, the first ram permit was offered for the Swakane herd, followed by one permit per year from 2000-2008. The only additional Swakane harvest was by the 2002 auction tag winner (Table 4). Currently, the bighorn season in the Swakane runs September 15-October 10. All of the hunters have been successful at killing a mature ram (≥3/4 curl). No bighorn permit was offered in the Swakane in 2009 due to the high number of vehicle collision mortalities along SR 97A in 2008. Highway mortalities were effectively stopped with the construction of a wildlife fence along SR 97A. A drawing permit for the harvest of one bighorn ram was reinstated for the 2010 hunting season. The ram harvested in 2010 is the new Washington State record and SCI World record California Bighorn Sheep.

Two permits have been offered in the Manson unit since the permit began in 2005. Both auction tag holders and raffle tag holders have regularly harvested rams from the Manson herd. There will be two drawing permits offered for the north shore of Lake Chelan for 2015.

The Chelan Butte herd was hunted for the first time in 2010, with hunters harvesting mature rams in each year since then. Aerial and ground surveys of the area have provided confirmation of an increasing herd and its composition. Another drawing permit for the herd will be offered in 2015. Additionally, due to the areas easy access and robust population, WDFW is offering 3 additional tags for Disabled Hunters (1 ram and 2 ewes) in 2015.

Surveys

Prior to 2009, herd population data was collected primarily from incidental reports from WDFW personnel, permit hunters, public sightings, and occasionally aerial and ground surveys during the spring and rut periods (Table 1, 2, 3). In March of 2009, 12 sheep were outfitted with telemetry collars in both the Swakane and Lake Chelan herds (18 ewes and 6 rams). VHF collars were placed on 12 ewes and 4 rams, and GPS collars were place on 6 ewes and 2 rams. Collars have improved our ability to locate sheep during ground and aerial surveys, improving survey data, population estimates, and knowledge of home range and habitat use. In 2014, an additional 13 sheep were outfitted with GPS telemetry collars in the Manson herd to continue monitoring efforts. Two ground surveys are conducted on each herd annually; a spring survey to document lamb production and a fall survey focusing on rams during the rut. Population estimates are produced from high counts based on sex/age composition. All three herds were surveyed by helicopter in June 2009 to document production and update herd estimates. Additionally, Chelan PUD has been recording bighorn sheep observations during their Lake Chelan big game surveys since 2007.

Population status and trend analysis

From 1996 to 2000, the Swakane bighorn population increased slowly (Table 1). In 2001 the population was estimated at 51 sheep, representing a 46 percent increase from the 1992-2000 average. The increased count in 2001 resulted after Swakane bands began using the cliffs/breaks along the Columbia River and SR 97A, allowing for better monitoring. The proliferation of residential developments and their associated ornamental plantings along the west shore of the Rocky Reach pool may have enticed bighorns to cross Highway 97A with increasing frequency. For over 30 years, no bighorn mortalities were attributed to vehicle collisions. However, 44 Swakane bighorns have been killed by vehicles on SR 97A (18 rams, 21 ewes, 5 lambs) since 2002.

In response to these events, multiple agencies and conservation groups including Washington Department of Transportation, State Patrol, WDFW and the Wenatchee Sportsmen's Association convened a working group to address deer and bighorn sheep vehicle collisions on SR 97A, and developed plans for a wildlife fence to reduce wildlife-vehicle collisions. Phase One of the fence was 4 miles long and extends from mile marker 212 on the north end to mile marker 208 on the south, the section where most collisions have occurred. Construction of this first section was completed 2009. Phase Two, completed in 2010, extended the fence roughly two miles to the south. The remaining 3.3 mile section (Phase Three) was completed in 2011. Vehicle collision mortalities have continued since completion of the fence mainly due to sheep finding vulnerable areas during the rut. Collision rates have dropped significantly, with only 2 vehicle collisions in the previous 12 month period.

Telemetry data from collared sheep has improved our ability to locate sheep and estimate population trends. In 2009, using telemetry collars, we documented the greatest number of sheep observed in the Swakane herd (Table 1), supporting previous population estimates and suggesting that the herd is increasing. Since then, focused ground surveys have increased our minimum counts.

The Manson herd on Lake Chelan exhibited rapid population growth typical of a founder population in excellent quality, unoccupied habitat. In 2004, June survey data were used to calculate 2002-2004 population trends, indicating a 3-year average annual population growth rate of roughly 38%. This increase seems to have slowed, based on decreased observed lamb production/survival. Locations from recent telemetry data show that several bands have moved westward uplake into steeper, rockier, unoccupied habitat. .Compared to the other 2 herds in this District, this herd consistently has lower lamb production. Due to the remote nature of the habitat of this herd, and the difficulty in locating sheep from the water, the population estimate of 101-122 is used from 2009, as a conservative estimate. The collars allowed for a productive aerial survey, where we documented the herd's highest observed count (Table 2). With the addition of new GPS collars we hope to have more accurate counts in the near future.

The Chelan Butte herd has also shown rapid growth and is now expanding their range north of Chelan Butte into Deer Mtn. and Howard Flats. We conducted an aerial survey of this herd to assess production and estimate numbers in 2009. A total of 84 sheep were observed in 2009, and the population was estimated at 84-98. Since 2009, this herd has shown an average 17% increase in the observed minimum count annually to a high of 183 in 2014 (Table 3). The Chelan Butte herd is easily viewed from the road system and counts occur regularly.

We estimate that less than 20 bighorns seasonally use the Colockum and Jumpoff Ridge areas in Chelan County. These sheep are part of the Quilomene herd. A group of 10-15 rams are regularly seen south of Jumpoff Ridge. Residents report a small group of 5-9 ewes and lambs on Jumpoff Ridge and that these animals reside there from spring to fall. If these are in fact resident, these observations suggest the Quilomene sheep have expanded their range.

Habitat condition and trend

Habitat conditions for Swakane, Lake Chelan and Chelan Butte bighorns are excellent, in part due to the high frequency of fires. Fires reduce tree and shrub cover and increase the abundance of grasses and forbs, which in turn benefit bighorns. During summer 2001, the Rex Creek fire on the north shore of Lake Chelan burned over 53,000 acres. However, only a small portion of this burn was known occupied bighorn habitat. During summer 2002, the Deer Point fire on the north shore of Lake Chelan, and down-lake from the Rex Creek fire, burned over 43,000 acres, including most of the occupied bighorn habitat of grass, bitterbrush, mixed shrubs, and ponderosa and lodgepole pine. In October 2002, at least 25 bighorns moved northerly to the Point-No-Point area of the Rex Creek burn, apparently to take advantage of the new forage; they continue to utilize this area. Forage quantity and quality appear to be excellent, following the release of nutrients from both the fires.

The Dinkelman fire in the Swakane area, which burned in 1988, proved beneficial to the Swakane bighorns. In 2010, 20,000 plus acres burned in a low intensity fire in the Swakane. The Chelan Butte herd continues to utilize many of the fallow agriculture fields and adjacent shrub-steppe habitat. There are further opportunities to enhance bighorn, mule deer and other wildlife habitats in Swakane and on Chelan Butte, but these have been limited due to funding constraints.

Several springs were developed or improved for bighorn sheep within the range of the Swakane herd along the breaks of the Columbia River. Prior to fence construction, ewe bands regularly moved to the river to access native riparian and ornamental forage. Completion of the SR 97A fence excluded sheep from a very small amount of habitat, as they have always spent most of their time in habitats west of the highway.

Telemetry data indicate that sheep have not altered their seasonal use habitat patterns use in response to the newly constructed wildlife fence. The fence eliminated the bighorn's use of a narrow band of habitat between SR 97A and the Columbia River. Due to the observed preference of California bighorns for low elevation habitats, those habitats susceptible to human encroachment, there is long-term impact occurring from conversion and development of native habitat. Maintenance of habitat connectivity at low elevations in Chelan County is vital to the long-term health of all 3 herds.

Wildlife damage
No official reports of agricultural damage attributed to bighorns were received in 2004-2010; however, we did receive calls this year from three orchardists (two in Swakane, one on Chelan Butte) about the presence of bighorns in their orchards. They have expressed concerns of damage to young trees; however no claims for damage have been filed. Observations indicate that the sheep are feeding mainly on grass within the irrigated orchards.

Augmentation
The Lake Chelan herd is likely continuing to grow, and presumably has good genetic diversity due to the variety of founder sources. In the Swakane, augmentation is desirable for the long-term health of this population, given the historic isolated nature of the population and its small founder population. Chelan Butte was selected as an introduction site for bighorns due to its close proximity to the Lake Chelan population. If the recently observed movements of sheep northward from Chelan Butte continue, it is likely that interchange between the Manson herd and sheep on the butte will occur. Anecdotal observations of bighorn sheep accessing habitat in between Swakane and Chelan Butte have also increased in the past two years, suggesting there is some interchange between these herds.

Management conclusions
The risk of disease transmission from domestic sheep is substantial for both the Swakane and Chelan Butte herds. Domestic sheep were documented 6 times within the core habitat of Swakane bighorns from 2000-2007. Domestic sheep were euthanized by WDFW (with permission from owners) in 2003 and 2007.

Bighorn rams were documented in domestic sheep grazing allotments twice during 2000. WDFW and the Okanogan-Wenatchee National Forest have reduced the risk to bighorns from domestic sheep on Forest Service lands, however, no final solutions have been developed. Bighorns in Swakane are still at risk for disease transmission from domestic animals. In both 2013 and 2014, two to four bighorn ewes were seen multiple times within occupied domestic grazing allotments in the Entitat Valley. Efforts to locate and remove the bighorn sheep were unsuccessful. WDFW continues to work closely with the USFS to minimize encounters between bighorn and domestic sheep.

The Swakane bighorn population is highly accessible for viewing during the winter months. Viewing opportunities, in particular large adult rams, are highly valued by the public. Harvest management should be conservative to maintain this viewing opportunity.

The population objective of 150 sheep for the Lake Chelan herd is conservative, based on the low potential for conflicts, US Forest Service management emphasis for bighorn sheep habitat, and the increase in habitat resulting from wildfires

Aerial surveys of sheep groups outfitted with telemetry collars present the best opportunity to monitor the status of Swakane, Chelan Butte and Lake Chelan herds. Optimum monitoring would involve helicopter surveys during the rut to monitor rams and total numbers. Routine monitoring of the active collars will be done to keep track of herd movements, range, general habitat use and trends, and contribute additional population data.

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Table 1. Observed population composition of the Swakane bighorn sheep herd, 1996-2015

			Rams							
Year	**Lambs**	**Ewes**	**Yrl**	**<3/4curl**	**≥3/4 curl**	**Total rams**	**Total sheep**	**Population estimate**	**Lambs:100 ewes**	**Rams:100 ewes**
1996	3	19	2	8	6	16	38	38	16	84
1997	2	4			2	2	8	25	50	50
1998	3	9		7	4	11	23	30	33	122
1999	4	20		5	7	12	36	36	20	60
2000	5	14	1	1	8	10	29	35	36	71
2001	9	23	3	6	10	19	51	51	39	83
2002	10	25	2	9	8	19	54	54	40	76
2003	13	26	3*	5*	8*	20*	59	58	50	77
2004	10	15	1	6	6	13	38	50-60	67	77
2005	7	27	1	6	6	13	47	50-60	26	48
2006	11	43	2	6	7	15	69	70-75	26	35
2007							No Survey			
2008	13	24	5	4	12	21	58	70-75	54	88
2009	17	34	5	5	20	30	81	81-90	50	88
2010	17	44		13	13	26	87	87-95	39	59
2011	13	63		14	16	23	107	110-120	22	48
2012	24	58	4	17	19	40	122	130-140	41	67
2013	27	63		12	29	41	131	130-140	43	65
2014	31	62	6	17	23	46	139	130-150	50	74

*12 rams classified from the observed 20.

Table 2. Observed population composition of the Lake Chelan (Manson) bighorn sheep herd, 1999-2014.

			Rams							
Year	Lambs	Ewes	Yrl	<3/4 curl	≥3/4 curl	Total rams	Total sheep	Lambs: 100 ewes	Rams: 100 ewes	Population estimate
1999	2	10	1	2		3	15	20	30	15
2000	6	33	5	6		11	50	18	33	50
2001	12	24	8	4		12	48	50	50	50
2002	17	36	8	6		14	67	47	39	70-75
2003	20	54	0	4	1	5	79	37	9	83-113
2004	16	62	0	11	5	16	94	26	26	98-129
2005	10	28	0	12	5	17	59*	36	61	98-129
2006	5	28	0	1	14	15	79*	18	54	98-129
2007	10	55	3	9	16	28	93	18	51	98-129
2008	6	31	7	4	5	16	98*	19	52	98-129
2009	11	59	5	7	26	43	113	19	73	113-130
2010	11	58		15	17	32	101	19	55	101-122
2011	10	51		6	21	25	86	20	49	101-122
2012	15	52	2	7	13	22	89	29	42	101-122
2013	18	65		6	11	18	101	28	26	101-122
2014	23	66	6	7	11	24	113	35	38	115-130

*High count of sheep observed by Chelan PUD during their 12 boat surveys per year.

** Spring 2013 count incomplete.

Table 3. Observed population composition of the Chelan Butte Bighorn sheep herd, 2004-2014.

			Rams							
Year	Lambs	Ewes	Yrl	<3/4 curl	≥3/4 curl	Total rams	Total sheep	Lambs: 100 ewes	Rams:100 ewes	Population estimate
2004	10	22		3		3	35	45	13	36-47
2005	5	27	1	1		2	34	19	7	34-53
2006	5	32	2	3	3	8	45	16	25	45-50
2007							No Survey			
2008	10	32				21	63	31	66	60-70
2009	12	48	7	3	14	24	84	25	50	84-98
2010	16	50		17	18	35	101	32	70	101-120
2011	19	46		15	13	28	93	41	61	101-120
2012	13	72	8	10	25	43	128	18	58	130-145
2013	25	97		17	26	41	163	26	42	160-170
2014	34	97	9	11	32	52	183	35	54	185-200

Table 4A: Summary of Ram Harvest: Swakane

Year	Permits	Harvest	Comments
2001	1	1	
2002	1	2	*
2003	1	1	
2004	1	1	
2005	1	1	
2006	1	1	
2007	1	1	
2008	1	1	
2009	0	0	**
2010	1	1	
2011	1	1	
2012	1	1	
2013	1	1	
2014	1	1	
Total	13	14	

* Includes harvest by Auction tag holder.

** No tag offered due to excessive vehicle mortalities.

Table 4B: Summary of Ram Harvest: Manson

Year	Permits	Harvest	Comments
2005	2	2	
2006	2	2	
2007	2	3	*
2008	2	2	
2009	2	1	
2010	2	4	*
2011	2	4	*
2012	2	3	*
2013	2	3	*
2014	2	2	
Total	20	26	

* Includes harvest by Auction and/or Raffle tag holders.

Table 4C: Summary of Ram Harvest: Chelan Butte

Year	Permits	Harvest	Comments
2010	1	1	
2011	1	1	
2012	1	1	
2013	1	1	
2014	1	1	
Total	5	5	

BIGHORN SHEEP STATUS AND TREND REPORT: REGION 3

QUILOMENE, CLEMAN MOUNTAIN, UMTANUM/SELAH BUTTE, AND TIETON

JEFFREY BERNATOWICZ, District Wildlife Biologist

Population objectives/guidelines

The statewide goals for bighorn sheep are:

1. Preserve, protect, perpetuate, and manage bighorn sheep and their habitats to ensure healthy, productive populations.

2. Manage bighorn sheep for a variety of recreational, educational and aesthetic purposes including hunting, scientific study, cultural and ceremonial uses by Native Americans, wildlife viewing and photography.

3. Manage for sustained yield.

4. Numerical goals for each herd are provided in Tables 2-5.

Hunting seasons and harvest trends

Region 3 supports three populations of California Bighorn Sheep: Cleman Mountain, Umtanum/Selah Butte, and Quilomene. The Tieton herd was eliminated due to a pneumonia outbreak in 2013. Hunting is by permit, for rams only (except Selah Butte, where five ewe permits were also issued in 2015) and occurs in all units. The number of permits and harvest are given in Table 1. The Yakama Nation issues permits for all herds, and the Muckleshoot Indian Tribe also issues permits for the Cleman Mountain and Umtanum/Selah Butte herds.

Surveys

Quilomene and Umtanum/ Selah Butte had typically been surveyed via helicopter in July. The survey timing was not a good index to actual recruitment or optimal for identifying disease problems. In 2014, surveys were changed to March. Cleman Mountain is surveyed at the feeding station in December/January.

Umtanum and Selah Butte were surveyed from helicopter and the ground numerous times from late 2009 through 2014 due to a disease outbreak and research project. Ground surveys are conducted in August/September to index early lamb recruitment. Final recruitment surveys are flown in February/March. All available information is used to estimate the total population. Survey results are given in Tables 2- 5.

Population status and trend analysis

Bighorn sheep were native to Region 3, but had been eliminated by over hunting and disease by the early 1900s. All existing populations are the result of reintroductions.

The Quilomene reintroduction was the first in the region (early 1960s) and the population was estimated at over 100 animals by the late 1960s. The population then crashed in the early 1970s. The cause of the decline was unknown, but the population had reportedly died out by 1990. Reintroductions occurred again in 1993. By 1996, 41 bighorns had been released in the area. The Quilomene population quickly grew to over 160 sheep (Table 2). Poor recruitment, observations of coughing sheep, and reports of mortalities indicated a disease problem circa 2004-2006. Adult ewe counts had been declining and reached lows in 2014. In 2013, a large, fast moving fire went through the north portion of the herd area. Post-fire, sheep became hard to find. This was apparently due to a shift in range as numbers rebounded to expected levels in 2015.

The Cleman Mountain population was established in 1967 with the release of 8 animals. The herd remained relatively unchanged for over 20 years. A portion of the population was captured, tested, and treated with antibiotics in 1990. Augmentation included 27 animals during 1989-96. Production increased after 1996, and the population exceeded the goal of 150 animals by 2000 (Table 2). Over 165 sheep have been captured and translocated from this herd since 2001. Over 140 were harvested during that period and the population is still above objective. The Cleman Mountain herd is considered at fairly high risk of a pneumonia outbreak due to recent disease problems in Tieton, Yakima River Canyon, and nearby domestic sheep grazing allotments. Concerns have led to frequent testing; the most recent testing in January 2013 indicated no evidence of pneumonia or the bacteria associated with it.

The Umtanum herd was established in 1970 with the release of 8 bighorns west of the Yakima River. Within 15 years, the population grew to an estimated 200 animals, and some sheep crossed the Yakima River. Originally, sheep on the east side of the river were considered a separate herd (Selah Butte). Surveys have shown large numbers of animals crossing the river in both directions, and it is now considered a single herd. In 2001, 11 sheep were released at the south end of the canyon, near Roza Dam.

Population estimates for Umtanum/Selah Butte varied between 170 and 200 animals until 2002 (Table 4). Dispersal, winter mortality, and the removal of 52 sheep for augmenting other populations probably kept the herd stable. The increase, after 2002, was largely due to the release of 11 animals and a subsequent increase in lamb production. Harvest was being increased during this period to maintain a stable population.

In December 2009, an outbreak of pneumonia was discovered at the north end of Umtanum. Disease loss and culling removed approximately 50% of the Umtanum herd by April 2010. The bacterial pneumonia jumped to the east of the river (Selah Butte) in summer 2010, but no significant adult mortality was noted. By August 2010, low lamb survival was apparent on both sides of the river. Lamb and adult survival was very high in 2011 and 2012. It appeared the herd had recovered and was back at objective. Testing of 30 animals in February 2013 found *Mycoplasma ovipneumoniae* (Movi) in one young ram. Adult survival has been high since 2013, but lamb recruitment low the last 2 years. Samples were collected from sheep on both sides of the river and confirmed pneumonia was present and was due the same strain of Movi as in 2010.

The Tieton herd was established with the release of 54 sheep during 1998-2002. Subsequent radio-telemetry indicated relatively low mortality and high lamb recruitment. An aerial survey in 2008 confirmed the population was over objective. Sixty-five animals were removed for translocation since 2009-2012. During the capture, crews confirmed population estimates, and the herd was found to be disease free (last capture March 2012). Harvest removed 49 animals during 2009-2012 in an attempt to keep the population near population objectives. In March 2013, a pneumonia outbreak was confirmed. Mortality appeared to be high, and a decision was made to euthanize the remaining animals to prevent spread to the nearby Cleman Mountain herd. A total of 57 bighorns were euthanized. Pneumonia and Movi were confirmed in all samples. The strain of Movi in the Tieton herd was different than that found in the Yakima River Canyon sheep.

Habitat condition and trend

Forage resources vary annually with moisture. Precipitation had been near or above average 2010-2012, undoubtedly increasing forage production. Drought conditions returned in 2013-2015. A significant portion of the north Quilomene range burned in 2013. Long-term, such fires are generally beneficial to bighorn sheep habitat.

Augmentation/habitat enhancement

Major augmentation efforts ended in 2002. Cleman Mountain has been the source for many translocation projects. No habitat enhancement projects have been funded for bighorn sheep in the region. In general, bighorn habitat is difficult to work in and success of any habitat projects would be limited due to shallow soils and dry conditions. Sheep at Cleman Mountain are fed during the winter, mostly for trapping purposes.

The most beneficial projects to bighorn populations would be to reduce/eliminate contact with domestic sheep/goats. In 2006, a large private ranch in Quilomene was purchased by WDFW, and domestic sheep grazing was subsequently eliminated. Similar efforts have secured habitat and reduced risk of domestic/bighorn interactions within the Cleman Mountain herd range.

Management conclusions

The main threat to bighorn sheep is bacterial pneumonia caused by contact with domestic sheep/goats. The Tieton herd was eliminated and probably shouldn't be re-introduced until the risk of contact with domestic sheep or goats is substantially reduced. The Yakima River Canyon herd rebounded from the initial die-off, but currently suffers from low lamb recruitment most years.

Disease outbreaks are not unexpected as domestic sheep and/or goats have been documented in close proximity to bighorns in every herd in the Region. Reducing/eliminating risk of contact between bighorns and domestics is essential to the long-term viability and health of bighorns. It may be possible to develop Movi free domestics for small herds. This would eliminate some risk. For some herds like Tieton, the larger risk is from domestic sheep grazing on public (USFS) land.

Table 1. Summary of bighorn sheep harvest in Region 3 since 2000.

Area	Year	Permits	Harvest	Comments
Cleman Mtn.	2000	5	6	Harvest includes auction hunter
	2001	6	8	Harvest includes raffle and auction hunters
	2002	3	3	
	2003	6	7	Harvest includes raffle hunter
	2004	7	8	Harvest includes auction hunter
	2005	9	5	4 no report
	2006	10	11	Harvest includes raffle hunter
	2007	10	10	Harvest includes raffle hunter, 1 no report
	2008	10	11	Harvest includes raffle, auction, tribal
	2009	6	9	Harvest includes tribal
	2010	6	8	Harvest includes raffle hunter, tribal
	2011	6	13	Harvest includes raffle hunter, tribal
	2012	12	24	Harvest includes raffle hunter, tribal
	2013	10	18	Harvest includes raffle hunter, tribal
	2014	8	11*	Harvest includes raffle hunter, tribal
Umtanum/Selah Butte	2000	3	4	Mt. Hull hunter allowed to hunt area
	2001	8	7	
	2002	7	7	
	2003	7	6	
	2004	7	7	
	2005	7	6	1 no report
	2006	10	10	
	2007	10	9	1 no report
	2008	10	14	Harvest includes tribal (2 ewes, 2 rams)
	2009	15	18	Harvest includes auction, tribal
	2010	10	15	Harvest includes raffle hunter, tribal
	2011	8	12	Harvest includes tribal
	2012	5	11	Harvest includes tribal
	2013	5	9	Harvest includes tribal
	2014	6	8*	Harvest includes tribal
Quilomene	2000	3	4	Harvest includes raffle hunter
	2001	6	5	
	2002	8	9	Harvest includes raffle hunter
	2003	7	6	
	2004	5	5	
	2005	5	5	
	2006	5	4	1 no report
	2007	6	6	
	2008	4	5	Harvest includes tribal
	2009	4	5	Harvest includes tribal
	2010	4	4	
	2011	4	5	Harvest includes auction hunter
	2012	3	4	Harvest includes tribal
	2013	3	4	Harvest includes tribal
	2014	3	3*	

* Yakama Nation harvest not reported

Table 2. Quilomene Population Composition

Year	Lambs	Ewes	Total Rams	Adult Rams	Total Count	Estimated Population	Desired Population
2001	29	68	34	22	131	165	
2002	11	33	24	16	68	165	
2003	23	63	28	18	114	Unknown	
2004	13	99	32	32	144	Unknown	
2005	16	77	24	21	117	Unknown	250-300
2006	14	89	30	22	133	135	250-300
2007	44	75	32	26	151	160	250-300
2008	33	77	14	11	124	160	250-300
2009	27	86	32	23	145	160	250-300
2010	25	57	20	14	102	160	250-300
2011	11	48	15	15	74	150	250-300
2012	41	65	43	37	149	160	250-300
2014	18	34	28	20	83	100	250-300
2015	20	93	47	44	160	160	250-300

Table 3. Cleman Mt. Population Composition

Year	Lambs	Ewes	Total Rams	Adult Rams	Total Count	Estimated Population	Desired Population
2001	18	63	53	39	134	141	
2002	25	91	55	36	171	171	
2003	32	104	66	35	203	203	
2004	17	83	85		185	185	
2005	28	82	67		177	188	150-160
2006	33	93	67	45		193	150-160
2007	20	100	68	50		198	150-160
2008	40	85	64	40		174	150-160
2009	30	98	70	45		198	150-160
2010	35	83	60	48	201	201	150-160
2011	34	83	88	65	205	205	150-160
2012	30	78	59	59	167	180	150-160
2013	45	101	60	50	206	210	150-160
2014						235	150-160

Table 4. Umtanum/Selah Butte Population Composition

Year	Lambs	Ewes	Total Rams	Adult Rams	Total Count	Estimated Population	Desired Population
2000	30	60	56	46	146	180	
2001	42	82	40	31	174	190	
2002	27	97	43	23	167	200	
2003	26	94	52	38	172	220	
2004	33	87	28		148	240	
2005	61	159	69	54	289	290	250-300
2006	27	106	24	21	157	300	250-300
2007	54	120	68	55	242	300	250-300
2008	63	156	60	51	*279	300	250-300
2009	47	149	62	52	257	300	250-300
2010	23	90	63	60	176	210	250-300
2011	33	109	53	50	195	220	250-300
2012	65	155	68	57	*288	270	250-300
2013	42	80	13		135	270	250-300
2014	14	168	85	58	267	270	250-300
2015	13	168	57	49	238	265	250-300

* Probable double count of ewes and lambs

Table 5. Tieton Maximum June Population

Year	Lambs	Ewes	Total Rams	Adult Rams	Total Count	Estimated Population	Desired Population
2000	11	24	11		46	46	
2001	13	35	19		67	67	
2002	10	30	8	8	48	70	
2003	10	40	20	11	70	80	
2004	19	33	5		57	90	
2005	20	88	4	3	112	110	75-150
2006	35	55	40	37	130	135	75-150
2007	23	63	7	0	93	160	75-150
2008	54	81	32	16	167	200	75-150
2009						200	75-150
2010	40	72	89	48		200	75-150
2012	33	66	24	16	125	150	75-150
2013	Herd	Eliminated					

Moose

MOOSE STATUS AND TREND REPORT
STATEWIDE

RICHARD B. HARRIS, Special Species Section Manager

Moose in Washington

Many of Washington's citizens living west of the Cascades are unaware that Washington contains moose. In fact, the moose population in northeastern Washington has increased steadily from when the first naturally occurring immigrants arrived in the middle part of the 20th century, to the point where moose are now one of the major components of the forested ecosystem, and permits to hunt moose have are among the most competitively sought.

Still, conservation and management of moose presents challenges. Moose are a boreal (i.e., northern forest) species, well adapted to cold climates and deep snow, and Washington lies at the southern end of their distribution; they are stressed by hot summer (and even by mild winter) temperatures. Moose do best where habitats feature a mosaic of early (e.g., providing shrubs for foraging) and mature (e.g., providing tall trees for to moderate high temperatures) successional stages. Historically, fires functioned to remove overstory and encourage the growth of shrubs (e.g., willow, dogwood, others) that moose prefer. In the era of fire suppression, that role can be played by timber cutting, if the shrub stage is not cut short. Adult moose, because of their imposing size and ability to defend themselves, are most susceptible to predation only when weakened, or under certain snow conditions. However, juveniles are vulnerable to predation by bears and cougars. The recent addition of wolves to the portion of Washington occupied by moose poses an additional challenge.

The growth of moose in Washington in recent years is notable; more North American moose populations living south of the Canadian border have declined in recent years than have increased. After many years of increase, moose in New England have recently declined in both Maine and New Hampshire, with juvenile mortality from winter ticks generally believed to be the primary reason in the latter state. Moose have declined markedly in Minnesota, both in northeastern Minnesota, where wolves are present and likely a factor in the decline, and in northwestern Minnesota where wolves are uncommon. Moose have also declined recently in many areas of Wyoming, Idaho, Utah, and Montana. However, moose in both North Dakota and Montana have recently increased their distribution along riparian corridors within regions dominated by prairie or agriculture. Introduced moose in high elevation areas of Colorado, where willow flats provide forage, have also increased recently. Studies are currently underway in most of these states to better understand why moose are doing poorly in many areas, while expanding their range and increasing on a few others. In Washington, a study focusing on demography and habitat use patterns of moose, implemented by the University of Montana with WDFW assistance, was initiated in December 2013. To date, a total of 52 adult female moose have been captured, body condition quantified, and fitted with GPS-enabled radio collars. Field work is focusing on documenting calf production and recruitment of these animals, approximately half of which occupy an area roamed by wolf packs, the other half exposed to lower risk of predation. An informal network of managers and researchers in the western U.S. has begun meeting occasionally and sharing information on moose populations and studies, to increase insight and learn from each other.

Within Washington, moose have increasingly been reported from beyond their well-known haunts in the northeastern portion of the state, with verified reports as far northeast as Rainy Pass in North Cascades National Park, and far southwest as Yakima County (Fig. 1).

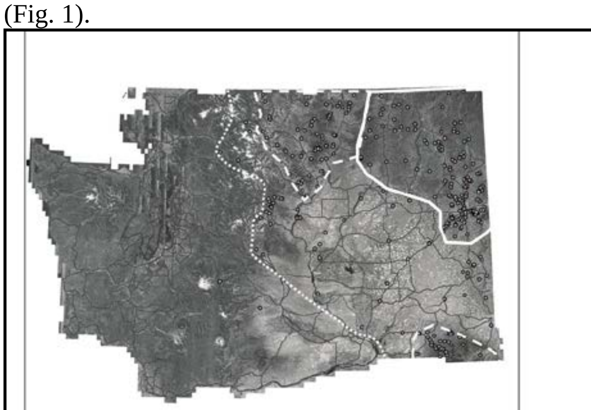

Figure 1. Approximate locations of primary (solid), secondary (dashed), and accidental (dotted) ranges of moose in Washington as of summer 2015. Open circles mark locations of citizen observations, and do not reflect relative abundance of moose.

The preponderance of Washington's moose population is located in the northeastern counties of Pend Oreille, Stevens, Ferry, and Spokane. A small moose population also seems to be developing in the Blue Mountains. Hunting seasons have thus far been developed only within the Colville and Spokane districts.

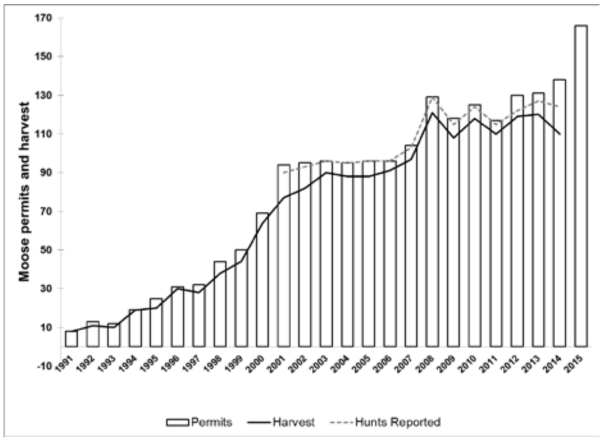

Figure 2. Moose draw permit numbers (open bars, not including Master Hunter conflict moose permits), hunts reported (dashed line) and harvest reported (solid line) for moose in Washington, 1991-2015.

Population objectives and guidelines

The population monitoring objective for moose is to work toward producing a statistically-valid estimate of abundance within moose habitats in Districts 1 and 2 (Ferry, Pend Oreille, Spokane, and Stevens counties) by 2017, while maintaining our ability to detect short-term changes at the district or GMU level of sufficient importance to merit changes in permit levels. A record low snowpack during winter 2014-15 prevented WDFW from conducting aerial surveys to support this objective; previous studies have shown clearly that surveys conducted with insufficient snow are not comparable to those with snow, and thus data obtained under these conditions would not have been useful.

The harvest objective is to provide recreational hunting opportunities consistent with sustainable yield, while also allowing for scientific study, cultural and ceremonial uses by Native Americans, wildlife viewing, and photography. Current harvest guidelines do not prescribe specific off-take quotas, but suggest that existing permit levels can be liberalized when average bull:cow ratios exceed 75 and median age of harvest bulls exceeds 5.5 years. Permit levels should be restricted when average bull:cows ratio is < 60, and median age of harvested bulls is less than 4.5 years. These guidelines were developed where most hunting occurs via unlimited, over-the-counter license purchasing

Preliminary analyses of abundance data, considered in light of indications from our understanding of moose body condition, pregnancy rates, and early calf survival, suggested that an increase in permit level was justified, beginning in 2015 (Fig. 2). WDFW plans to monitor ages of harvested moose, as well as indices of moose abundance obtained through citizen-reported moose observations (using a free, downloadable 'smart phone app') and hunter metrics, to assess the population-level effects of this increased harvest level.

Hunting seasons and harvest trends

Moose hunting opportunity in Washington is limited by permit. Permit availability (and therefore hunter opportunity) increased substantially beginning in the late 1990s (Fig. 2), and is currently at higher than at any time since moose hunting began in Washington. In 2014, there were a total of 134 moose permits available (not including 7 master hunter permits, 3 of which were used), of which 124 were reported as being used by hunters, resulting in 110 moose reported harvested. Permits types available were any moose (86), antlerless only (23), youth antlerless (18), 65-and-over antlerless (4), disabled antlerless (4), hunter instructor incentive antlerless (2), raffle (2), and auction (1). Of the 110 moose harvested, 71 were male and 39 were female. An additional 7 damage-hunt permits were issued to master hunters, and 3 were reported used during 2014. The moose season began on October 1 and ended on November 30. Hunters were able to use any legal weapon except in the Parker Lake area, where archery only and muzzle-loader only hunts were authorized.

Surveys

Surveys were conducted using a helicopter and generally occurred between December and February. These surveys assisted district biologists in crafting permit level recommendations, and generally supported information from hunts indicating a continued positive trend in the moose population in northeastern Washington (Harris et al., 2015).

A more rigorous aerial survey protocol was initiated in winter 2013-14 that is intended to provide a baseline population estimate from which future trends will be assessed. Initial results from surveys conducted in the Colville and Spokane districts are promising, and a population estimate will be developed following additional aerial surveys during winter 201-16.

Population status and trend analysis

Moose are newcomers to the state of Washington, having naturally colonized the northeastern portion of the state from neighboring British Columbia and Idaho. Moose were unknown in Washington prior to the 1930s, and rare prior to the 1960s. By the 1970s, it was clear that moose had become resident in northeastern Washington; the first hunts occurred in 1977 (Base et al. 2006). Moose populations have increased in Washington, and are now almost certainly at their highest level in history. An estimate of abundance will be developed following the winter 2015-16 surveys. Hunter success has remained high (~ 90%), and harvest per days spent afield has tended to decline, despite gradually increasing permit levels. Although imprecise, estimate of the bull component relative to cows remain reasonably high and steady. The age of bulls harvested is acceptable, and higher than in some neighboring states. Vehicle collisions with moose have also increased, and in 2013 were at an all-time high.

The positive trajectory of moose in Washington contrasts with many moose populations in the lower 48 US states (and adjacent areas of southern Canada). Although some moose populations are thriving, many other moose populations are suffering. Causes for declines elsewhere are varied, and include parasite infestation, climate-related stress, habitat changes (e.g., excessive forage loss from recent fires in some locations, forest maturation in others), and predation.

It seems unlikely that the positive trajectory of moose can be sustained indefinitely. Moose populations face increasingly aged forest conditions (resulting in lower abundance of their preferred browse forage), warmer temperatures (that may be encouraging greater parasite loads), and new predation pressures from recently re-colonizing wolves (adding to existing predation from black bears and cougars). Thus, understanding how moose are faring under the present circumstances will allow us to respond appropriately if and when the population stabilizes or begins to decline.

Habitat condition and trend

Fire suppression policies and natural forest succession continues to degrade moose foraging habitat. Moose are adapted to colonize forested areas post-disturbance. They can persist at low densities in Washington's forested areas without disturbance, but we expect to see a tempering of population increase unless early seral habitats (e.g., shrub-fields) can be sustained in a mosaic with mature forest (needed for thermal regulation). Use of herbicides following timber harvest may also reduce habitat capability for moose. Climate change may pose challenges for moose populations in the future, both from the direct energetic effects (moose are adapted to cold climates and become heat stressed, both in summer and winter, when temperatures exceed their thermo-neutral tolerances), and indirect effects (if parasites typically harbored by moose become excessively numerous). WDFW is also monitoring for the presence and prevalence of the arterial worm *Eleaophora schneideri,* whose typical host is mule deer but has been documented in moose elsewhere in the lower 48 US states. Moose are susceptible to morbidity and mortality from the brain worm *Parelaphostrongylus tenuis*, whose normal host is the white-tailed deer. *P. tenuis* has not yet been documented in or west of the Rocky Mountains.

Management conclusions

In contrast to many areas along the southern extent of their North American distribution, moose have done well in Washington over the past few decades. Hunter demand continues to far exceed supply, however. Thus, even if permit level are increased, moose hunting will be a rare (and generally once-per-lifetime) experience for Washingtonians. Although moose populations are very difficult to quantify, we are increasing our knowledge of their abundance through recently-increased efforts. That said, tracking moose population trends long-term over large areas will likely always be approximate, and prone to time-lags. Moose may continue to increase outside of their base in Northeastern Washington, and it is possible that, in future, hunting opportunities can be developed in other parts of the state. As humans continue to occupy the urban-wildland interface, we expect conflicts with moose to increase. We anticipate seeing a reduction in the rate of growth, or possibly a decline, as the moose population reaches the capacity of available forage to feed it and as other natural factors (e.g., predators, parasites) respond to their abundance.

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MOOSE STATUS AND TREND REPORT: REGION 1

GMUs 101, 105, 108, 111, 113, 117, 121, 124W

DANA L. BASE, District Wildlife Biologist
ANNEMARIE PRINCE, Assistant District Wildlife Biologist

Population objectives and guidelines

Statewide goals for managing moose include the following: 1) preserve, protect, perpetuate, and manage moose and their habitats to ensure healthy, productive populations; 2) manage moose for a variety of recreational, educational, and aesthetic purposes, including hunting, scientific study, cultural and ceremonial uses by Native Americans, wildlife viewing, and photography; and 3) manage statewide moose populations for a sustainable hunting quota (Washington Department of Fish and Wildlife 2014).

Hunting seasons and harvest trends

Moose hunting in Washington is regulated through a permit system. Return of a hunter report is required to the Washington Department of Fish and Wildlife (WDFW). Permit availability, and therefore moose hunting opportunity, has increased in Washington in the last 10 years (Figure 1). In 2014, there were 63 any moose permits available in 6 moose management units within the Colville District, including the Kettle Range, Threeforks, Selkirk Mountains, 49 Degrees North, Parker Lake, and Huckleberry Range (Game Management Units 101/105/204, 108/111, 113, 117, and 121/124 West respectively). In 2014, 7 antlerless only permits for youth, senior, or disabled hunters were offered in 49 Degrees North and 2 in the Huckleberry Range. In addition, 2 hunter education incentive permits, 3 raffle permits (one via a multi-species raffle), and 1 auction permit were offered in 2014. General permit season dates remained October 1st through November 30th. All moose units except Parker Lake were open for the use of any legal hunting method (archery, muzzleloader, or modern firearm). Parker Lake hunts were for archery only (early) and muzzle-loader only (late).

A total of 63 moose, consisting of 52 antlered bulls and 11 cows, were harvested within the Colville District units in 2014 (Tables 1 and 2). Hunter success calculated over all hunts was 91% and mean days/kill was 6.0. For “any moose” permits only, hunter success rate was 92% and hunters averaged 6.4 days of hunting per moose harvested. Permit hunters for Youth, Senior, and Hunters with Disabilities, which includes the 49 Degrees North B, C, and Youth Only and the Huckleberry Range B permits, harvested 8 antlerless moose from the 9 permits issued. Hunters averaged 3.0 days of hunting per moose harvested in those permit hunts. Four additional moose were harvested (3bulls, and 1 cow) during the other special permit opportunities (incentive, raffle, and auction). Three moose (all bulls) were killed by master hunters in nuisance situations.

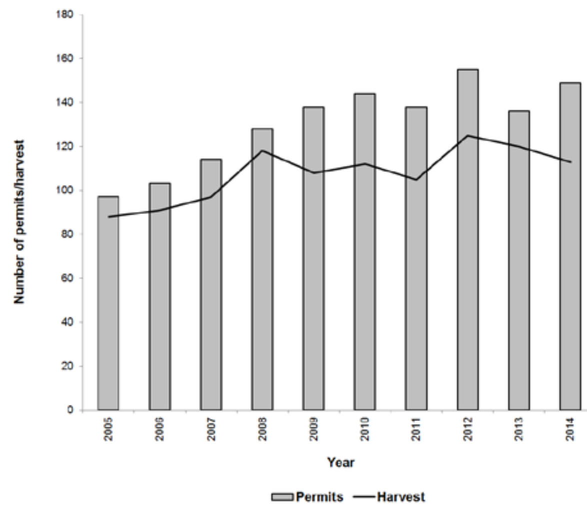

Figure 1. Statewide moose permit quota and harvest, - 2005 - 2014.

Surveys

Early winter composition survey flights have been accomplished all but 1 of the last 20 years. However, survey methods have varied. In winter 2013-14, a pilot project was initiated for estimating moose abundance that incorporates more intensive and rigorous sampling approaches; surveys were conducted under a multiple-observer distance (MRDS) sampling framework. This approach will allow estimation of moose density in a statistically rigorous way, and should be applicable to other areas with moose should funding allow for its expansion. In addition to the new survey protocol, a research project using radio-collared cow moose was initiated during winter 2013-14. This research study was initiated in cooperation with the University of Montana to gain a better understanding of moose population dynamics with respect to bottom-up (habitat) and top-down (predation) factors.

The winter of 2014-15 was extraordinarily mild as it concluded early with the last substantial snowfall in the first week of February. Only one helicopter survey flight had been accomplished before winter virtually ended. Hence few additional data were obtained from the 2014-15 winter. Consequently moose bull to cow and calf to cow ratios are only available for 2013-14 and other years prior (Figures 2 and 3). With the exception of 2011, bull: cow ratios were similar for all survey years. Calf:cow ratios also were similar for all survey years.

Population status and trend analysis

Age and antler spread of harvested bull moose are monitored to detect trends in structure of the bull population, which in turn provides information on the mortality rate of the bull population (Figure 4). For the Colville District in 2014, the mean antler spread of harvested bull moose was 39 inches. The average age of bull moose taken in 2014 was 5.4 (SD = 2.7, n = 31) years. Among bulls, 58% were age 5 years or older, 42% were age 2-4. More adult bulls than sub-adults or yearlings were harvested in 8 of the 10 years from 2005 through 2014 (Table 3). The limited hunter harvest has likely had a low impact on the overall population of moose within the Colville District.

Table 1. Colville District (GMUs # 101/105/204, 108/111, 113, 117, and 121/124 West) moose harvest and hunter effort, 2004 – 2013. This table does not include hunter education incentive, raffle, or auction permits.

Year	Permit Quota	Success	Bull	Cow	Total	Total Days	Days / kill
2005	57	89 %	47	4	51	271	5.3
2006	60	96 %	48	8	56	338	6.0
2007	74	82 %	50	11	61	325	5.3
2008	78	95 %	63	11	74	457	6.2
2009	68	94 %	51	13	64	415	6.5
2010	68	96%	55	10	65	414	6.4
2011	68	85%	53	7	60	427	7.1
2012	68	92%	51	11	62	254	4.1
2013	68	90%	58	7	65	376	4.3
2014	72	91%	52	11	63	392	6.0

Habitat condition and trend

Moose commonly select 15-25 year-old regenerating forests or pre-commercially thinned forest stands on moist sites. Forest regeneration in these areas tends to produce dense stands of willow and other shrubs which are preferred browse. Logging in northeast Washington has been substantial since 1980, especially on private industrial forests. In the past, forest successional stages have been excellent for moose browse production. In recent years, however, large tracts of private industrial forests have been treated with herbicides to control shrubs to reduce competition for regenerating coniferous trees. The broad-scale-application of herbicides may cause a reduction in forage for moose in northeastern Washington. Moose population trends, however, do not indicate a lack of quality moose habitat. Current research by the University of Montana, may evaluate both the quality and quantity of moose habitat in NE Washington.

Human safety and nuisance problems

Moose occasionally create potential safety concerns in small towns or other areas of human occupation within the Colville District. These conflicts are usually handled by hazing the moose away or by stopping traffic long enough for the animals to move away on their own accord. A more serious issue in rural areas of the Colville District is the increasing rate of motor vehicle collisions with moose. Moose, especially cows with calves, have also been known to attack snowmobilers, hikers, and other humans as a defensive reaction.

Disease

The WDFW is collecting baseline health data on Washington's moose. Moose populations in Washington remain robust, but are declining in many other states and provinces. Obtaining baseline data on moose health now will help us manage and conserve moose in Washington. Some suspected causes of moose declines around the United States include: arterial worm, brain worm, winter ticks and liver flukes. In 2013, WDFW began sampling hunter harvested moose for parasites. The arterial worm (*Eleaophora schneideri*) was not detected, but sample size from hunter-supplied carcasses was low (n=12, Colville and Spokane Districts combined). WDFW hopes to increase sample size in future years.

Management conclusions

Moose survey and harvest data indicated continue to suggest a robust moose population, with high quality hunting opportunity and reasonable numbers of mature bulls. At some point, we anticipate that the increase in moose abundance observed over the past decades will level-off, but we have not seen clear evidence of that yet. Hunter success remains high.

New survey techniques and research projects will give WDFW a better understanding of the demographics of the NE Washington moose population.

Literature Cited

Washington Department of Fish and Wildlife. 2014. Game Management Plan. Washington Dept. of Fish and Wildlife, Olympia, WA. 162 p.

Table 2. Moose quotas, harvest, and days per kill in the Colville District for the 2014 season.

Area	Permit quota	Total moose Harvested	Average number of days per kill
Kettle Range	10	9	7.7
Three forks	6	6	6.3
Selkirk Mtns.	15	14	7.9
49 Degrees N	28	26	4.7
Huckleberry Mtns.	9	9	5.9
Parker Lake	4	2	7.0
Total :	72	63	Weighted mean = 6.0

Table 3. Antler spread (inches) and moose age (years) for harvested bull moose in the Colville District, 2005 - 2014.

Year	Antler Spread		Age		Yearling	2-4 years	≥ 5 years
	Mean (in)	Sample Size	Mean (yrs)	Sample Size			
2005	39	46	4.5	43	5%	56%	39%
2006	38	48	4.8	40	2%	65%	33%
2007	38	50	5.0	26	0%	46%	54%
2008	39	58	5.0	46	0%	39%	61%
2009	39	51	5.6	43	5%	33%	63%
2010	39	60	6.0	49	4%	35%	61%
2011	40	56	5.9	72	4%	32%	64%
2012	40	55	6.1	41	2%	27%	71%
2013	40	60	6.1	35	3%	31%	67%
2014	39	53	5.4	31	0%	42%	58%

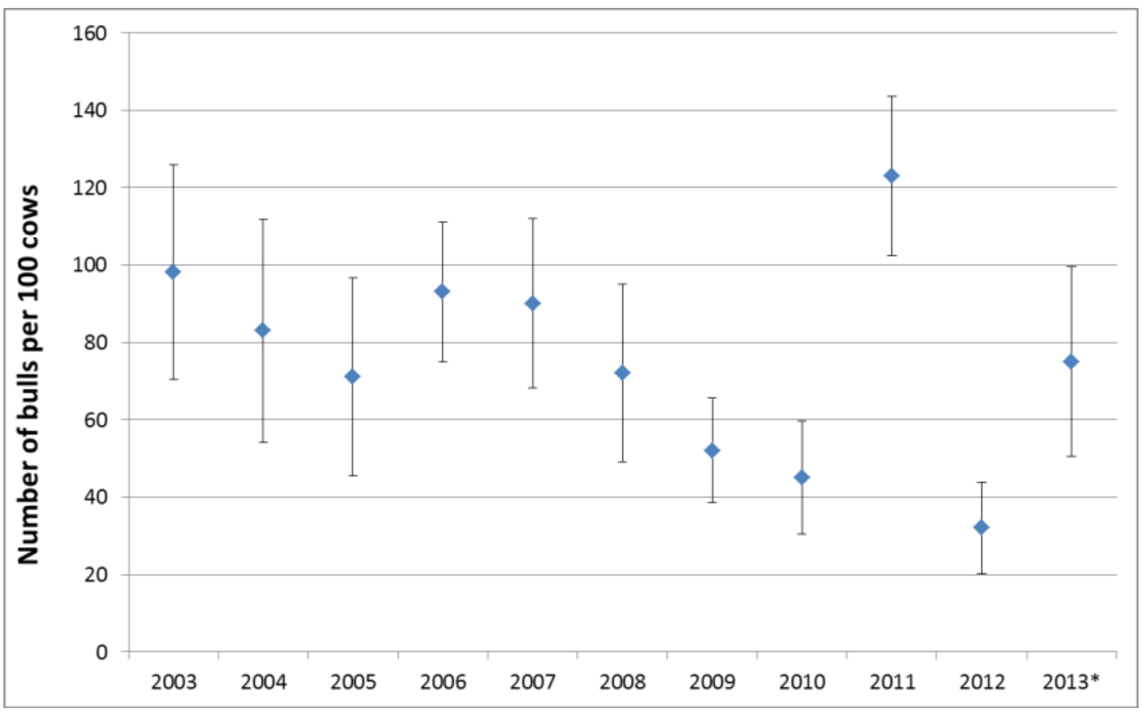

Figure 2. Bull: cow ratios of moose observed during winter helicopter surveys, WDFW Colville District, 2003-2013, showing point estimates (diamond symbol) and 90% confidence intervals. Areas surveyed vary annually. Year 2013 (denoted with asterisk) was the first year that MRDS transects were flown; surveys occurred later in winter than during earlier years, but gender was determined from the presence of vulvar patches rather than antlers.

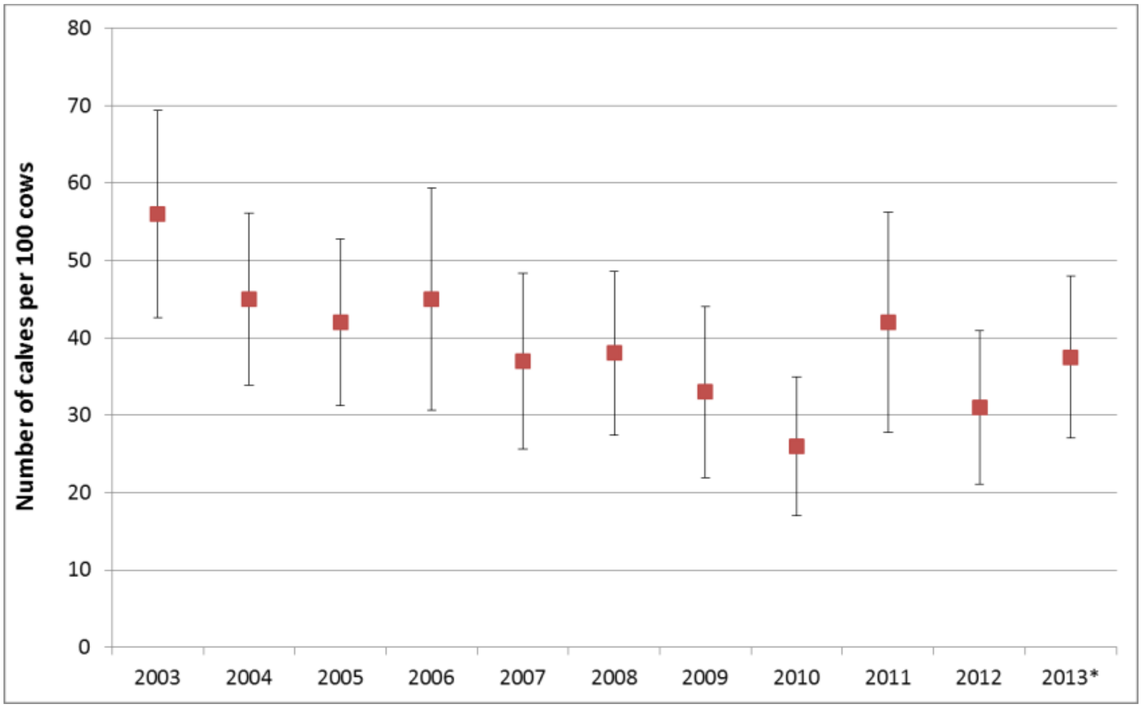

Figure 3. Calf to cow ratios of moose observed during winter helicopter surveys, WDFW Colville District, 2003-2013, showing point estimates (square symbol) and 90% confidence intervals. Areas surveyed vary annually. Year 2013 (denoted with asterisk) was the first year that MRDS transects were flown.

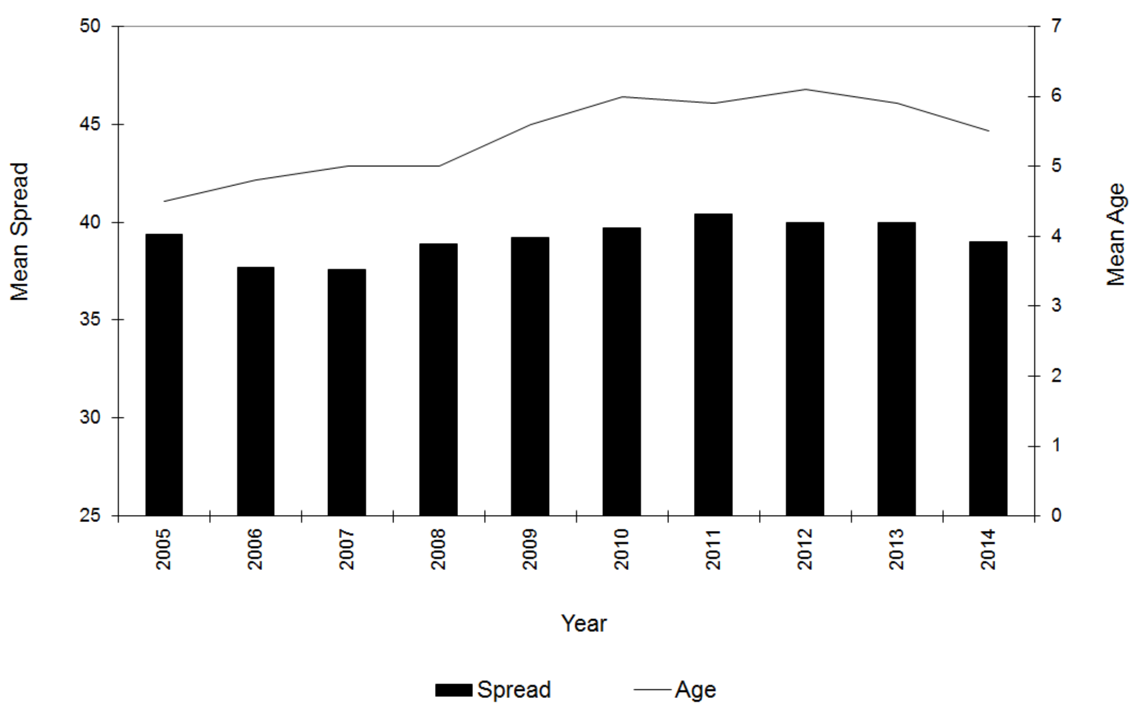

Figure 4. Mean age (line, in years) and antler spread (bars, in inches) of bull moose harvested in the Colville District, 2005 - 2014.

MOOSE STATUS AND TREND REPORT: REGION 1

GMUS 124E, 127, AND 130

MICHAEL ATAMIAN, District Wildlife Biologist
CARRIE LOWE, Wildlife Biologist

Population objectives and guidelines

Statewide moose management goals are to: 1) Preserve, protect, perpetuate and manage moose and their habitats to ensure healthy productive populations; 2) Manage for a variety of recreational, educational and aesthetic purposes; and 3) Manage statewide moose populations for a sustained yield. Harvest management emphasizes quality hunting opportunities through a limited entry permit process. The proximity of an expanding moose population to the Spokane metropolitan area adds the challenge of balancing population objectives with community's tolerance of moose.

Hunting seasons and harvest trends

Moose hunting opportunities in Washington are by permit only. This is a once in a lifetime permit with the exception of antlerless, raffle and auction hunts. Permit season dates remained October 1 - November 30. Moose hunts are open to the use of any legal weapon in order to provide eligibility to all hunters for all units and to maintain hunter weapon choice.

Total permits in 2014 (not including Master Hunter, raffle, or auction) offered remained at 62, up from the 50 offered from 2008-2011. The 12-permit increase was entirely within the Mt. Spokane unit and associated with splitting the unit into North and South Mt. Spokane units. The unit was split in order to promote better use of the entire area and to help distribute hunter pressure more evenly across the population. These subunits are described in a new map in the Big Game Regulations pamphlet and online at http://wdfw.wa.gov/hunting/regulations/moose_units. Permits were split evenly: 24 each for both the North and South Mt. Spokane areas. For the Hangman units permits remained at 14.

Interest continues to increase for these hunts with 34,958 applications in 2014, compared to 33,622 in 2013 and a 5-year mean of 26,788 previous to that. Both the Hangman and the two Mt. Spokane units had an either-sex (any) moose hunt and antlerless-only hunt. The two Mt. Spokane units also had youth-only antlerless hunts with 8 permits each. One Disabled Hunter antlerless permit was offered in the Mt. Spokane North area.

In addition, 10 Master Hunter damage permits were offered for all of District 2 (GMUs 124-142). These permits are not activated until damage has occurred and a need for a hunt has been determined by the Department. This year 3 permits were used, this doubles the use of this hunt since its creation in 2009 (total moose harvested is 6). Note that the following data do not include this damage hunt.

Sixty permittees out of the 56 potential hunters reported in 2014, with only 1 reporting they did not hunt. A total of 47 moose were killed this year, 5 less than last year and one less than the previous 5-year average. The decline in harvest was primarily due to lower harvest in the Antlerless Only hunt (Table 1). The mean numbers of days hunted per kill increased for the Any Moose hunt this year to the highest it has been in the past 10 years, but has remained relatively stable for the Antlerless Only hunt (Table 1). The success rate for all hunts combined this year was 88%, down from the 94% average for the previous 5-years (Table 1). The decline in the Antlerless Only hunt success was largely due to lower success in the Hangman hunt, 3 of 7 hunters were successful, whereas the Mt Spokane hunts had 25 of 27 hunters harvest. The Any Moose permit hunters (i.e., "once in a lifetime" hunts) success rate was 90%, similar to last year's success of 91%, but below the 5-year average of 96%.

The mean antler spread for bulls harvested in the Mt. Spokane units were 35 inches, the same as last year for the South unit and one inch shorter than the average for the North unit (Table 2). The all-time record individual antler spread for Mt. Spokane was 53 inches in 2003. The mean antler spread for the Hangman unit was 37 inches, same as last year. The all-time high for Hangman is 52 inches harvested in 2012 (Table 2).

Surveys

The first standardized aerial surveys for moose in Washington (and adjacent management units of Idaho) were flown during the winter of 1999-2000. These surveys were conducted by WDFW's Wildlife Science Division, in cooperation with Idaho Fish and Game. From 2002-2012, annual aerial surveys were flown every winter (December/January) by district biologists, covering some of the same survey units as those flown in 1999 except for those units extending into Idaho. In

2008, survey units were decreased in size and standardized to around 15 km^2, and additional survey units were established in the northern end of the Mt. Spokane unit and in the Hangman unit around Tekoa Mtn. In 2012, survey units were added in the Tower Mtn. area of the Hangman unit.

Upon review, District 1 and 2 survey methodologies were found to not meet management needs (Harris et al. 2015) . Thus in 2013 a joint project began for surveying moose in both Districts that incorporates more intensive and rigorous sampling approaches. Once refined, this technique should produce more statistically defensible population density estimates and allow for expansion to other parts of Washington. However, it will require reduced coverage of individual moose units. WDFW has modified an existing "Smart Phone App" used in Alberta, and will be encouraging outdoorsmen- and –women to use it to report moose data during the fall months of each year.

In addition to the new survey protocol in 2013, a research project using radio-collared cow moose was initiated in cooperation from the University of Montana. The project's goal is to assess and compare population demographics parameters in two study areas that differ in land management methods and predator composition.

Population status and trend analysis

The number of moose observed during aerial surveys varies from year to year. Some of the variation can be modeled (Harris et al. 2015), and some is likely due to the movement of moose back and forth across state lines (all units border Idaho). Snow depths have a strong influence not only on the distribution of moose across survey unit, but also on the ability of the surveyors to detect moose. Heavy snowfalls tend to push moose down into the lowlands, while in low snow years they remain at higher elevations. The 2014 winter flight survey was not conducted due to lack of snow and high temperatures. Figures 1-3 are still included in this report for reference, but are the same as last year.

The low count observed in both areas in 2013 is likely due to the survey methodology change resulting in reduced coverage (Figure1). However, the calf to cow ratios (Figure 2) and bull to cow ratios (Figure 3) from the new survey method appear to be in-line with previous surveys estimates, except for Hangman calf to 100 cow ratio (23) which is the lowest observed since surveys began in 2002. Calves to 100 cow ratios have averaged 50 for Hangman over the past 10 years. The low calf to 100 cow ratio in 2013 in the Hangman unit is likely due to the new survey methodology resulting in only a few transects in this area and a low number of moose observed (24 total, 13 cows and 3 calves).

Carcass removal data gathered by the Washington Department of Transportation (DOT) indicates an increasing trend in the number of moose being killed on Interstate-90 west of Spokane, indicating a resident population in the area. The only moose data we have from this area come from moose observed while performing elk surveys in and around Turnbull National Wildlife Refuge. These sightings have indicated low moose numbers that have been slowly increasing; 17 moose were recorded during this year's survey, the second highest to date. Moose observations continue to increase in outlying areas, including southern Spokane, Whitman, Lincoln, and Adams counties, and reports of moose within the Spokane urban area continue.

The harvest data, aerial survey data, DOT carcass reports, nuisance moose complaints, and sighting reports combine to indicate a stable to increasing population in Mt. Spokane. The low antlerless harvest success in 2013 and 2014, combined with the low calf to cow ratios observed in 2013 raise some concerns about the Hangman population. However, this unit has a significant amount of private and conservancy land sanctuaries that moose are known to inhabit but are not available for harvest. WDFW also receives a large number of nuisance moose complaints from this area. We will continue to closely watch this population over the next couple of years, as calf to 100 cow ratios below 30 is of concern.

Habitat condition and trend

Moose prefer 10-20 year old clear-cuts or thinned stands on mesic sites, and forested cover is important during summer heat and deep winter snow (Costain 1989). Generally, in both the Mt. Spokane and Hangman units, it appears conditions for moose production will be optimal for the next few decades. Private timberlands provide a large portion of moose range in these units, and management practices on these lands over the past 15 years are providing excellent forage areas for moose.

The higher elevation portion of the Mt. Spokane unit is primarily composed of large private timberlands in some stage of succession that is of benefit to moose, especially in winter range. Clear-cut logged habitats with abundant high quality forage and good hiding cover are thought to be important to moose in all seasons. Lands owned by Washington State Parks provide ample security habitat but little forage in the Mt. Spokane unit.

Other than the lands immediately surrounding Mica Peak, Dishman Hills, and Turnbull National Wildlife Refuge, the Hangman Unit is mostly private agricultural land, with moose concentrations highest in the northeast portion of the area. The limited forage areas for moose in the Hangman Unit restrict the opportunity for moose to expand greatly there. Where moose do occur in the Hangman unit, habitat quality appears high and able to support high densities of moose. Many of these moose may spend part of the year in Idaho where moose habitat appears to be less limited.

Human safety and nuisance problems

Individual moose can create human safety or nuisance concerns within the metropolitan area of Spokane. The procedure for addressing moose within the urban/suburban area is outlined in the WDFW Dangerous Wildlife Policy. WDFW's Enforcement Program takes the lead on moose incident reports in and near the city. Incidents range from single moose sightings with no associated WDFW response, to moose in dangerous situations requiring immobilization and translocation. The number of moose incidents per year has been as high as 87 and 83 in 2001 and 2005 respectively, and as low as 16 in 2009. A Master Hunter moose damage/nuisance hunt was initiated in 2009 and has continued through 2014. This hunt is a limited entry hunt (10 Master Hunters only) and runs from August 1 through March 31. Only six animals have been harvested thus far. Dealing with urban/suburban moose will continue to be a priority for WDFW in the Spokane area.

Management conclusions

Moose are apparently expanding their distribution in the district, and the greatest increases appear to be occurring on private lands and at lower elevations where hunter access is limited. There is tremendous interest in moose hunting in Washington, and Antlerless Only permit levels will be increased where doing so does not compromise the research efforts, but Any Moose permits will remain relatively low.

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Harris, R.B., M. Atamian, H. Ferguson, and I. Keren. 2015. Estimating moose abundance and trends in northeastern Washington state: Index counts, sightability models, and reducing uncertainty. Alces 51:1-13.

Table 1. Moose harvest and hunter effort for GMUs 124, 127, and 130 "Any Moose" and "Antlerless Only" hunts. Does not include Master Hunter, Auction, or Raffle Hunt data.

Hunt Type	Year	Permits Offered	Actual Hunters	Bulls	Cows	Total	Success	Days/ Kill
Any Moose	2005	15	15	14	0	14	93%	5.9
	2006	15	13	13	0	13	100%	5.6
	2007	15	14	14	0	14	100%	4.0
	2008	19	18	17	1	18	100%	5.2
	2009	19	19	18	0	18	95%	3.2
	2010	19	19	19	0	19	100%	4.3
	2011	19	18	15	2	17	94%	5.5
	2012	23	22	22	0	22	100%	3.1
	2013	23	23	20	1	21	91%	4.1
	2014	23	21	19	0	19	90%	6.7
Antlerless Only	2005	23	22	3	18	21	95%	3.6
	2006	25	20	1	19	20	100%	5.3
	2007	25	21	0	21	21	100%	2.6
	2008	31	31	0	26	26	84%	3.4
	2009	31	30	0	26	26	87%	3.0
	2010	31	29	0	25	25	86%	4.5
	2011	31	28	0	27	27	96%	3.7
	2012	39	35	0	35	35	100%	3.6
	2013	39	34	1	30	31	91%	4.4
	2014	39	34	0	28	28	82%	4.7

Table 2. Average and Maximum Moose Antler Spread by Year and Hunt Unit

Year	Hangman			Mt. Spokane			Mt. Spokane North			Mt. Spokane South		
	Num	Avg	Max	Num	Avg	Max	Num	Avg	Max	Num	Avg	Max
2005	5	35	43	9	36	40						
2006	4	34	39	9	31	35						
2007	5	32	42	9	39	44						
2008	6	33	41	11	32	41						
2009	7	37	47	11	36	50						
2010	7	43	50	12	39	46						
2011	6	39	44	9	32	42						
2012	7	36	52				8	36	45	7	35	46
2013	5	37	45				7	35	44	8	35	40
2014	5	37	42				8	35	43	6	36	40

Figure 1. Raw counts of observed moose in the Mt. Spokane (Mt. Spokane North and South combined for 2012-2013) and Hangman units, from December/January aerial surveys 2003-2013. 2013 data is from the new survey methodology and should not be directly compared with previous years.

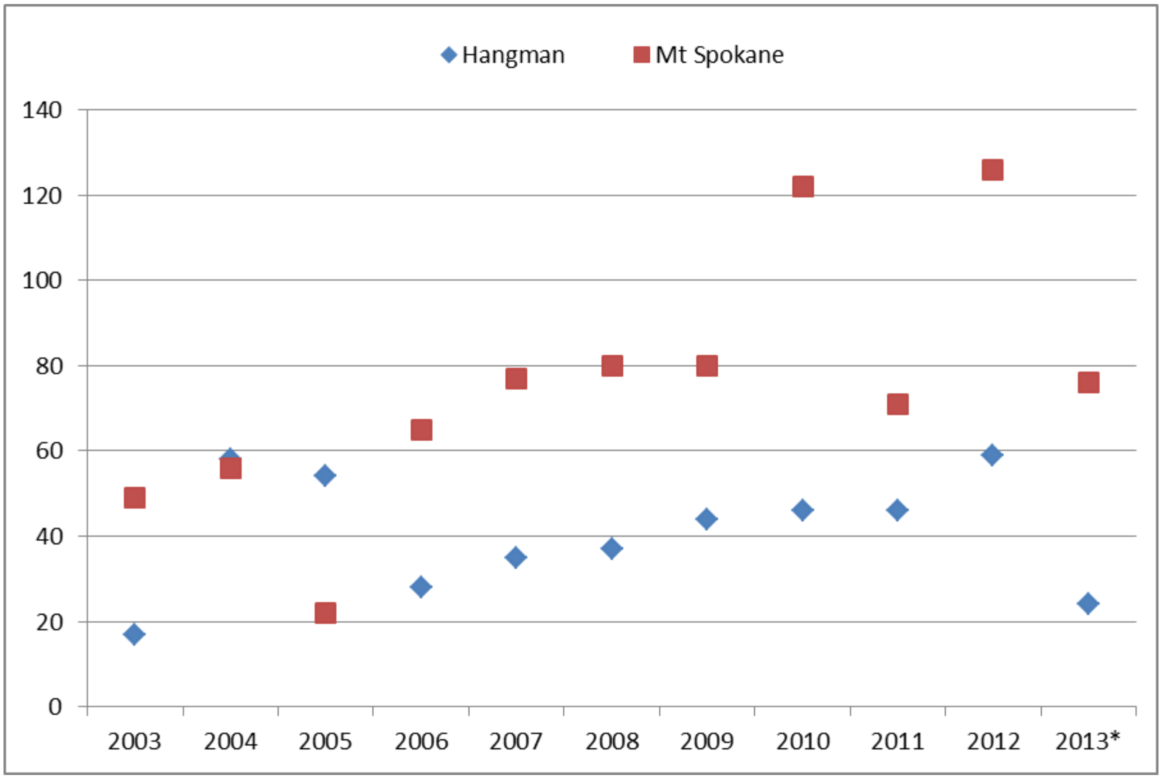


Figure 2. Moose calf:100 cow ratios for Mt. Spokane (Mt. Spokane North and South combined for 2012-2013) and Hangman units, showing point estimates (square symbols) and 90% confidence intervals, from December/January aerial surveys 2003-2013. 2013 data is from the new survey methodology.

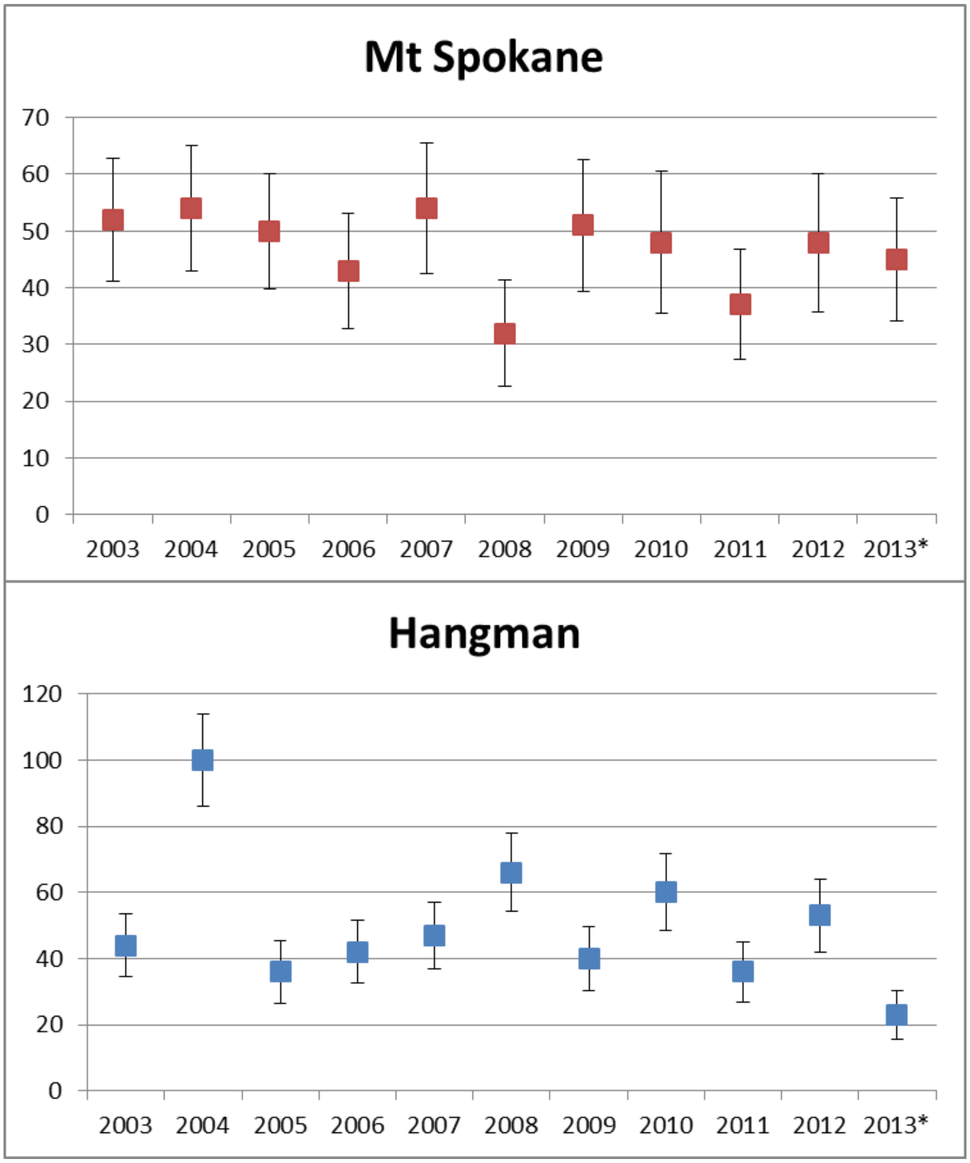
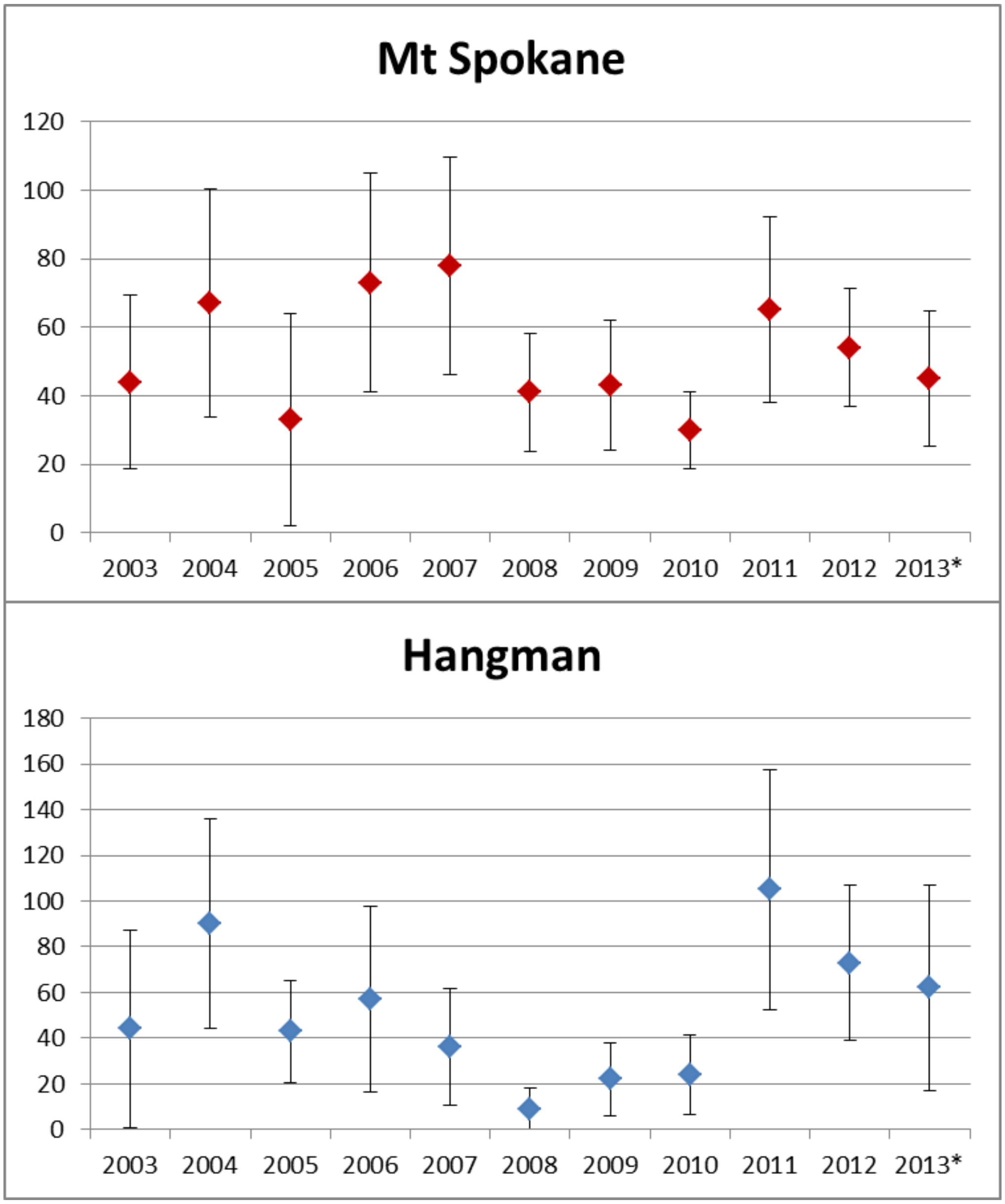


Figure 3. Moose bull:100 cow ratios for Mt. Spokane (Mt. Spokane North and South combined for 2012-2013) and Hangman units, showing point estimates (diamond symbols) and 90% confidence intervals, from December/January aerial surveys 2003-2013. 2013 data is from the new survey methodology.



Cougar

COUGAR STATUS AND TREND REPORT
STATEWIDE

SCOTT A. BECKER, *Acting* Carnivore Section Manager

Distribution and abundance
Cougar *(Puma concolor)* occur throughout most of the forested regions of Washington State, encompassing about half of the State (Fig. 1). There is no reliable estimate of statewide cougar abundance. However, cougar population size has been estimated in three project areas in eastern Washington; extrapolation from those projects corresponds to roughly about 1,800 to 2,100 animals (excluding yearlings and kittens) statewide.

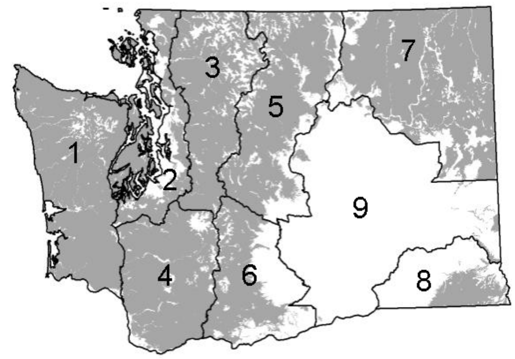


Figure 1. Distribution of cougars (gray) and cougar management units in Washington.

Population objectives and status
The statewide cougar management goal is to maintain healthy, self-sustaining cougar populations within each cougar management unit (CMU; except CMUs 2 & 9; see 2009 Game Management Plan), while minimizing the number of negative human-cougar interactions. The methods for assessing cougar populations are improving in Washington, largely due to better scientific data becoming available. The status of cougar populations in Washington are assessed using cougar demographic data from living cougar populations in five study sites. The department invests most of its monitoring efforts on adult female cougar survival (because of its importance to population growth) and population size. Ancillary data on litter size, cub survival, and adult male survival are collected on an opportunistic basis. Washington State University and University of Washington also have provided valuable data on population growth rates from cougar research projects in Washington. These data suggest that cougar populations appear to be stable throughout most of Washington.

Hunting seasons and harvest trends
With the completion of several cougar research projects and the findings from those studies, the Department conducted a comprehensive assessment of cougar hunting season structure in 2011 with research partners from University of Washington and Washington State University. Following a science review the proposed re-vamped cougar season framework was circulated with the public for input through the Fish and Wildlife Commission process and Game Management Advisory Council. The scientific rational and new cougar season framework was also recently published (Beausoleil et al. 2013).

Table 1. Cougar population objectives for each cougar management unit in Washington, 2009.

CMU	Geographic Area	Population Objective
1	Coastal	Maintain a stable cougar population
2	Puget Sound	Manage cougar population at a level that increases public safety and protection of property
3	North Cascades	Maintain a stable cougar population
4	South Cascades	Maintain a stable cougar population
5	East Cascades North	Maintain a stable cougar population at 2007 level
6	East Cascades South	Maintain a stable cougar population
7	Northeastern	Maintain a stable cougar population at 2007 level
8	Blue Mountains	Maintain a stable cougar population
9	Columbia Basin	Unsustainable; not considered suitable cougar habitat

Under the new framework, the Department manages for stable cougar populations in all areas of the state (except the Columbia Basin and Puget Sound areas where the habitat is not suitable for cougar; Game Management Plan 2008). To achieve that objective, the Department divided the state into 49 cougar population management units (PMUs) and applied a 12-16% harvest guideline to each PMU based on the estimated population within each PMU (excluding kittens; not applied to Columbia Basin and Puget Sound PMUs).

During the 2014-2015 cougar seasons, the Department implemented two any weapon general seasons: an early season from September 1 to December 31, 2014 followed by a late season from January 1 to March 31, 2015. Each PMU has a harvest guideline that corresponds to a 12-16% harvest rate of the estimated population within each PMU. Only general season harvested cougar counted toward the harvest guideline. If a PMU harvest guideline was reached during the late season, the Director (under existing Director Authority) considered closing the season. During the late season cougar hunters could hunt in any PMU until the harvest guideline was reached and the Director closed the seasons or March 31, whichever occurred first.

Based on the summation of the harvest guidelines for all 49 PMUs, the total allowable statewide cougar harvest was 205-277. The total statewide cougar harvest was 158 in 2014 (Table 2).

Human conflict

The general trend in confirmed human safety incidents, and pet and livestock depredations has decreased since the recorded high of 936 in 2000 and is now at the lowest documented level (Figure 2). However, the levels of interactions continue to be problematic in some areas. It is important to point out that the management actions the Department takes to manage human-cougar conflict do not necessarily equate to the observed trends in confirmed interactions. Several factors likely impact the rate of human-cougar interactions, such as changing public attitudes, significant media events, cougar population size and structure, etc.

Management conclusions

Washington has experienced wide fluctuations in cougar harvest methods, cougar population size, and even cougar management objectives. With such a dynamic management arena, the importance of scientific data for guiding management decisions cannot be overstated.

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Table 2. Cougar harvest guidelines and total harvest by hunt area, 2012-2013, 2013-2014, and 2014-2015 seasons.

		2012-2013 Season		2013-2014 Season		2014-2015 Season		
Hunt Area	**Harvest Guideline**	**Harvest Mortality**	**Hunt area closed during late season?**	**Harvest Mortality**	**Hunt area closed during late season?**	**Harvest Mortality**	**Hunt area closed during late season?**	**3-year Mean Harvest**
GMU 101	7-9	1	No	5	No	8	Yes	5
GMU 105	2	2	Yes	2	Yes	4	Yes	3
GMUs 108, 111	5-6	6	Yes	6	Yes	7	Yes	6
GMU 113	4-6	3	No	5	Yes	6	Yes	5
GMU 117	6-8	9	Yes	12	Yes	12	Yes	11
GMU 121	5-6	7	Yes	5	Yes	7	Yes	6
GMUs 124, 127, 130	7-9	8	Yes	5	Yes	8	No	7
GMUs 133, 136, 139, 142, 248, 254, 260, 262, 266, 269, 272, 278, 284, 290, 330, 334, 371, 372, 373, 379, 381	None	11	No	13	No	10	No	11
GMUs 145, 166, 175, 178	3-4	7	Yes	6	Yes	7	Yes	7
GMUs 149, 154, 157, 162, 163	4-6	10	Yes	10	Yes	3	No	8
GMUs 169, 172, 181, 186	3-4	4	Yes	4	Yes	1	No	3
GMU 203	4-6	0	No	0	No	0	No	0
GMU 204	6-8	4	No	5	No	1	No	3
GMUs 209, 215	4-5	4	Yes	2	No	3	No	3
GMUs 218, 231	4-6	2	No	3	No	2	No	2
GMU 224	2-3	1	No	2	Yes	1	No	1
GMUs 233, 239	3-4	2	No	0	No	1	No	1
GMUs 242, 243	4-6	4	Yes	4	Yes	3	No	4
GMUs 244, 246, 247	5-6	3	No	3	No	1	No	2
GMUs 245, 250	5-6	2	No	0	No	4	No	2
GMUs 249, 251	5-6	6	Yes	6	Yes	3	No	5
GMUs 328, 329, 335	6-8	10	Yes	9	Yes	7	No	9
GMUs 336, 340, 342, 346	5-7	8	Yes	5	Yes	6	No	6
GMUs 352, 356, 360, 364, 368	5-7	6	Yes	5	Yes	6	No	6
GMUs 382, 388	3-4	4	Yes	10	Yes	1	No	5
GMU 407	None	2	No	1	No	2	No	2
GMUs 418, 426, 437	11-15	1	No	2	No	0	No	1
GMUs 448, 450	9-13	0	No	0	No	0	No	0
GMU 454	None	0	No	2	No	3	No	2
GMU 460	5-7	2	No	1	No	0	No	1
GMUs 466, 485, 490	2-3	0	No	2	Yes	0	No	1
GMUs 501, 504, 506, 530	7-10	1	No	1	No	1	No	1
GMUs 503, 505, 520, 550	6-8	0	No	2	No	7	No	3
GMUs 510, 513	3-4	0	No	1	No	2	No	1
GMU 516	3-5	1	No	3	Yes	3	No	2
GMUs 522, 524, 554, 556	3-4	1	No	0	No	0	No	0
GMU 560	5-6	1	No	4	No	1	No	2
GMUs 564, 568	3-4	2	No	4	Yes	0	No	2
GMU 572	3-4	1	No	2	No	1	No	1
GMU 574, 578	3-5	3	Yes	5	Yes	4	No	4
GMUs 601, 602, 603, 612	5-7	1	No	3	No	1	No	2
GMUs 607, 615	4-5	0	No	1	No	0	No	0
GMUs 618, 636, 638	4-5	2	No	4	Yes	4	No	3
GMUs 621, 624, 627, 633	None	2	No	5	No	1	No	3
GMUs 642, 648, 651	6-8	10	Yes	6	Yes	6	No	7
GMUs 652, 666	None	2	No	1	No	1	No	1
GMUs 653, 654	4-6	1	No	1	No	1	No	1
GMUs 658, 660, 663, 672, 673, 681, 684, 699	9-12	1	No	1	No	1	No	1
GMU 667	3-4	1	No	3	Yes	7	Yes	4
Total		**159**		**182**		**158**		**166**

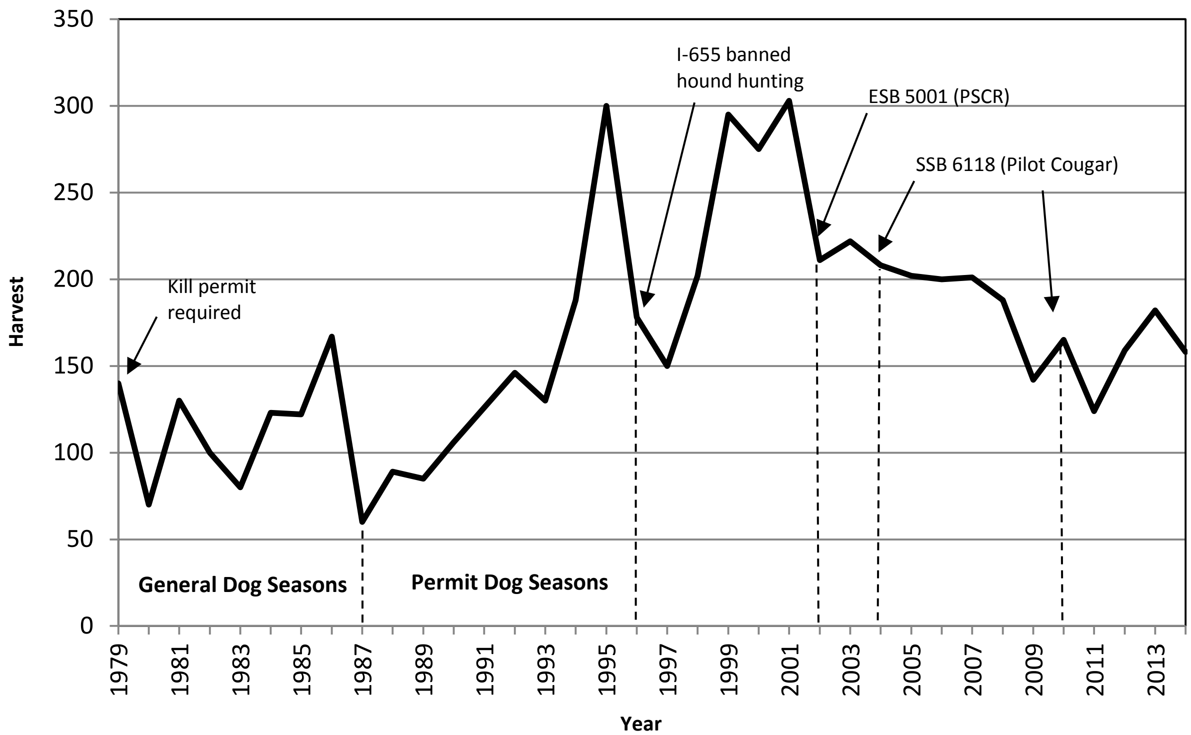

Figure 2. Trend in cougar harvest and hunting season structure, 1979-2014.

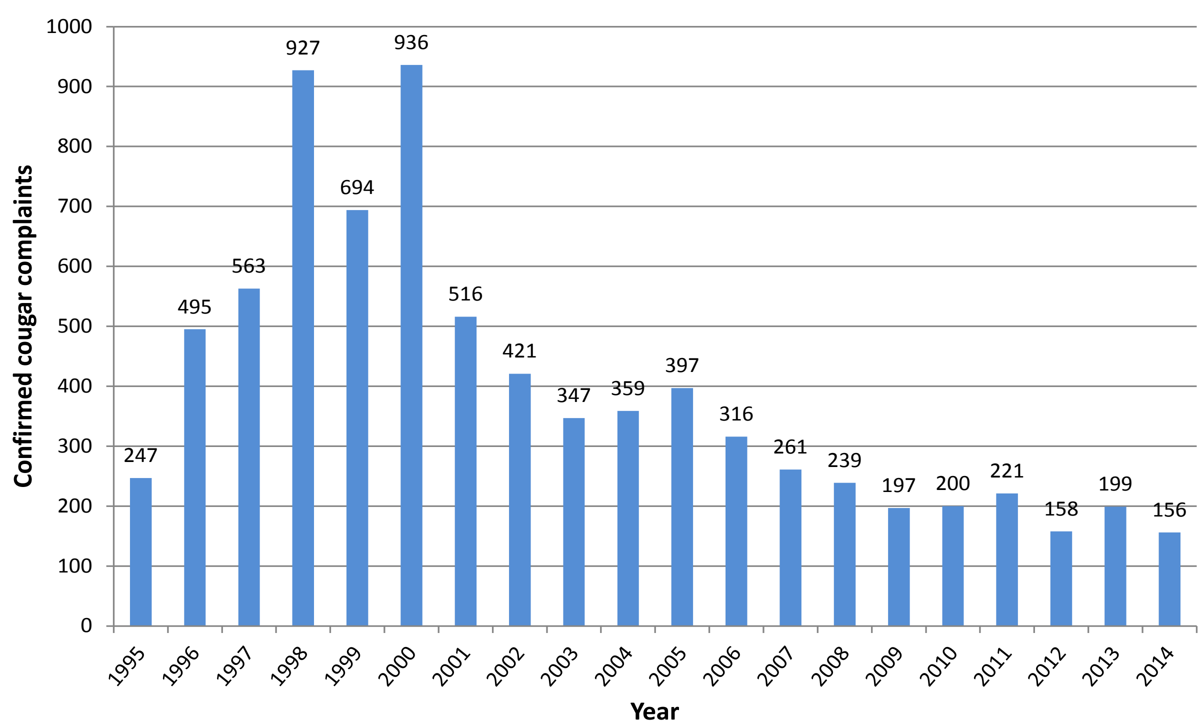

Figure 3. Confirmed statewide cougar complaints, 1995-2014, WDFW.

Black Bear

BLACK BEAR STATUS AND TREND REPORT
STATEWIDE

SCOTT A. BECKER, *Acting* Carnivore Section Manager

Distribution and abundance

In Washington, black bears (*Ursus americanus*) inhabit 31 of 37 counties, occupying all forested habitats within western Washington, the Cascade Mountain Range, the Okanogan Region, the Selkirk and Blue Mountains ranges. Only two island counties within the North Puget Sound area and the shrub-steppe habitat of the Columbia Basin do not support resident black bear populations.

Although population surveys are not being conducted on a statewide basis, all indications are that Washington State has an abundant and healthy black bear population. Rough population estimates based on population reconstruction and computer modeling suggest the statewide black bear population is around 25,000-30,000 animals.

Management guidelines and objectives

The goals for black bear management in Washington are to: 1) preserve, protect, perpetuate, and manage black bear and their habitats to ensure healthy, productive populations; 2) minimize threats to public safety from black bears, while at the same time maintaining a sustainable and viable bear population; 3) manage black bear for a variety of recreational, educational and aesthetic purposes including hunting, scientific study, cultural and ceremonial uses by Native Americans, wildlife viewing and photography; and 4) manage populations statewide for a sustained yield (Washington Department of Fish and Wildlife, 2002).

For management purposes, the state is divided into 9 black bear management units (BBMUs) (Figure 1). Harvest levels vary between BBMU depending on local population dynamics and environmental conditions. To maintain stable bear populations, modifications to harvest levels are made on a three-year rotation through the Fish and Wildlife Commission process. The Department uses the percentage of females in the total harvest and median ages of males and females as indicators of exploitation (Beecham and Rohlman 1994) (Table 1). However, sex and age structure data of harvested bears may provide misleading interpretations (Caughley 1974, Bunnell and Tait 1981, Garshelis 1991, Clark 1999).

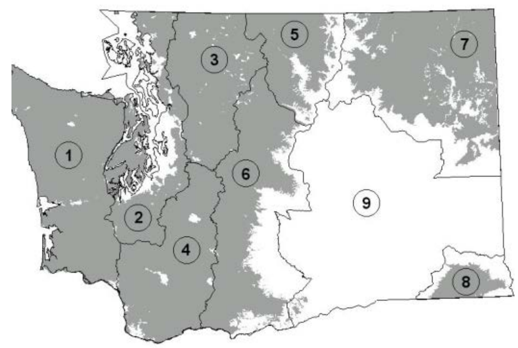

Figure 1. Black bear distribution and black bear management units.

For example, the age structure of a declining bear population can be the same as the age structure in an increasing population. In addition to this shortcoming, there is often a time lag between when a population begins to decline and when that decline is evident in sex and age structure data (Harris 1984). In some cases, by the time a decline is detected, bear numbers may have been reduced to a point where it could take longer than a decade to recover the population. However, detecting a decline early can enable managers to make a quicker recovery or retain stability.

Table 1. General black bear harvest guidelines used in Washington (Game Management Plan 2015).

Parameter	Liberalize	Harvest Acceptable	Restrict
% Females in harvest	< 35%	35-39%	> 39%
Median age of harvested females	> 6 years	5-6 years	< 5 years
Median age of harvested males	> 4 years	2-4 years	< 2 years

Sensitivity analyses of bear populations indicate that adult female and cub survival are the most influential parameters to population growth rates (Clark 1999). As such, WDFW monitored bear survival in Thurston County from 2004 to 2011, and initiated a project in new bear demographics project in Chelan and King Counties in 2013.

Hunting seasons and harvest trends

The use of bait and hounds for hunting black bear has been illegal in Washington since the 1996 season. Since that time, bear seasons were lengthened, bag limits increased from 1 to 2 in some areas, and spring seasons have been expanded to 20 of Washington's 136 Game Management Units (GMUs). Legislation also passed that provided authority to the Fish and Wildlife Commission to reduce costs for black bear transport tags. These changes resulted in an increased number of bear hunters, and therefore bear harvest, between 1998 and 2000. In 2014, 1,471 bears were harvested during recreational seasons which nearly equaled the long-term average of 1,477 bears per year for the previous 17 years (Tables 2 & 3).

Depending on location, black bear hunting season begin between August 1st and September 1st and continue through November 15th. In GMUs where a spring hunt occurs, the dates are early to mid April through late May to mid-June. While there is no physical mandatory sealing requirement for bear, successful hunters must report harvest statistics and submit the first upper premolar of their kill for aging via a tooth envelope provided by WDFW.

Research

The Department has conducted important scientific research with regards to black bears. From 1963 to 1969, the Department studied black bear damage to coniferous forests and gathered basic demographic information that was used to establish management guidelines (Poelker and Hartwell 1973). The next study occurred from 1994-1999 and documented habitat use, home range size, and survival in three ecoregions in Washington (Koehler and Pierce 2003). Finally, from 1996-1997, WDFW conducted bait station surveys as a measure of relative bear abundance. However, an analysis of statistical power indicated that at the level of survey intensity, the Department would not be able to detect a change in bear abundance using bait stations (Rice et al. 2001). For that reason, the survey technique was discontinued.

From 2004-2011, research efforts focused on adult female survival in selected areas of western Washington with spring bear damage seasons to better assess bear population status and impacts of hunting (see Coastal Black Bear Management Unit report 2010). New research efforts are being initiated in Chelan and King Counties to assess bear demographics, tree damage, and tools for addressing problem bears.

Table 2. Statewide black bear harvest, hunter effort, and median age information, 1996 - 2014, Washington Department of Fish and Wildlife.

								Median Age		
Year	Male	Female	Total Harvest	# of Hunters	% Success	# Hunter Days	# Days per kill	Males	Females	% Females
1996	951	359	1,310	12,868	10%	104,431	80	4.5	5.5	27%
1997	546	298	844	11,060	8%	97,426	115	4.5	5.5	35%
1998	1,157	645	1,802	20,891	9%	216,456	120	4.5	5.5	36%
1999	757	349	1,106	37,033	3%	481,319	435	4.5	5.5	32%
2000	777	371	1,148	37,401	3%	296,849	259	3.5	5.5	32%
2001	919	512	1,431	25,141	6%	230,431	161	3.5	4.5	36%
2002	800	427	1,227	24,844	7%	219,428	127	3.5	5.5	35%
2003	989	583	1,556	22,510	7%	192,544	123	3.5	4.5	37%
2004	1,093	561	1,654	21,573	8%	186,626	113	3.5	5.5	34%
2005	940	333	1,333	20,724	6%	172,527	129	3.0	5.0	25%
2006	1,061	581	1,642	21,801	8%	168,237	103	3.0	4.0	35%
2007	1,096	489	1,585	23,667	7%	168,237	106	3.0	5.0	31%
2008	1,450	758	2,208	26,347	8%	215,032	102	3.0	5.0	34%
2009	931	465	1,396	23,767	6%	192,347	147	3.0	6.0	33%
2010	1,254	718	1,972	24,118	8%	185,389	98	2.9	4.7	37%
2011	NA	NA	1,503	21,852	7%	166,814	111	4.0	5.0	NA
2012	1,054	499	1,633	21,656	7%	161,459	104	4.0	5.0	32%
2013	799	355	1,234	21,489	6%	164,954	144	4.0	5.0	29%
2014	893	493	1,471	21,621	7%	166,089	120	3.0	4.5	36%

Human-black bear conflict

The total number of black bear-human interactions over the past decade has range from a low of 294 in 2009 to a high of 890 just a year later in 2010 (Figure 2). Generally, complaints have remained relatively consistent during the last 18 years with an average of 512 confirmed black bear complaints per year during that time span. Spikes in complaint levels, such as 2010, are associated with reduced summer-fall berry production statewide. This in turn causes bears to increase their search range for food and often puts them in close proximity to people. In Washington, negative black bear/ human interactions overwhelmingly involve garbage issues (i.e. poor storage), but tree peeling as well as livestock, orchard and apiary depredations also occur. Human population growth and development has only compounded these issues. The Department completed a statewide policy on the handling of black bear/human conflicts by field personnel. The policy specifies circumstances in which animals will be monitored, captured and relocated, or captured and destroyed. The Department has also worked proactively to prevent these conflicts by conducting “Living with Wildlife” workshops annually to schools and local communities, distributing educational materials to stakeholders and to the public in areas with relatively high incidences of bear/human interactions, purchasing and installing bear-proof containers, and supplying regional WDFW offices with bear education materials for public dissemination.

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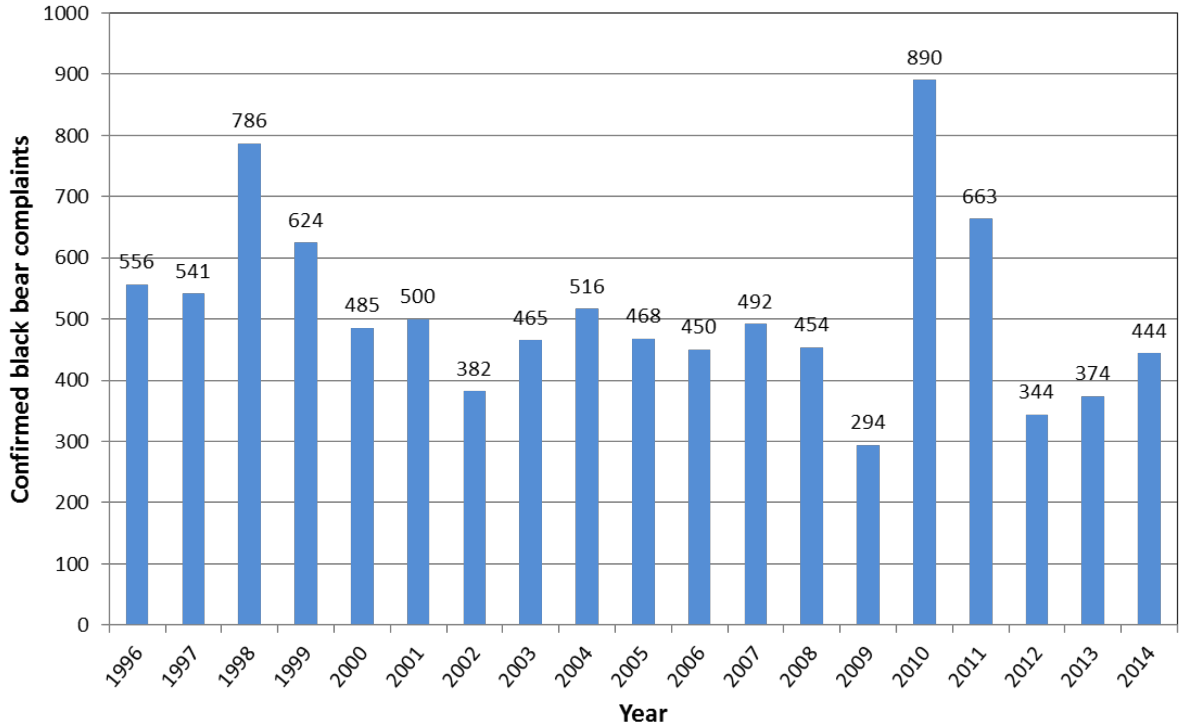


Figure 2. Trend in confirmed human-black bear interactions in Washington, 1996-2014.

Table 3. Statewide black bear harvest and hunter effort by Black Bear Management Unit for 2014.

BMU	Bear Management Unit Name	Total Harvest	Number Hunters	Hunter Success Rate	Hunter Days	Days/Kill
1	Coastal	137	3,071	4.5%	27,146	198.2
2	Puget Sound	129	1,919	6.7%	15,848	122.9
3	North Cascades	144	1,947	7.4%	13,946	96.9
4	South Cascades	141	3,620	3.9%	28,917	205.1
5	Okanogan	110	1,436	7.7%	8,978	81.6
6	East Cascades	211	4,700	4.5%	33,060	156.7
7	Northeastern	453	4,452	10.2%	29,495	65.1
8	Blue Mountains	63	1,259	5.0%	8,071	128.1
9	Columbia Basin	1	73	1.4%	527	527
General Hunting Season Total		1,386	21,200	6.5%	166,089	119.8
Spring Bear Permit Hunt		85	421	20.2%		
Recreational Harvest Total		1,471	21,621			

Band-Tailed Pigeon and Mourning Dove

BAND-TAILED PIGEON / MOURNING DOVE STATUS AND TREND REPORT
STATEWIDE

DON KRAEGE, Waterfowl Section Manager

Introduction
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 in 1994 established a population objective for band-tailed pigeons in Washington based on the WDFW call-count survey (PFC 1994). Since that time, PFC has revised the population objective and established closure thresholds based on a new mineral site survey (PFC 2010). Population objectives for mourning doves are being developed as part of the national mourning dove harvest strategy.

Hunting season regulations
The band-tailed pigeon season was closed in Washington from 1991-2001. A limited season was reopened in 2002 and has continued since then, with season dates of September 15-23 and bag/possession limits of 2/4. The mourning dove season was September 1-15 from 1980 through 2007, and September 1-30 since 2008. Bag/possession limits have been 10/20 since 1980.

Methods
Band-tailed pigeon call-count survey
The WDFW band-tailed pigeon call-count survey was initiated in 1975, and was patterned after the mourning dove survey. A total of 50 routes, 5.7 miles in length comprised the survey, conducted in western Washington below 1,000 ft. elevation. Surveys were completed during a 16-day period beginning the Saturday closest to June 21, as designed by Jeffrey (1989). Data were sent to USGS in Laurel, MD (Bill Kendall) for analysis using route regression programs developed for the mourning dove survey (Sauer *et al.*, 2003). The WDFW call-count survey was discontinued after 2003, but is presented in this report for comparison to the mineral site survey.

Band-tailed pigeon mineral site survey
In 2001, USGS-BRD (California Science Center) received a grant from USFWS to design a population index survey for use throughout the range of the Pacific Coast population of band-tailed pigeons. USGS conducted mineral site surveys at 8 western Washington locations in 2001-03 (Overton and Casazza 2004). These included two in Region 4 (Oyster Creek - Pigeon Point and Sumas Springs), one in Region 5 (Cedar Creek), and five in Region 6 (Lilliwaup, McAllister Creek, Mud Bay, Potlatch, and Red Salmon Creek). As part of an earlier grant, USGS-BRD evaluated several population survey techniques, and found that an optimally timed mineral site survey offered statistical advantages over other surveys, including the WDFW call-count survey.

A final report on the mineral site survey was completed in 2004, and coastal states adopted the new mineral site survey as the official index for this population. In 2004, WDFW expanded surveys to 15 sites, as specified under protocols developed for the Pacific Flyway (Overton and Casazza 2004). The 15 sites included the 8 locations established in 2001, along with two in Region 4 (Lake Cavenaugh Rd.-Pefley and Warm Beach), four in Region 5 (Altoona, Newaukum River, St. Martin's Hot Springs, and Upper Kalama) and one in Region 6 (Willapa Estuary). Since 2004, the site list has been modified due to access restrictions or other changes in status. Cooperators from WDFW and USFWS completed 15 surveys during the July 10-20, 2015 survey period.

Mourning dove call-count survey
The mourning dove survey was discontinued by USFWS after the 2013 survey (Seamans and Sanders 2014). WDFW staff in Districts 1, 3, 4, 9, and 17 participated in evaluation of a new point-distance sampling method during 2015, but results are not yet available.

Band-tailed pigeon harvest survey

Band-tailed pigeon harvest is estimated annually using mandatory harvest reporting. Written authorization and harvest reports have been required of band-tail hunters in western Washington since the season reopened in 2002. Hunters were required to return a harvest report card by September 30 to avoid a $10 penalty the following year. Reminders were sent out prior to the reporting deadline. Harvest reports returned by the deadline were included in the analysis as the 'first wave' of respondents. A special follow-up survey of non-respondents was conducted via a telephone survey through Washington State University. Responses from this survey were included as the 'second wave' and then the harvest estimates were computed accounting for the non-response bias.

Mourning dove harvest estimation

Mourning dove harvest was estimated as part of the statewide hunter survey conducted by WDFW (WDFW 2015).

Results

Band-tailed pigeon call-count survey

Past call-count survey results are presented in Table 1 and Figure 1.

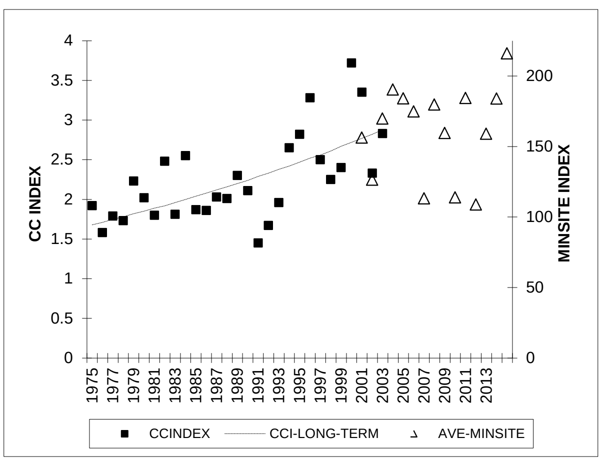


Figure 1. Band-tailed pigeon call-count results and mineral site raw data summaries.

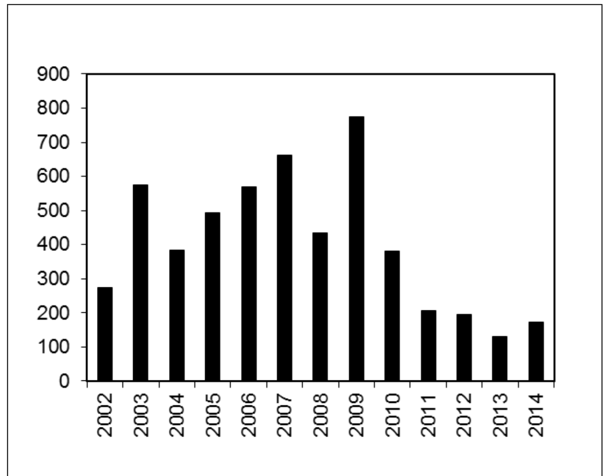
Band-tailed pigeon mineral site survey

Mineral site survey raw data summaries are presented in Table 2 and Figure 1. Complete 2015 survey results are available through USFWS (Sanders 2015).

Band-tailed pigeon harvest

Harvest and hunter activity for the 2002-2014 seasons are summarized in Figures 2-3 and Table 3.

Figure 2. Band-tailed pigeon harvest.



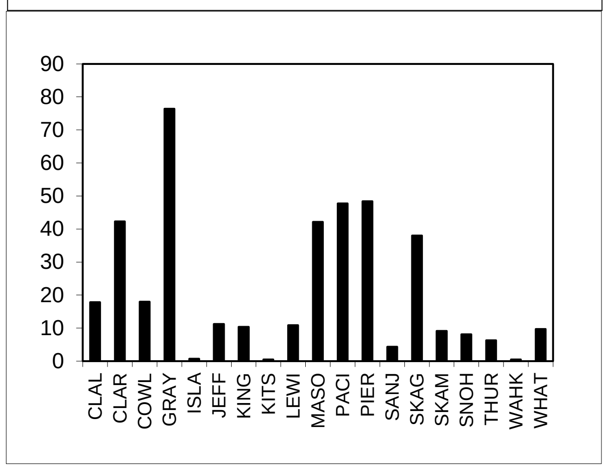


Figure 3. Band-tailed pigeon 2002-13 average annual harvest by county.

Mourning dove harvest

As measured by WDFW (2014) surveys, harvest in 2014 was estimated at 45,732 doves, down 9% from 2013 (Figure 4). Hunter numbers were estimated at 3,897, down 10% from 2013. Number of days hunted was 12,901, down 4% from 2013.

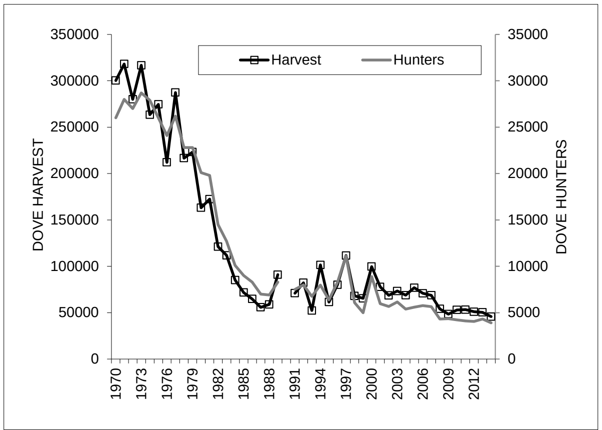


Figure 4. Mourning dove harvest and hunter numbers 1970-2014.

Population status and trend analysis

Figure 1 and Table 1 show that based on the call-count survey, the band-tailed pigeon population generally increased from 1975-2003. The route regression method was less precise in determining short-term trends than long-term trends, as evidenced by the large confidence intervals for the two-year trends in Table 1. The large spans of these intervals are caused by low sample size due to changing observers from year to year.

The mineral site survey in 2001-2003 exhibited the same general trend as the call-count survey when the two surveys were run concurrently (Figure 1). This rough correlation can be used in the future to develop population objectives for WA consistent with the PFC management plan (PFC 2010).

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Table 1. Band-tail call-count survey results - route regression method.

Start Year	End Year	Change	Lower 90% CI	Upper 90% CI	Routes Used	Sig. level
1975	1992	-7.8%	-14.0%	-2.0%	63	p<0.05
1991	1992	10.1%	-50.0%	75.0%	11	n.s.
1975	1993	-6.0%	-11.0%	-1.0%	65	p<0.05
1992	1993	44.0%	-49.0%	152.0%	13	n.s.
1975	1994	-3.4%	-8.2%	1.4%	69	n.s.
1993	1994	71.0%	1.4%	141.0%	24	p<0.05
1975	1995	-2.7%	-9.8%	4.5%	70	n.s.
1994	1995	12.1%	-31.3%	55.3%	12	n.s.
1975	1996	-0.8%	-6.5%	4.9%	59	n.s.
1992	1996	24.3%	10.4%	38.2%	30	p<0.01
1995	1996	36.4%	-35.9%	108.7%	18	n.s.
1975	1997	-0.8%	-6.0%	4.3%	62	n.s
1993	1997	8.9%	0.2%	17.6%	32	p<0.10
1996	1997	-14.3%	-35.4%	6.7%	18	n.s.
1975	1998	-1.5%	-5.5%	2.4%	65	n.s.
1994	1998	2.1%	-8.7%	13.0%	34	n.s.
1997	1998	-11.0%	-45.8%	23.9%	11	n.s.
1975	1999	-0.1%	-4.1%	3.8%	67	n.s.
1995	1999	-3.3%	-11.5%	4.9%	38	n.s.
1998	1999	26.7%	-19.7%	73.1%	14	n.s.
1975	2000	-0.3%	-6.2%	5.5%	70	n.s.
1996	2000	5.9%	-2.3%	14.1%	41	n.s.
1999	2000	21.1%	-12.5%	54.8%	24	n.s.
1975	2001	1.7%	-2.3%	5.7%	70	n.s.
1997	2001	15.8%	8.0%	23.6%	44	p<0.01
2000	2001	1.8%	-16.6%	20.2%	36	n.s.
1975	2002	0.7%	-3.7%	5.0%	71	n.s.
1998	2002	9.4%	2.6%	16.2%	45	P<0.05
2001	2002	0.9%	-27.5%	25.8%	32	n.s.
1975	2003	1.8%	-1.7%	5.4%	71	n.s.
1999	2003	0.6%	-4.8%	5.9%	48	n.s.
2002	2003	5.2%	-30.5%	40.8%	25	n.s.

Table 2: WA band-tailed pigeon mineral site survey raw data

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Altoona				64	0	5	0								
Cedar Cr.	328	215	157	215	185	231	191	312	163	154		142	181	267	207
L. Cavenaugh - Pefley				108	172	76	71	117	70	89	113	146	156	110	98
Lilliwaup	60	77	108	199	143	273	141	89	110	123	167	74	210	197	178
McAllister	82	118	174	124	174	87	25	136	46	134	107	102	77	78	90
Mud Bay	164	154	222	134	371	294	95	203	130	70	175	87	214	136	297
Oyster Cr. – Pigeon Pt.	362		455	474	542	293	157	331	314	190	344	121	51	39	14
Newaukum				634	167	335	309	219							
Potlatch	135	147	90	297	285	306	168	295	480	129	297	288	333	254	506
Red Salmon	52	103	121	179	103	64	33	107	41		0	47	5		93
Soda Springs												58	112		193
St. Martins				220	128	191	189	141	210	214	439	180	308	354	435
Sumas	67	71	31	46		68					78	17	82	74	78
U. Kalama				110	225	327	120	350	317	111	368	258	245	187	322
Totten -Oyster Bay										119	53	101	192	332	486
Warm Beach				48	58	62	83	36	29	29	72	10	60		33
Willapa				3	24	10	3	0	5	5		2			

Table 3: WA band-tailed pigeon harvest report summary

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2002-14 AVE.
NUMBER OF PERMITS ISSUED	522	657	766	809	909	894	917	567	632	178	237	244	266	584
TOTAL DAYS	357	337	209	382	315	364	247	548	362	151	195	85	191	288
TOTAL HARVEST	273	574	383	492	569	661	434	776	381	205	196	129	172	403
HARVEST BY COUNTY														
CLAL	37	35	14	25	35	37	5	0	39	0	0	6	0	18
CLAR	29	45	29	35	60	51	56	94	18	48	29	12	44	42
COWL	28	54	4	2	3	32	24	39	12	18	15	0	4	18
GRAY	47	53	104	76	71	145	103	129	83	47	55	26	55	76
ISLA	0	0	0	0	9	0	0	0	0	0	1	0	0	1
JEFF	10	16	31	26	14	29	6	4	6	3	0	0	2	11
KING	4	23	13	6	11	14	9	43	12	0	0	0	0	10
KITS	0	1	0	0	0	0	0	0	0	1	0	5	0	1
LEWI	7	13	11	34	5	22	13	19	15	0	1	0	1	11
MASO	26	38	48	62	63	84	59	126	19	2	2	0	18	42
PACI	13	21	37	35	73	80	82	136	56	1	47	33	6	48
PIER	20	82	30	62	85	63	32	85	43	14	34	42	36	48
SANJ	0	0	12	0	0	0	0	0	0	45	0	0	0	4
SKAG	33	99	15	97	74	65	31	30	42	3	2	2	3	38
SKAM	5	16	0	10	16	21	11	27	7	3	3	0	0	9
SNOH	15	29	3	12	11	3	4	4	10	13	2	0	1	8
THUR	0	13	8	2	24	10	0	5	13	7	0	0	0	6
WAHK	0	0	0	0	0	0	0	7	0	0	0	0	0	1
WHAT	0	34	24	6	14	4	0	28	6	0	5	3	2	10

Waterfowl

WATERFOWL: BREEDING POPULATIONS AND PRODUCTION STATUS AND TREND REPORT
STATEWIDE

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Introduction
This report summarizes waterfowl productivity data collected during 2015 in Washington State, including information on breeding waterfowl populations, duck broods, and goose nest surveys. Washington Department of Fish and Wildlife (WDFW), U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service (USFWS), Yakama Indian Nation, Colville Confederated Tribes, Washington Waterfowl Association, and Chelan County Public Utility District contributed data.

Duck Breeding Population Survey
Methods
Historical surveys to estimate breeding duck populations in eastern Washington were conducted annually within seven strata in eastern Washington: West Okanogan Potholes, Omak-Douglas Potholes, Far East Potholes, Northeast, and Palouse Streams, Columbia Basin Irrigated, and Yakima Valley Irrigated (Fig. 1). Surveys were conducted by ground counts of transects or sections, except helicopter counts were used for the 1/4-sections in the Desert Wildlife Area (Frenchman and Winchester Wasteways) within the Columbia Basin Irrigated strata (Fig. 1). Samples were multiplied by weighting factors to provide an index to the total number of breeding ducks and coots within the defined areas (Tables 1-3). Weighting factors were determined from the proportion of areas within the strata that were sampled. Observations were treated as complete counts within sampling units (transects or quadrats) with no corrections for visibility bias.

Due to concerns about design of past surveys (lack of random sample selection and variance estimates), WDFW began the process of redesigning the eastern Washington waterfowl breeding population survey in 2008, in conjunction with staff from the Pacific Flyway office in Portland, OR and the USFWS Branch of Population and Habitat Assessment in Laurel, MD. The new design consists of randomly selected ¼ mile helicopter transects to replace the past survey design. The goal of the new survey is to provide breeding population indices (with variance estimates) comparable to surveys conducted in other parts of the Pacific Flyway, for inclusion in the western mallard management protocols adopted by USFWS in 2008.

The new and old survey designs were run concurrently for three years (2009-11), and the old design was discontinued after the 2011 survey. The new survey design (including the Irrigated, Potholes, and Northeast Highlands strata) was modified in 2012 to address continued safety and efficiency concerns for the Northeast Highlands stratum (Fig. 2). As a result, transects in this stratum were placed at 10 mile intervals on an east-west orientation across major river valleys. In addition, minor boundary adjustments were made to other stratum boundaries, including elimination of Saddle Mountain from the Irrigated stratum. Overall, in eastern Washington, observers surveyed approximately 1,688 transect miles over a 5 day period between May 4–8, 2015.

Beginning in 2010, line-transect surveys, similar to the new eastern Washington survey, were developed and flown for the new western Washington breeding waterfowl population survey (Fig. 3). Observers surveyed approximately 984 transect miles between April 27–May 1, 2015.

The modifications to survey design and areas during the initial years of the aerial survey created difficulties in comparing results across years. To address this issue, survey results from 2009-2012 were reevaluated and standardized by matching strata boundaries to the surveys boundaries used in 2013. Transects and observations from 2009-12 that fell outside 2013 strata boundaries were dropped from analyses. Data from the Highlands in 2010 and 2011 were also excluded from analyses due to different survey methods.

Methods for estimating total number of breeding ducks follow the Standard Operating Procedures of Aerial Waterfowl Breeding Ground Population and Habitat Surveys in North America (USFWS & CWS 1987). Breeding populations are estimated by multiplying the number of pairs, lone drakes, and flocked drakes (<5 male birds) by 2, and grouped birds (mixed or >5 males) by 1. Lone hens are multiplied by 1 for redhead, scaup, ring-necked duck, and ruddy duck only. These diver species are known to be late nesters and males significantly outnumber females.

Results

Total breeding ducks numbered 131,482 (*SE* 19,659) within three eastern Washington strata (Table 4). Total mallards numbered 55,774 (*SE* 7,168). Gadwall was the second most numerous species on the survey (20,950, *SE* 5,077), followed by ruddy duck (20,651 *SE* 17,039), cinnamon teal (8,957 *SE* 1,983), and American wigeon (4,831 *SE* 2,540) (Fig. 4).

The Potholes stratum comprised 61% of the total duck count in 2015, followed by the Irrigated stratum (25%) and the Highlands stratum (14%). Compared to the 2014 survey, 2015 total breeding duck counts increased 2% in eastern Washington (Fig. 5, Table 4).

The revised survey design for western Washington estimated the total breeding duck population at 61,668 *SE* 6,485). Mallards numbered 30,618 (*SE* 3,966), followed by American green-winged teal (9,454 *SE* 4,356), American wigeon (3,722 *SE* 1,678) and wood duck (3,265 *SE* 554) (Fig. 6, Table 5). The North Puget Lowlands stratum held the majority of breeding ducks in 2015 (51%), followed by the South Puget Lowlands (25%), Dungeness (9%), Chehalis River Valley (8%), and Hood Canal (7%) (Fig. 7, Table 5).

Statewide, the total breeding duck estimate in 2015 was 193,149 *SE* 20,701), an increase of 9.2% compared to last year and up 9.0% over the 3-year average (Table 6). Compared to the 3-year average, mallards showed no change at 86,392 (*SE* 8,192), American wigeon increased 40% to 8,553 (*SE* 3,044) and gadwall increased 12% to 22,532 (*SE* 5,108. Wood ducks decreased 20% to 4,911 (*SE* 644) since last season but showed no change over the 3-year average (Fig. 8). Northern shovelers declined slightly from 2014 (-4%) and compared to the 3-year average (-10%). Bufflehead (-28%), blue-winged teal (-45%), and redheads (-22%) declined more substantially from 2014 (Fig. 8). These decreases may be due to detection difficulties and typically lower annual breeding effort in the state.

Duck Production Survey (Brood Survey)

Methods

The same sampling transects used for historic breeding duck surveys are used for brood surveys in the Potholes, Palouse, and Northeast strata (Fig. 1). These surveys are conducted in late June to early July. All broods observed are recorded by species. The numbers of broods observed are multiplied by the weighting factors for each stratum to provide an index to duck production. Average brood size is very difficult to estimate. Historic surveys in the Irrigated strata were designed to estimate average brood size. As a result the survey effort varied somewhat among years. To provide more consistency, the surveys in the Columbia Basin were redesigned in 1995 by using six sample sites to provide an index to production.

Broods for most species are highly secretive and difficult to observe. The current year's growth of emergent vegetation is more developed than during breeding population surveys in May. Production surveys should be viewed as a rough estimate of production with greater value for long-term trends than for year-to-year changes.

Results

The 2015 duck brood production survey index for the Potholes, Palouse, and Northeast strata declined 30% from 2014, but remains 7% above the long-term for all combined duck species (Fig. 9, Table 10). Brood production increased 16% in the Okanogan, 6% in the Northeast, and 7% in the Columbia Basin strata. Dramatic declines continued in the Channeled Scablands (-53%). The Palouse survey was not conducted in 2013 or 2014, and the current survey was down 73% compared to 2012 results (Table 10).

Canada Goose Breeding Population Survey

Methods

Canada goose breeding populations are indexed by nest searches conducted within four major geographic areas, mainly along the Snake and Columbia rivers (Table 10). Surveys are conducted annually, biennially, or periodically. Total number of goose nest attempts is used as an index of the goose breeding population, and surveys are focused on areas with high densities of nesting geese. Some areas with relatively recent goose population expansions are not surveyed. Total geese observed during historic and new aerial breeding duck surveys also provide an index to the goose population in those areas not surveyed during nest searches.

Results

The 2015 goose nest index increased 12% statewide compared to last year, remaining 30% above the 1974-2014 average. The total eastern Washington index increased 14% compared to last year; remaining 33% above the 1974-2014 average (Fig. 10, Table 10). Nest indexes increased in the upper Columbia (17%) and Columbia Basin strata (22%), but the lower Columbia stratum remained unchanged (Fig. 11-12, Table 10). Previous counts were used to estimate 2015 nests in the Snake River stratum, and are 39% above their long-term average (Fig. 11). The mid-Columbia River stratum estimates increased 9% from last year (Fig. 11, Table 10). One section of this stratum is only surveyed every 5 years and was last surveyed in 2012. The other section was only partially surveyed. Therefore, counts from the previous year were used. Seven out of 21 surveys were conducted statewide according to the variable survey schedule. Most strata in the state are above their long-term averages (1974-2014) with the exception of the Upper Columbia River stratum, which began a steep decline starting in 2003 (Fig. 11, Table 10).

The number of geese observed during the breeding duck surveys is presented in Fig. 13 and Table 10. This index provides information about the expansion of Canada geese into areas of Washington outside of our traditional goose nest index areas, and shows an increasing trend over the long term.

Potential Improvements to Waterfowl Breeding and Production Surveys

- Compare new duck survey results with traditional survey results during concurrent years to project long-term trends.
- Evaluate the duck productivity and goose nest surveys for accuracy, frequency, and completeness of surveys.
- Evaluate ways to combine goose nest surveys and aerial surveys into a more representative goose breeding population index survey.

Literature Cited

U. S. Fish and Wildlife Service and Canadian Wildlife Service. 1987. Standard operating procedures for aerial waterfowl breeding ground population and habitat surveys in North America; revised. Unpublished report.

Figure 1. Historic waterfowl breeding survey areas.

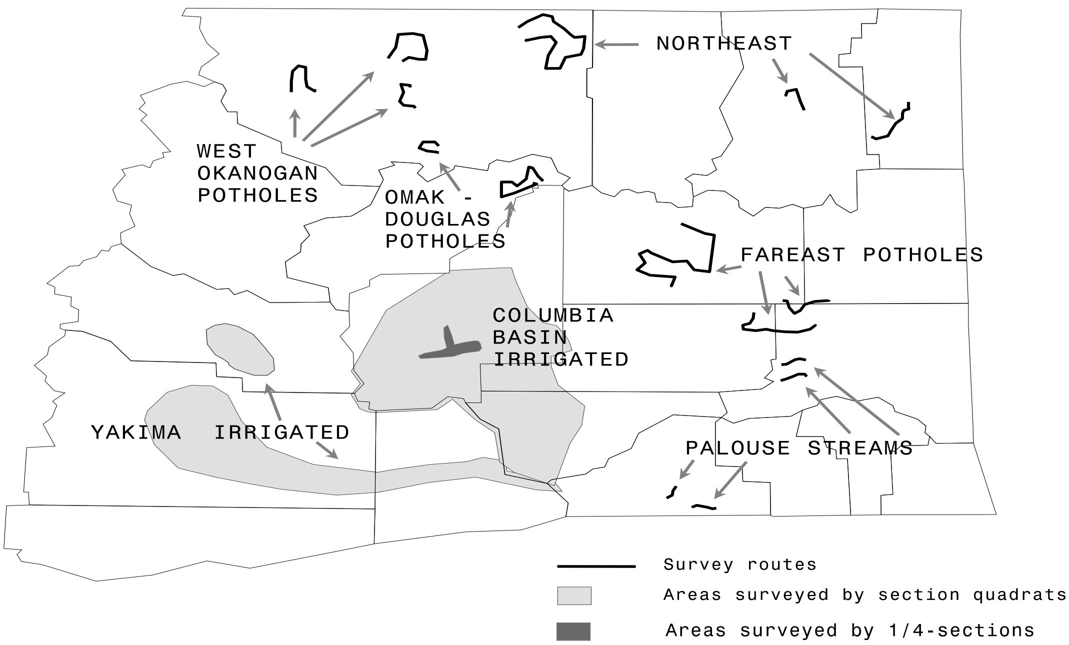

Figure 2. Eastern Washington aerial breeding waterfowl survey transects flown in 2015.

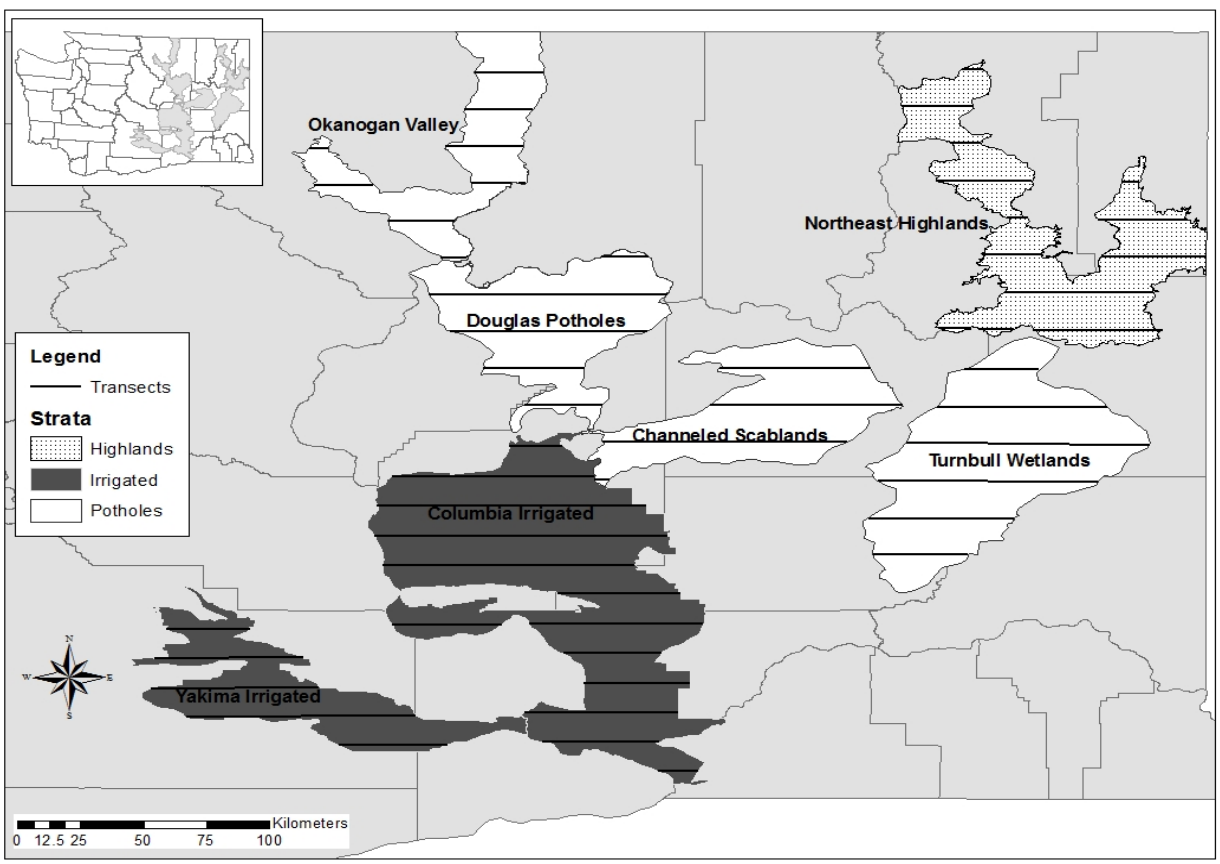

Figure 3. Western Washington aerial breeding waterfowl survey transects flown in 2015.

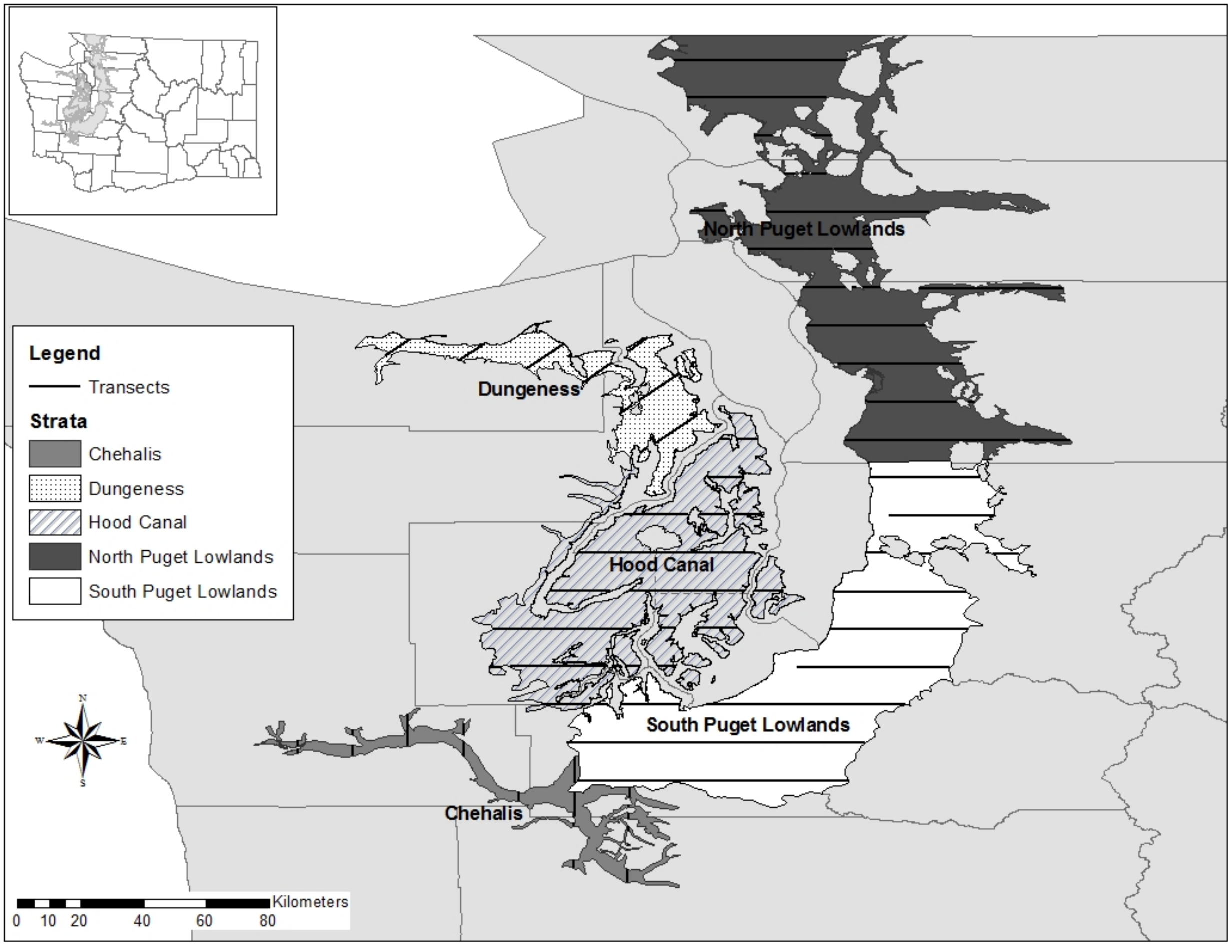

Figure 4. Eastern Washington duck breeding population survey results by species, 2010-15.

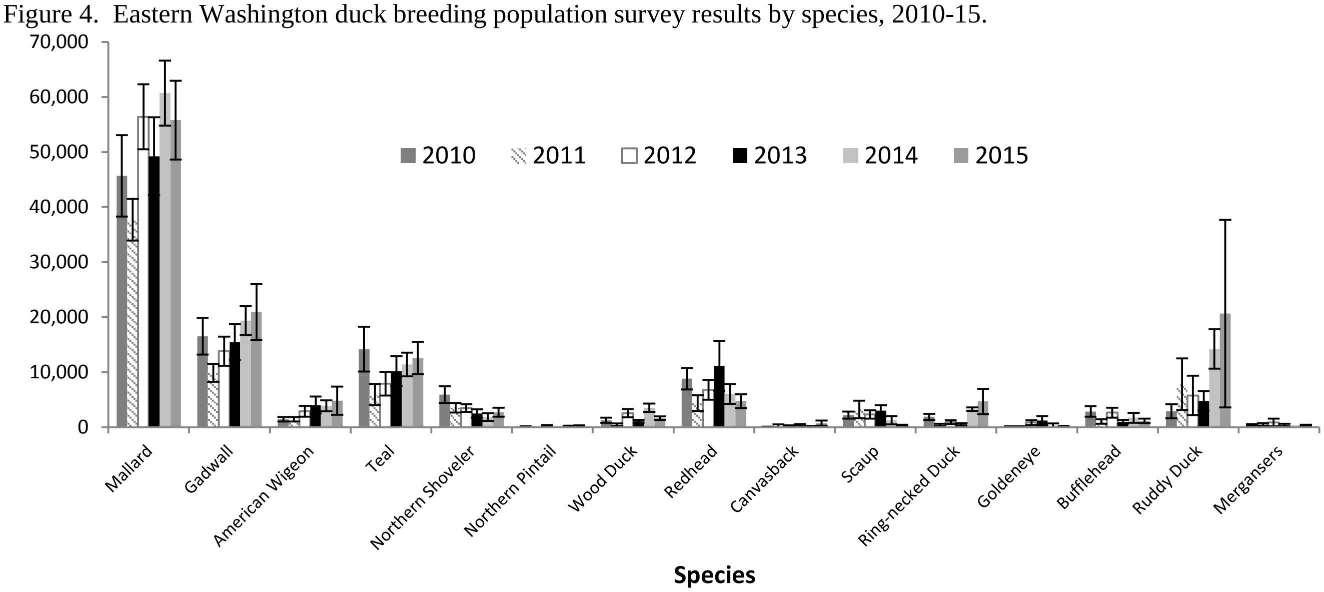

Figure 5. Eastern Washington duck breeding population survey results by species and strata, 2015.

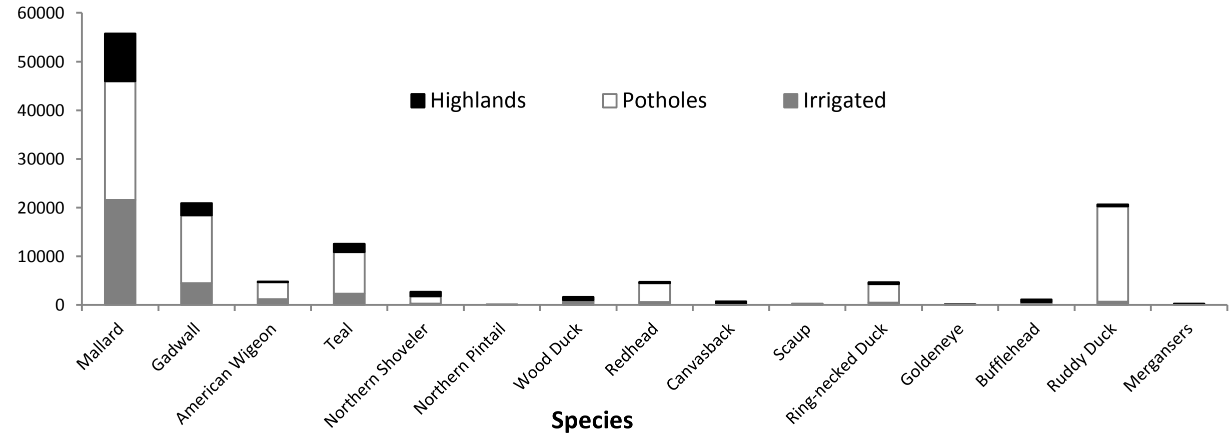

Figure 6. Western Washington duck breeding population survey results by species, 2010-15.

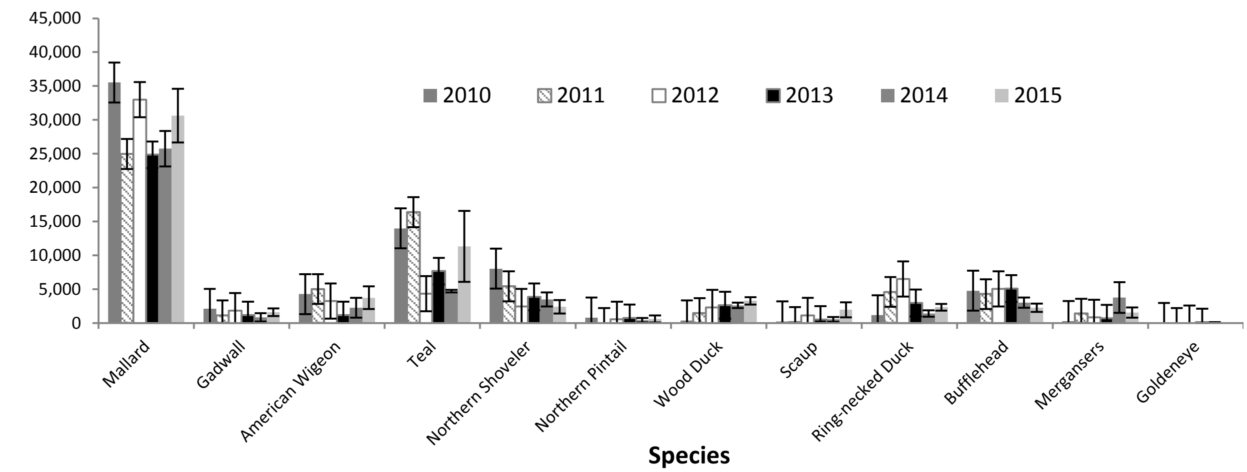

Figure 7. W. Washington duck breeding population survey results by species and strata, 2015.

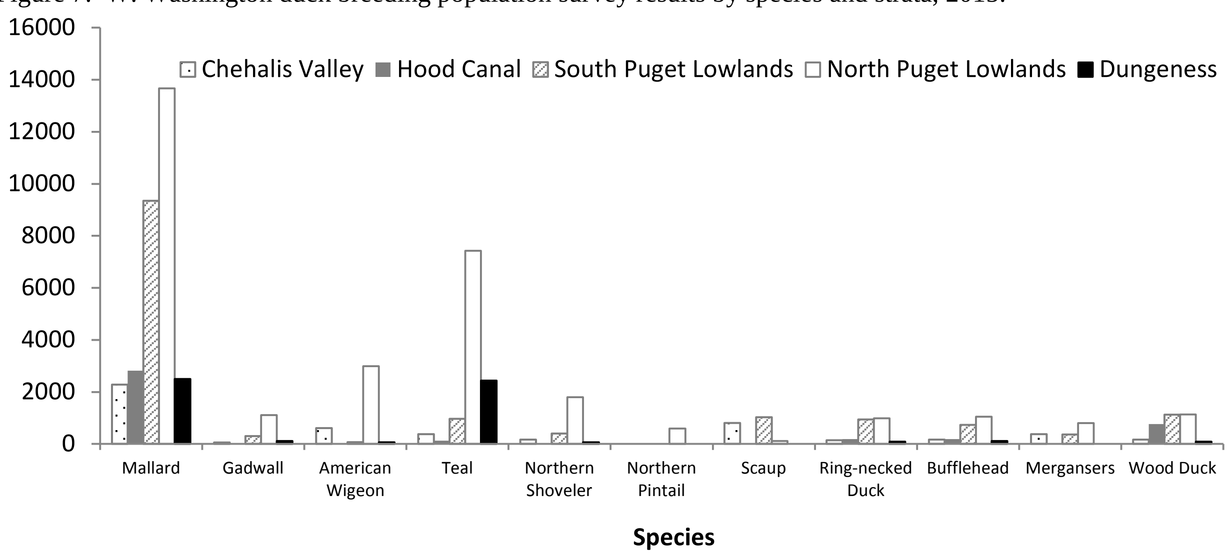

Figure 8. Statewide duck breeding population survey results by species, 2011-15.

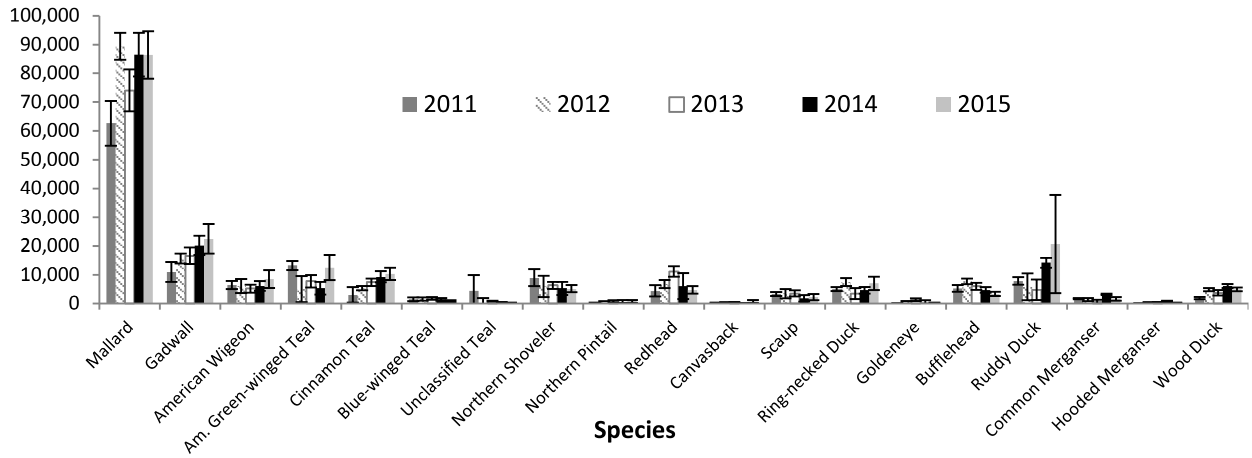

Figure 9. Brood index: Potholes, Palouse, Northeast Strata

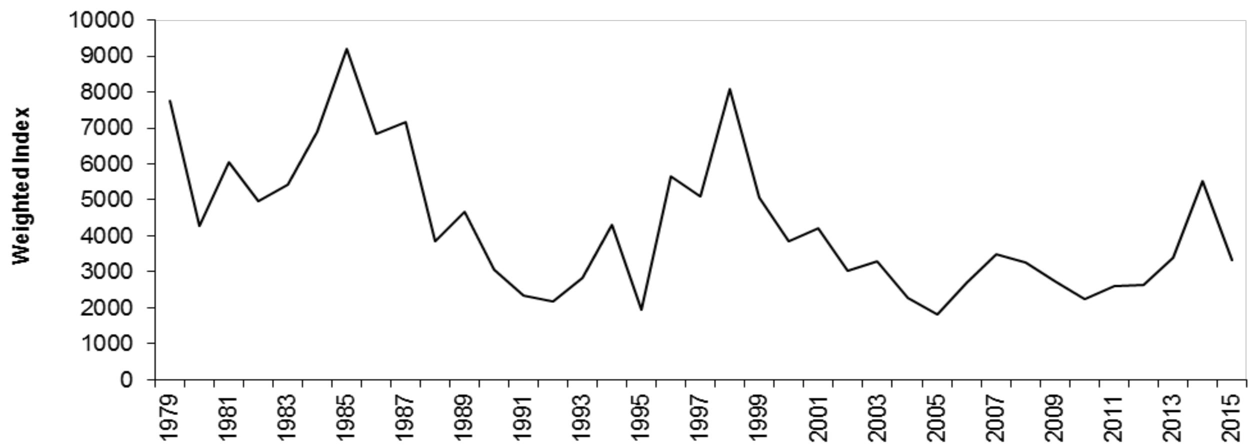

Figure 10. Total Canada goose nests counted in in eastern Washington, 1982-2015.

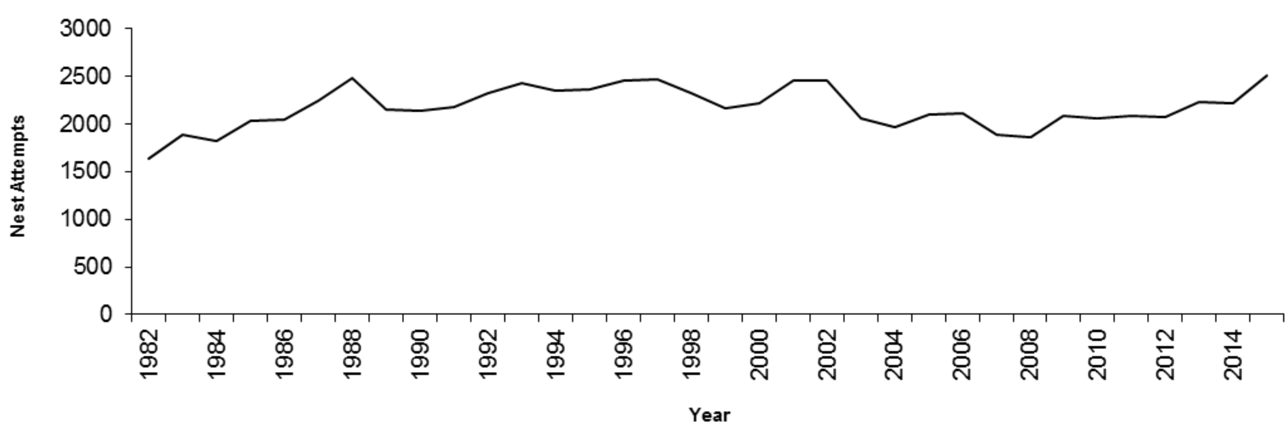

Figure 11. Canada goose nest survey trends in eastern Washington, 1985-2015. UCR = Upper Columbia River; MCR = Middle Columbia River; SR = Snake River; CB= Columbia Basin

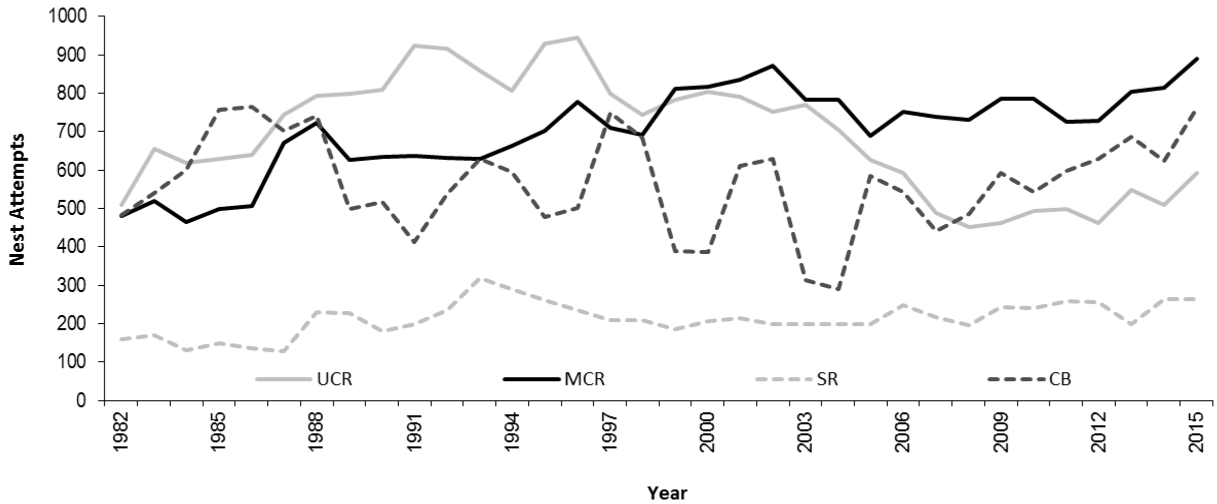

Figure 12. Total Canada goose nests in the lower Columbia River stratum, 1987-2015.

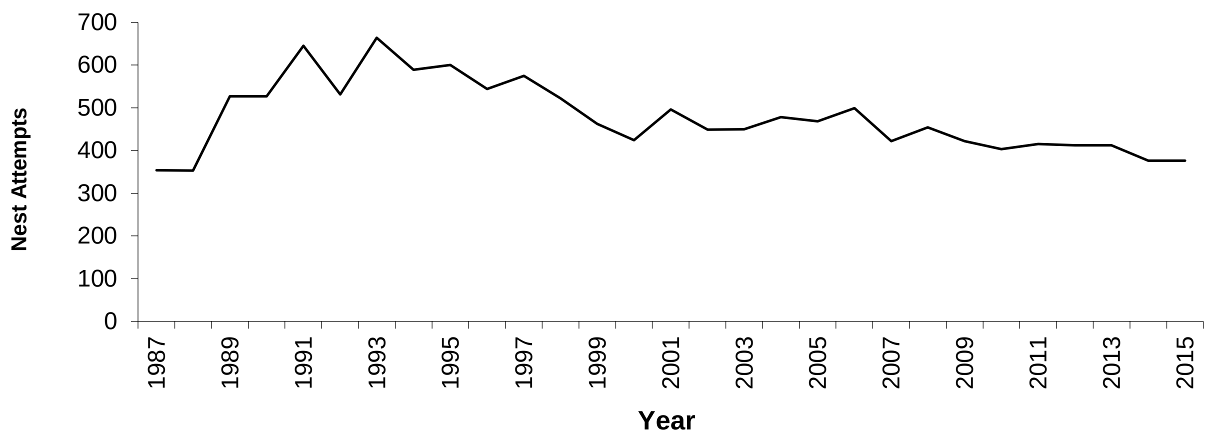

Figure 13. Breeding Canada goose index from breeding duck surveys.

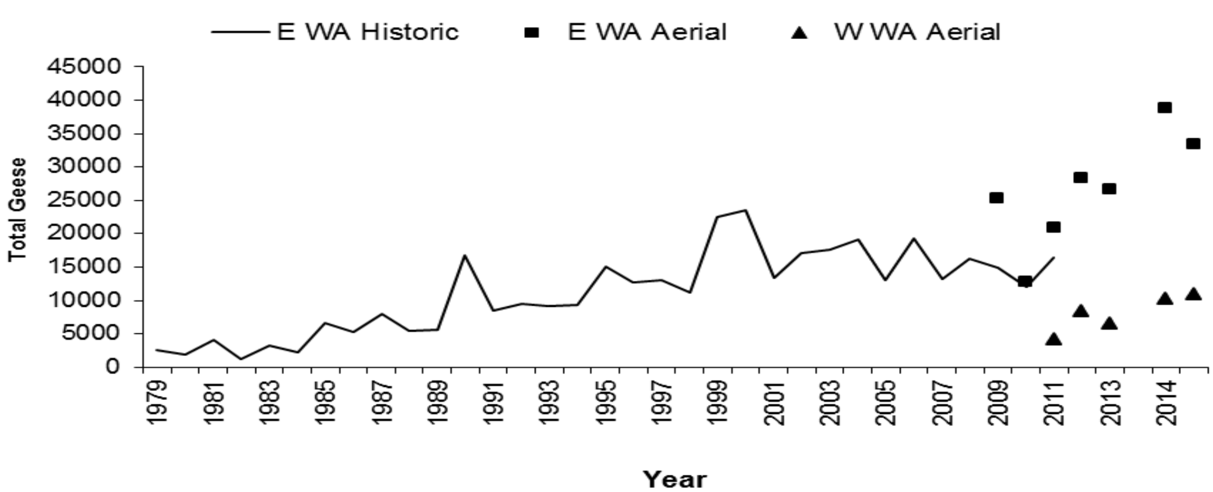

Table 1. Areas and subareas historically surveyed with weighting factors for pond indices, and duck and goose breeding surveys.

Area	Subarea	Survey	Weighting Factor	% of Total 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		
		Molson-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
	Wasteways[a] – 19 ¼ -sections		10.05	9.9
	Yakima – 35 sections		24.49	3.9

[a] Surveyed by helicopter beginning in 1994

Table 2. Weighted breeding duck population indices by species for eastern Washington historic survey areas (2002-2011).

Species	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2002-2011 average**
Mallard	44676	39843	39958	40794	45485	46053	50647	47977	49160	54940	45953
Gadwall	18527	15353	15185	15665	17995	17165	14065	10277	10277	11735	14624
Am. Wigeon	6501	5028	5442	3439	6012	6240	2618	4283	2844	3248	4566
Am. green-winged teal	2673	1749	1477	2406	4095	4060	1590	1612	1844	1905	2341
Blue +cinnamon teal	13717	11274	14619	12404	9544	11999	11921	9282	8657	6645	11006
Northern shoveler	5968	7794	6293	4477	6581	5409	4898	5555	4199	6249	5742
Northern pintail	395	608	1096	644	1089	723	450	1198	542	2489	923
Wood duck	1863	616	1553	1375	1549	1870	1781	1327	2409	1527	1587
Redhead	11831	8117	8365	4978	8492	8265	7757	7156	6466	6072	7750
Canvasback	1507	919	618	610	1460	756	1132	873	385	765	903
Scaup spp.	9289	12722	4807	5741	9709	6530	4244	5982	2484	3429	6494
Ring-necked duck	1405	3063	850	2525	3640	2732	2995	2521	2381	2136	2425
Goldeneye spp.	4036	4713	3255	3567	2847	2837	3841	3686	3495	3121	3540
Bufflehead	1606	3034	1280	2425	6361	2809	3728	949	2701	6838	3173
Ruddy duck	9023	12175	9624	10150	10464	9538	8262	8378	6400	9306	9332
Merganser spp.	327	757	463	304	121	1279	969	1095	794	1848	796
Total ducks	**133343**	**127764**	**114883**	**111503**	**135442**	**128265**	**120897**	**115663**	**105036**	**122254**	**121505**
American coot	18171	19328	19085	12346	22151	33763	22069	25521	20511	16834	20978
Canada goose	17179	17596	19137	13022	19253	13244	16342	16023	12014	16511	16032

Table 3. Weighted breeding duck population indices by area for eastern Washington historic surveys (1979-2011).

Year	Irrigated	Potholes	Palouse	Northeast	Total
1979	28948	57784	1951	9960	98643
1980	36870	58752	3057	15063	113742
1981	74711	58026	2341	13173	148252
1982	66161	63150	4455	12663	146429
1983	84969	48044	3545	12969	149527
1984	101486	73478	4618	16697	196278
1985	94789	95463	5984	19990	216226
1986	97901	79899	3837	22135	203771
1987	72503	80100	5073	25887	183564
1988	78137	103452	7068	53143	241799
1989	73411	50663	2341	35908	162323
1990	77838	56462	5138	29474	168912
1991	65698	50293	3382	21420	140793
1992	69547	22581	3252	20884	116264
1993	75969	42335	3577	27955	149836
1994	64537	43502	2699	13173	123912
1995	71513	46068	2472	26934	146987
1996	73364	62221	1691	25658	162933
1997	68589	85137	2667	16058	172451
1998	65503	96982	2341	20424	185251
1999	72697	101140	3089	23283	200210
2000	61126	70072	2537	22594	156328
2001	47438	70106	2537	26321	146402
2002	52341	59958	1106	19939	133342
2003	52648	49794	1170	24151	127764
2004	55098	39393	1041	19351	114883
2005	58339	35014	585	17564	111503
2006	72138	46672	1626	15650	135442
2007	63349	42119	2211	20271	128265
2008	62230	38710	1756	17999	120109
2009	50846	44020	1496	19301	115078
2010	55631	30351	1106	17948	105036
2011	71399	36352	1048	13454	122254
1979-2011 ave.	67204	58730	2812	21133	149834

Table 4. Summary of eastern Washington breeding waterfowl population survey (2010-2015).

		Species																				
Region	Year	Mallard	Gadwall	American Wigeon	Green-winged Teal	Cinnamon Teal	Blue-winged Teal	Northern Shoveler	Northern Pintail	Redhead	Canvasback	Scaup	Ring-necked Duck	Goldeneye	Bufflehead	Ruddy Duck	Common Merganser	Hooded Merganser	Wood Duck	**TOTAL DUCKS**	American Coot	Canada Goose
Irrigated	2010	27,372	3,129	198	560	4,809	264	3,953	0	1,746	66	1,647	659	0	2,240	231	264	0	1,054	**48,190**	7,016	4644
	±SE	*5,879*	*698*	*73*	*292*	*2,213*	*127*	*1,417*	*0*	*547*	*52*	*574*	*155*	*0*	*903*	*126*	*116*	*0*	*432*	***6,614***	*2,802*	*1141*
	2011	20,791	1,749	583	453	648	259	583	0	648	0	1,231	0	0	259	194	259	0	194	**27,916**	1,749	8452
	±SE	*2,415*	*517*	*169*	*89*	*253*	*117*	*351*	*0*	*433*	*0*	*524*	*0*	*0*	*126*	*89*	*136*	*0*	*159*	***2,621***	*1,015*	*2270*
	2012	25,192	1,943	96	287	2,229	127	955	64	955	0	1,656	287	605	2,102	573	64	0	510	**37,644**	1,369	7102
	±SE	*4,275*	*454*	*76*	*188*	*1,113*	*101*	*475*	*53*	*406*	*0*	*679*	*122*	*388*	*860*	*279*	*50*	*0*	*354*	***4,663***	*439*	*1502*
	2013	17,188	4,520	1,432	191	1,114	859	446	0	509	0	923	223	1,146	573	0	64	0	127	**29,316**	3,342	5507
	±SE	*2,633*	*1,129*	*600*	*106*	*388*	*303*	*223*	*0*	*154*	*0*	*349*	*175*	*804*	*277*	*0*	*49*	*0*	*106*	***3,128***	*1,139*	*1672*
	2014	25,815	4,902	1,464	764	3,247	382	637	127	1,114	0	382	127	0	382	0	127	0	446	**39,915**	7,830	7639
	±SE	*5,350*	*1,707*	*469*	*349*	*1,768*	*254*	*454*	*69*	*420*	*0*	*175*	*59*	*0*	*181*	*0*	*71*	*0*	*171*	***5,963***	*3,075*	*1696*
	2015	21,581	4,520	1,210	318	1,973	64	318	0	637	32	191	477	0	318	668	159	0	764	**33,231**	3,247	5570
	±SE	*3,292*	*1,055*	*948*	*139*	*608*	*50*	*104*	*0*	*188*	*26*	*150*	*263*	*0*	*160*	*449*	*136*	*0*	*252*	***3,700***	*1,927*	*1071*
Potholes	2010	18,295	13,422	1,278	2,397	4,634	1,518	1,997	80	7,070	0	559	1,238	80	639	2,676	160	0	240	**56,284**	7,110	7829
	±SE	*4,436*	*3,261*	*393*	*712*	*1,481*	*636*	*497*	*83*	*1,861*	*0*	*276*	*529*	*86*	*355*	*1,280*	*122*	*0*	*142*	***6,281***	*2,310*	*2261*
	2011	16,888	8,160	873	1,527	2,356	611	2,967	0	3,753	262	2,007	436	87	785	7,637	262	0	262	**48,874**	7,288	14139
	±SE	*2,920*	*1,545*	*400*	*643*	*763*	*393*	*788*	*0*	*1,342*	*257*	*1,530*	*217*	*90*	*379*	*4,663*	*192*	*0*	*146*	***6,249***	*1,920*	*4420*
	2012	20,622	11,054	2,598	454	2,887	1,155	2,145	165	5,486	206	660	454	82	330	5,197	660	0	330	**54,691**	2,887	13487
	±SE	*3,609*	*2,580*	*978*	*168*	*596*	*412*	*500*	*164*	*1,749*	*167*	*337*	*278*	*81*	*250*	*3,560*	*646*	*0*	*238*	***6,164***	*600*	*3616*
	2013	21,564	9,854	2,515	495	5,937	536	2,062	0	8,494	247	1,855	165	82	165	3,876	165	82	247	**58,424**	15,709	11462
	±SE	*5,468*	*3,028*	*1,416*	*265*	*1,852*	*249*	*738*	*0*	*4,292*	*173*	*901*	*170*	*85*	*160*	*1,660*	*161*	*85*	*133*	***8,205***	*7,924*	*3661*
	2014	24,212	10,952	2,098	0	5,119	755	1,007	0	3,525	0	168	1,091	0	168	11,372	0	84	1,511	**62,061**	13,721	17246
	±SE	*5,842*	*2,805*	*708*	*0*	*1,696*	*334*	*527*	*0*	*1,267*	*0*	*111*	*634*	*0*	*114*	*9,417*	*0*	*86*	*871*	***11,715***	*7,770*	*5354*
	2015	24,367	13,895	3,463	1,649	6,350	495	1,484	165	3,876	0	82	3,834	82	330	19,626	0	0	247	**79,946**	7,092	19337
	±SE	*5,809*	*4,863*	*2,355*	*442*	*1,840*	*334*	*571*	*162*	*1,235*	*0*	*85*	*2,278*	*85*	*263*	*17,031*	*0*	*0*	*169*	***19,075***	*5,642*	*7525*
Highlands*	2009*	2,245	1,020	0	0	0	204	204	0	0	204	0	204	0	0	102	0	204	816	**5,204**	2,551	5919
	±SE	*383*	*294*	*0*	*0*	*0*	*47*	*59*	*0*	*0*	*59*	*0*	*59*	*0*	*0*	*29*	*0*	*71*	*142*	***521***	*736*	*1136*
	2012	10,582	832	238	79	238	238	396	0	357	0	0	198	159	238	0	79	79	1,704	**15,417**	436	8719
	±SE	*1,896*	*250*	*112*	*50*	*112*	*157*	*127*	*0*	*149*	*0*	*0*	*122*	*105*	*66*	*0*	*46*	*50*	*621*	***2,042***	*148*	*2810*
	2013	10,482	1,112	79	516	238	238	0	0	2,184	159	238	119	0	238	913	0	79	715	**17,311**	6,909	9608
	±SE	*3,617*	*514*	*53*	*176*	*107*	*112*	*0*	*0*	*1,449*	*105*	*146*	*51*	*0*	*146*	*606*	*0*	*49*	*209*	***3,997***	*3,939*	*4274*
	2014	10,697	3,526	317	0	832	317	238	0	1,426	79	713	2,060	317	1,189	2,853	158	0	1,585	**26,308**	10,539	13946
	±SE	*2,994*	*1,527*	*160*	*0*	*341*	*210*	*157*	*0*	*785*	*52*	*362*	*560*	*121*	*249*	*1,831*	*61*	*0*	*494*	***4,031***	*6,230*	*4323*
	2015	9,826	2,536	158	1,109	634	0	951	0	238	713	0	396	79	515	357	158	0	634	**18,304**	1,902	8439
	±SE	*2,608*	*1,009*	*64*	*394*	*420*	*0*	*574*	*0*	*130*	*472*	*0*	*184*	*55*	*301*	*236*	*110*	*0*	*124*	***2,989***	*701*	*1795*
Total - Eastern Washington	2010*	45,667	16,551	1,476	2,957	9,443	1,781	5,950	80	8,816	66	2,206	1,897	80	2,879	2,907	423	0	1,294	**104,473**	14,126	12474
	±SE	*7,364*	*3,335*	*400*	*770*	*2,663*	*649*	*1,501*	*83*	*1,940*	*52*	*637*	*551*	*86*	*970*	*1,286*	*168*	*0*	*455*	***6,281***	*3,631*	*2532*
	2011*	*37,679*	*9,909*	*1,456*	*1,981*	*3,004*	*870*	*3,550*	*0*	*4,401*	*262*	*3,238*	*436*	*87*	*1,045*	*7,831*	*521*	*0*	*456*	***76,790***	*9,036*	*22591*
	±SE	*3,789*	*1,629*	*435*	*649*	*804*	*410*	*862*	*0*	*1,410*	*257*	*1,618*	*217*	*90*	*400*	*4,664*	*235*	*0*	*216*	***6,249***	*2,172*	*4969*
	2012	56,396	13,829	2,932	820	5,354	1,520	3,496	229	6,798	206	2,316	938	846	2,670	5,770	803	79	2,544	**107,752**	4,693	29308
	±SE	*5,908*	*2,632*	*988*	*257*	*1,267*	*453*	*701*	*173*	*1,802*	*167*	*758*	*327*	*410*	*898*	*3,571*	*649*	*50*	*754*	***6,493***	*758*	*4820*
	2013	49,234	15,486	4,027	1,202	7,289	1,634	2,507	0	11,187	406	3,017	507	1,228	976	4,789	229	162	1,089	**105,051**	25,960	26577
	±SE	*7,065*	*3,273*	*1,539*	*336*	*1,895*	*408*	*771*	*0*	*4,533*	*202*	*977*	*250*	*808*	*352*	*1,767*	*169*	*98*	*270*	***9,127***	*8,922*	*5870*
	2014	60,724	19,380	3,879	764	9,198	1,454	1,881	127	6,065	79	1,263	3,279	317	1,738	14,224	286	84	3,541	**128,284**	32,091	38832
	±SE	*8,469*	*3,621*	*864*	*349*	*2,474*	*469*	*713*	*69*	*1,549*	*52*	*417*	*848*	*121*	*328*	*9,594*	*93*	*86*	*1,016*	***13,750***	*10,423*	*7088*
	2015	55,774	20,950	4,831	3,077	8,957	558	2,753	165	4,750	745	273	4,708	162	1,163	20,651	318	0	1,645	**131,482**	12,240	33347
	±SE	*7,168*	*5,077*	*2,540*	*608*	*1,983*	*337*	*816*	*162*	*1,256*	*473*	*173*	*2,301*	*101*	*430*	*17,039*	*175*	*0*	*328*	***19,659***	*6,003*	*7810*

*Highlands stratum survey methods changed in 2012 and are not comparable to previous years.

Table 5. Summary of western Washington breeding waterfowl population survey (2010-2015).

		Species																					
Region	**Year**	Mallard	Gadwall	American Wigeon	Green-winged Teal	Cinnamon Teal	Blue-winged Teal	Unclassified Teal	Northern Shoveler	Northern Pintail	Redhead	Canvasback	Scaup	Ring-necked Duck	Goldeneye	Bufflehead	Ruddy Duck	Common Merganser	Hooded Merganser	Wood Duck	**TOTAL DUCKS**	American Coot	Canada Goose
Chehalis Valley	2010	1,670	0	835	0	0	0	1,035	67	0	0	0	0	200	0	67	0	0	0	0	**3,875**	0	3708
	±SE	*511*	*0*	*777*	*0*	*0*	*0*	*776*	*62*	*0*	*0*	*0*	*0*	*99*	*0*	*50*	*0*	*0*	*0*	*0*	***1,217***	*0*	*3166*
	2011	1,569	58	291	1,104	0	232	494	58	0	0	0	58	1,511	0	349	0	349	0	58	**6,131**	0	174
	±SE	*705*	*59*	*294*	*372*	*0*	*231*	*318*	*59*	*0*	*0*	*0*	*59*	*1,040*	*0*	*170*	*0*	*346*	*0*	*45*	***1,455***	*0*	*148*
	2012	2,156	485	1,967	2,263	0	0	0	701	216	0	0	54	1,455	0	701	0	162	0	189	**10,347**	0	458
	±SE	*1,349*	*470*	*729*	*1,954*	*0*	*0*	*0*	*515*	*209*	*0*	*0*	*52*	*1,349*	*0*	*379*	*0*	*162*	*0*	*148*	***2,952***	*0*	*261*
	2013	1,652	103	0	1,678	52	155	52	155	0	0	0	0	52	0	361	0	0	0	310	**4,569**	129	929
	±SE	*675*	*70*	*0*	*1,304*	*54*	*112*	*42*	*149*	*0*	*0*	*0*	*0*	*50*	*0*	*257*	*0*	*0*	*0*	*92*	***1,509***	*146*	*736*
	2014	2,091	52	1,575	310	0	0	0	568	0	0	0	207	129	0	258	0	258	0	103	**5,550**	0	826
	±SE	*473*	*50*	*1,400*	*182*	*0*	*0*	*0*	*476*	*0*	*0*	*0*	*234*	*98*	*0*	*125*	*0*	*89*	*0*	*65*	***1,593***	*0*	*382*
	2015	2,281	53	610	212	159	0	0	159	0	0	0	796	133	0	159	0	371	0	159	**5,093**	0	875
	±SE	*790*	*51*	*554*	*151*	*153*	*0*	*0*	*105*	*0*	*0*	*0*	*903*	*89*	*0*	*128*	*0*	*239*	*0*	*59*	***1,375***	*0*	*266*
Hood Canal	2010	2,296	0	574	0	0	0	0	287	0	0	0	0	0	0	430	0	0	0	96	**3,683**	0	813
	±SE	*179*	*0*	*349*	*0*	*0*	*0*	*0*	*190*	*0*	*0*	*0*	*0*	*0*	*0*	*250*	*0*	*0*	*0*	*58*	***505***	*0*	*369*
	2011	2,779	0	0	0	0	0	192	0	0	0	0	0	511	0	447	0	0	0	128	**4,057**	0	511
	±SE	*629*	*0*	*0*	*0*	*0*	*0*	*114*	*0*	*0*	*0*	*0*	*0*	*189*	*0*	*171*	*0*	*0*	*0*	*127*	***700***	*0*	*287*
	2012	2,619	0	607	192	0	0	0	0	0	0	0	0	831	0	256	0	0	256	415	**5,175**	0	735
	±SE	*694*	*0*	*564*	*176*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*477*	*0*	*119*	*0*	*0*	*112*	*142*	***1,051***	*0*	*280*
	2013	2,080	63	0	63	0	0	126	0	0	0	0	0	63	0	851	0	126	126	126	**3,624**	0	851
	±SE	*494*	*58*	*0*	*59*	*0*	*0*	*129*	*0*	*0*	*0*	*0*	*0*	*59*	*0*	*435*	*0*	*116*	*116*	*67*	***701***	*0*	*152*
	2014	3,466	0	0	0	0	0	126	63	0	0	0	0	32	63	189	0	0	378	189	**4,380**	0	1008
	±SE	*1,022*	*0*	*0*	*0*	*0*	*0*	*129*	*64*	*0*	*0*	*0*	*0*	*30*	*58*	*120*	*0*	*0*	*153*	*127*	***1,052***	*0*	*423*
	2015	2,822	0	127	127	0	0	0	0	0	0	0	0	190	0	190	0	0	0	761	**4,090**	0	380
	±SE	*576*	*0*	*116*	*116*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*182*	*0*	*126*	*0*	*0*	*0*	*319*	***704***	*0*	*308*
Dungeness	2010	2,649	0	0	0	0	0	294	1,030	0	0	0	0	0	0	0	0	0	0	0	**3,974**	0	37
	±SE	*378*	*0*	*0*	*0*	*0*	*0*	*169*	*502*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	***650***	*0*	*24*
	2011	1,661	181	60	1,963	0	0	0	0	0	0	0	0	453	0	453	0	60	0	0	**4,832**	30	272
	±SE	*527*	*185*	*62*	*1,859*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*318*	*0*	*426*	*0*	*65*	*0*	*0*	***2,014***	*31*	*192*
	2012	2,053	755	0	1,027	0	0	0	60	0	0	0	272	0	0	302	0	0	0	30	**4,499**	0	423
	±SE	*885*	*737*	*0*	*840*	*0*	*0*	*0*	*65*	*0*	*0*	*0*	*252*	*0*	*0*	*99*	*0*	*0*	*0*	*33*	***1,452***	*0*	*300*
	2013	2,971	119	238	1,218	59	0	0	743	0	0	0	505	386	0	713	0	0	0	59	**7,011**	0	861
	±SE	*1,241*	*121*	*162*	*843*	*64*	*0*	*0*	*759*	*0*	*0*	*0*	*471*	*205*	*0*	*292*	*0*	*0*	*0*	*57*	***1,796***	*0*	*893*
	2014	3,162	716	0	1,581	0	0	0	0	60	0	0	0	627	0	1,074	0	0	239	60	**7,518**	0	1581
	±SE	*908*	*611*	*0*	*1,541*	*0*	*0*	*0*	*0*	*61*	*0*	*0*	*0*	*381*	*0*	*527*	*0*	*0*	*230*	*64*	***2,014***	*0*	*1128*
	2015	2,495	119	59	2,228	0	178	30	59	0	0	0	0	89	0	119	0	0	0	89	**5,466**	0	743
	±SE	*665*	*84*	*57*	*2,278*	*0*	*120*	*32*	*64*	*0*	*0*	*0*	*0*	*83*	*0*	*115*	*0*	*0*	*0*	*66*	***2,384***	*0*	*537*
South Puget Lowlands	2010	8,691	0	325	0	0	0	372	186	0	0	0	232	511	0	2,974	0	186	0	186	**13,664**	46	1859
	±SE	*1,549*	*0*	*215*	*0*	*0*	*0*	*175*	*148*	*0*	*0*	*0*	*163*	*282*	*0*	*424*	*0*	*131*	*0*	*121*	***1,678***	*40*	*390*
	2011	8,926	509	2,067	1,438	60	120	779	3,175	0	0	0	0	1,048	0	1,917	0	0	120	659	**20,818**	150	1647
	±SE	*1,307*	*538*	*1,635*	*596*	*55*	*76*	*629*	*3,193*	*0*	*0*	*0*	*0*	*380*	*0*	*554*	*0*	*0*	*78*	*466*	***4,037***	*91*	*397*
	2012	15,127	60	449	300	0	0	0	899	60	0	0	120	3,295	0	2,426	0	60	30	539	**23,364**	30	3684
	±SE	*3,569*	*61*	*283*	*218*	*0*	*0*	*0*	*589*	*61*	*0*	*0*	*125*	*1,153*	*0*	*585*	*0*	*56*	*28*	*221*	***3,868***	*28*	*1163*
	2013	10,274	734	499	2,495	0	0	59	2,789	0	0	0	0	2,407	59	2,671	0	59	176	822	**23,043**	29	2436
	±SE	*1,520*	*777*	*528*	*1,365*	*0*	*0*	*62*	*1,977*	*0*	*0*	*0*	*0*	*1,098*	*54*	*624*	*0*	*62*	*93*	*288*	***3,265***	*27*	*880*
	2014	7,359	0	493	0	0	0	92	954	0	0	0	0	431	0	985	0	185	62	1,293	**11,854**	31	3664
	±SE	*932*	*0*	*392*	*0*	*0*	*0*	*95*	*600*	*0*	*0*	*0*	*0*	*227*	*0*	*417*	*0*	*109*	*61*	*182*	***1,291***	*28*	*878*
	2015	9,347	302	60	484	423	0	60	393	0	0	0	1,025	938	0	726	0	181	181	1,119	**15,245**	151	4295
	±SE	*1,680*	*208*	*63*	*374*	*433*	*0*	*64*	*260*	*0*	*0*	*0*	*627*	*307*	*0*	*249*	*0*	*101*	*132*	*315*	***1,986***	*106*	*924*
North Puget Lowlands	2010	20,220	2,087	2,534	2,981	0	0	9,290	6,459	795	0	0	0	447	0	1,292	0	99	0	99	**46,303**	99	696
	±SE	*1,760*	*710*	*1,117*	*1,353*	*0*	*0*	*5,424*	*2,446*	*351*	*0*	*0*	*0*	*130*	*0*	*429*	*0*	*66*	*0*	*66*	***6,513***	*46*	*253*
	2011	10,026	375	2,592	6,820	0	239	2,933	2,183	0	0	0	68	1,057	0	1,091	0	784	68	614	**28,850**	0	1364
	±SE	*2,061*	*205*	*1,804*	*4,074*	*0*	*236*	*1,490*	*1,674*	*0*	*0*	*0*	*68*	*600*	*0*	*476*	*0*	*388*	*68*	*215*	***5,479***	*0*	*430*
	2012	11,034	532	199	399	0	66	66	798	266	0	0	665	931	0	1,363	0	332	0	1,130	**17,781**	0	2626
	±SE	*1,515*	*321*	*194*	*250*	*0*	*67*	*68*	*645*	*198*	*0*	*0*	*648*	*478*	*0*	*346*	*0*	*204*	*0*	*439*	***1,991***	*0*	*571*
	2013	7,869	150	449	1,107	60	0	539	180	748	0	0	0	60	60	479	0	209	0	1,316	**13,224**	0	1316
	±SE	*1,692*	*74*	*306*	*695*	*60*	*0*	*478*	*176*	*753*	*0*	*0*	*0*	*42*	*56*	*244*	*0*	*110*	*0*	*463*	***2,137***	*0*	*348*
	2014	9,664	60	180	2,693	120	0	0	1,885	359	0	0	329	180	0	509	0	2,513	120	957	**19,567**	0	3022
	±SE	*1,955*	*59*	*92*	*2,594*	*75*	*0*	*0*	*695*	*312*	*0*	*0*	*266*	*147*	*0*	*283*	*0*	*1,956*	*114*	*344*	***3,908***	*0*	*1238*
	2015	13,673	1,107	2,992	6,403	838	60	120	1,795	598	0	0	120	987	60	1,047	30	778	30	1,137	**31,773**	0	4488
	±SE	*3,393*	*517*	*1,581*	*3,689*	*433*	*56*	*83*	*955*	*504*	*0*	*0*	*113*	*319*	*60*	*524*	*29*	*541*	*29*	*312*	***5,481***	*0*	*1379*
Total - Western Washington	2010	35,526	2,087	4,268	2,981	0	0	10,992	8,029	795	0	0	232	1,159	0	4,763	0	285	0	381	**71,498**	146	7112
	±SE	*2,436*	*710*	*1,421*	*1,353*	*0*	*0*	*5,485*	*2,510*	*351*	*0*	*0*	*163*	*326*	*0*	*655*	*0*	*146*	*0*	*149*	***6,884***	*61*	*3221*
	2011	24,961	1,124	5,010	11,325	60	591	4,397	5,416	0	0	0	126	4,581	0	4,257	0	1,193	188	1,459	**64,688**	180	3969
	±SE	*2,670*	*607*	*2,454*	*4,533*	*55*	*339*	*1,652*	*3,606*	*0*	*0*	*0*	*90*	*1,312*	*0*	*879*	*0*	*524*	*103*	*530*	***7,279***	*96*	*695*
	2012	32,989	1,832	3,223	4,180	0	66	66	2,457	541	0	0	1,110	6,511	0	5,047	0	554	285	2,303	**61,166**	30	7925
	±SE	*4,256*	*933*	*983*	*2,160*	*0*	*67*	*68*	*1,017*	*294*	*0*	*0*	*708*	*1,899*	*0*	*793*	*0*	*266*	*115*	*533*	***5,555***	*28*	*1384*
	2013	24,845	1,169	1,185	6,561	171	155	775	3,866	748	0	0	505	2,968	119	5,075	0	394	302	2,634	**51,470**	158	6394
	±SE	*2,722*	*795*	*632*	*2,182*	*103*	*112*	*501*	*2,130*	*753*	*0*	*0*	*471*	*1,120*	*78*	*889*	*0*	*171*	*148*	*560*	***4,607***	*149*	*1503*
	2014	25,742	828	2,247	4,584	120	0	92	3,470	419	0	0	536	1,398	63	3,015	0	2,956	798	2,603	**48,869**	210	10101
	±SE	*2,604*	*616*	*1,457*	*3,022*	*75*	*0*	*95*	*1,036*	*318*	*0*	*0*	*354*	*478*	*58*	*750*	*0*	*1,961*	*305*	*419*	***4,964***	*117*	*1975*
	2015	30,618	1,581	3,722	9,454	1,420	238	210	2,407	598	0	0	1,944	2,337	60	2,241	30	1,331	211	3,265	**51,668**	211	10782
	±SE	*3,966*	*566*	*1,678*	*4,356*	*631*	*132*	*109*	*997*	*504*	*0*	*0*	*1,105*	*494*	*60*	*618*	*29*	*599*	*135*	*554*	***6,485***	*123*	*1791*

Table 6. Summary of statewide Washington breeding waterfowl population survey (2010-2015).

Species	2010	SE	2011	SE	2012	SE	2013	SE	2014	SE	2015	SE
Mallard	81,193	7,757	62,640	4,635	89,385	7,281	74,079	7,571	86,466	8,860	86,392	8,192
Gadwall	18,638	3,410	11,033	1,739	15,660	2,793	16,654	3,368	20,208	3,673	22,532	5,108
American Wigeon	5,744	1,476	6,465	2,492	6,154	1,394	5,212	1,663	6,126	1,694	8,553	3,044
Am. Green-winged Teal	5,938	1,556	13,306	4,579	5,000	2,175	7,763	2,208	5,348	3,042	12,530	4,398
Cinnamon Teal	9,443	2,663	3,064	806	5,354	1,267	7,460	1,898	9,318	2,475	10,377	2,081
Blue-winged Teal	1,781	649	1,461	532	1,587	458	1,789	423	1,454	469	797	362
Unclassified Teal	10,992	5,485	4,462	1,653	273	177	857	507	92	95	210	109
Northern Shoveler	13,978	2,924	8,966	3,707	5,954	1,235	6,373	2,265	5,352	1,258	5,160	1,289
Northern Pintail	875	361	0	0	770	341	748	753	546	326	763	529
Redhead	8,816	1,940	4,401	1,410	6,798	1,802	11,187	4,533	6,065	1,549	4,750	1,256
Canvasback	66	52	262	257	206	167	406	202	79	52	745	473
Scaup	2,439	657	3,364	1,620	3,426	1,037	3,522	1,085	1,799	547	2,217	1,118
Ring-necked Duck	3,056	640	5,017	1,330	7,450	1,927	3,475	1,148	4,676	974	7,045	2,353
Goldeneye	80	86	87	90	846	410	1,347	812	380	134	222	118
Bufflehead	7,642	1,170	5,302	966	7,717	1,198	6,051	956	4,754	819	3,405	753
Ruddy Duck	2,907	1,286	7,831	4,664	5,770	3,571	4,789	1,767	14,224	9,594	20,681	17,039
Common Merganser	709	223	1,714	574	1,357	702	623	240	3,242	1,963	1,648	624
Hooded Merganser	0	0	188	103	365	125	464	178	882	317	211	135
Wood Duck	1,675	479	1,915	573	4,847	923	3,723	622	6,144	1,099	4,911	644
TOTAL DUCKS	175,971	11,427	141,478	9,945	168,918	9,734	156,521	10,691	177,154	14,619	193,149	20,701
American Coot	14,272	3,632	9,216	2,174	4,723	759	26,118	8,923	32,301	10,424	12,451	6,004
Canada Goose	19586	4097	26560	5017	37234	5015	32972	6060	48933	7358	44128	8013

Western Washington not surveyed in 2009. NE Highlands not included in 2010-2011 due to different survey methods.

Table 7. Weighted duck brood indices by species for the Potholes, Palouse, and Northeast strata, 2003-2014.

													03-14	% change from	
Species	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Avg**	**2014**	**Average**
Mallard	1260	1284	1221	1200	1786	1419	1416	1035	1042	966	1597	2706	1017	1411	-62%	-28%
Gadwall	299	116	15	107	132	292	87	87	379	274	284	204	383	190	88%	102%
Wigeon	170	95	146	54	54	48	43	10	35	26	26	0	0	59	0%	-100%
Green-winged teal	158	14	26	118	94	151	183	176	233	272	244	204	179	156	-12%	15%
Blue-winged teal	212	92	26	15	0	42	48	0	30	47	101	26	51	53	96%	-4%
Cinnamon teal	48	24	40	14	103	91	14	138	30	82	0	103	102	57	-1%	78%
Northern shoveler	238	63	0	29	15	59	44	49	19	19	19	0	25	46	0%	-46%
Northern pintail	158	20	0	0	0	0	0	0	0	14	0	0	0	16	0%	-100%
Wood duck	14	42	33	82	107	28	28	42	33	112	141	153	77	68	-50%	13%
Redhead	267	40	0	121	211	252	154	94	184	210	205	383	383	177	0%	117%
Canvasback	128	26	15	65	26	90	0	32	0	77	14	51	51	44	0%	17%
Scaup	82	0	0	20	14	21	94	17	34	0	26	102	76	34	-25%	123%
Ring-necked duck	26	85	0	108	26	50	14	86	23	14	26	51	77	42	51%	82%
Goldeneye	26	266	163	438	444	412	331	275	391	231	138	332	255	287	-23%	-11%
Bufflehead	26	0	26	0	40	14	24	43	14	26	179	0	0	32	0%	-100%
Scoter	0	0	0	0	0	0	0	0	0	0	26	0	0	2	0%	-100%
Ruddy duck	167	86	110	201	222	219	183	104	86	218	298	332	492	186	48%	165%
Merganser	14	15	0	128	204	77	77	65	56	40	82	102	154	72	51%	115%
TOTAL BROODS	3089	3166	1819	4085	3477	3265	2741	2253	2588	2626	3402	4749	3322	3105	-30%	7%

Table 8. Weighted duck brood indices for E. Washington strata and total unweighted brood counts for the Columbia Basin.

Year	Channeled Scablands	Okanogan	Northeast	Palouse	Total Broods	Columbia Basin
1979	6274	420	868	195	7757	
1980	2598	936	715	33	4281	
1981	4435	1041	485	98	6059	
1982	2296	1131	1123	423	4973	
1983	3349	1080	715	293	5437	
1984	4806	1123	791	195	6915	
1985	6133	1614	1123	325	9196	
1986	4743	965	842	293	6843	
1987	4574	1206	1072	325	7177	
1988	1557	1112	749	434	3851	
1989	2395	1023	894	358	4669	
1990	1099	946	894	130	3068	
1991	246	472	1506	130	2355	
1992	317	434	1021	390	2163	
1993	1232	590	613	390	2825	
1994	2587	672	928	130	4316	
1995	555	504	689	195	1943	160
1996	3922	554	945	228	5649	218
1997	1703	1345	1864	184	5095	179
1998	5193	1837	894	163	8086	279
1999	2816	1362	715	163	5055	170
2000	2898	239	536	163	3836	192
2001	2993	423	715	65	4196	167
2002	2360	139	460	65	3024	137
2003	2011	295	919	65	3291	164
2004	440	905	791	130	2266	147
2005	328	482	945	65	1819	178
2006	450	986	1200	65	2701	178
2007	435	984	1864	195	3477	160
2008	945	1413	842	65	3265	61
2009	860	1160	689	33	2741	64
2010	703	854	664	33	2253	51
2011	1155	890	511	33	2588	61
2012	1018	731	842	98	2626	78
2013	1111	1376	817	No Survey	3402	47
2014	759	1633	918	No Survey	3310	76
2015	357	1889	970	26	3242	81
LTA	2258	913	893	181	4236	138
2015 vs. 2014	-53%	16%	6%	-73%	-2%	7%
2015 vs. LTA	-84%	107%	9%	-86%	-23%	-41%

Table 9. Goose nest survey areas in Washington

Survey Area	Year Survey Initiated	Agency Conducting Survey	Frequency of Survey
UPPER COLUMBIA			
Hanford	<1974	WDFW	Biennial
Priest Rapids	<1974	WDFW	Biennial
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
Rufus Woods	1981	Army Corps	Annual
Mouth of Yakima	<1974	WDFW	Biennial
SNAKE RIVER			
Snake River	1975	Army Corps	Annual
Snake River Cliff	1979	Army Corps	Discontinued
MID COLUMBIA			
McNary	<1974	USFWS	Discontinued
John Day	<1974	Umatilla NWR	Biennial
Dalles	<1974	Army Corps	Periodic
Bonneville	1982	Army Corps	Periodic
Tri-Cities	1982	WDFW	Biennial
COLUMBIA BASIN			
Moses Lake	1981	WDFW	Biennial
Potholes Res.	1981	WDFW	Biennial
Lenore, Alkali, Park	1981	WDFW	Periodic
LOWER COLUMBIA			
I-5 to Bonneville	1981	Army Corps	Periodic
I-5 to Puget Island	1981	WDFW	Annual, Biennial starting in 2012

Table 10. Number Canada goose nest counted per region (1974-2015), and total Canada geese observed on duck surveys.

	Canada Goose Nests							Total Geese observed during breeding duck surveys		
Year	**Upper Columbia**	**Snake River**	**Mid Columbia**	**Columbia Basin**	**E WA Total**	**Lower Columbia**	**TOTAL**	**E WA Ground**	**E WA Aerial**	**W WA Aerial**
1974	279		363		642		642			
1975	297	50	344		691		691			
1976	310	51	345		706		706			
1977	358	51	384		793		793			
1978	329	51	330		710		710			
1979	303	87	292		682		682	2570		
1980	393	112	339		844		844	1925		
1981	500	145	318	249	1212	14	1226	4053		
1982	509	160	480	484	1633	15	1648	1203		
1983	656	171	520	541	1888	15	1903	3225		
1984	618	132	466	601	1817	15	1832	2305		
1985	630	150	500	757	2037	131	2168	6674		
1986	641	136	507	765	2049	73	2122	5225		
1987	745	130	670	702	2247	354	2601	7938		
1988	794	229	723	742	2488	353	2841	5426		
1989	799	227	627	500	2153	527	2680	5605		
1990	808	180	634	518	2140	527	2667	16695		
1991	923	199	637	414	2173	645	2818	8483		
1992	916	236	633	538	2323	531	2854	9483		
1993	858	319	629	628	2434	664	3098	9190		
1994	806	290	662	595	2353	589	2942	9396		
1995	929	261	702	477	2369	600	2969	15017		
1996	944	236	777	501	2458	544	3002	12758		
1997	798	210	711	676	2395	575	2970	13019		
1998	744	210	693	610	2257	522	2779	11199		
1999	783	187	811	315	2096	462	2558	22598		
2000	797	207	816	313	2133	424	2557	23449		
2001	790	214	835	539	2378	496	2874	13307		
2002	751	199	872	629	2451	449	2900	17179		
2003	793	199	782	374	2148	450	2598	17596		
2004	728	199	782	350	2059	478	2537	19137		
2005	626	199	689	584	2098	468	2566	13022		
2006	593	248	753	544	2138	499	2637	19253		
2007	489	217	734	442	1882	422	2304	13244		
2008	451	197	727	485	1860	454	2314	16342		
2009	461	243	749	594	2047	422	2469	14858	25364	
2010	493	241	750	544	2028	403	2431	12014	12782	
2011	499	259	725	599	2082	415	2497	16511	20993	4045
2012	462	255	728	628	2073	412	2485		28347	8231
2013	549	199	803	687	2238	412	2650		26577	6394
2014	508	263	814	624	2209	376	2585		38832	10101
2015	**593**	**263**	**891**	**762**	**2509**	**376**	**2885**		**33347**	**10782**
2015 vs. 2014	17%	0%	9%	22%	14%	0%	12%		-14%	7%
Long Term Avg.	626	189	626	546	1888	404	2223		25483	7193
2015 vs. LTA	-5%	39%	42%	40%	33%	-7%	30%		31%	50%

WATERFOWL: WINTER POPULATIONS AND HARVEST STATUS AND TREND REPORT
STATEWIDE

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Introduction
This report summarizes the 2014-15 Washington winter waterfowl surveys, waterfowl hunting regulations, waterfowl harvest, and waterfowl hunter trends. This summary compares current data with data collected over the past 30 years in the state as well as the Pacific Flyway. These data are part of a long-term database archived by the Washington Department of Fish and Wildlife (WDFW) Waterfowl Section. Several of the data sets extend back to the late 1940s.

Population surveys
Methods
The primary survey to determine status of wintering waterfowl throughout the Pacific Flyway is the January Midwinter Waterfowl Survey (MWS). This is a coordinated, comprehensive survey of the most important waterfowl wintering areas, using a combination of standardized surveys from fixed-winged aircraft and ground observation locations. The MWS is a combined effort among several agencies, including WDFW, ODFW, Yakama Nation, USFWS, and Canadian Wildlife Service.

WDFW also conducts special winter surveys focused on sea ducks during December and January, as part of the Puget Sound Ecosystem Monitoring Program (PSEMP). Consistent winter aerial surveys of greater Puget Sound began in 1993-94, and have been conducted each year since then (except for 2006-07, due to funding limitations). Survey methods have been peer reviewed by a science panel as part of PSEMP. These surveys sample the entire marine shoreline and open water areas using six depth strata. The transects annually cover 7% to 8% of the marine waters in Puget Sound and the Strait of Juan de Fuca, totaling between 6,400-7,100 km of transects. Population estimates from these surveys represent minimum estimates because observers are not able to detect all birds present within the transect strip, due to environmental conditions (e.g. glare, waves) and reactions of some species to aircraft (e.g. diving, flight).

Because the MWS does not capture migration peaks or patterns of habitat use throughout the fall/winter, additional fixed-wing and ground surveys take place in key wintering areas from October–March. Specific age structure surveys also take place in the north Puget Sound area for snow geese, brant, and swans, along standard ground observation routes.

Midwinter Waterfowl Survey Results
WDFW, tribal, and U.S. Fish and Wildlife Service (USFWS) personnel completed the MWS in January 2015. Washington's midwinter index for total waterfowl was estimated at 876,294, a decrease of 15% from the previous year, but no change (0%) from the 10-year average (2005-2014; Table 1).

The 2015 Pacific Flyway midwinter index for total waterfowl was 6.69 million. This represents a16% increase from 2014 (5.88 million), and 1.1% above the long-term average (1955-2014).

Ducks--The 2015 midwinter index for total ducks in the 12 Pacific Flyway states was 6.2 million (Fig. 1), an increase of 37% from the 2014 count (4.5 million) and 11% above the long-term average (1955-2014).

In Washington, the 2014 total wintering duck population was 761,039, down 12% from 2014 levels and 5.4% below the 10-year average (Fig. 2). The Washington total duck count represented 12.2% of the Pacific Flyway wintering population, 2% lower than the state's 10-year average (Fig. 3). The 1991 MWS represents the highest ratio of Washington ducks to total Pacific Flyway (28.6%).

The 2015 mallard total for the Pacific Flyway was 703,627, down 21.3% from 2014 and 53.7% below the long-term average (1955-2014). The total number of mallards counted in Washington in 2014 was 381,428, a 28% decrease from the previous year, and only 2% above the 10-year average (Table 1). Washington typically holds a high percentage of the Pacific Flyway mallard population, with a 10-year average of 41% (Fig. 4). In 2015, Washington held 54% of the Pacific Flyway mallards during the MWS.

Results for special Puget Sound winter surveys are presented in Table 2. The current 3-year average for scoters is 54,239, which has declined significantly from the 1994-96 average of 107,214.

Canada geese--Canada geese are often not well represented in midwinter surveys as they forage in widespread agricultural areas, making them difficult to locate during aerial surveys. Wintering Canada goose numbers began to build in the 1990s, when the MWS first indexed over 400,000 geese. The 2015 MWS total for Canada geese in the Pacific Flyway was 221,191. The count decreased 64.0% from 2014, and was 37.9% below the long-term average.

The number of Canada geese wintering in Washington has been variable over the past 20 years. Canada geese numbered over 90,000 during the winter of 1998-99 and 2000-01. The 2015 total of 35,564 was down 59% from 2014 and 29 % below the 10-year average (Table 1, Fig. 5).

Snow geese--The northern population of snow geese that over-winter in Skagit, Snohomish, and Island counties of NW Washington and the Fraser River Delta, B.C. nest primarily on Wrangel Island, Russia. Juvenile snow geese comprised 8.5% of the wintering population in the Fraser and Skagit River Deltas in December 2014. MWS snow goose aerial photo counts by WDFW in late December 2014 numbered 64,712. This represents a 7% decrease over the December 2014 count of 69,685 and 6.5% below the 10-year average (Table 3, Fig. 6). There was no report in 2014 regarding nesting conditions at Wrangel Island's Tundra River colony.

Brant--The number of brant counted in Washington during the 2014 midwinter survey was 10,706, a 39% decrease from 2014, and 41% below the 10-year average (Table 1, Fig. 7). The number of brant counted during the northern Puget Sound midwinter aerial survey on December 30, 2014 was 6,975; a decrease of about 33% from 2013. The largest concentrations of brant were in Lummi, Padilla, and Samish bays.

No breast color measurements were taken from brant in Skagit County because the season was closed in 2014-15. Since 2006, the WHA harvest composition has ranged from 21-75%.

Swans--The 2015 northern Puget Sound (Island, King, San Juan, Skagit, Snohomish, and Whatcom counties plus Sumas Prairie, BC) trumpeter swan MWS totaled 14,040 (Table 3), a 24% increase from the 2014 count of 11,352. Table 3 includes 341 trumpeters observed in Sumas Prairie, B.C. Juveniles accounted for 18.9% of the trumpeters observed (Table 3). The 2014 northern Puget Sound tundra swan midwinter index was 1,643, increasing 71% from the 2014 index (959). Juveniles represented 13.7% of the population (Table 3).

Since 1999, trumpeter swans and, to a lesser degree, tundra swans wintering in northwestern Washington and southwestern British Columbia have experienced high rates of mortality due to ingestion of lead shot pellets. Of the 2,332 carcasses collected from 2000-2011, the majority of deaths were lead-related (66%). An average of 18 lead and 7 steel pellets were recovered per gizzard of lead-exposed swans (n=1,736 gizzards, 43,767 pellets). From 2001-2005, a total of 315 trumpeter and tundra swans were trapped and blood samples collected for lead residue analysis. Trumpeter swans were outfitted with VHF radio transmitters (n=243) or satellite transmitters (n=6); 61 tundra swans were fitted with neck collars. Locations of radio-tagged swans were used to identify primary forage and roosting areas. Judson Lake, a major roost site on the Washington/British Columbia border, was identified as a potential source of lead shot ingestion. During the winters of 2006-2009, active hazing activities were used to discourage swans from using the lake. The successful hazing of swans from Judson Lake coincided with an approximate 70% reduction in lead-caused swan mortalities during the first 3 winters (average 67 lead-related mortalities in 2006-09) when compared to the average of 227 lead-related mortalities per year over the previous five years (2001-06). Starting in 2009 hazing at Judson Lake focused on the area of highest lead shot concentration. Bamboo poles and fencing prevented swans from landing in the exclusion area, while allowing them use of about 50% of the lake. The barrier system was successful in excluding swans without an appreciable increase in lead related swan mortality or any swan injuries due to the barrier system. In 2014-15, a total of 235 trumpeter swan mortalities were recovered in northern Puget Sound and the Sumas Prairie, of which 50 were suspected to be from lead poisoning.

Periodic Aerial Survey Results

Aerial waterfowl surveys in northern Puget Sound were accomplished by WDFW. Surveys in the Columbia Basin were conducted cooperatively between USFWS and WDFW (Table 3).

North Puget Sound--The North Puget Sound January 2015 aerial survey totaled 230,009 dabbling ducks. The record high count for this area took place in December 2006 (n=974,180). Waterfowl frequently move between the Fraser River Delta and Boundary Bay, B.C. depending on weather conditions, resulting in high variability in the North Puget Sound survey.

Eastern Washington—MWS results for eastern Washington totaled 488,439 waterfowl. Results of other periodic surveys in the Columbia and Yakima basins are presented in Table 3.

Long-term monitoring of small Canada geese (Lesser and Taverner's) staging on Stratford (Brooke) Lake and Round Lake has taken place since the early 1970s. These lakes are located near the town of Stratford in central Grant County. Both lakes are on private property and are not hunted. Population trends of Washington's small Canada geese have not been well documented because they forage in widespread agricultural areas and are mixed with other subspecies, making them difficult to survey from the air. October staging surveys were originally aerial counts but switched to ground counts in 2006. Survey results (1976-2015) are presented in Figure 8, with 1,050 counted in 2015. The highest historical count was 80,050 in 1984. This population is of concern due to past high harvest return rates of geese in the Columbia Basin that were banded in Alaska. Biologists in WDFW Region 2 have made an effort in recent years to capture and band staging small Canada geese using rocket nets. It is though the very low counts in 2015 area result of the implementation of a new water feed route through the lakes that has eliminated many of the preferred staging areas for small Canada geese. It is not known at this time where these populations may have shifted to.

Hunting Season Regulations

The 2014-15 waterfowl harvest was regulated under Washington State regulations (Table 4). The federal framework allowed the maximum (107 days) number of days under the Migratory Bird Treaty Act. Washington's season length was 105 days statewide with two additional days for the statewide Youth Hunt on Sept. 20-21. The daily bag-limit was 7 ducks, to include not more than 2 hen mallard, 2 pintail, 3 scaup, 1 canvasback, and 2 redhead statewide; and to include not more than 1 harlequin (season limit), 2 scoter, 2 long-tailed duck, and 2 goldeneye in western Washington (Table 4).

Substantial waterfowl populations in the Pacific Flyway over the last 15 years have allowed for liberal seasons and bag limits (Table 5). The season lengths between 1988-89 and 1993-94 were the most restrictive since 1950. Current regulations are among the most liberal ever offered in Washington and beginning last season hunters could retain three times the daily bag in their possession for most waterfowl (Table 5).

WDFW instituted a new license format for the 1999-00 hunting season. A small game license and big game license replaced a general hunting license. For people who hunted a variety of small game species, there was little change in total costs. For people who hunted waterfowl exclusively, the new format resulted in an increase in cost. Before the 2002-03 hunting season, the cost of a migratory bird validation increased from $6.00 to $10.00 (excluding transaction and dealer fees). A 10% surcharge was added to all WDFW licenses in 2009-10 and 2010-11. The validation was replaced with a migratory bird permit in 2011, and the cost was raised to $15.00. Beginning in 2011-12, hunters of brant and snow geese in Goose Management Area 1, sea ducks in western Washington, and all geese in SW Washington were required to purchase a special $13 migratory bird authorization to obtain harvest record cards for these species (harvest record cards were free before then). The federal migratory bird stamp remained at $15.00 (Table 5).

Goose hunting regulations are structured to protect declining populations of 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 2014-15 (Fig. 9).

Prior to 1984, the goose season length in southwest Washington was 93 days, with bag/possession limits of 3/6. Since that time, the season has evolved to 1) conserve the dusky goose subspecies, which has declined in numbers since the 1970s; 2) provide control of agricultural damage resulting from higher numbers of other Canada geese in the area; and 3) provide recreational opportunity. Historic season regulations for SW Washington are presented in Table 6. A special late season damage control hunt initiated in 1995-96 was continued in Area 2A during 2014-15. The season was open Saturdays and Wednesdays during February 4 – March 8, 2015 with a season quota of 5 dusky geese for the area. The season was open to WDFW Master Hunters and youth hunters.

For the 2014-15 season, the Aleutian goose daily bag limit was 1 in Area 2B, but 4 in all other areas. Previously listed as both a federal and state endangered species, Aleutian Canada goose populations have experienced strong population growth in recent years and have caused crop and pasture depredation complaints in coastal agricultural areas, mainly in Oregon and California.

Agricultural depredation by snow geese in Skagit County led to the development of the Snow Goose Quality Hunt Program on Fir Island. Thousands of acres were available as Feel Free to Hunt or Register to Hunt. Numerous complaints of public safety concerns due to unethical snow goose hunting led to special restrictions in Skagit County. Hunters were restricted from discharging a firearm within 100 feet of any paved public road for the purpose of hunting snow geese anywhere in Skagit County. Violation of these rules, trespass, exceeding the snow goose bag limit, or shooting across a paved road resulted in invalidation of the hunter's snow goose authorization for 2014-15 and the subsequent season.

The January-only brant season took place in 2015, with 10 hunt days in Pacific County (Table 4). However, the Skagit County brant hunt is dependent on a pre-season count of at least 6,000 brant. On December 30, 2014, the Skagit County MWS estimated only 3,730 brant. The count was conducted again on January 3, 2015 and estimated 3,585 brant. The 8 day season in Skagit County was then cancelled to protect wintering brant (Table 3).

Harvest surveys

Methods

Harvest estimates were based on the Small 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 county. The species composition of the waterfowl harvest was derived from a Daily Waterfowl Harvest Report Card Survey. In this survey, cards were sent to 2,500 waterfowl hunters prior to the start of the season to record the species of the birds they bagged. These data were used to tabulate the species composition of the waterfowl harvest.

Because statewide surveys are not accurate enough to measure harvest of several priority waterfowl species, special surveys have been developed that utilize written hunting authorizations and mandatory reporting. The sea duck (harlequin, scoter and long-tailed duck), brant, and snow goose harvest is estimated annually using a mandatory harvest report card for each species. Written authorization and harvest reports have been required of sea duck hunters in all of western Washington since 2004, brant hunters in all hunt areas since 1990, and snow goose hunters in the primary harvest area (Skagit, Island, Snohomish counties) since 1993. Hunters must return a harvest report card in order to be included in the permit mailing the following year. Starting in 2012-13, hunters failing to turn in their harvest reports were charged a $10 administrative fee to obtain a harvest report card the following year. Reminder notices were sent out to hunters via email and postcards, reminding them to return reports by the deadline. Hunters were required to report harvest by species and county with mandatory harvest report cards by February 15, 2015. Harvest reports returned by the deadline are included in the analysis as the "first wave" of respondents. A special telephone survey of non-respondents was conducted in 2015 through Washington State University, and then the harvest estimates were computed accounting for non-response bias.

The harvest of dusky Canada geese is determined at mandatory hunter check stations in southwest Washington. During 1991-95, WDFW used a key developed by USFWS (Ridgefield NWR) to estimate dusky harvest based on culmen, total tarsus, age, and sex. Beginning in 1996, WDFW used standardized criteria for classifying duskys, where a dusky was classified as a dark-breasted Canada goose (Munsell $\leq$5) with a culmen length of 40-50 mm. Cacklers were classified at the check stations using culmen measurements of $\leq$32 mm. Total tarsus, age, and sex were taken from other geese with culmen >32 mm and <50 mm. The key was then applied via subsequent data analysis to determine subspecies for geese other than duskys and cacklers. Dark geese (Munsell $\leq$5) with culmen >50 mm were classified as Vancouver Canada geese.

WDFW continued enhanced goose hunter training for people who wish to hunt geese in areas 2A and 2B. The training program was initially developed in 1996, and revised in 1997 in conjunction with Oregon DFW. In this program, hunters study a goose identification workbook and are advised to view a training videotape. The study materials, including the video, are available from the WDFW website. The workbook is also available through regular mail from WDFW and the video can also be purchased from a vendor. Originally, hunters took a 40 question written test at one of eight testing locations and could choose from several testing dates. In 2007-08, WDFW provided the opportunity to take tests online, and by appointment at WDFW offices. Hunters are required to pass the test with a minimum score of

80%. Hunters who fail the test are required to wait 28 days before retesting.

Waterfowl Harvest Survey Results

The 2014-15 Washington waterfowl harvest of 549,089 increased 17% from the 2013-14 harvest of 469,429. The 2014-15 duck harvest of 480,774 increased 18% from the 2013-14 harvest of 407,925. The duck harvest in Washington declined steadily from over 1,000,000 in the late 1960s, to a low of 242,516 in 1993-94 (Fig. 10). Duck harvest rates in Washington have stabilized over the past 10 years, averaging approximately 427,000 birds annually.

Mallards comprised 54% of Washington's 2014-15 harvest, followed by American wigeon (17%), American green-winged teal (9%), and northern pintail (7%) (Table 7).

The total goose harvest for 2014-15 was 68,315, up 11% from the 2013-14 harvest of 61,504. A record low harvest of 26,479 occurred in 2004-05; the record high harvest (72,721) occurred in 2006-07. During recent years, the presence of resident large Canada geese has increased in Washington, which has contributed to an overall increasing trend in harvest (Fig. 11). The 2014-15 large Canada goose harvest (38,869) was up 16% from the previous year and 48% above the long-term average.

The harvest of small Canada geese in 2014-15 (15,279) decreased 23% from the previous year, and fell 40% below the long-term average (Fig. 11). The highest recorded harvest of small Canada geese in Washington was 47,270 in 1979-80. The lowest harvest (8,880) took place in 2003-04. The reasons for the dynamic small goose harvest are uncertain.

Waterfowl harvest is summarized by WDFW administrative regions in Table 8 and Fig. 12. Region 2 has traditionally represented the highest percentage of the state's waterfowl harvest. However, for the 2014-15 season, Region 4 accounted for 25% of the harvest followed by Regions 2 (22%) and 3 (19%). The proportion of duck harvest was highest in Region 4 (26%), followed by Regions 2 (24%) and 3 (21%). Region 2 accounted for the highest proportion of goose harvest (31%), followed by Regions 3 (21%), and 1 (19%).

Mandatory Harvest Reporting Results

Restrictive bag limits for most sea ducks were maintained for western Washington in 2014-15. Concerns about low recruitment rates in sea ducks, increasing interest in sea duck hunting, and the unknown impact of reduced sea duck bag limits on compensatory species, particularly Barrow's goldeneyes, led to the measure. The harvest survey indicated a total harvest of 684 scoters, 108 long-tailed ducks, 107 harlequin ducks and 360 goldeneyes (Fig. 13, Table 9). The reported goldeneye harvest included 63% common goldeneye. From a total of 1,961 authorizations, an estimated 506 hunters were successful and hunted a total of 1,425 days. Primary harvest areas included Island, Mason, Skagit, Clallam, Pierce, and Whatcom counties.

The 2014-15 pre-season count of brant in Padilla/Samish/Fidalgo Bays was below the threshold of 6,000, triggering the cancellation of the January brant season in Skagit County. Brant hunting was allowed in Pacific County and harvest of brant was 40, 54% above the 2013-14 estimate of 26 (Fig. 14, Table 10).

The 2014-15 snow goose harvest was estimated at 2,758, down 52% from the 2013-14 harvest of 5,721. Snow goose harvest in Washington is historically variable (Table 11, Fig. 15) depending on several factors including age and production of the Wrangel Island snow goose flock. In addition, the harvest of snow geese in northern Puget Sound is weather dependent, with high wind events leading to greater harvest. This factor, as well as proportion of juveniles, may be of greater importance to harvest than total abundance, because the erratic annual harvest (Fig. 15) does not follow the number of geese counted in Washington during the MWS (Fig.6). These geese have recently expanded their wintering range in northeastern Washington to portions of Snohomish and King Counties.

In the southwest Washington goose season, hunters who passed the identification test in 1996-2014 and didn't take a dusky in 2013-14 were authorized to hunt in 2014-15. New hunters and those harvesting duskys in 2013-14 were required to take a new test to obtain an authorization. A total of 1,551 permits were issued in 2014-15. The number of harvested duskys remained below the quotas, allowing Zones 1-5 to remain open throughout the regular seasons. The percentage of duskys in the harvest increased to 2%, due to illegal dusky harvest activity discovered by WDFW Enforcement in north Willapa Bay. A total of 2,377 geese were checked during the regular season, a 19% increase from last year and 14% above the 3-year average of 2,088 (Table 12, Fig. 16). A total of 459 individuals checked birds at check stations during the 2014 regular season. The 2014 late season had 58 Master Hunter program participants, of which 56 checked geese at check stations. Total late season harvest was 222 geese, which was 9% below the 2013-14 late season estimates and similar to the 3-year average. A combination of uniformed and undercover officers documented hunter compliance through individual field checks throughout the regular and late seasons. Compliance with regulations was estimated to remain within acceptable levels as determined by past emphasis patrols.

Hunter Numbers and Success

The Washington small game hunter survey was used to estimate the number of waterfowl hunters in the state. During the 2014-15 season, an estimated 25,216 hunters participated in the Washington waterfowl season, up 0.9% from 2013-14 (Fig. 17). Following a steep decline in 2002, there has been a stable to slightly increasing number for the last thirteen years, although waterfowl stamp and permit sales have been stable since the early 1990s. Prior to that, there was a steady decline in hunters through the 1980s (Fig. 17). The 2004-05 estimate of Washington waterfowl hunters (23,078) was the lowest on record.

The estimated average number of ducks harvested per hunter in 2014-15 was 18.3. Hunter success, based on ducks harvested per hunter per year, has been on an upward trend since the mid-1990s (Fig. 18). Therefore, it appears the downward trend in duck harvest (Fig. 10) is more related to hunter numbers (Fig. 17) than decreased annual hunter success. The high success rate may indicate that the state has retained many avid and successful waterfowl hunters.

Members of the hunting public often believe the decline in hunter numbers is a result of the restrictive regulations that began in the mid-1980s (Table 5). This may have contributed to the reduced hunter participation (Fig. 17), but the downward trend in hunter numbers began in the early 1980s 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 5). The 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 good. Decreased hunter numbers result in lower hunter densities in the field and success has remained stable to increasing. In addition, the state is holding a large percentage of the Pacific Flyway's ducks. Urban encroachment in traditional hunting areas will be one of the biggest challenges faced by waterfowl hunters and managers. Regardless, the value of Washington’s waterfowl resources remains high and provides quality hunting recreation for the state’s hunting population.

WDFW has recognized a decline of quality hunting opportunities found on public hunting areas. In response, WDFW has developed initiatives to address public hunting opportunities on public and private lands. In 2014-15 there were 5 regulated access areas (RAA) on WDFW lands, including Winchester Ponds and Frenchman Ponds in Region 2, and Bailie Youth Ranch, Mesa Lake, and Windmill Ranch in Region 3. WDFW also continued the Fir Island Snow Goose Quality Hunt in Region 4 and maintained and expanded a private lands access program for waterfowl hunting in Regions 2, 3, and 4. Some of these programs featured limited access designed to reduce hunter crowding and/or limit waterfowl disturbance (Fig. 19).

Recommendations

- Monitor and evaluate success of quality hunt areas and snow goose quality hunt.
- Provide summary of mallard and Canada goose band returns

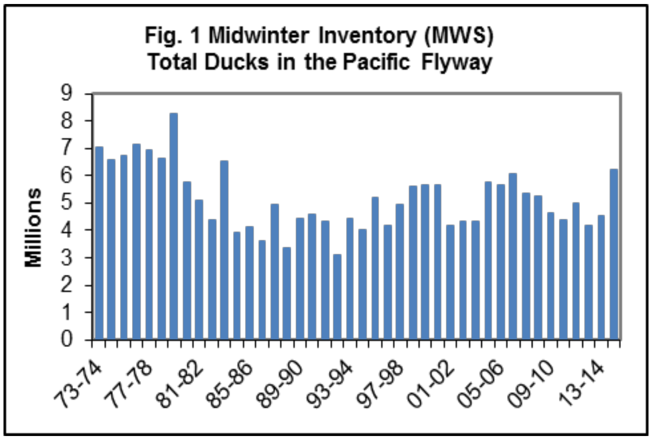


Fig. 1 Midwinter Inventory (MWS) Total Ducks in the Pacific Flyway

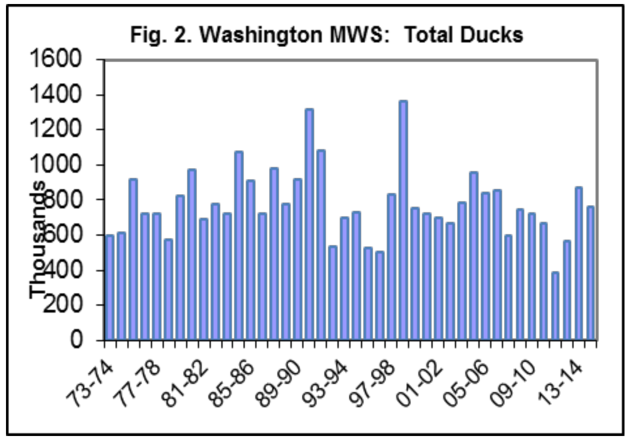


Fig. 2. Washington MWS: Total Ducks

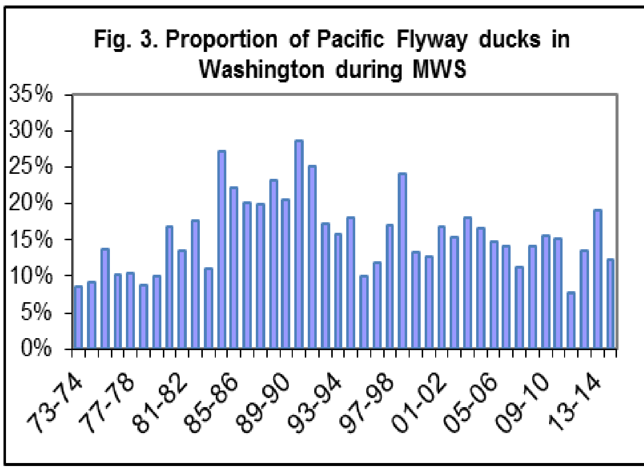


Fig. 3. Proportion of Pacific Flyway ducks in Washington during MWS

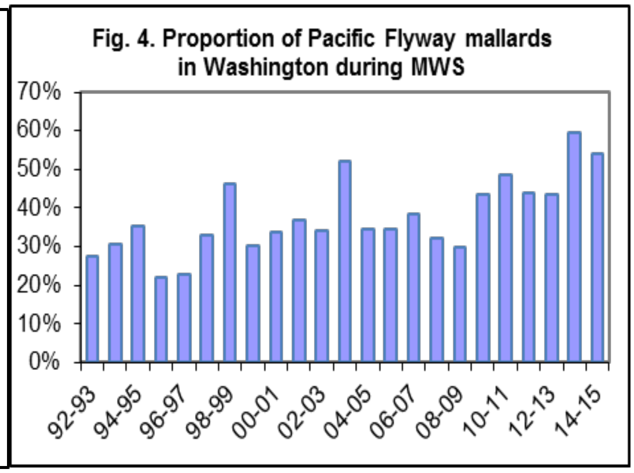


Fig. 4. Proportion of Pacific Flyway mallards in Washington during MWS

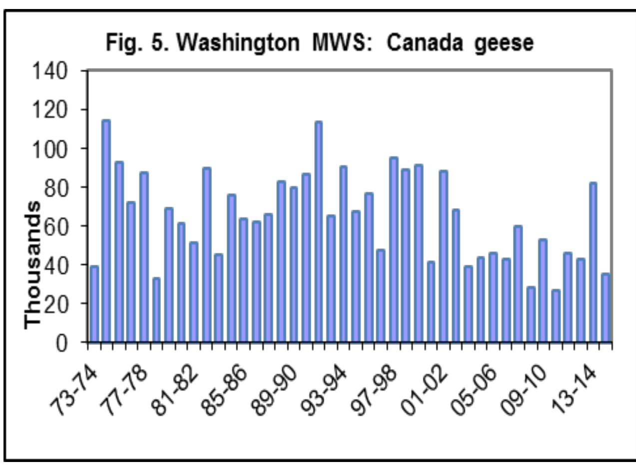


Fig. 5. Washington MWS: Canada geese

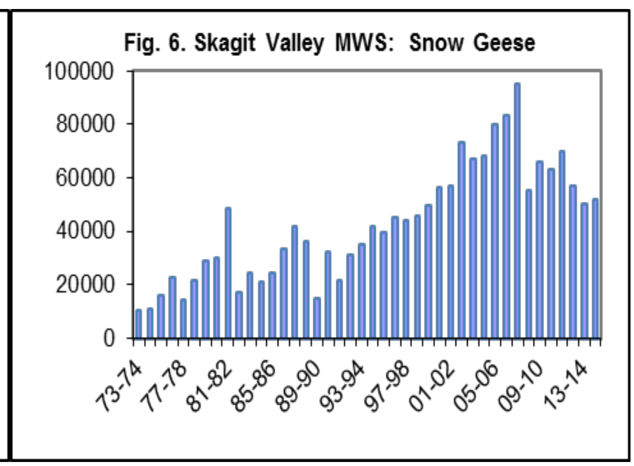
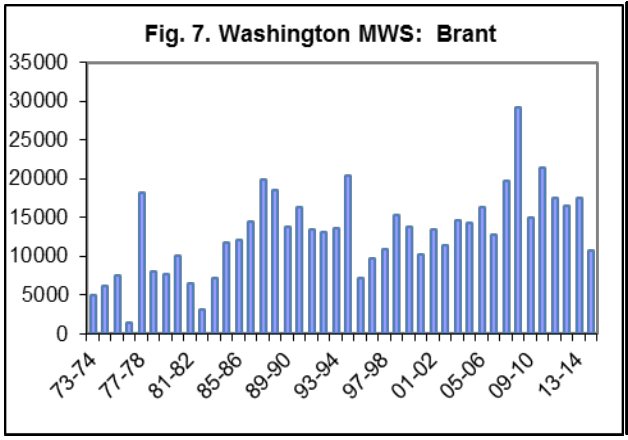


Fig. 6. Skagit Valley MWS: Snow Geese



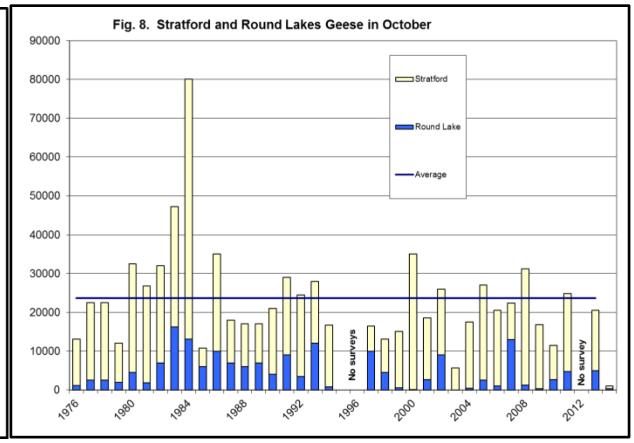


Figure 9. Washington Goose Management Areas

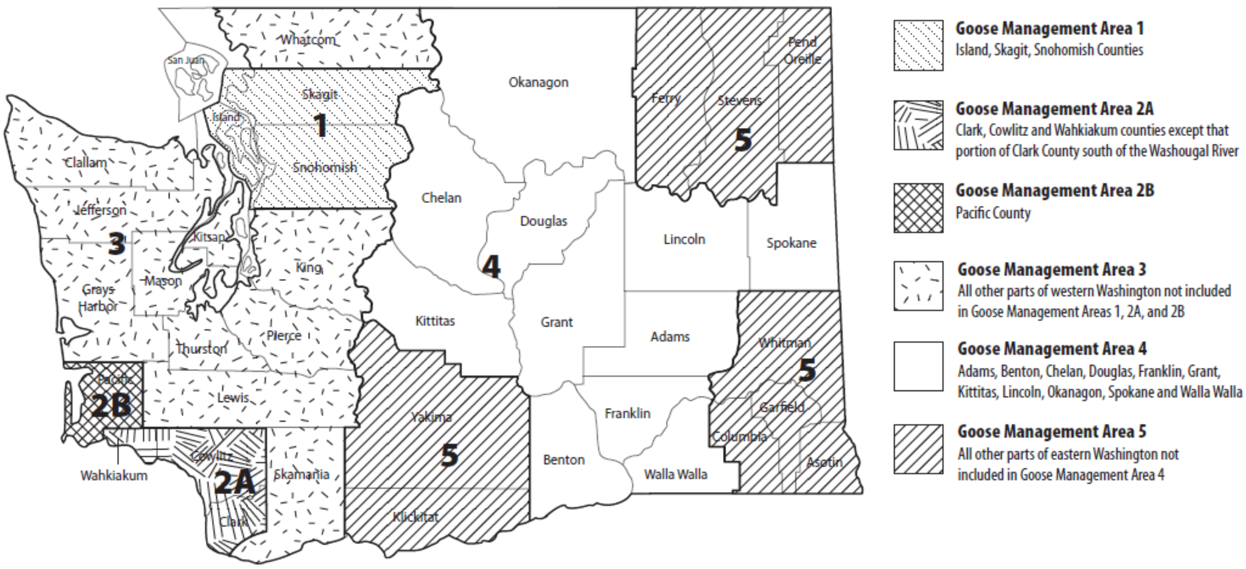


Figure 10. Total harvest of ducks in Washington (1962 – 2015).

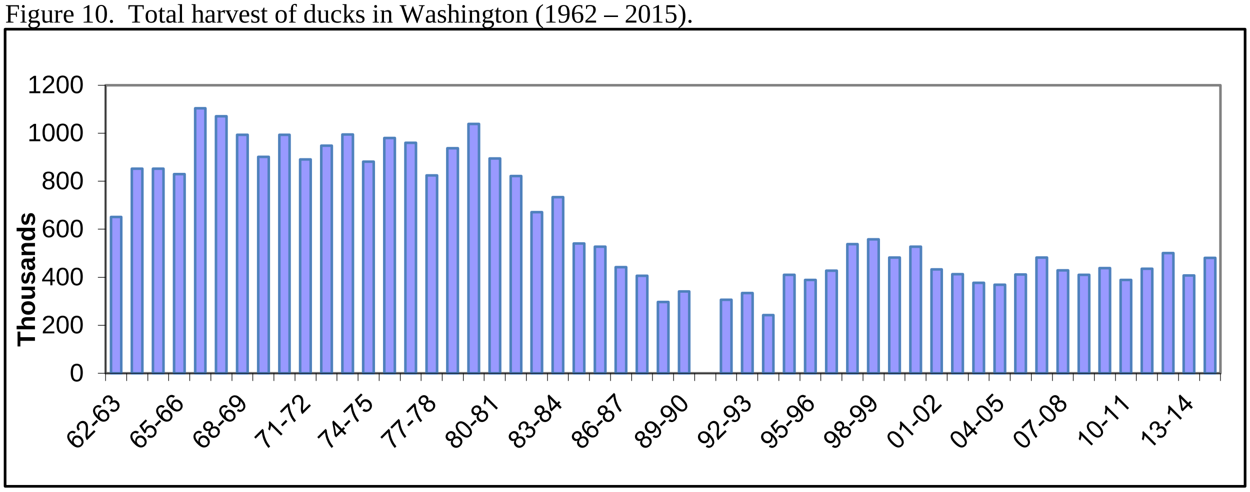
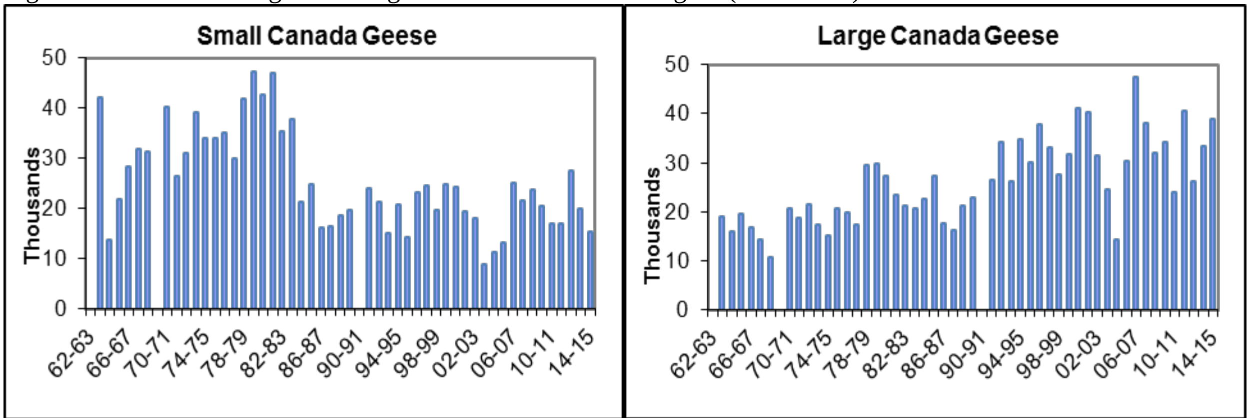
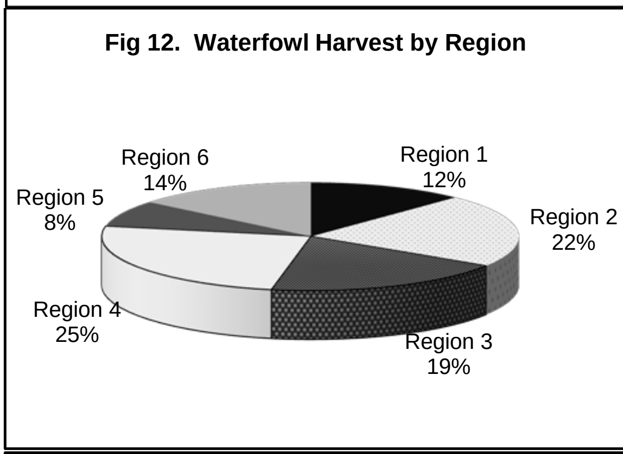
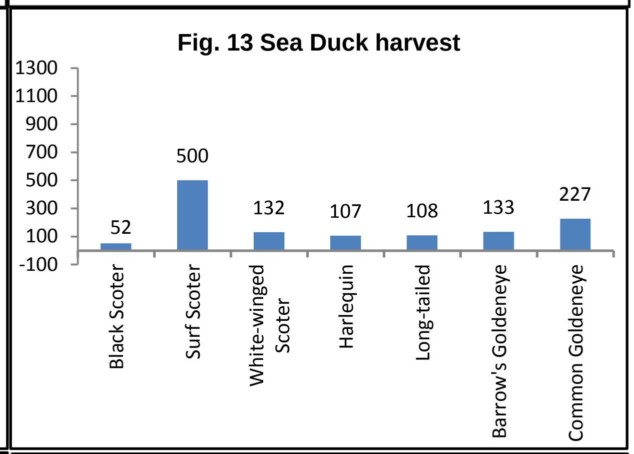
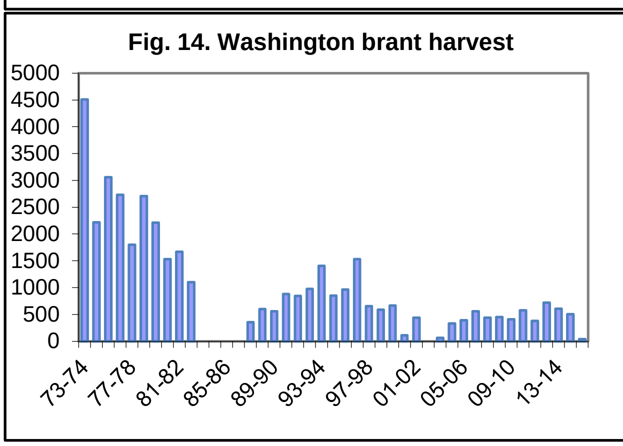


Figure 11. Small and large Canada goose harvested in Washington (1962-2015).









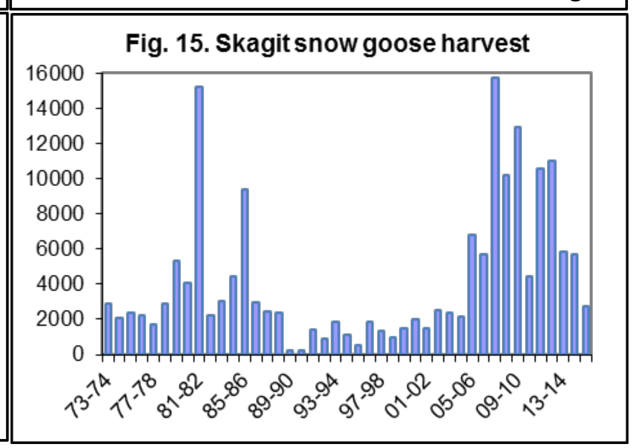
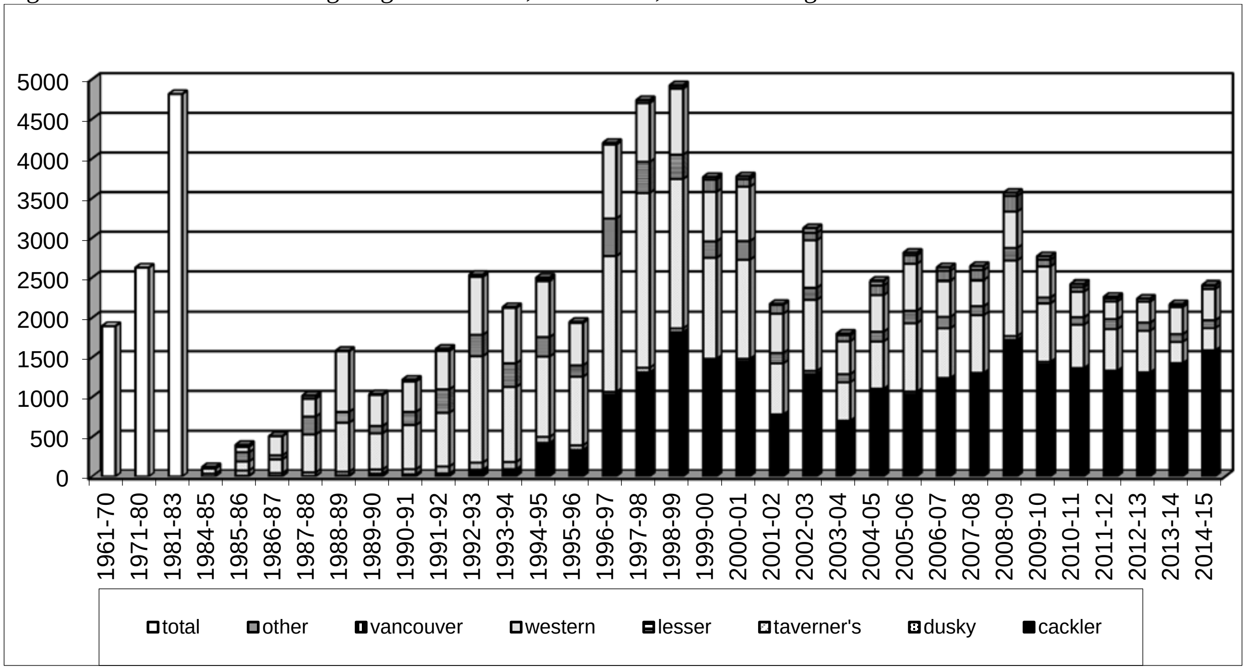
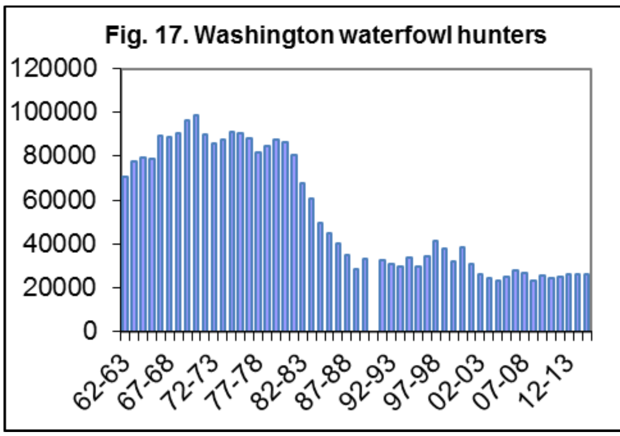


Figure 16. Southwest Washington goose harvest, 1970-2015, Goose Management Areas 2A and 2B





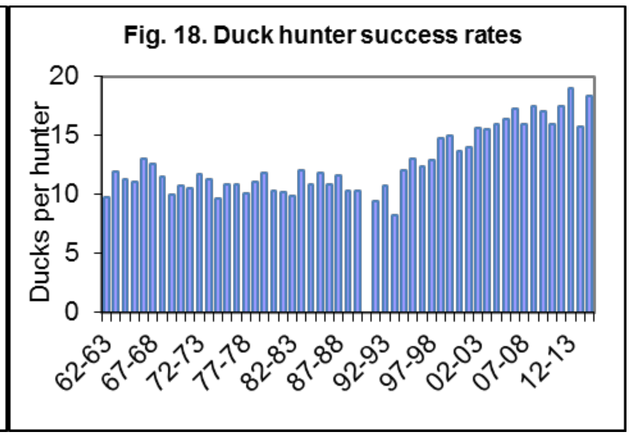


Figure 19. The regulated access program promotes quality hunting opportunities by reducing hunting pressure.

Table 1. Washington Department of Fish and Wildlife Midwinter Waterfowl Survey (MWS) – January 2015.

SPECIES	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	15 vs. 14	05-14 ave	15 vs. ave.
Mallard	470186	374881	494597	313871	254655	405604	349790	282601	254057	529671	381428	-28%	372991	2%
Gadwall	10904	5780	5314	5854	5324	6877	4149	3790	4236	2209	2845	29%	5444	-48%
Wigeon	195798	170491	90734	89614	207236	126059	106149	101072	102264	112831	123440	9%	130225	-5%
Green-winged Teal	33358	29492	30947	15506	15175	11554	18795	16225	8559	14196	22277	57%	19381	15%
B.W. & Cinn. Teal	4	5	272	2	12	20	335	9	3	4	4	0%	67	-94%
Shoveler	2553	4130	8763	2210	2671	2474	919	5419	2793	3872	2121	-45%	3580	-41%
Pintail	117296	94327	113949	45848	117235	40787	71083	73635	66024	71339	109825	54%	81152	35%
Wood Duck	472	173	99	378	309	1406	501	380	150	9796	220	-98%	1366	-84%
Redhead	4795	13026	3645	2443	4668	3550	4015	2501	3226	1132	761	-33%	4300	-82%
Canvasback	2929	2504	1501	3790	3239	3789	3148	2157	1528	462	1489	222%	2505	-41%
Scaup	34884	52519	29711	35052	40306	43003	31118	49304	52394	41984	42610	1%	41028	4%
Ringneck	8358	8507	12642	16568	19740	8763	5192	5415	3937	5327	8552	61%	9445	-9%
Goldeneye	15941	19184	13973	15106	15976	14578	14457	11599	13570	10700	10507	-2%	14508	-28%
Bufflehead	23293	21857	17511	21230	25510	21609	19451	24019	19830	29131	23964	-18%	22344	7%
Ruddy Duck	1937	1718	2179	3096	1508	1428	1180	2026	1744	2353	2626	12%	1917	37%
Eider	0	0	0	0	0	0	0	0	0	0	0	0%	0	0%
Scoter	16753	18265	15307	16742	12585	10445	11944	13432	13677	13287	14799	11%	14244	4%
Long-tailed Duck	654	927	804	504	547	439	663	652	722	867	872	1%	678	29%
Harlequin	793	1015	733	902	670	839	692	1067	918	961	1019	6%	859	19%
Merganser	10202	8355	7443	6377	6523	7894	8775	8302	8262	8771	8834	1%	8090	9%
Unidentified Ducks	5869	7458	4731	2515	9981	13440	5507	0	2765	9180	2846	-69%	6145	-54%
Snow Goose*	47111	80060	75141	82583	55016	66176	38976	49699	56973	50354	52023	3%	60209	-14%
White-fronted Goose	27	17	82	42	119	22	113	36	47	24	41	71%	53	-22%
Canada Goose	43908	45857	42759	60131	28629	53259	26999	45641	42686	82347	33564	-59%	47222	-29%
Brant	14286	16305	12712	19775	29243	14895	21457	17502	16454	17485	10706	-39%	18011	-41%
Tundra Swan**	2778	3422	3548	3570	3380	3211	2544	2247	1652	1171	1767	51%	2752	-36%
Trumpeter Swan**	5508	7904	9104	7747	9852	9457	9984	7603	11043	11623	14225	22%	8983	58%
Unknown Swan**	2381	232	842	292	1100	540	221	1775	2381	3609	2929	-19%	1337	119%
Coot	105522	119856	72265	69305	101951	84543	54017	48978	51996	43827	69030	58%	75226	-8%
TOTAL	1178500	1108267	1071308	841053	973160	956661	812174	777086	743891	1078513	945324	-12%	954061	-1%
*B.C. Snow Geese	21030	0	8007	12276	2495	7788	24285	22265	10225	19633	17309	-12%	12800	35%

*B.C. results not included in table totals **Comprehensive western Washington swan surveys in 1989, 1991, 1996, 2001, 2006, 2011

Table 2. Puget Sound winter survey estimates for sea ducks

	Scoters				Goldeneye				Bufflehead				Harlequin Duck				Long-tailed Duck				Mergansers			
Year	Pop	SE	95CL	90CL	Pop	SE	95CL	90CL	Pop	SE	95CL	90CL	Pop	SE	95CL	90CL	Pop	SE	95CL	90CL	Pop	SE	95CL	90CL
1994	*99953*	*11826*	23180	19395	42884	3636	7127	5963	42884	3636	7127	5963	3328	432	846	708	2823	586	1149	961	12176	1287	2522	2110
1995	*125287*	*8390*	16445	13760	53273	3005	5890	4928	81124	5964	11689	9781	3323	502	984	823	15872	2288	4484	3752	20367	2823	5533	4629
1996	*96403*	*5686*	11144	9324	32460	2639	5172	4328	62021	7551	14800	12384	4112	653	1279	1070	6935	1194	2340	1958	16592	1159	2271	1900
1997	*101186*	*6775*	13279	11111	32084	4074	7984	6681	54498	2925	5734	4797	3946	493	967	809	7898	1557	3051	2553	13452	1186	2325	1946
1998	*81967*	*6023*	11805	9877	23206	1866	3657	3060	39218	1872	3670	3071	3544	629	1234	1032	5676	1420	2783	2329	7739	574	1125	941
1999	*90088*	*6961*	13643	11416	27307	2029	3976	3327	46245	2538	4974	4162	3114	377	739	618	5057	590	1156	967	13024	1830	3586	3001
2000	*85942*	*4898*	9599	8032	28370	2955	5791	4846	41502	2101	4118	3446	4009	671	1315	1100	3530	371	727	609	10510	677	1327	1111
2001	*76720*	*4698*	9209	7705	31201	2270	4449	3722	57338	3559	6976	5837	3150	591	1159	970	9399	1867	3658	3061	17247	1226	2403	2011
2002	*68348*	*4402*	8628	7220	26789	2222	4355	3644	38512	2353	4612	3859	2887	450	882	738	4052	519	1018	852	11937	1005	1971	1649
2003	54673	3021	5921	4955	32384	2390	4684	3919	68485	2902	5688	4760	3082	294	576	482	5583	579	1135	950	16953	1215	2381	1992
2004	67820	4573	8963	7500	28526	2253	4416	3695	52427	2254	4418	3697	3709	512	1004	840	4006	817	1601	1339	11361	704	1381	1155
2005	66506	3801	7450	6233	25094	1496	2933	2454	46674	1994	3907	3269	2915	301	590	494	5651	568	1114	932	15318	903	1770	1481
2006	67169	4556	8929	7472	25321	2016	3950	3306	50588	2332	4570	3824	3073	312	612	512	4601	541	1061	888	13629	1052	2062	1726
2007																								
2008	66694	5353	10492	8779	25348	2001	3922	3282	50797	2278	4466	3737	3350	377	739	618	4832	632	1239	1037	11079	956	1874	1568
2009	47781	3081	6039	5053	24593	2151	4215	3527	42344	1750	3430	2870	2325	267	524	439	4041	593	1163	973	13087	891	1746	1461
2010	42318	2731	5352	4478	24618	2545	4987	4173	50507	2414	4730	3958	2844	242	475	397	4754	649	1272	1065	16547	1420	2783	2329
2011	44584	1984	3889	3254	20461	1639	3213	2688	41208	1853	3632	3039	1853	205	401	335	4992	560	1097	918	10703	685	1342	1123
2012	51451	2569	5035	4213	21719	1435	2813	2354	54874	2475	4852	4060	3250	296	581	486	4373	462	906	758	15891	1113	2181	1825
2013	54190	3214	6300	5271	25938	2526	4952	4143	48017	2007	3934	3292	2970	292	572	478	5021	476	933	780	17875	2217	4344	3635
2014	54103	5891	11547	9662	24574	1656	3246	2716	67187	2972	5824	4873	2913	342	671	561	6138	631	1237	1035	20763	1797	3522	2947
2015	54422	4444	8710	7288	26299	1853	3631	3038	55211	3172	6217	5202	3292	341	668	559	4667	439	861	720	14995	1159	2271	1900

Table 3. 2014-15 waterfowl surveys conducted in the Columbia Basin; waterfowl surveys, snow goose photo counts, aerial brant surveys, age-ratio counts conducted in North Puget Sound.

North Columbia Basin	**Oct.**	**Nov.(Dec 1-2)**	**Dec.**	**Jan. 29-30**
Mallards		199,265		72,106
Total Ducks		215,704		97,467
Total Geese	No	10,056	No	6,880
Total Swans	Survey	95	Survey	315
Total Coots		44,569		12,785
SURVEY TOTAL		268,301		104,662
South Columbia Basin	**Oct.**	**Nov. 23**	**Dec.**	**Jan. 22,29**
Mallards				173,329
Total Ducks				200,311
Total Geese	No	No	No	4,068
Total Swans	Survey	Survey	Survey	98
Total Coots				43,773
SURVEY TOTAL				355,018
Yakima Basin	**Oct.**	**Nov.**	**Dec.**	**Jan. 22**
Mallards				18,109
Total Ducks				22,849
Total Geese	No	No	No	5,827
Total Swans	Survey	Survey	Survey	83
Total Coots				438
SURVEY TOTAL				28,759
Northern Puget Sound	**Oct.**	**Nov. 11**	**Dec. 11**	**Jan. 12,15**
Mallards		37,900	114,125	81,350
Northern pintail		22,550	37,225	66,779
American wigeon	No	26,650	35,585	64,830
Green-winged teal	Survey	3,250	4,025	17,050
TOTAL DABBLERS		90,350	190,960	230,009

Snow Goose Aerial Photo Counts	**Date**	**Skagit/ Snohomish/ Island Co.**	**Fraser**	**Total**	**% Young**
	12/01/14	37,462	20,545	58,007	
	12/22/14	47,403	17,309	64,712	8.52%
Brant Aerial Surveys	**Date**	**Skagit Co.**	**Whatcom Co.**	**Total**	
	12/30/14	3,730	3,245	6,975	
	01/03/15	3,585	3,040	6,625	

Swan Population Estimates and Age Ratios - North Puget Sound and Sumas Prairie, BC MWS

Species	**Population size**	**Juveniles**	**% Young**	
Trumpeter Swan	14,040	2,659	18.9%	
Tundra Swan	1,643	225	13.7%	

Table 4. 2014-15 Washington migratory bird season regulations

Species	Area	Season Dates (inclusive)/Restrictions	Daily Bag Limit	Possession Limit
Duck	Statewide	Sept. 20-21 (Youth Hunting Only[a])	7[b]	14[b]
		Oct. 11-15 & Oct. 18 - Jan. 25, except scaup season closed Oct. 11-31	7[b]	21[b]
Coot	Statewide	Sept. 20-21 (Youth Hunting Only[a])	25	50
		Oct. 11-15 & Oct. 18 - Jan. 25	25	75
Snipe	Statewide	Oct. 11-15 & Oct. 18 - Jan. 25	8	24
Canada Goose Early Seasons	Goose Mgmt Areas 1 & 3	Sept. 10-15	5	15
	Goose Mgmt Area 2A	Sept. 10-15	3	9
	Goose Mgmt Area 2B	Sept. 1-15	15	45
	Goose Mgmt Areas 4 & 5	Sept. 13-14	3	6
	Statewide (except Goose Mgmt Areas 2A & 2B)	Sept. 20-21 (Youth Hunting Only[a])	4	8
Goose (except Brant)	Goose Mgmt Area 1	Snow, Ross', or Blue Goose : Oct. 11 - Jan. 25[d]	4	12
		Other geese: Oct. 11-23 & Nov. 1 - Jan. 25		
	Goose Mgmt Area 2A	All areas except Ridgefield National Wildlife Refuge: 8 a.m. to 4 p.m., Saturdays, Sundays, & Wednesdays only Nov. 8- 30 & Dec. 11 - Jan. 24, except closed Nov. 11, 27, Dec. 25 & Jan. 1	4[e]	12[e]
		Ridgefield National Wildlife Refuge: 8 a.m. to 4 p.m. Tuesdays, Thursdays, & Saturdays only Nov. 8-29 & Dec.11 - Jan. 24 except closed Nov. 11, 27, Dec. 25 & Jan. 1	4[e]	12[e]
	Goose Mgmt Area 2B	8:00 a.m. to 4:00 p.m., Saturdays, & Wednesdays only Oct. 11-25 and Nov. 1 - Jan. 17	4[e]	12[e]
	Goose Mgmt Area 3	Oct. 11-23 & Nov. 1 - Jan. 25	4	12
	Goose Mgmt Area 4	Saturdays, Sundays, & Wednesdays only: Oct. 11 – Jan. 18; Nov. 11, 27, 28 ; Dec. 25, 26, 29, 30; Jan.1; & every day Jan. 19-25	4	12
	Goose Mgmt Area 5	Oct. 11-13 & every day Oct. 18 - Jan. 25	4	12
Brant	Skagit County	Jan. 10, 11, 14, 17, 18, 21, 24, 25 **Note:** If Skagit County pre-season. brant population is below 6,000 (determined by early January survey), this season will be canceled.	2	6
	Pacific County	Jan. 3, 4, 6, 8, 10, 11, 13, 15, 17, 18	2	6

a. Special youth hunting season open to hunters under 16 years of age (must be accompanied by an adult at least 18 years old who is not hunting).

b. Daily bag limit: 7 ducks, to include not more than 2 hen mallard, 2 pintail, 3 scaup , 1 canvasback, and 2 redhead statewide; and to include not more than 1 harlequin, 2 scoter, 2 long-tailed duck, & 2 goldeneye in western Washington. Possession limit (Youth Hunting Weekend):14 ducks, to include not more than 4 hen mallard, 4 pintail, 6 scaup, 2 canvasback, and 4 redhead statewide; and to include not more than 1 harlequin, 4 scoter, 4 long-tailed duck, and 4 goldeneye in western Washington. Possession limit (regular Season): 21 ducks, to include not more than 6 hen mallard, 6 pintail, 3 canvasback, and 6 redhead statewide; and to include not more than 1 harlequin, 6 scoter, 6 long-tailed duck, and 6 goldeneye in western Washington. Season limit: 1 harlequin in western Washington.

c. Daily bag and possession limits: to include Canada geese only

d. Skagit County Special Restrictions: While hunting snow geese, if a hunter is convicted of 1) trespass, 2) shooting from across or along the maintained part of any public highway, 3) discharging a firearm for the purpose of hunting waterfowl within 100 feet of any paved public road on Fir Island or discharging a firearm for the purpose of hunting snow geese within 100 feet of any paved public road in other areas of Skagit County, or 4) exceeding the daily bag limit for snow geese, written authorization will be invalidated for the remainder of the current snow goose season and an authorization will not be issued for the subsequent snow goose season.

e. Daily bag limit: 4 geese, to include not more than 1 sucky Canada goose Areas 2A & 2B; and to include not more than 1 Aleutian goose in Area 2B. Possession limit: 12 geese, to include not more than 1 dusky Canada goose in Areas 2A & 2B; and to include not more than 3 Aleutian geese in Area 2B. Season Limit: 1 dusky Canada goose. A dusky Canada goose is defined as a dark breasted (Munsell 10 YR, 5 or less) Canada goose with a culmen (bill) length of 40-50 mm.

Table 5. Significant historical changes in duck hunting regulations.

	Season		Bag Limit		Special Limits		Stamp Fees		Hunting	Steel shot
Year(s)	East	West	East	West	Mallard	Pintail	State	Federal	License	Regulation
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	-
77-79	100	93	7	7	-	-	-	5.00	7.50	3 zones[1]
79-80	100	93	7	7	-	-	-	7.50	7.50	" "
80-82	100	93	7	7	-	-	-	7.50	7.50	1 zone[2]
82-84	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	5 (1 ♀)	5 (1 ♀)	-	7.50	12.00	" "
86-87	86	79	5	5	4 (1 ♀)	4 (1 ♀)	5.00	7.50	12.00	Large zones[3]
87-88	86	79	5	5	4 (1 ♀)	4 (1 ♀)	5.00	12.00	12.00	" "
88-91	66	59	4	4	3 (1 ♀)	1	5.00	12.00	12.00	" "
91-94	66	59	4	4	3 (1 ♀)	1	6.00	15.00	15.00	Steel statewide
94-95	76	69	4	4	3 (1 ♀)	1	6.00	15.00	15.00	" "
95-96	100	93	6	6	6 (1 ♀)	2	6.00	15.00	15.00	Bismuth-tin added
96-97	100	93	7	7	7 (1 ♀)	2	6.00	15.00	15.00	" "
97-98	106[5]	106[5]	7	7	7 (2 ♀)	3	6.00	15.00	15.00	Tungsten-iron added
98-99	106[5]	106[5]	7	7	7 (2 ♀)	1	6.00	15.00	15.00	Tungsten-polymer added
99-00	106[5]	106[5]	7	7	7 (2 ♀)	1	6.00	15.00	30.00[4]	Tungsten-matrix added
00-01	105[6]	105[6]	7	7	7 (2 ♀)	1	6.00	15.00	30.00	" "
01-02	105[6]	105[6]	7	7	7 (2 ♀)	1	6.00	15.00	30.00	Tungsten-nickel-iron added
02-03	105[6]	105[6]	7	7	7 (2 ♀)	1[7]	10.00	15.00	30.00	TINT[8] added
03-04	105[6]	105[6]	7	7	7 (2 ♀)	1[9]	10.00	15.00	30.00	" "
04-05	105[6]	105[6]	7	7	7 (2 ♀)	1[10]	10.00	15.00	30.00	Tungsten-bronze, and tungsten-Tin-bismuth added
05-06	105[6]	105[6]	7	7	7 (2 ♀)	1	10.00	15.00	30.00	" "
06-07	105[6]	105[6]	7	7	7 (2 ♀)	1	10.00	15.00	30.00	Tungsten-iron-copper-nickel, Tungsten-tin-iron added
07-08	105[6]	105[6]	7	7	7 (2 ♀)	1	10.00	15.00	30.00	Tungsten-tin-iron-nickel added
08-09	105[6]	105[6]	7	7	7 (2 ♀)	1	10.00	15.00	30.00	
09-10	105[6]	105[6]	7	7	7 (2 ♀)	2	11.00	15.00	36.00	
10-11	105[6]	105[6]	7	7	7 (2 ♀)	2	11.00	15.00	36.00	
11-12	105[6]	105[6]	7	7	7 (2 ♀)	2	15.00	15.00	38.00	
12-13	105[6]	105[6]	7	7	7 (2 ♀)	2	17.00	15.00	40.50	
13-14	105[6,a]	105[6,a]	7	7	7 (2 ♀)	2	17.00	15.00	40.50	
14-15	105[6,b]	105[6,b]	7	7	7 (2 ♀)	2	17.00	15.00	40.50	

[1]Non-toxic shot zones were established at Barney Lake, Skagit Bay, and the Columbia River flood plain.
[2]Only Barney Lake was retained as a non-toxic shot zone.
[3]Steel shot in progressively larger zones from 86-87 through 91-92 when steel shot was required statewide.
[4]New small game license format.
[5]Youth hunt one additional day
[6] Youth hunt two additional days
[7]pintail season limited to 62 days (Sept. 21-22; Oct.5-11; Oct 26-Dec. 17)
[8]tungsten-iron-nickel-tin shot
[9] pintail season limited to 62 days (Sept. 20-21; Oct. 11-15, Dec. 2-Jan. 25)
[10]pintail season limited to 62 days (Sept. 18-19; Oct. 16-20; Dec. 7-Jan. 30)
[a] scaup (lesser and greater) season limited to 86 days (Nov. 2-Jan. 26)
[b]scaup (lesser and greater) season limited to 86 days (Nov. 1-Jan. 25)

Table 6. History of southwest Washington Canada goose season regulations

Year	Season	ID Class	Quota	Scheduled Dates (# days)	Closure (# Days Hunted / Sched.)
<1984	Regular	No	No	mid-Oct. to mid-Jan.	None (93)
1984-85	Regular	No	No	Nov. 17-Dec. 16 (30)	Dec. 4 (18/30)
1985-86	Regular	All	40	Nov. 17-Dec. 29 (43)	Nov. 22 (6/43)
1986-87	Regular	All	90	Nov. 15-Jan. 4 (15)	No (15/15)
1987-88	Regular	All	90	Nov. 14-Jan. 10 (17)	No (17/17)
1988-89	Regular	New	90	Nov. 13-Jan. 7 (16)	No (16/16)
1989-90	Regular	New	45	Nov. 26-Jan. 13 (8)	Jan. 2 (6/8)
1990-91	Regular	All	45	Nov. 25-Jan. 12 (8)	Dec. 27 (5/8)
1991-92	Regular	New	90	Nov. 23-Jan. 11 (15)	CC(4/15),RF(11/15),PW(15/15)*
1992-93	Regular	New	90	Nov. 29-Jan. 16 (15-23)	CSC(6/15),RF(8/15), PWNC(23/23)*
1993-94	Regular	New	90	Nov. 27-Jan. 23 (17-25)	CSC(8/17),RF(11/17), PWNC(23/25)*
1994-95	Regular	New	90	Nov. 26-Jan. 22 (16-24)	CSC(8/16),RF(12/16), PWNC(24/24)*
1995-96	Regular	New	67	Nov. 25-Jan. 21 (8-21)	C(8/16),SC(2/9),RF(5/8), P(5/21),WNC(21/21)*
	Late	New	5	Feb. 5-Mar. 10 (12) – CSC only	No (12/12)
1996-97	Regular	All	67	Nov. 23-Jan. 19 (23-25)	C(25/25),SC(25/25),RF(19/25), P(23/23),WNC(23/23)*
	Late	All	5	Feb. 5-Mar. 10 (15)	No (15/15)
1997-98	Regular	New	80	Nov. 22-Jan. 17 (25)	No (all zones 25/25)
	Late	New	5	Jan. 24-Mar. 9 (20)	No (20/20)
1998-99	Regular	New	80	Nov. 25-Jan. 17 (37)	RF (32/37)*, Others (37/37)
	Late	New	5	Jan. 23-Mar. 10 (22)	No (22/22)
1999-00	Regular	New	80	Nov. 24-Jan. 16 (38)	No (38/38)
	Late	New	5	Jan. 22-Mar. 10 (21)	No (21/21)
2000-01	Regular	New	80	Nov. 22-Jan. 14 (21-29)	RF (9/21)*, Others (29/29)
	Late	New	5	Jan. 20-Mar. 10 (23)	No (23/23)
2001-02	Regular	New	80	2A: Nov. 21-Jan. 13 (23-29) 2B: Nov. 10-Dec. 30 (23)	2A: RF (12/23)*, Others (29/29) 2B: No (23/23)
	Late	New	5	Jan. 19-Mar. 10 (23) – 2A* only	No (23/23)

* 2A=Clark, Cowlitz, Wahkiakum; 2B=Grays Harbor, Pacific; C=Clark Private; CC=Clark-Cowlitz Private Lands; CSC=Clark/S. Cowlitz Private Lands; P=Pacific; WNC=Wahkiakum/N. Cowlitz; PW=Pacific-Wahkiakum; PWNC=Pacific/Wahkiakum/N. Cowlitz; RF=Ridgefield; SC=S. Cowlitz

Table 6. History of southwest Washington Canada goose season regulations (continued)

Year	Season	ID Class	Quota	Scheduled Dates (# days)	Closure (# Days Hunted / Sched.)
2002-03	Regular	New	80	2A: Nov. 27-Jan. 26 (25-27) 2B: Nov. 9-Dec. 29 (23)	2A: RF (9/25)*, Others (27/27) 2B: No (23/23)
	Late	New	5	Feb. 1-Mar. 9 (17) – 2A* only	No (17/17)
2003-04	Regular	New	80	2A: Dec. 9-Jan. 24 (19) 2B: Nov. 15-Jan. 4 (15)	2A: RF (9/19)*, Others (19/19) 2B: No (15/15)
	Late	New	5	Jan. 31- Mar. 10 (12) – 2A* only	No (12/12)
2004-05	Regular	New	80	2A: Nov. 27-Jan. 22 (15, RF 25) 2B: Oct. 16-Jan. 15 (14)	2A: No (15/15, RF 25/25) 2B: No (14/14)
	Late	New	5	Feb. 5 - Mar. 9 (10) – 2A* only	No (10/10)
2005-06	Regular	New	80	2A: Nov. 12-27, Dec. 7-Jan. 29 (30, RF 25) 2B: Oct. 15-Jan. 14 (27)	2A: No (30/30, RF 25/25) 2B: No (27/27)
	Late	New	5	Feb. 5 - Mar. 9 (10) – 2A* only	No (10/10)
2006-07	Regular	New	80	2A: Nov. 11-26, Dec. 6-Jan. 28 (32, RF 25) P: Oct. 15-Jan. 14 (27)	2A: No (32/32, RF 25/25) P: No (27/27)
	Late	New	5	Feb. 3 - Mar. 7 (10) – 2A* only	No (10/10)
2007-08	Regular	New	80	2A: Nov. 10-25, Dec. 5-Jan. 27 (32, RF 25) P: Oct. 13-Jan. 12 (27)	2A: No (32/32, RF 25/25) P: No (27/27)
	Late	New	5	Feb. 2 - Mar. 5 (10) – 2A* only	No (10/10)
2008-09	Regular	New	80	2A: Nov. 8-23, Dec. 3-Jan. 25 (32, RF 26) P: Oct. 11–Jan. 10 (27)	2A: No (32/32, RF 26/26) P: No (27/27)
	Late	New	5	Feb. 7 – Mar. 7 (9)	No (9/9)
2009-10	Regular	New	40	2A: Nov. 14-20, Dec. 9-Jan. 31 (31, RF 28) P: Oct. 17–Jan. 16 (27)	2A: No (31/31, RF 28/28) P: No (27/27)
	Late	New	5	Feb. 6 – Mar. 10 (10)	No (10/10)
2010-11	Regular	New	40	2A: Nov. 13-28, Dec. 8-Jan.30 (30, RF 27) P: Oct. 16–Jan 15 (26)	2A: Yes (30/30, RF 5/27) P: No (26/26)
	Late	New	5	2A: Feb. 5 – Mar. 9 (10)	No (10/10)
2011-12	Regular	New	40	2A: Nov. 12-27, Dec. 7-Jan.29 (30, RF 29) P: Oct. 15–26 and Nov. 5-Jan 21 (26)	2A: Yes (30/30, RF 16/29) P: No (26/26)
	Late	New	5	2A: Feb. 4 – Mar. 7 (10)	No (10/10)
2012-2013	Regular	New	40	2A: Nov. 10-25, Dec. 5-Jan. 27 (30, RF 28) P: Oct. 13-24, Nov. 3-Jan. 19 (27)	2A: No (30/30, RF 28/28) P: No (27/27)
	Late	New	5	2A: Feb. 2-Mar. 6 (10)	No (10/10)
2013-2014	Regular	New	40	2A: Nov. 9 – Dec. 1, Dec. 11-Jan. 26 (30, RF 29) P: Oct. 12-23, Nov. 2-Jan. 26 (31)	2A: No (30/30, RF 28/28) P: No (28/28)
	Late	New	5	2A: Feb. 1-Mar. 5 (10)	No (10/10)
2014-2015	Regular	New	80	2A: Nov. 8 – 30 & Dec. 10 – Jan. 25 (32, RF 28) P: Oct. 11-25, Nov. 1-Jan. 17 (30)	2A: No (32/32, RF 28/28) P: No (30/30)
	Late	New	5	2A: Feb. 4-Mar. 8 (10)	No (10/10)

* 2A=Clark, Cowlitz, Wahkiakum; 2B=Grays Harbor, Pacific; C=Clark Private; CC=Clark-Cowlitz Private Lands; CSC=Clark/S. Cowlitz Private Lands; P=Pacific; WNC=Wahkiakum/N. Cowlitz; PW=Pacific-Wahkiakum; PWNC=Pacific/Wahkiakum/N. Cowlitz; RF=Ridgefield; SC=S. Cowlitz

Table 7. Waterfowl harvest by species in Washington (2014-15)[1]

Species	Harvested	Composition (%)
Mallard	260,337	54
American wigeon	80,787	17
Green-winged teal	45,473	9
Northern pintail	31,041	7
Total ducks	480,774	
Large Canada	38,869	57
Small Canada	15,279	43
Total geese	68,315	
Total waterfowl	549,089	

[1]The number of each species harvested is estimated from the Daily Waterfowl Harvest Report Card Survey. The total number of ducks and geese harvested is estimated from the more extensive Small Game Harvest Questionnaire.

Table 8. Waterfowl harvest by region (2014-15)

Region	Ducks Harvested	% of State Total Ducks Harvested	Geese Harvested	% of State Total Geese Harvested
Region 1	50,988	11%	13,316	19%
Region 2	115,017	24%	21,141	31%
Region 3	102,918	21%	14,127	21%
Region 4	122,668	25%	10,154	15%
Region 5	36,771	8%	4,484	7%
Region 6	52,412	11%	5,093	7%

Table 9. Estimated number of sea ducks harvested in 2014-15[1]

Species	Harvest
Scoters	684
Black Scoter	52
Surf Scoter	500
White-winged Scoter	132
Harlequin	107
Long-tailed	108
Barrow’s Goldeneye	133
Common Goldeneye	227
TOTAL	1,259

[1] These figures are based on analysis of mandatory report returns, corrected for non-response bias.

Table 10. Brant harvest report summary[1]

YEAR	MONTH	PERMITS ISSUED	SUCCESSFUL HUNTERS	HUNTER DAYS	SEASON DAYS	SKAGIT CO. HARVEST	WHATCOM CO. HARVEST	PACIFIC CO. HARVEST	TOTAL HARVEST
1990	DEC	490	338	763	11	808	0	73	881
1991	DEC	654	330	647	11	790	3	52	845
1992	DEC	747	319	709	11	950	9	18	977
1993	DEC	1194	496	765	11	1347	7	53	1407
1994	DEC	1069	287	484	9	825	0	23	848
1995	DEC	1207	343	552	11	918	0	44	962
1996	DEC	1445	379	549	11	890	0	24	914
1997	JAN	1331	197	326	5	597	0	59	656
1998	JAN	1348	243	350	5	570	0	18	588
1999	JAN	1336	218	386	9	581	0	86	667
2000	JAN	1295	39	59	5*	0	0	108	108
2001	NOV				5	56	0	20	76
2001	JAN				5	347	0	17	364
2001	ALL	1436	187	277	10	403	0	37	440
2002	NOV				5	18	0	9	27
2002	JAN				5*	0	0	33	33
2002	ALL	1387	27	277	10	18	0	42	60
2003	NOV				5	22	0	13	35
2003	JAN				5	235	0	64	299
2003	ALL	1187	152	200	10	257	0	77	334
2004	NOV				5	36	0	11	47
2004	JAN				5	308	0	34	342
2004	ALL	1612	126	209	10	344	0	45	389
2005	JAN	1707	220	336	5	504	0	53	557
2006	JAN	1793	199	272	7	367	0	74	441
2007	JAN	1795	166	243	7	341	0	112	453
2008	JAN	2116	191	262	7S/10P	328	0	81	409
2009	JAN	1681	232	510	8S/10P	545	0	31	576
2010	JAN	1030	200	387	8S/10P	253	0	125	378
2011	JAN	1232	214	502	8S/10P	638	0	80	718
2012	JAN	1362	254	604	8S/10P	541	0	63	604
2013	JAN	1364	192	651	8S/10P	479	0	26	505
2014	JAN	1352	14	76	10P*	0	0	40	40

*Skagit closed

[1] Figures are based on mandatory report returns, corrected for non-response bias. [2] Days hunted estimate from 1990-2008 included successful hunters only.

Table 11. Snow goose harvest report summary[1]

YEAR	PERMITS ISSUED	SUCCESSFUL HUNTERS	DAYS HUNTED*	ISLAND CO. HARVEST**	SKAGIT CO. HARVEST**	SNOHOMISH CO. HARVEST**	TOTAL HARVEST**
1993	2298	572	1096	58	677	1124	1859
1994	2588	433	664	60	496	522	1078
1995	2313	221	373	57	99	331	487
1996	2363	427	996	39	381	1400	1820
1997	2795	424	812	38	545	749	1332
1998	3086	341	585	29	678	262	969
1999	3061	445	777	71	815	598	1484
2000	3076	460	1039	18	1058	919	1995
2001	3144	407	953	4	753	696	1453
2002	3196	442	1217	18	1419	1084	2522
2003	3013	530	1155	20	1465	889	2374
2004	3333	474	1075	37	1267	893	2160
2005	3546	895	2665	50	4588	2154	6792
2006	4068	1061	2566	7	3780	1876	5663
2007	4859	1662	5528	53	11462	4175	15690
2008	5583	1253	2912	117	6295	3743	10155
2009	4015	1370	9840	8	9979	2959	12946
2010	4830	770	5078	0	3388	1032	4420
2011	2776	1113	6011	0	6924	4079	11003
2012	2811	966	4359	0	3903	1956	5859
2013	2884	861	4013	126	4016	1579	5721
2014	3010	1110	4499	6	2069	683	2758

*days hunted estimate from 1993-2008 included successful hunters only

**harvest estimates do not include estimated wounding loss

Table 12. Southwest Washington Canada goose harvest summary

Season	Period	Aleutian	Cackler	Dusky	Lesser	Taverner	Vancouver	Western	Other	Total CAGO	Snow	Whitefront	Total
1961-70	10 Year Ave.									1894			
1971-80	10 Year Ave.									2624			
1981-83	10 Year Ave.									4814			
1984-85	Season Total		0	37	0	63	0	20	0	120			
1985-86	Season Total		11	66	116	113	0	67	25	398			
1986-87	Season Total		8	36	51	172	0	241	0	508			
1987-88	Season Total		7	45	225	478	4	224	35	1018			
1988-89	Season Total		17	43	136	617	0	763	7	1583			
1989-90	Season Total		37	52	92	455	9	391	0	1036			
1990-91	Season Total		28	65	165	555	20	383	3	1219			
1991-92	Season Total		39	88	295	675	14	483	15	1609			
1992-93	Season Total		84	91	270	1340	25	722	2	2534			
1993-94	Season Total		93	90	299	944	8	697	4	2135			
1994-95	Season Total		422	77	246	1011	31	704	6	2497			
1995-96	Regular Season		321	57	134	787	12	515	1	1827			
	Late Season		13	2	10	75	0	21	0	121			
	Season Total		334	59	144	862	12	536	1	1948			
1996-97	Regular Season		1001	32	327	1678	9	808	2	3857			
	Late Season		29	3	148	27	9	124	1	341			
	Season Total		1030	35	475	1705	18	932	3	4198			
1997-98	Regular Season		1158	56	376	2042	31	672	5	4340			
	Late Season		153	2	16	155	2	70	0	398			
	Season Total		1311	58	392	2197	33	742	5	4738			
1998-99	Regular Season		1588	44	292	1736	28	724	9	4421			
	Late Season		232	2	14	141	6	109	0	504			
	Season Total		1820	46	306	1877	34	833	9	4925			
1999-00	Regular Season		1255	24	205	1150	140	540	32	3346			
	Late Season		200	3	4	115	15	83	1	421			
	Season Total		1455	27	209	1265	155	623	33	3767			
2000-01	Regular Season		1310	30	130	1236	82	583	34	3405			
	Late Season		140	2	105	6	13	104	1	371			
	Season Total		1450	32	235	1242	95	687	35	3776			
2001-02	Regular Season		664	22	130	601	87	430	11	1945			
	Late Season		94	1	0	43	25	66	0	229			
	Season Total		758	23	130	644	112	496	11	2174			
2002-03	Regular Season		1183	37	152	836	88	551	60	2907			
	Late Season		108	1	1	60	5	40	1	216			
	Season Total		1291	38	153	896	93	591	61	3123			
2003-04	Regular Season		598	24	102	470	73	372	19	1658			
	Late Season		76	4	2	13	5	41	0	141			
	Season Total		674	28	104	483	78	413	19	1799			
2004-05	Regular Season		989	25	123	576	105	424	49	2291			
	Late Season		90	0	0	21	17	37	4	169			
	Season Total		1079	25	123	597	122	461	53	2460			
2005-06	Regular Season		948	30	155	823	106	558	28	2648			
	Late Season		89	1	2	40	2	26	4	164			
	Season Total		1037	31	157	863	108	584	32	2812			
2006-07	Regular Season	8	1085	26	141	580	110	410	44	2404			
	Late Season		127	1	2	48	14	40	1	233			
	Season Total	8	1212	27	143	628	124	450	45	2637			
2007-08	Regular Season	2	1160	21	108	684	113	292	49	2429			
	Late Season		122	1	5	45	12	31	2	218			
	Season Total	2	1282	22	113	729	125	323	51	2647			
2008-09	Regular Season	4	1636	43	154	887	195	406	41	3366	88	27	3481
	Late Season		87	2	4	59	3	52	0	207			207
	Season Total	4	1723	45	158	946	198	458	41	3573	88	27	3688
2009-10	Regular Season	13	1301	28	73	706	75	358	41	2595	8	19	2622
	Late Season		111	4	3	30	12	25	1	186			186
	Season Total	13	1412	32	76	736	87	383	42	2781	8	19	2808
2010-11	Regular Season	4	1245	17	94	525	57	297	37	2276	26	65	2367
	Late Season	1	100	3		22	2	25		153			153
	Season Total	5	1345	20	94	547	59	322	37	2429	26	65	2520
2011-12	Regular Season	1	1150	25	121	505	35	180	21	2038	16	60	2114
	Late Season		154	3	4	20	3	43		227			227
	Season Total	1	1304	28	125	525	38	223	21	2265	16	60	2341
2012-13	Regular Season	16	1168	17	101	503	25	231	1	2062	33	64	2159
	Late Season		125		1	23	13	33		195	2		197
	Season Total	16	1293	17	102	526	38	264	1	2257	35	64	2356
2013-14	Regular Season	4	1247	18	96	257	17	287	8	1934	35	17	1990
	Late Season		160	2	1	12	12	54		241	1	3	245
	Season Total	4	1407	20	97	269	29	341	8	2175	40	20	2235
2014-15	Regular Season	16	1424	42	137	431	20	249	14	2333	7	37	2377
	Late Season		155	3	1	14	3	43		219	3		222
	Season Total	16	1579	45	138	445	23	292	14	2552	10	37	2599

Note: Mandatory check stations initiated in 1984-85 season, prior estimates from USFWS harvest survey.

Wild Turkey

WILD TURKEY STATUS AND TREND REPORT:
STATEWIDE

SEAN Q. DOUGHERTY, *Acting* Small Game/Furbearer/Private Lands Section Manager

Population objectives and guidelines
Wild Turkeys were first successfully introduced in Washington in 1960. Population augmentation in the 1980s and 1990s expanded their distribution (Figure 1) and increased hunting and wildlife viewing opportunities (Washington Department of Fish and Wildlife, 2005).

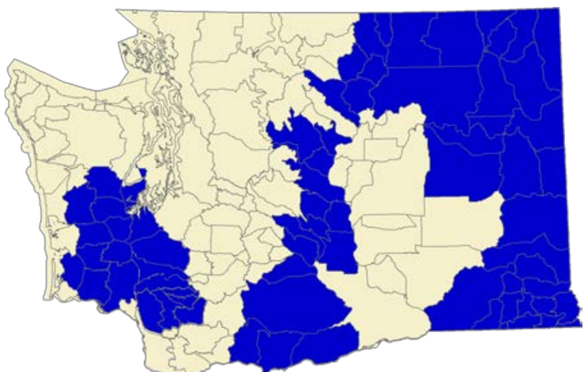


Figure 1: Primary current distribution of wild turkeys in Washington based on Game Management Units

Very few translocation activities have occurred in recent years. The WDFW management plans identify, trapping and translocation as a potential response to damage and nuisance complaints, but those actions have not been a significant part of turkey management.

In January 2006, the Department adopted a statewide turkey management plan as a supplement to the Game Management Plan in response to increasing populations and issues related to turkey management. Population management strategies are included in the plan and will be included and updated in future Management Plans.

Hunting seasons and harvest trends
Estimated harvest of wild turkeys is based on analysis of mandatory hunter reporting of turkey tags. Hunters must report all turkey tags, even if they didn't go hunting. Successful hunters are required to submit a harvest report with date, location, sex, and age of harvested birds. This mandatory reporting system has produced more accurate estimates of harvest and hunter participation than those made prior to the reporting requirement.

Hunting seasons for wild turkeys have varied from a 2-day, fall season in 1965 to the current 47-day spring season with additional fall hunting opportunities that vary by GMU.

Beginning in 2004, GMUs 105-124 had a weeklong general early fall season instead of permit-based hunting. In 2005, this was extended to 2 weeks, and in 2006, GMU 101 was included. In 2008, the early fall seasons in GMUs 105-124 were changed to "beardless turkeys only" with the intent to decrease the fall season male harvest. This strategy was successful as male turkey harvest decreased from approximately 55% to less than 20% in the target area.

In 2006, a late fall permit hunt (November 20-December 15) in NE Washington was also added for GMUs 101-124. This permit hunt was changed to a general season hunt in 2009 because hunting pressure did not exceed management goals for that population. GMU's have since been added to where the late fall general season includes almost all 100 series GMUs. A late fall permit hunt was added for Game Management Units in Okanogan County (218-231 and 242) in 2008 and in 2012 a permit hunt was added in GMU 335 in Kittitas County. All late fall seasons are either sex.

In 2009, the early fall general season was extended to Mica Peak (GMU 127), Roosevelt (GMU 133), and Blue Mountains Game Management Units (GMUs 145, 149-16, and 172-186). Klickitat County (GMUs 382, 388, 568-578) remains permit only hunting.

Turkey hunting is open to shotgun, archery and crossbow hunting during the spring and fall seasons. Dogs, baiting, electronic decoys, and electronic calls are not legal in Washington. Non-electronic decoys are permitted. In 2006, the Fish and Wildlife Commission adopted a regulation permitting falconers to hunt turkeys during the fall and winter.

Current regulations are considered relatively conservative. Spring season timing results in harvest of gobblers after peak breeding. The season ends before most nests hatch, so disturbance is minimized. Records show that prior to turkey augmentation activity in the late 1980s, turkey hunter numbers fell to a low of 428 (1987) and turkey harvest averaged 65-birds per year (1983-1987). In 2014, an estimated 11,153 individuals hunted turkeys during the spring general season, taking an estimated 3,743 birds. The harvest above was 1% below 2014 estimated harvest of 3,768 and 21% below the ten year average (Figure 2 at end of report).

There were 3,275 hunters that pursued turkeys during the 2014 fall general seasons in PMU 10 and 15 and they were able to harvest 1,489 birds. This represents a 41% increase in harvest and an 18% increase in hunter participation from 2013 seasons.

Game Management Units have been grouped to define turkey populations into Population Management Units (PMUs). Washington State is divided into 7 PMUs: Northeast (P10), Southeast (P15), North Central (P20), South Central (P30), Klickitat (P35), Northwest (P40), and Southwest (P50) (Table 1). Changes in harvest, as an indicator of population status, have been tracked at the PMU level. Although harvest years 2011 through 2013 are consistent, differences have occurred in how PMU estimates were calculated in the past, which may cause slight differences when comparisons are made to prior years or ten year averages.

PMU	GMUs Included
P10	101-136
P15	139-186
P20	All 200 GMUs
P30	All 300 GMUs EXCEPT GMU 382 & 388
P35	GMUs 382,388,578,574,572,568
P40	All 400 GMUs PLUS GMUs 601-627
P50	All 500 GMUs EXCEPT 568-578 PLUS GMUs 633-699

Table 1: Game Management Units included in each Population Management Unit

The 2014, spring turkey harvests were about the same across all PMUs when compared to 2013. Harvest in all PMUs was below prior ten year averages in all PMUs. The declining trends have been continued following record, or near record, harvests in 2010 and 2011. Prior to this time increasing trends were clearly evident (Figure 3 at end of report).

Surveys

Between 2004 and 2014 the Colville District carried out an annual winter survey of wild turkeys in northeastern Washington (PMU 10). The primary objective of these surveys were to initiate the development of an annual harvest-independent population index for wild turkeys as called for in the agency Game Management Plan. The pilot project tested methodology developed between 2006-2010, and relied on volunteers to help collect data. The greatest corollary benefit was that district biologists were able to gain valuable experience and knowledge of local turkey range, movements, habitat availability, and usage. The survey protocol was modified in 2011 and standardized route lengths, increased the number of routes, and each transect was run once rather than multiple times. No quantifiable population estimate can be calculated from these surveys, but they do provide useful insight in to the current sex ratios and can also provide biologists with some understanding of the number of mature males that would be available for harvest.

District 7 utilizes wintering site surveys to track turkey numbers in Chelan County. Counts have been conducted at 33 sites on three separate dates to obtain a minimum count and sex ratio for the past seven years. The counts appear to track with harvest changes but a formal analysis has not been done. A total of 602 turkeys were observed (80 adult males), and when pooled at the GMU level were 15-35% higher than during the winter of 2013-2014. Despite the overall increase in the number of birds observed, the number of adult males decreased 18% from the previous year (Jon Gallie personal communication).

Population Status and Trend

Using a combination of winter survey results and harvest estimates, turkey numbers in P10 appear to be stable. The population level in parts of this PMU has grown to the point where agricultural and nuisance conflicts with humans have become a larger concern. The most liberal fall general seasons are in place here to help address these issues.

Based on harvest trends (Table 2; Figure 3), the Blue Mountains population (P15) has expanded substantially over the past 15 years but may actually be leveling off.

Even though harvest trends in PMU 20 and 30 indicate some stability, local hunters continue to report concern over decreasing populations. Harvest in PMU 20 and 30 increased substantially in 2010 but has returned to previous levels (Table 2). Additional fall hunting opportunity will continue be available on a limited permit only basis.

PMU	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
P10	3401	3445	3571	3660	2677	2845	2861	3695	2512	2400	2461
P15	471	480	730	605	578	761	731	866	642	533	500
P20	209	215	220	258	232	228	412	231	203	188	181
P30	178	182	169	221	172	245	417	234	162	143	137
P35	301	345	362	487	370	447	863	473	514	474	436
P40	15	10	8	9	3	5	13	8	5	5	1
P50	54	53	77	62	50	65	68	41	30	25	25
Total	4629	4730	5137	5302	4082	4596	5365	5548	4068	3768	3741

Table 2: Estimated spring turkey harvest in each turkey Population Management Unit (PMU) 2004-2014

With the exception of 2010, when harvest was unusually high, Turkey harvest in PMU P35 has been relatively stable over the past six years (Table 2; Figure 3). The population here is believed to be stable and provides most of the hunting opportunity in Southwest Washington.

Determining population trends for the wild turkey population in PMU P50 is difficult. Sightings of wild turkey continue to be reported in locations away from the original release sites. In addition, turkeys continue to be harvested throughout the season. Harvest in southwest Washington has declined over the last four years (Table 2; Figure 3). These factors, considered together, suggest wild turkeys have been reproducing at low levels but are likely maintaining a viable population. Declines in harvest in this area may be due in part to more restrictive access policies recently put in place by large private landowners.

Habitat condition and trend

Most of the turkey range in Region 1 is in close proximity to agricultural lands that provide abundant food in the form of waste grain as well as some berries and fruits during winter months. The Blue Mountains and surrounding areas have provided exceptional habitat for the Rio Grande turkey subspecies. While Stevens, Pend Oreille, Ferry, and northern Spokane counties contain excellent habitat for the Merriam's subspecies.

Ponderosa pine nuts are probably the most important winter food source for turkeys in eastern Washington. In Chelan, Kittitas, and Okanogan counties, the density and distribution of ponderosa pines is much less than in Ferry and Stevens counties where the largest turkey population can be found.

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 also limit population expansion.

Most of PMU 30 is probably marginal turkey habitat. The forested zone is on the edge of higher elevations and receives significant snowfall. Deep snows in 1992-93 and 1996-97 may have impacted turkey survival in the region. Mild winters and supplemental feeding is the most likely reason recent transplants have been successful.

Winter conditions in Klickitat County (PMU P35) can impact the resident turkey population. Severe weather in 1996 impacted turkey harvest in 1997 and 1998. Mild winters since 1996 have allowed the turkey population to increase and hunting has improved to current levels.

Although we do not specifically monitor habitat conditions related to turkeys in PMU 50, conditions should continue to be adequate, as there were no major changes in habitat management or weather conditions that would have changed turkey survival.

Augmentation and habitat enhancement

There were no new releases of turkeys in any PMU across the state and none are planned in the future. Turkeys are already present in most of the areas that would be considered suitable and concerns related to human/wildlife conflict have precluded introductions in the past. As mentioned previously turkeys can be trapped and relocated to reduce human conflicts.

Habitat enhancement priorities are identified in the 2015-2021 Game Management Plan. Of special interest are habitat improvements that increase habitat values for a variety of wildlife species in addition to turkeys. The Klickitat Oak Habitat Initiative began in May 2009 focusing on improving oak stand health and understory habitat improvement on the Klickitat Wildlife Area and surrounding lands in Klickitat County. Other efforts have focused in northeast Washington to provide enhanced food resources through weed control, agricultural manipulation and forest improvements. WDFW works closely with the National Wild Turkey federation on efforts to promote and fund habitat enhancement work.

Management conclusions

Although harvest since 2012 has been lower than the preceding ten year average, it is not currently believed to necessarily represent a declining population trend. As turkeys were introduced and expanded their range and population, an eventual leveling off was expected as the carrying capacity of the habitat was reached. The lower harvest can probably also be attributed to a decline in hunter numbers which appears to be associated with a past change in turkey tag fees. Turkey populations across the state appear to be relatively stable with the largest concentrations in Region 1. Spring hunter success rate has remained fairly stable since 2002, hovering around 30%. Management decisions will seek to maintain good hunter success rates in the spring, while also addressing human conflict issues.

Habitat enhancement activities for wild turkeys will continue to focus on winter food enhancements by increasing available grain, clovers, fruiting shrubs, and mast producing trees. The Klickitat Oak Habitat Initiative and efforts in northeast Washington will continue to strive to improve winter habitat for turkeys.

Spokane County has seen an increase of turkeys despite the suburban nature of the area. Turkey nuisance complaints are being received from areas within PMU P10 as well as a few reports from north-central and western Washington. Additional hunting opportunities have been created in the Spokane County area to help address these nuisance complaints. WDFW will be seeking ways to focus hunter effort in areas with private lands experiencing damage.

The turkey population along the eastern Cascade range may have reached the long-term carrying capacity of the habitat. That population will likely fluctuate with adverse and favorable weather conditions. Conflicts with turkeys had been escalating in the Methow and Okanogan watersheds of Okanogan County. Expansion of turkeys in the Methow area has been exacerbated by illegal releases of domestic turkeys. These birds end up as problem animals, particularly in winter when little natural forage is available. A fall permit season has been created for the Methow watershed to help manage conflicts with turkeys.

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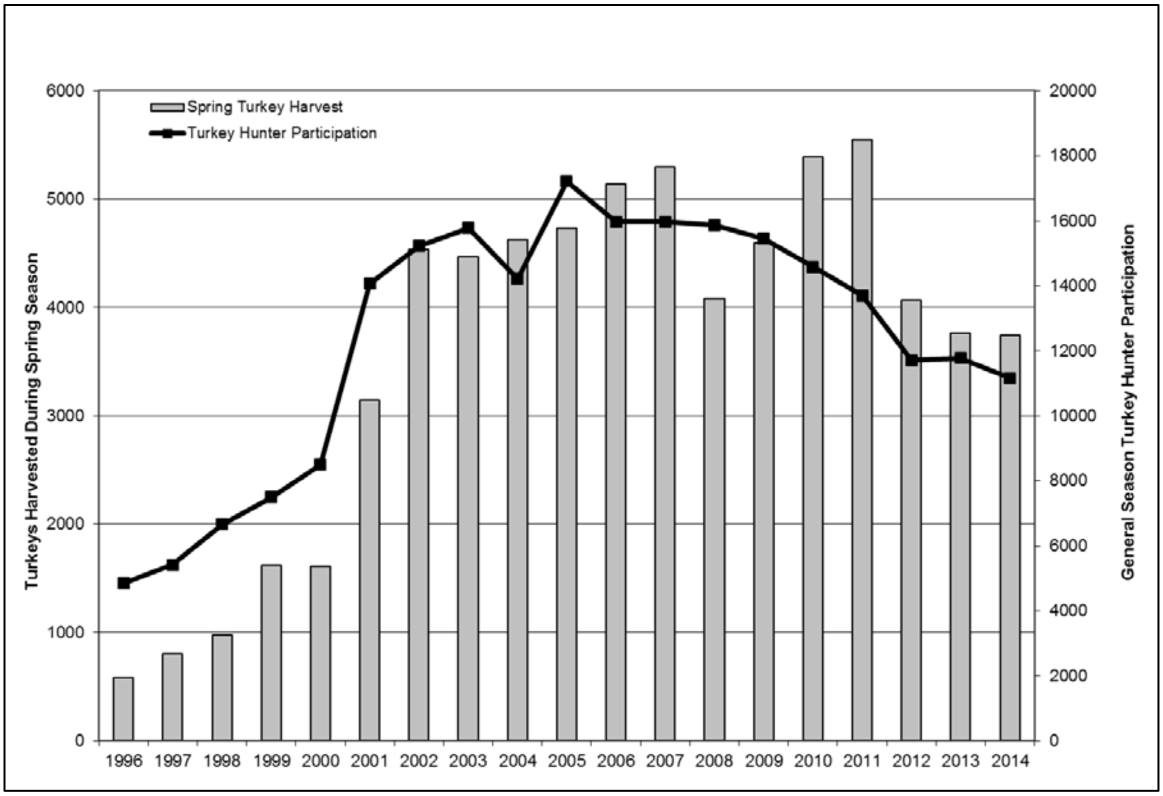

Figure 2: Estimated statewide spring turkey harvest and hunter participation 1996-2014.

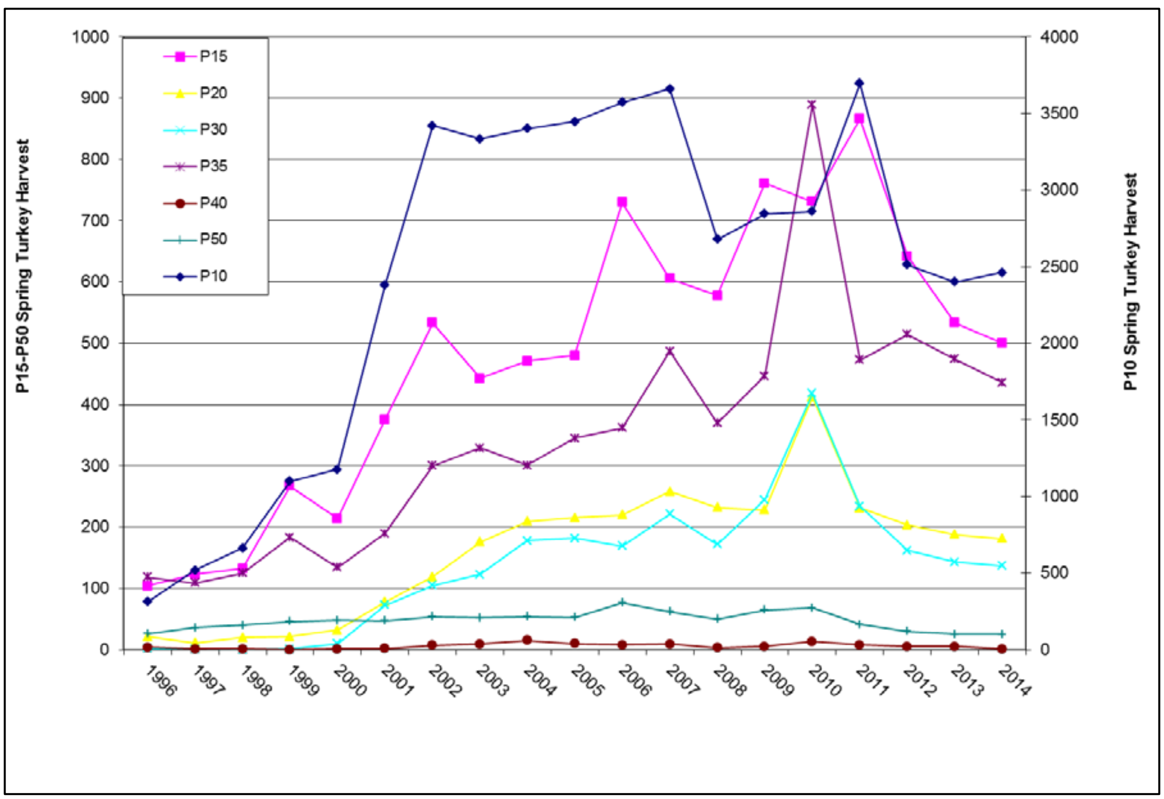

Figure 3: Estimated spring turkey harvest in each turkey Population Management Unit (PMU), 1996-2014

Pheasant

PHEASANT STATUS AND TREND REPORT
STATEWIDE

SEAN Q. DOUGHERTY, *Acting* Small Game/Furbearer/Private Lands Section Manager

Population Objectives and Guidelines
Management objectives for upland birds, including pheasant, are outlined in the Washington Department of Fish and Wildlife's (WDFW) Game Management Plan (WDFW 2015). Goals are to bolster pheasant numbers and enhance their habitats to ensure healthy, productive populations for recreation. A specific strategy to enhance Washington pheasant populations is described in the National Wild Pheasant Conservation Plan (Midwest Pheasant Study Group 2013) which focuses on maximizing the values of permanent herbaceous cover to enhance brood success.

In March of 2003, WDFW held a workshop that collected information to help identify key management strategies that would give the greatest chance of increasing naturally occurring pheasant populations in Washington. Experts in the field of pheasant management discussed research findings and management strategies that may help address population declines in areas where pheasant populations have been historically high. Perhaps the most significant recommendation from the workshop was to focus efforts in select areas and to give priority to habitat enhancements that address limiting factors for pheasant populations. A complete 2003 Pheasant Workshop meeting summary can be found at **http://wdfw.wa.gov/publications/pub.php?id=00414**.

Population Status
Pheasant harvest has varied widely over the past 50 years. Statewide harvest was at its highest during the mid-to-late 1960s with another peak in the late 1970s when over 500,000 pheasants were harvested. Since that time, pheasant harvest has steadily declined. Using harvest as an index of population status, pheasant populations in Washington appear to be much lower than they were in the 1960s and 1970s. Surveys (crowing count and brood index) conducted between 1982 and 1998 also indicated a decrease in pheasant numbers in eastern Washington (Rice 2003).

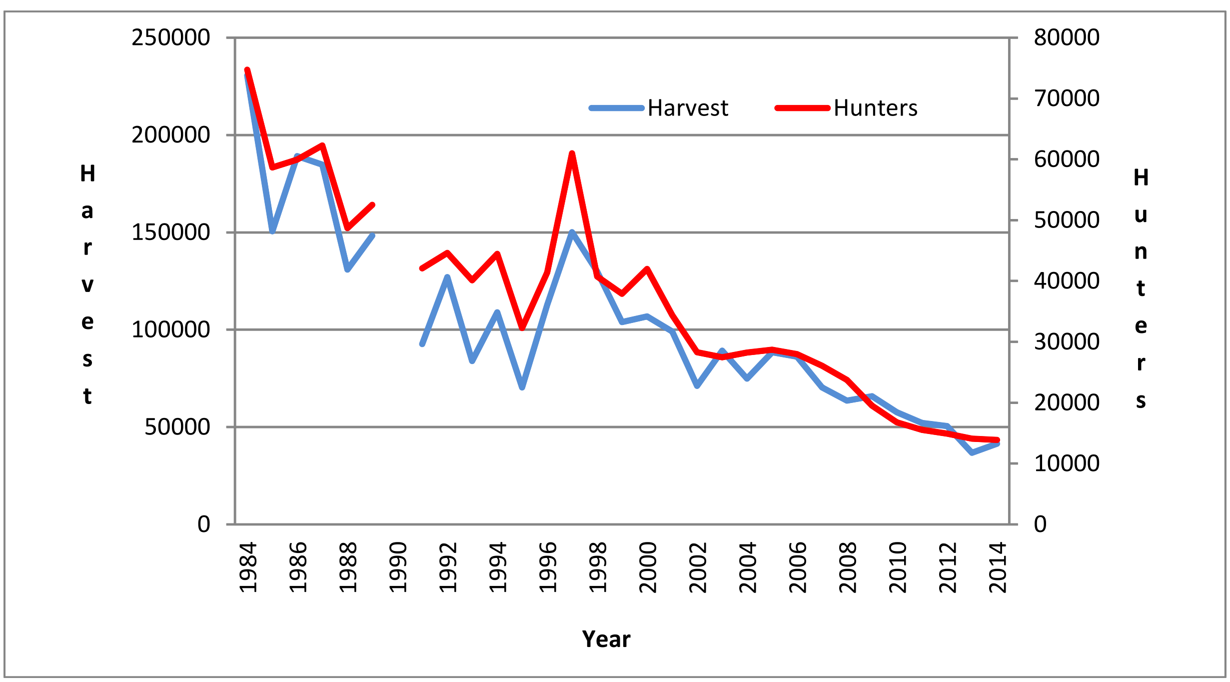

Figure 1 : Estimated annual pheasant harvest and annual hunter participation in Washington 1984-2013

Harvest estimates between 1984 and 2014 also indicate a decline in pheasant numbers (Figure 1). It is important to note that in 2001 WDFW changed the small game survey protocols by sampling 25,000 small game hunters to increase the precision of harvest and participation estimates.

Since nearly all wild pheasant (i.e., not pen-raised) populations occur in eastern Washington, estimates of harvest and hunter participation for this report include the following counties: Adams, Asotin, Benton, Chelan, Columbia, Douglas, Ferry, Franklin, Garfield, Grant, Kittitas, Klickitat, Lincoln, Okanogan, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman, and Yakima. Due to previous methods of calculation, figures presented for statewide, and basinwide hunter numbers in years prior to 2009 are probably somewhat higher than the actual participation at the time. Harvest estimates are assumed to be accurate.

A primary pheasant management zone was established in Washington where populations have been historically high. Within this primary zone, WDFW has delineated a southeast Washington pheasant focus area that includes portions of Columbia, Garfield, Walla Walla, and Whitman Counties to focus pheasant management efforts where adequate rainfall (i. e., 14-inches and over) is most conducive to supporting desirable plant communities (Figure 2).

Rooster pheasants have been released in the fall as part of the state-funded Eastern Washington Pheasant Enhancement Program (EWPEP) since 1997. Harvest estimates have included both released and wild birds and therefore the harvest of wild pheasants would be lower than depicted in Figure 1. WDFW has attempted to estimate the contribution of released birds to total harvest but recently it became evident that inconsistency with marking released birds have compromised these estimates.

In 2009, the EWPEP was audited at the request of the legislature and found the department was fulfilling its legislatively mandated strategy of releasing pheasants. Auditors concluded that pheasant populations continued to decline primarily due to loss of habitat and releasing pen-raised pheasants was not effectively sustaining or improving pheasant populations in eastern Washington. In 2009, the legislature rescinded the requirement for the program to use 80 percent of EWPEP funding for purchasing domestically reared pheasants for wild release. Since that time, WDFW has been reducing the number of birds purchased for release to eventually reach a point where the majority of the funds are devoted to habitat enhancement. In 2014, WDFW released 10,240 pheasants in eastern Washington, reduced from 11,350 in 2013. Funding now allocated to habitat enhancements will help address objectives identified in the 2016-2021 Game Management Plan (WDFW 2015); to increase the amount of quality pheasant habitat in the pheasant focus area.

Harvest estimates for the Columbia, Snake River, and Yakima Basins have been used to track trends within the primary pheasant management zone. The number of pheasants harvested each year reflects decreasing trends in overall populations from 2005 to 2014 (Figure 3), similar to the statewide harvest trend (Figure 1).

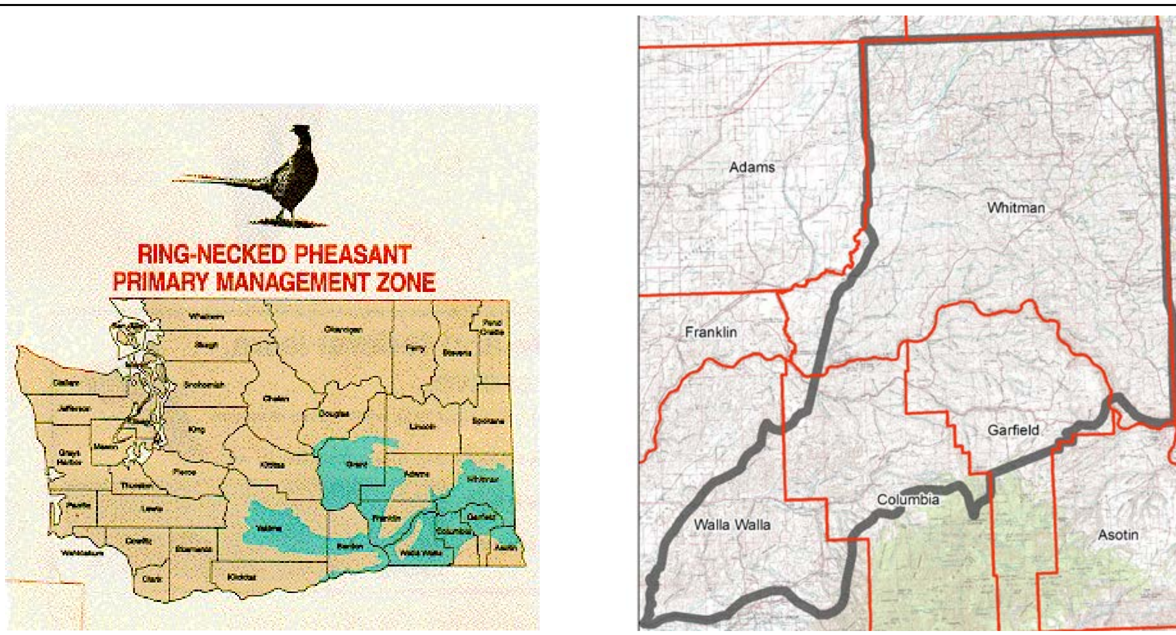

Figure 2: Washington State ringed neck pheasant primary management zone (left) and the southeast Washington Pheasant Focus Area (right)

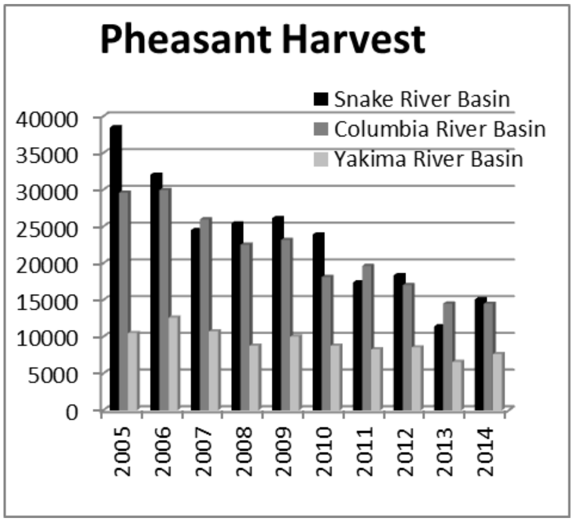

Figure 3. Estimated annual pheasant harvest for eastern Washington river basins between 2005-2014.

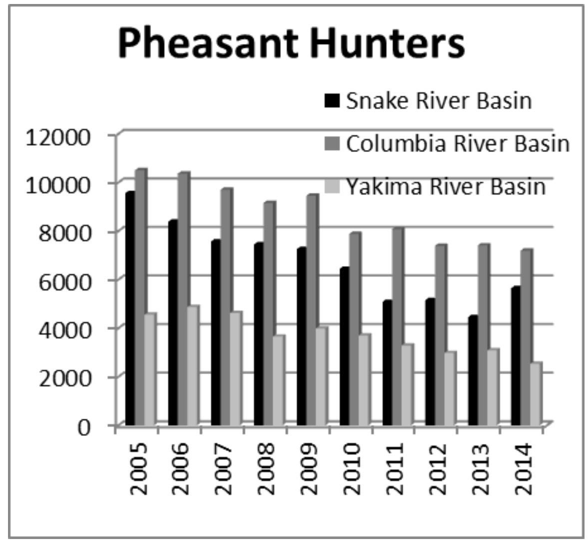

Figure 4. Estimated annual pheasant hunters for eastern Washington river basins during the period 2005-2014.

For this report, the "Yakima River Basin" consists of Yakima and Benton counties, the "Snake River Basin" is made up of Asotin, Garfield, Columbia, Walla Walla, and Whitman counties, and the "Columbia River Basin" includes Lincoln, Adams, Grant, Douglas, and Franklin counties.

The 2014 estimated harvest in the Columbia River Basin was 14,500 pheasants, which was 36% below the ten year average of 22,727 and was roughly the same as the 2013 harvest. The Yakima River Basin harvest increased from the 6,583 birds harvested in 2013 to 7,659 pheasants in 2014 (16% increase) but was still 20% below the ten year average of 9,625. The Snake River Basin saw the largest increase, jumping from 11,432 to 15,088 (32% increase) but remained 39% below the previous ten year average of 24,661 (Figure 3). There are multiple reasons for the increased harvest within the Snake River Basin. WDFW has been actively seeking to increase hunting opportunity on private lands and as a result hunters have access to areas that were previously unavailable. Aside from the increased access, habitat improvements made through the Conservation Reserve Program (CRP) and other habitat programs have helped to improve habitat quality throughout the area, and thus helping to increase pheasant productivity.

Hunter Participation

Hunter numbers have also dropped steadily since 1984 (Figure 1). A commonly held upland game philosophy is that hunters will participate in relation to the abundance of the targeted species. In the case of pheasant hunting in Washington, variations in harvest closely mirror hunter participation (Figure 1). Even though pheasant population declines are apparent, it is not fully understood whether other factors such as limitations on hunting access, economic changes, or some other factors, might be playing a role in declining participation. Over the past five years, eastern Washington pheasant hunters spent an average of 5.5 days afield and averaged 3.1 birds per hunter at a harvest rate between 0.5 and 0.6 birds per day.

The estimated hunter participation in the Snake River Basin in 2014 increased to 5,650 total hunters 27% increase from 2013 but remained 19% below the prior ten year average of 7,002 hunters. Columbia River Basin pheasant hunter numbers remained essentially unchanged but was also 21% below the ten year average of 9,067. The estimated Yakima River Basin hunter participation decreased by 18% and was 36% below the ten year average of 3,963 (Figure 4).

Habitat Trend

Permanent cover is critical to pheasant production particularly where the stands consist of a diverse mix grasses and broadleaf, flowering plants (forbs). Diverse vegetative can in turn produce more suitable nesting and brood rearing habitat (Midwest Pheasant Study Group, 2013). Most of eastern Washington pheasant habitat is heavily influenced by agriculture, and as a result CRP is the driving force behind all contiguous pheasant habitat. Conversion of CRP to annual crops creates a net loss of pheasant nesting and brood rearing habitat, and therefore negatively impacts pheasant populations. In an effort to reduce these losses, WDFW continues to work with the Farm Service Agency (FSA) and the Natural Resource Conservation Service (NRCS) to develop criteria for the State Acres for Wildlife Enhancement (SAFE).

SAFE is a CRP program for private landowners to develop, restore, and enhance native wildlife habitat in priority areas. Several WDFW private lands biologist staff in eastern Washington have completed the NRCS Planning Certification which has provided better access and easier integration with our conservation partners. Private lands biologists provide technical assistance to landowners concerning the installation and enhancement of wildlife habitat. Private lands staff also assist with planting of high-diversity mixes of grasses and forbs, shrub cover plots, and food plots across eastern Washington that benefit upland birds and other wildlife.

WDFW has received grants through NRCS's Voluntary Public Access and Habitat Improvement Program. Portions of these grants were directed at improving pheasant habitat and hunting access within the pheasant focus area. Roughly 100,000 acres of private property has been contracted to provide public hunter access. Of the acres enrolled for hunter access approximately 3,700 acres have been enhanced with native forbs and grasses to improve brood rearing habitat on these properties. With these efforts WDFW is hoping to increase pheasant populations in the Pheasant Focus Area.

In the Columbia River basin, WDFW has been leveraging federal funding through the Environmental Quality Incentive Program (EQIP) to increase habitat quality in the largely irrigated landscape where habitat is often scattered and generally of poor quality. The focus here involves planting unfarmed irrigation circle corners with grasses, forbs, and/or shrubs. These efforts provide high quality habitat, in areas that are otherwise devoid of any habitat.

Cause of Decline

The cause of the decline in pheasant populations in Washington is not fully understood, but there are likely several causes. Research in many parts of the United States indicates that loss of habitat is the primary reason pheasant populations have declined (Labisky 1976, Warner et al. 1984). Of particular importance is nesting and brood rearing habitat, winter cover and escape cover, to elude predators (Warner 1979).

Farming practices are evolving and most changes have had a negative impact on pheasants. During the 1970s, genetically modified wheat was beginning to be used due its high yield capabilities and its dwarf stubble stalk. Herbicide application to wheat stubble and reduced stubble height are considered major causes of the long-term decline of pheasants on the central High Plains (Rodgers 2002) and may also play a role in Washington. In some areas of eastern Washington, wheat stubble may be the only cover available to pheasants at certain times of the year. The shorter stubble heights increases a pheasant's visibility to predators. Wheat stubble and the associated waste grain, an important food source for farmland pheasants, are commonly tilled under and re-cropped in higher rainfall or in the irrigated areas of Washington further reducing resources available to pheasants.

Upland game bird fall population densities, and related harvest, also depend on spring weather conditions. Spring rains are needed to provide early plant growth for nesting cover while consistent warm early summer rains create an insect rich environment for pheasant chicks. Early spring drought conditions, even with normal temperatures, may decrease insect availability. Chicks depend on calorically dense, high protein insects as a major portion of their diet (Savory, C. J. 1989). Lower temperatures in experiments impacted pheasant chicks more than pheasant eggs in any stage of incubation (MacMullan, R. A. and L. L. Eberhardt 1953). When Washington experiences cold, wet springs there is a strong likelihood of poor pheasant production. In the past two years, 2013 and 2014, the weather conditions have been ideal for nesting and brood rearing.

In addition to the factors discussed previously, pesticide use and urban sprawl are also believed to be strong contributors to pheasant population decline. Pesticide use in early spring reduces the early germinating plants that are important food resources at that time of the year (De Snoo, G. R. and J. De Leeuw 1996). Some insecticides, organophosphates for example, can also have a direct effect on individual pheasants by sickening them or by actually killing them (Blus, L. J. and C. J. Henny 1997). Herbicide use reduces the overall plant diversity, which is a crucial component of high quality pheasant habitat. Across all agricultural states, pesticides are used on an increasingly broader scale, and have negatively impacted pheasant habitat quality throughout the introduced range. Additionally, houses now occupy many of the areas where pheasants were abundant. This trend is especially apparent in within the Columbia Basin and southwest Washington.

Surveys

Upland bird surveys in Washington were discontinued in the late 1990s due to limited time and funding for district biologists. When survey data is routinely collected, it is possible to combine that information with available state and national land use databases to link wildlife population changes to land use (Nusser et al., 2004).

Two different pheasant surveys were established in the pheasant focus area with nine survey routes in 2010. The spring pheasant crowing survey has been conducted twice each spring for the past five years between April 15 and May 25 to develop a spring male pheasant breeding population index and track land use changes over time. The raw data from the spring of 2015 suggests that the population is about the same as in past years, which is important given that the 2014 hunting season was especially productive within the Snake River Basin. Given the increased harvest during the 2014 hunting season (Figure 3) coupled with favorable winter and spring weather, WDFW is optimistic that the 2015 hunting season will yield a greater number harvested pheasants. As these surveys continue into the future, trends may become more evident and more precise predictions could be made. For now, the spring pheasant crowing surveys are expected to continue in the pheasant focus area and may be extended throughout the primary management zone as staff time allows.

Research

WDFW and Washington State University conducted research to determine the effects of different habitat types on the abundance of insects available to pheasant broods. Insect availability is believed to be a primary limiting factor for pheasant populations in the area (Savory, C. J. 1989). However, the study found that insect availability was not limiting in any of the habitat types sampled. The study sought to determine and quantify the insect diversity within existing CRP stands, in CRP stands with nonnative forbs and in CRP stands with native forbs. The study determined that insect abundance was greater in CRP fields with a forb component, but there was no significant statistical difference between the native and nonnative forb plantings (Quinn 2015).

An additional component of the study was added in 2013 that involved placing human imprinted pheasant chicks in these various stand types to forage on insects and then evaluating their diet while on site. Fifty four pheasant chicks survived the imprinting process then the four to nine day old pheasant chicks were used to perform foraging trials within each treatment on four farms to measure diet composition, travel rates, and mass change while foraging. The diets of the pheasant chicks did not differ between plots with an average of 2% arthropods, and the remainder consisting of seed, soil, and foliage. The pheasant chicks did travel twice as far while foraging in the in existing CRP stand than in fields with forb plantings, which reflects the results discussed previously (Koepke 2014 and Quinn 2015).

Management Conclusions

Reductions in hunter interest and harvest are some evidence of a declining population of pheasants in eastern Washington. Diligent monitoring and efforts to improve habitat will be key in improving the pheasant populations in eastern Washington. Long term figures indicate that pheasant populations have declined dramatically since the 1980s and have continued to remain at relatively low levels. Causes for the decline are not clearly understood, but habitat loss and alteration is likely the primary cause. Suitable habitats are becoming increasingly fragmented and isolated or have been severely degraded. In order to address this situation, the following action items have been developed to guide WDFW’s efforts to improve habitats for more productive pheasant populations:

1) Continued support for an Upland Game Bird Specialist within the southeast Washington pheasant focus area.

2) Use of Geographic Information System (GIS) technology to evaluate existing and potential pheasant habitat areas within the pheasant focus area.

3) Continue pheasant crowing surveys in the pheasant focus area to monitor trends and relationships to habitat conditions.

4) Continue partnerships with Pheasants Forever and Quail Forever.

5) Complete the study in coordination with science division to investigate insect response to planting native and non-native forbs and legumes in strips or blocks within existing CRP stands.

6) Utilize a variety of funding sources to place habitat technicians in the pheasant focus area to provide habitat implementation assistance to farmers.

7) Ensure biologists and technicians have full knowledge of all state and federal habitat programs available to assist farmers in improving pheasant habitats.

8) Utilize mid-contract management for existing CRP contracts to improve habitat conditions.

9) Create and restore nesting cover and brood-rearing habitat.

10) Release rooster pheasants only as put-and-take enhancement of hunting opportunity, not as a population management tool.

11) Work closely with FSA to promote development of habitat for pheasants and other upland wildlife. This is critical as large numbers of CRP contracts expire.

12) Continue efforts with Washington State University and the Pacific Northwest Direct Seed Association to retain stubble height.

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Chukar

CHUKAR AND GRAY PARTRIDGE STATUS AND TREND REPORT: STATEWIDE

SEAN Q. DOUGHERTY, *Acting* Small Game/Furbearer/Private Lands Section Manager

Population objectives and guidelines

Management objectives for upland birds, including chukar partridge (*Alectoris chukar*) and gray partridge (*Perdix perdix*), are outlined in the Game Management Plan (WDFW 2014). Harvest management is designed to provide maximum recreation opportunity without negatively impacting populations.

Hunting seasons and harvest trends

The hunting season for chukar and gray partridge has varied in length over the years by regions. In the early 1960s and 1970s Region 1 had a split early and late season while the rest of eastern Washington was regulated with one general season. In 1997, the implementation of one, standardized season was set to start October 1 and end the second Sunday in January. The season was changed again in 2003 starting on the first Saturday of October extending to mid-January.

The 2014-2015 season opened on October 4th and closed on January 19th. The opportunity to harvest both species was also included in the September 20-21 youth hunting weekend. Daily bag limits are 6 chukar and 6 gray partridge with 18 of each in possession during the general season.

The 2014 Chukar harvest of 6,541 was a 13.93% increase from 2013, but remained 52% below the ten year average of 13,543 birds (Figure 1). Gray partridge harvest had been on the rise from 2008-2012 then in 2013 harvest dropped approximately 59% from the previous year. However, the total harvest in 2014 was 4,361 which was a 33.94% increase from 2013, but still remains 26% below the ten year average. Chukar hunter numbers have steadily declined over the last decade. There were 2,501 hunters who hunted Chukar in 2014 representing a 14.35% drop from 2013 and 30% below the ten year average of 4,154 (Figure 1). The most productive counties for Chukar were Asotin (1212), Chelan (1081) and Kittitas (896). Whitman (668), Kittitas (499) and Asotin (441) Counties led the state in Gray Partridge harvest.

Chukar hunting was a major recreational pursuit in southeastern Washington during the 1970s when harvest averaged more than 66,000 birds in Region 1 alone. Estimated chukar harvest for the past ten years in Regions 1, 2, and 3 is illustrated in Figure 2. Estimated chukar hunter numbers in Regions 1 and 2 were similar to numbers in 2013 (+8% and -1%, respectively), but there was 43% decline in hunter numbers for Region 3. Despite a similar number of hunters between 2013 and 2014 harvest increased substantially, 63% for Region 1 and 86% for Region 2. However, Region 3 saw a decline in harvest of about 38%. All regions remained below the prior the year average Region 1 was 34% below the prior ten year average of 3,533, Region 2 was 56% below the ten year average of 6,188, and Region 3 was 65% below the ten year average of 4,080.

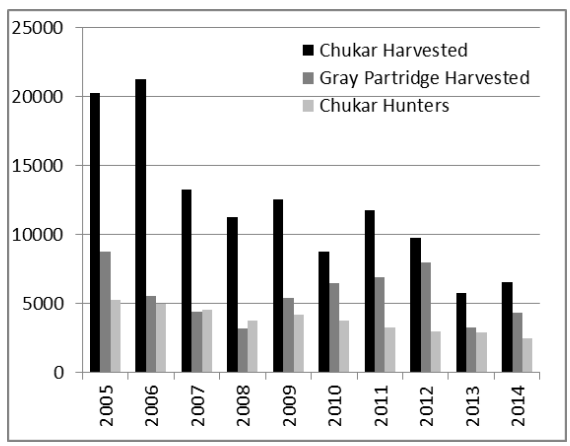

Figure 1. Chukar hunters, chukar and gray partridge harvest statewide for the period 2005 – 2014.

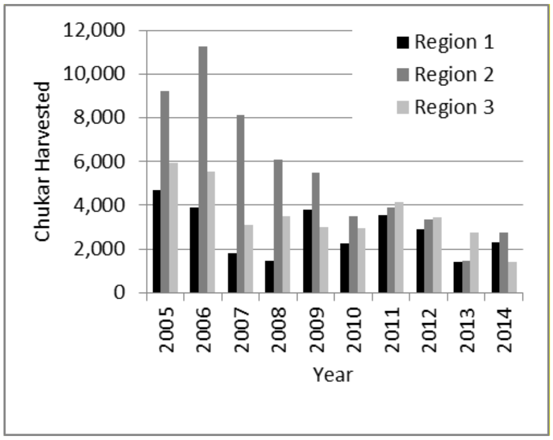

Figure 2. Estimated chukar harvest for Regions 1, 2 and 3 for the period 2005 – 2014.

Hunter participation peaked in the late 1970s and early 1980s but has been on a steady decline ever since. In 2014, approximately 2,500 hunters pursued chukar in the state of Washington (Figure 1). The estimated 2014 harvest per hunter (2.62) was much improved over 2013 but still 44% below the 25 year average of 3.52. The increase from the previous year likely reflected the mild winter and abundant numbers of insects for brood forage.

Surveys

Chukar populations were surveyed by helicopter from 1987 to 1997, when aerial surveys were terminated due to budget constraints. Depending on time and weather conditions volunteers in Region 2 drive three routes (Colockum-Tarpiscan, Swakane-Nahahum, and Chelan Butte) in early August to count chukar and other game birds. Each route is approximately 20 miles long, and replicated three times. However, in recent years conditions have not been conducive to conducting these surveys. In other regions, field personnel note the abundance of broods during regular field operations and other surveys, but no formal surveys are conducted.

Population status and trend

Absent field survey information, harvest and hunter effort have been used as an index to population trends. These data are estimated through a post-season hunter surveys. Harvest trends suggest that the chukar population remains well below long term averages, but this could also be a result of reduced harvest and lower hunter participation. Gray Partridge harvest which had been at its highest level in seven years in 2012 dropped to near record lows in 2013, but rebounded slightly to 4,361in 2014. The steep drops in harvest for both species are believed to be due to the impacts of poor weather during the nesting and brood rearing period.

Breeding Bird Survey (BBS) information (Sauer et al., 2014) for Washington suggests a stable or steadily increasing population of chukar for the last few years but data credibility is at a moderate level for this species due to low sample size. The BBS data for Gray Partridge illustrate a long term decline with the same moderate level of confidence.

In order for chukar and Gray Partridge populations to thrive they are dependent upon recruitment, over-winter survival and spring insect productivity. Persistent snow cover during the winters of 1992-93 and 1996-97 may have influenced the dramatic declines recorded in areas of the state. Populations rebounded rapidly following these rough years with seemingly favorable nesting and brood rearing conditions. Recently spring drought conditions have likely been a negative impact on populations.

Habitat condition and trend

Chukar habitat includes arid areas with steep slopes, deep valleys, and rocky outcrops. Chukar habitat is found where topography, combined with shallow soils, prevented extensive agriculture and/or development. Cheatgrass is a staple of the chukar diet during spring and fall, and the availability of cheatgrass can have a significant impact on chukar populations.

In Region 1, some of the best chukar habitat has been overtaken by yellow star-thistle (Centaurea solstitialis). Thousands of acres of habitat along the breaks of the Snake River south of Clarkston are now covered with yellow star-thistle, and likely hinders population recovery. The problem of star-thistle is now so wide spread, that several counties have halted control programs, leaving it up to the private landowners to control. Although certainly a negative impact, yellow star-thistle is likely not the ultimate cause of the regional population decline.

Chukar habitat is relatively stable in Region 2 because of the precipitous nature of the terrain. However, development is increasing (especially in the Wenatchee Valley) near chukar habitat, which could impact chukar populations in the future.

In Region 3, WDFW and Department of Defense (DOD) manage the majority of chukar habitat. Both WDFW and DOD are working to increase the chukar numbers on their respective properties. One effort taken by the DOD was discontinue cattle grazing in 1995 to reduce impacts on wildlife and increase vegetation biomass. Despite collaborative efforts, a substantial portion of both WDFW and DOD property have burned in recent years and has greatly reduced shrub cover available to resident chukars. Biologists report that chukars in these areas tended to utilize shrub cover more during the winter and breeding season, so losing this habitat type to fires likely reduces the overall habitat quality.

Management conclusions

The continued apparent long term decline in the chukar population is most likely due to diminishing habitat quality. For example, the invasion of yellow star-thistle has taken over thousands of acres of quality habitat in southeastern Washington reducing available food resources for chukars. Habitat quality in some portions of the state may have actually improved over time with the abundance of wildfires that influenced the spread of annual grasses. However, the concurrent loss of shrub habitat due to fires may be detrimental. Residential development, irrigated agriculture, and wind energy facilities are concerns creeping into chukar habitat that may reduce the quality or amount of available habitat in the future. Chukar populations can also be expected to fluctuate annually in response to weather variability and other factors which influence habitat and reproduction

It is certain that chukar and gray partridge populations in Washington have experienced long term declines. However, the recent decline in harvest rates, which have continued to be used as the primary population indicator, merit further investigation to determine whether they represent a reliable picture of population status or are influenced more heavily by other independent factors.

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Quail

QUAIL STATUS AND TREND REPORT:
STATEWIDE

SEAN Q. DOUGHERTY, *Acting* Small Game/Furbearer/Private Lands Section Manager

Population objectives and guidelines
Objectives for quail in Washington include maintaining healthy populations in all suitable habitats within the state. At the same time, WDFW seeks to maximize recreational opportunities consistent with population management objectives outlined in the Game Management Plan (WDFW 2014). In the case of mountain quail (*Oreortyx pictus*) the primary objective is to recover populations in the Blue Mountains and potentially other parts of eastern Washington where significant declines have occurred.

Hunting seasons and harvest trends
The general hunting season for California quail and northern bobwhite (Colinus virginianus) in eastern Washington was October 4, 2014 through January 19, 2015. A special youth only hunting weekend occurred on September 20-21. As in previous years, the general season mixed bag limit of 10 per day with a possession limit of 30. The general season for California, bobwhite and mountain quail (Oreortyx pictus) in western Washington ran from September 27th through November 30th 2014. Bag limits were the same as eastern Washington except that mountain quail had a daily bag limit of 2 and a possession limit of 4. Mountain quail hunting was closed throughout eastern Washington.

Quail harvest has continued to decline following a peak harvest of 190,062 in 2003 (Figure 1). The estimated statewide harvest in 2014 was 70,498 and represents a 3% decline from the 2013 harvest. Eastern Washington accounts for approximately 98% of the statewide total harvest.

The 2014 harvest estimate of 13,930 quail in Region 1 represents a 34% increase from the 2013 harvest of 10,400 but was 35% below the prior ten year average of 21,296 (Figure 2). Harvest in Region 2 increased by 6% with 32,852 quail, but was still 29% below the prior ten year average of 46,156 birds (Figure 2). Despite the increases in annual harvest noted for Regions 1 and 2, the harvest in Region 3 declined 25% to 22,229 birds and was 47% below the prior ten year average (Figure 2). The combined harvest estimate for Regions 4, 5 and 6 increased 3% to 1,487, with approximately half of that harvest occurring in Klickitat County.

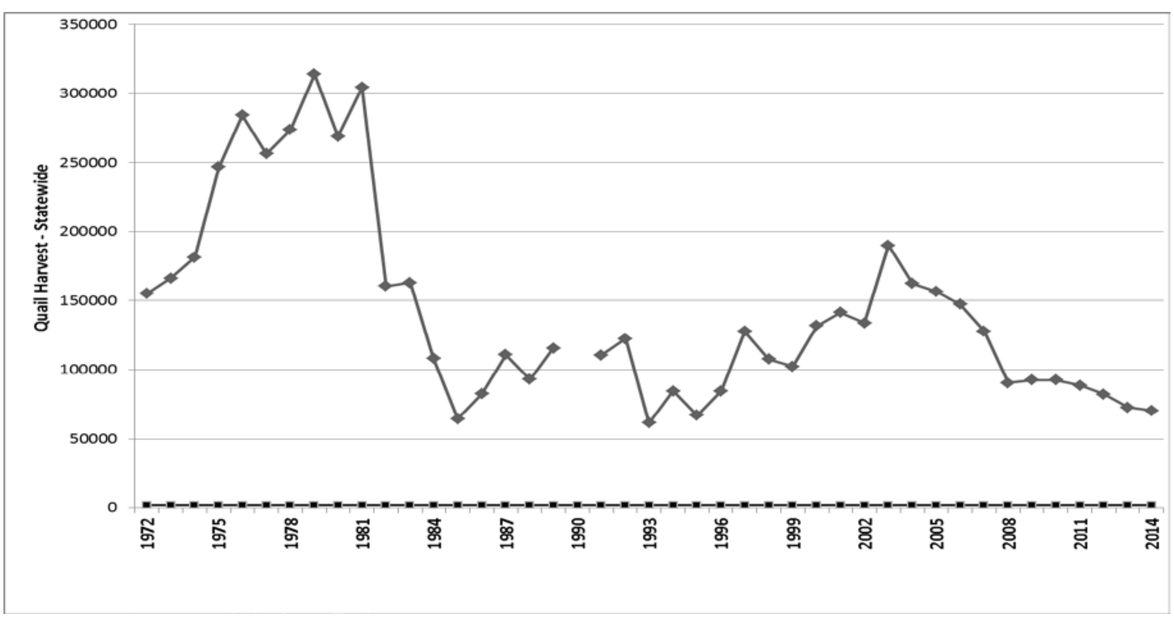

Figure 1: Estimated Washington State quail harvest for the period of 1972 - 2013

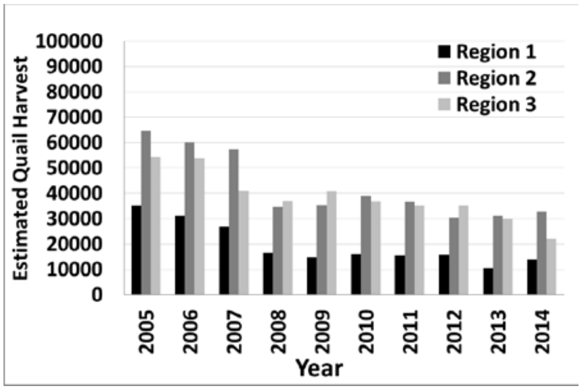

Figure 2: Region 1, 2, 3 quail harvest 2005 - 2014

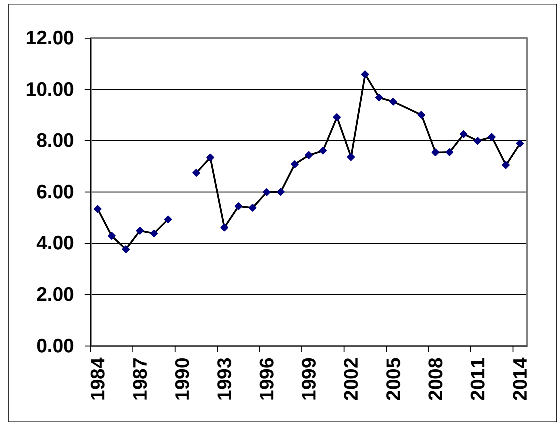

Figure 3: Washington Quail harvest per hunter

Population status and trend

Because field surveys are not conducted to estimate or track populations, harvest estimates have been used as an index of the population status. Based on harvest, it appears that quail populations in Washington are currently much lower than they were in the late 1970s and early 1980s (Figure 1). This decline is most likely related to "clean" farming practices introduced in the early 1980s that has encouraged the removal of shrubby cover along fence lines and draws. In the last 5 years the US Geological Survey breeding bird survey information for Washington has suggested an increasing trend for California quail populations (Sauer et al 2014) which bodes well for quail hunters in 2015. Another indicator of population is harvest per hunter, but this rate has dropped from an all-time high in 2003 (11 per hunter). Harvest per hunter remained fairly stable from 2008 to 2012 at around 8 birds per hunter, but dropped to 7.05 in 2013 probably reflecting poor spring conditions. In 2014, harvest per hunter rebounded slightly to 7.89 birds per hunter (Figure 3).

Given the right environmental conditions quail can be very productive, which may have been the key to the peak in 2003. In 2015, winter was quite mild and spring came early bringing with it lots of insects and could have the makings of a great season.

Habitat condition and trend

As with other agriculturally associated wildlife, quail habitat quantity and quality has declined for decades. Breeding habitat (including nesting and brood rearing habitat), wintering habitat and habitat that can provide escape cover are especially important for quail to be successful. Land development and "clean farming" practices have dramatically reduced and fragmented suitable habitat for all upland game birds including quail.

A food habits study conducted in southeastern Washington performed an analysis on 157 California quail crops from March – September. The study found that male and female quail were selective in their feeding habits, preferring leafy green plants in the spring and then transitioning to insects and seeds in the summer (Anthony 1970). The timing of herbicide use in agriculture often corresponds to the "spring green-up" and flushes of undesirable weeds which can reduce the abundance of those early season leafy greens that quail rely on, and thus can negatively impact quail populations.

The Conservation Reserve Program (CRP) has been a tremendous benefit to all upland bird species. The program provides financial incentives to producers to establish perennial vegetation. However, dense vegetation, litter accumulation, and decreased species diversity of older CRP fields, most likely limits the habitat value for some species (Rodgers 1999). Recently, CRP programs have been encouraging landowners to diversify their CRP lands through State Acres for Wildlife Enhancement (SAFE), Environmental Quality Incentives Program (EQIP) and simply requiring more diverse plantings to be reenrolled in the general CRP program. Flowering plants are very beneficial to upland birds because of the insects that are attracted to them. The insects in turn serve as an important food resource for newly hatched chicks allowing for greater brood rearing success. Continuation of these programs is considered to be vital to enhance upland bird habitat in eastern Washington.

The highest California quail densities are typically associated with brushy riparian areas and shrub-steppe habitat near riparian areas; however quail have adapted well to urban neighborhoods. Residents enjoy watching quail and often feed them throughout the winter months. Urban quail populations with high survival may act as population reservoirs by providing brood stock to adjacent non-urban populations.

Augmentation and habitat enhancement

Occasionally, Private Lands Biologists and Wildlife Area staff will trap California quail from urban populations to augment populations that appear to be reduced or to enhance recreational opportunity. No trapping and relocation efforts were conducted this past year.

A three-year project to enhance mountain quail populations in southeast Washington was implemented in March 2005. Mountain quail were trapped in southwest Oregon for release in Idaho and Washington. Washington released 73 birds in March 2005 and 89 in March 2006 in the Asotin Creek watershed. Monitoring of the released birds was accomplished by fitting 50 of the birds with necklace-style radio collars each year. Of the 50 marked birds in 2005, 34% survived to 6 months post release. In 2005, 8 nests had 100% nest success. Average clutch size was 9.25, with average hatch date of July 2. Six of the eight successfully nesting birds had chicks present at 28 days post-hatch, the other 2 failed to have successful flush counts. In March 2006, 89 birds were released with 49 being fitted with necklace-style radio transmitters. By August 2006, 82% of the radio-marked birds had died. Five of the 8 birds attempting to nest during 2006 successfully hatched their nests. Male mountain quail incubated sixty percent of the nests over the 2 years, with 47% of all successful nests raising chicks to 28 days of age. (Stephenson 2008). Unfortunately, birds captured from southwestern Oregon during the winter of 2006/2007 all died in a holding facility in south-central Washington.

In 2012, the mountain quail augmentation effort was reinitiated which included the construction of a new holding facility and the release of 94 birds from western Oregon. However, the survival of the birds from this release was not monitored as closely as with the earlier releases. In 2013, 49 mountain quail trapped in western Oregon were released in the Asotin Creek drainage. 25 of these birds were marked with necklace type transmitters for monitoring. As with previous releases, the initial mortality was high with only eight collared birds alive at the end of June. Two of which were tending nests but neither were successful.

Surveys on the small, dispersed populations of mountain quail are not cost effective, as such the augmentation effort in terms of reestablishing a viable population is very difficult to assess. Prior to any further releases, a full evaluation of the reintroduction effort will need to take place.

Surveys

All population and production surveys were discontinued in 1999 due to limited time and funding for district biologists. The post-hunting season questionnaire is now used to estimate harvest and currently provides the best index of population status.

Five calling survey routes specifically designed to detect the presence of mountain quail were re-established in the Asotin Creek drainage in the spring of 2009. Mountain quail were either heard or observed on 2 of the 5 survey routes that year. University of Idaho had originally established the routes with WDFW in 2005 using the protocol from "Validation of a Mountain Quail Survey Technique" (Heekin and Reese 1995). These surveys have not been conducted over the past few years.

Management conclusions

Washington quail are a major upland game bird species and also of significant interest to wildlife viewers. Habitat improvements, including the various Farm Bill programs are the key to WDFW's ongoing efforts to enhance upland game bird populations across the state.

A full evaluation of the mountain quail augmentation project in southeastern Washington is needed to determine whether the methods are helping to reestablish a viable population or whether changes to the current strategy are needed. A first step in this evaluation should be a search for similar evaluations in the neighboring states of Oregon and Idaho where similar augmentation has been occurring. If a review of those efforts is inconclusive, field surveys may be necessary in Washington to examine the current status of mountain quail in the reintroduction area. Habitat enhancements may be needed in conjunction with future releases or as a next step in the recovery effort.

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Grouse

FOREST GROUSE STATUS AND TREND REPORT:
STATEWIDE

SEAN Q. DOUGHERTY, *Acting* Small Game/Furbearer/Private Lands Section Manager

Population objectives and guidelines
Forest grouse in Washington include dusky grouse (*Dendragapus obscures)*, sooty grouse (*Dendragapus fuliginosus)*, and ruffed grouse (*Bonasa umbellus*), which occur throughout the forested lands in Washington, as well as spruce grouse (*Falcipennis canadensis*), which are closely tied to higher elevation spruce/fir habitats. Dusky and Sooty Grouse were once collectively classified as Blue Grouse. Forest grouse management objectives are:

1. Preserve, protect, perpetuate, and manage forest grouse and their habitats to ensure healthy, productive populations.

2. Manage for a variety of recreational, educational and aesthetic purposes including hunting, scientific study, wildlife viewing, cultural and ceremonial uses by tribes, and photography.

3. Manage statewide populations for sustained harvest.

Brewer (1980) stated that ruffed grouse could sustain harvest of up to 50% of the fall population without threat of decline and our objective is to avoid a take that exceeds that number. Present harvest is thought to be well below 50% although exact population and harvest levels are not known.

Hunting seasons and harvest trends
A statewide harvest estimate (determined by using a mailed hunter questionnaire) is the main indicator for long-term population trends. Developing estimates of forest grouse hunter numbers and harvest is challenging because of a licensing structure that allows harvest with a big game license as well as a small game license. Forest grouse harvest survey methods were modified in 1998 and 1999 because of 1) difficulty in separating effort among the 3 grouse species, 2) inaccuracy in species identification by some hunters, and 3) changes in hunting license structure that impacted hunter sample stratification. Because of this change in survey technique, comparison of forest grouse harvest information before and after this time should be done with some caution.

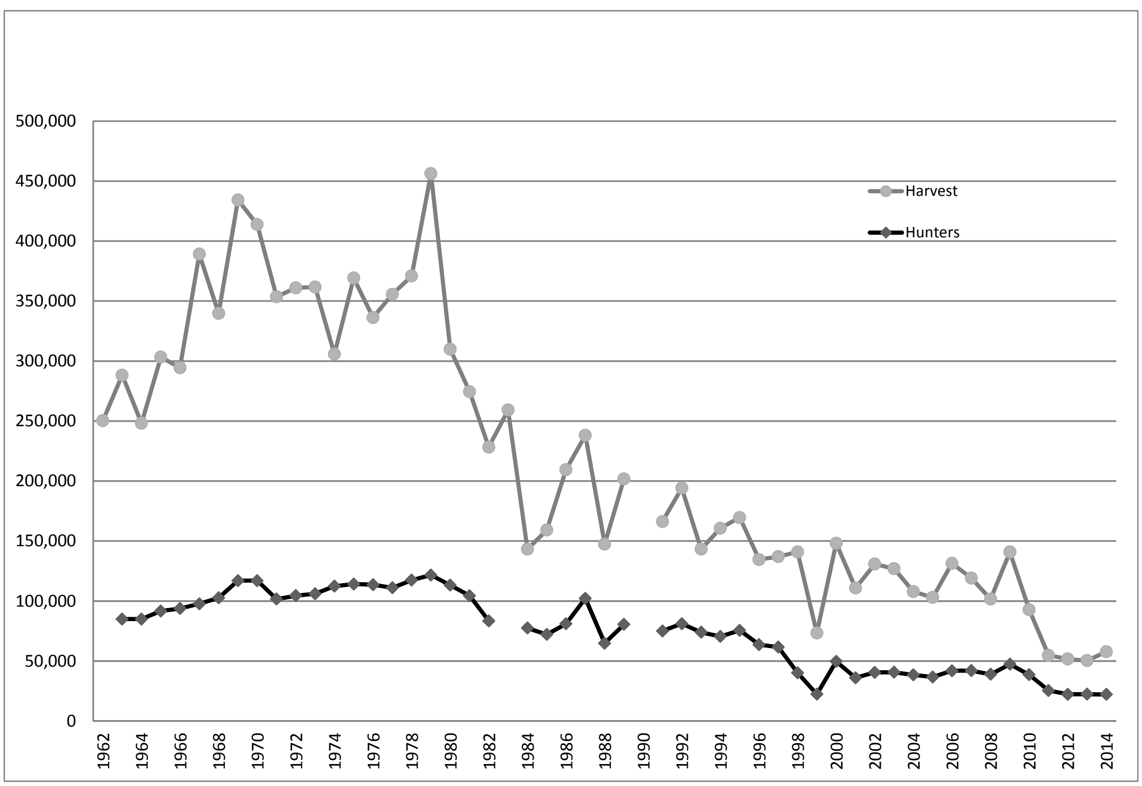

Figure 1: Long-term trend in grouse harvest and hunter numbers, 1963-2014

The current Sep. 1 to Dec. 31 hunting season structure has been in place since 1987. A daily bag limit of 3 of any of the three species was in place from 1952 to 2009 when the bag limit was raised to four. This increase in the bag limit was not made in response to increasing populations, but rather in response to a desire to increase opportunity. Since hunters had been taking approximately 0.4 grouse per day hunted, which had been the case for over 50 years, it was believed that increasing the bag limit would not impact overall populations. Interestingly, the harvest per day has been approximately 0.3 birds per day since the bag limit was increased. Beginning in 2015 the bag limits were changed again to address hunter concern regarding reduced numbers of grouse being seen by hunters. The regulation at this time is a daily limit of 4 forest grouse but only 3 of any one species.

Estimated hunter numbers and harvest have declined from the historic highs of the 1970s and dropped sharply from 2009-2011 but have since leveled off over the past three years (Figure 1). The statewide hunter harvest of 57,814 in 2014 was up 35% from 2013 but remained 39% below the prior ten year average. Harvest estimates continue to be closely tied to hunter participation which was essentially unchanged from the previous season (Figure 1). Increased restrictions in motorized travel and new fee permit access programs within industrial timberlands may influence hunter participation as much as grouse numbers and contribute to the downward trends. Harvest monitoring since 1999 should provide comparable data. In addition, improvements in data collection and analysis should provide a better understanding of harvest both regionally and statewide.

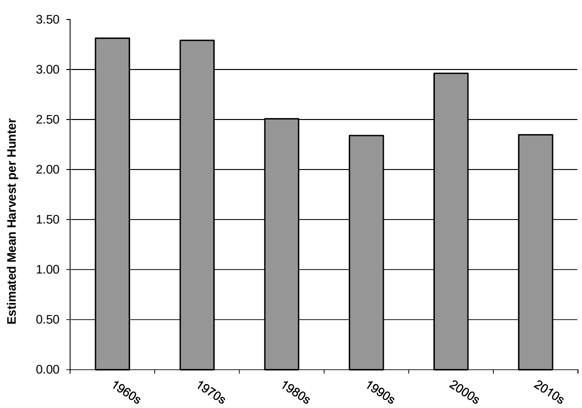

Figure 2: Estimated grouse harvested per hunter in Washington 1963-2014.

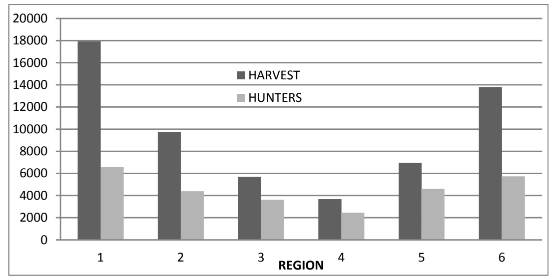

Figure 3: 2014 Forest grouse harvest and hunters by WDFW region

Although grouse hunter and harvest estimates have varied substantially over time, annual estimates of harvest per hunter (an indicator of hunter success) have not declined as dramatically. Estimates of hunter success since 2000 have been higher than, or similar to, the 1980s and 1990s (Figure 2).

The estimated harvest and hunter numbers by region in 2014 are depicted in Figure 3. The estimated harvest in all Regions increased, except in Region 4 which declined by about 29%. The harvest in Region 3 increased by 74% while Regions 1, 2, 5 and 6 had increases ranging from 5 to 28%. The effect of spring weather on chick production and survival is a well-known factor influencing variation in population, the wide range of variation between regions is difficult to explain. Changes in access for hunting may play a role, it may be attributed to variation within the sample of hunters surveyed from one year to the next, or it could be recent wildfires force hunters to try new locations.

The cause of the long term and recent harvest declines are not well understood, but reductions in hunter participation are a likely contributor. Loss or changes in forest habitat and vehicular or other access restrictions may also be affecting populations and harvest opportunities.

Region 1 typically has the highest number of both forest grouse hunters and birds harvested and accounted for 31% of the grouse harvested in the state. Okanogan and Stevens Counties produced the highest numbers of Grouse in eastern Washington at 7,480 and 7,465 respectively. Clallam and Grays Harbor Counties were the top producers west of the Cascades with 4,605 and 3,298.

Surveys

Statewide population surveys for forest grouse are not conducted; however, some surveys have been conducted in north-central Washington and northeastern Washington. Forest grouse wings were collected in the same areas by placing barrels in strategic locations where hunters voluntarily deposit one wing from each grouse harvested. The collected wings are then classified by species, sex, and age. However, in the last two years these surveys have not been conducted in north-central Washington due to limited time and resources.

Historic statewide wing collections from 1993-95 provided several pieces of important information, such as, more than 70% of forest grouse harvest occurs in September and early October, before modern firearm deer seasons. Therefore, current seasons that extend through December probably have very little impact on grouse populations. In addition, there is a tendency for hunters to misidentify grouse species, which has resulted in forest grouse species being combined for current harvest estimation purposes.

The Little Pend Oreille National Wildlife Refuge has continued wing barrel collections, but after this year will discontinue the collection due time constraints. Total numbers of wings collected has varied over time but the number of wings deposited by hunters was about average in 2014. Species here include Dusky, Spruce and Ruffed Grouse with Ruffed Grouse accounting of most of the total harvest. (Table1; Michael Munts, USFWS, personal communication)

Table 1. Little Pend Oreille National Wildlife Refuge 2014 Harvest Total

Species	Adult	Juvenile
Ruffed Grouse	47	61
Dusky Grouse	3	3
Spruce Grouse	0	0
TOTAL	**50**	**64**

Population status and trend analysis

Based on long-term harvest trends, it appears that forest grouse populations may be declining. However, it is difficult to draw concrete conclusions due to the fact that harvest estimating methods have changed, hunter participation has declined, hunting access has been more restricted and there could be other factors that influence harvest independently from population size. The fact that harvest per hunter has not varied much over time (Figure 2) may indicate that the number of grouse available to hunters has not changed as dramatically as the total harvest suggests. Since hunters are not able to consistently identify the species of forest grouse harvested, evaluating population trends for individual species is even more difficult.

Annual production is greatly influenced by weather conditions during the peak of hatching (late May early June). Wet and windy weather reduces chick survival due to over-exposure as well as 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

Although long term habitat losses have occurred, forest management and wildfire are the most significant factors statewide for influencing habitat condition and forest grouse population trends. Historically, timber harvest activities have been considered beneficial for most species of forest grouse. Recent changes to silvicultural techniques such as control of broadleaf species that are important food resources, with herbicides may play a significant role in the degree to which commercial forests provide benefits.

Future benefits from timber harvest will depend on the manner in which regenerating forests are managed. 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 fewer habitat benefits may negatively impact grouse populations.

In eastern Washington, 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 increasingly become infested by pine beetles, killing the trees. Forest managers want to harvest those trees before they decay or burn in wildfires. Whether changes such as these will significantly affect forest grouse are difficult to determine with any degree of certainty.

Wildfires are an important factor influencing grouse habitat in eastern Washington. Several large fires have occurred in forested areas of Region 2 since the late-1980s. These areas are currently in early successional shrub communities, which should be beneficial to grouse for several years to come but this may be offset by loss of mature forest stands important to winter survival.

There is significant potential to reduce spruce grouse habitat if 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 harvested stands may end up at much lower stocking rates than are currently present. Both of these outcomes could reduce value of the habitat for spruce grouse.

Augmentation and habitat enhancement

Supplementation of forest grouse populations is generally considered unnecessary in Washington State. No large-scale efforts have been made to enhance habitat for forest grouse. However, WDFW Habitat Program staff frequently responds to Forest Practice Applications with recommendations to mitigate forest management impacts on wildlife. 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-fir trees 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

Many factors may be influencing forest grouse harvest which historically has been used as the primary population status indicator. While harvest has declined, hunter success rates have been reasonably consistent which might suggest that grouse availability to hunters has not changed as significantly as total harvest suggests. In recent years, the finest level of harvest tracking has been at the regional level which has not necessarily been adequate enough to identify what factors might be influencing harvest. To this end, future monitoring should include assembling existing data at the county level or identifying geographic assemblages of counties across the state to track changes.

Exploring a variety of survey based population monitoring techniques may also be necessary as well as studying the effect of hunter harvest and changing silvicultural practices on populations.

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Private Lands Access

PRIVATE LANDS ACCESS

SEAN Q. DOUGHERTY, *Acting* Small Game/Furbearer/Private Lands Section Manager

Purpose:

WDFW's Private Lands Access Program works with landowners to provide public access to private property for the purposes of outdoor recreation with an emphasis on hunting. Program goals include assisting and encouraging landowners to provide public hunting access and addressing the costs that landowners incur when allowing the public on their property (WDFW 2014). The program, funded primarily by Pittman-Robertson funds distributed by the U.S. Fish and Wildlife Service, relies heavily on partnerships with private landowners, sportsman's groups and volunteers.

During Fiscal Year 2014, WDFW had active formal hunting access agreements with 496 landowners encompassing more than 1.3 million acres of private land in eastern and western Washington (Tables 1 and 2). While WDFW prefers to work within the context of formal agreements, in some parts of the state where the emphasis is on access to industrial timberlands field staff work closely with large landowners on a less formal basis to help facilitate access for hunters. Work of this type is more difficult to measure and is not included in Table 1.

The formal agreements, noted above, fall into one of the following five hunting access types:

- *Feel Free to Hunt* –Lands where WDFW has a management agreement with the owner to provide public access for hunting in exchange for cash payments and/or services and materials (signs) for the posting and enforcement of regulations on these lands on an open and non-restrictive basis.

- *Register to Hunt* –Lands on which WDFW has a management agreement with the owner or organization and hunting is regulated by on-site registration. Typical work includes: the annual sign-up of farmers, posting and changing signs as crops are harvested, monitoring of hunter use and pick up and analysis of registration forms. This is typically used on large circle-irrigation corporate farms and in some cases, may include cash incentive payments to landowners.

- *Hunt by Reservation* –This new component in the private lands program, launched in 2013, has been attractive to some landowners. Signs, staff monitoring and other services are provided and in some cases landowners also receive cash incentives for their participation in high priority areas. The program requires hunters to make advance reservations via an automated on-line system prior to arriving at the site to hunt. Landowners have access to hunter names that will be on their land and may specify that hunters contact them prior to hunting.

- *Written Permission Program* – This includes private lands where WDFW provides information signs to those property owners who voluntarily open their land to public hunting on a contact-for-permission basis. Typical signs provided to cooperating farmers are: Hunting by Written Permission, Watch for Livestock, Close the Gate, and Don't Litter. Typical work in this sub-program is continual personal communication with farmers and farm groups explaining the availability and variety of signs offered. Permission slips for access are provided by WDFW and are collected at the end of the year.

- *Landowner Hunting Permit (LHP) Program* – This program includes private lands where WDFW negotiates public hunting access to unique and/or high quality hunting opportunities. Landowners are allowed to work with the Department to set special hunting season dates on their property and have hunting opportunities on their lands be customized.

	FY 2015		Change from 2014		% Change	
Region	Cooperators	Acres	Cooperators	Acres	Cooperators	Acres
1	249	540,965	-28	-11,396	-11%	-2%
2	121	283,006	-8	-28,413	-7%	-10%
3	58	230,489	-17	-16,243	-29%	-7%
4	44	197,926	-21	36,097	-48%	18%
5	12	69,040	-4	-40,482	-33%	-59%
6	12	1,831	-6	-1,053	-50%	-58%
State Total	**496**	**1,323,257**	**-84**	**-61,490**	**-30%**	**-20%**

Table 1: FY 15 Cooperators, Acreage, and Change from 2014

Regional Information and Trends

Objectives and priorities within the Private lands Access program vary by region depending on the nature of the landscape and hunter access needs. The number of landowner contracts and acres under contract are summarized by region in Table 1 along with changes since the last reporting period. However, these figures do not necessarily represent the full scope of access opportunities provided by the work of private lands biologists as many of their efforts do not necessarily fall into the realm of formal agreements.

Declines in acreages and contracts in some parts of the state are, in part, due to landowners, who had enrolled in conjunction with past Federal Conservation Reserve Program (CRP) agreements, returning lands to agricultural use. With reductions in the CRP program acreage available and changes in the economic value of certain crops, some landowners have chosen to return to farming previous CRP ground and often prefer not to have hunters in areas where crops are being grown.

There were 249 cooperators and 540,965 acres enrolled in access agreements in Region 1. The decline reflects some contracts that were expired and were not able to be renewed due to uncertainty in available funds to continue those incentivized agreements. However, WDFW is confident that other funds will come available and additional contracts will be secured for hunter access. The practice of paying landowners for hunter access has been occurring in focused areas due to existing quality wildlife habitat and areas with relatively limited amounts of publicly owned property. Overall, the program in the focus area has been well received and most of the landowners, who enrolled, chose the Hunt by Reservation option. Not captured in either Table 1 or 2, Region 1 also has several landowners enrolled in a Feel Free to Fish program that allows stream bank fishing access in Walla Walla County.

For this reporting period there were 283,006 acres including 121 landowners enrolled in access agreements within Region 2. These figures represent a decline which is heavily influenced by the reduction in available CRP acreage and economic factors drawing more land back into crop production. One of the region's more popular programs with waterfowl and upland bird hunters offers landowners monetary incentives to allow access on croplands where cornstubble is left in order to provide food resources throughout the winter months. For more information see http://wdfw.wa.gov/hunting/cbcs/. All of the corn stubble sites are managed through the reservation system.

There were 58 cooperators in the access program in Region 3 encompassing 230,489 acres available to the public. A large portion of the acres available are signed up through the Feel Free to Hunt and the Landowner Hunting Permit programs, primarily for deer and elk hunting opportunity. The region also enrolls croplands in the cornstubble retention program described under Region 2 and sees potential to expand the acreage if additional funds become available.

Region 4 efforts primarily focus on waterfowl and pheasant hunting access but staff here have also been working with both small and large landowners to improve access for deer, elk and bear hunting. During this reporting period there were 44 cooperators and 197,926 acres under contracts. The majority of these agreements were on relatively small parcels intended for waterfowl hunting and viewing. However, the majority of the acreage was included in new contracts with timber companies to facilitate deer, elk and spring bear hunting access. Some of the waterfowl sites in Region 4 are in the Hunt by Reservation Program and are typically managed to provide quality experiences. Providing these opportunities in the northern part of the region also help landowners address crop damage problems posed by large numbers of snow geese migrating through the area.

The private lands access program in Region 5 has primarily focused on Klickitat County where roughly 66,000 acres enrolled has been enrolled in the Feel Free to Hunt Program providing deer and turkey hunting opportunities. Other agreements provide upland bird hunting opportunities. More focus will be directed at securing additional acres for deer and turkey hunting.

In Region 6 there were 12 active contracts encompassing 1,831 acres of public access opportunities during the reporting period. This included waterfowl hunting opportunities in Grays Harbor and Mason Counties and pheasant hunting on private lands in Kitsap County. As in Region 4, a great deal of the effort in Region 6 was devoted to working with large industrial timber companies that are not enrolled in formal contracts. These relationships have helped facilitate public access and assisted the landowners with managing public recreation. Work in this area relies heavily on directing volunteer efforts to monitor use by discouraging abuse of private lands, conducting cleanup of illegal dump sites, and maintaining signage and gates. Much of the private industrial timberland acreage in Region 6 has new landowner fee access requirements or is being privately leased. Some of these newly implemented permit programs have limited hunter numbers below past levels. This trend is a growing concern for hunters who are finding it harder to locate places to hunt or are not willing to pay fees for access.

WDFW's Private Lands Access Program continues to be a valuable asset to the hunting public and to the landowners that choose to participate. Urban development and changing land uses have continued to reduce the amount of land available to hunters, but timberland owners implementing fee permits or exclusive lease access policies is the newest emerging trend in western Washington. There are roughly one million acres in western Washington that have been switched to this type of access. WDFW is concerned that this growing trend could severely limit hunting opportunities. As a result WDFW has continued to engage those large landowners. Most of the programs that have been implemented issued relatively fee permits at fairly high cost and has limited the ability of some hunters to acquire those permits. Presently WDFW does not have the resources to match the income potential of these new programs. In some instances, WDFW has been successful at persuading landowners to increase the numbers of lower cost permits to allow more hunters to access those properties. Hunters who are unwilling or unable to obtain permits are still forced to look elsewhere for hunting access which will increase pressure on other private and public lands. Addressing this trend has become the most important issue facing the Private Lands Access Program.

WDFW is determined to increase public access and hunter opportunity. As situations and opportunities arise, WDFW will pursue funding sources and/or no cost agreements to improve the recreational access for the public.

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Table 2: Access Agreements and Acreage by County

	Feel Free To Hunt		Hunt By Reservation		Register to Hunt		Hunt by Written Permission		Landowner Hunting Permit (LHP)		County Totals	
County	**Cooperators**	**Acres**	**Cooperators**	**Acres**	**Cooperators**	**Acres**	**Cooperators**	**Acres**	**Cooperators**	**Acres**	**Cooperators**	**Acres**
Adams	9	10,701					47	113,144			56	123,845
Asotin	2	2,582			2	4,218	6	11,394			10	18,194
Benton	15	46,288			2	8,320	1	12,150	1	58,009	19	124,767
Chelan							1	40			1	40
Columbia	12	26,772					11	20,606	1	9,835	24	57,213
Cowlitz	1	390									1	390
Douglas	5	6,928			1	1,640	20	50,062			26	58,630
Ferry			1	563			4	1,599			5	2,162
Franklin	18	27,130	1	4,116			7	12,175			26	43,421
Garfield	4	3,603	3	2,000	1	1,837	5	11,273			13	18,713
Grant	12	17,239	3	17,600			23	66,047	1	41,870	39	142,756
Gray's Harbor	2	624	1	139	1	59	2	130			6	952
Island	3	1,179									3	1,179
Jefferson			1	118							1	118
King	1	288									1	288
Kittitas							2	10,080			2	10,080
Klickitat	5	66,880					3	1,364			8	68,244
Lincoln	7	7,245					30	39,134			37	46,379
Mason	3	610									3	610
Okanogan	1	175									1	175
Pacific							1	65			1	65
Pend Oreille	3	74,872	1	238			1	120			5	75,230
Skagit	12	1,570	6	280	1	50	1	5,370	3	157,092	23	164,362
Snohomish	2	58	1	114					1	17,331	4	17,503
Spokane			1	370			3	3,633	1	3,974	5	7,977
Stevens	1	122,240	4	1,743			12	10,463			17	134,446
Wahkiakum			1	60	1	86	1	120			3	266
Walla Walla	28	55,124	2	3,423			13	23,552	1	7,280	44	89,379
Whatcom	7	1,096	4	836	1	226					12	2,158
Whitman	14	12,177	52	57,100	2	320	21	21,290			89	90,887
Yakima	6	7,196					3	2,980	2	12,662	11	22,838
GRAND TOTAL	**173**	**492,967**	**82**	**88,700**	**12**	**16,756**	**218**	**416,791**	**11**	**308,053**	**496**	**1,323,267**

Wildlife Conflict

WILDLIFE CONFLICT STATUS AND TREND REPORT
STATEWIDE

STEPHANIE L. SIMEK, Wildlife Conflict Section Manager

Introduction
This is the first attempt by the Washington Department of Fish and Wildlife (WDFW) to include a status a trend report for wildlife conflict management through the Wildlife Program Game Division. This report is meant to facilitate meeting Game Management Plan objectives (WDFW 2014) while creating a historical account of wildlife conflict management actions. A renewed focus on wildlife conflict management by WDFW will improve both data collection methods and knowledge of human-wildlife conflict issues in Washington. This knowledge will further improve development of specific guidelines for managing human-wildlife conflict in Washington for long-term sustainability of wildlife resources.

Human-wildlife interactions in Washington will likely continue to increase over time as human population expands. In addition, there is increasing public demand for recreational use of Washington's wildlands, which potentially brings more people into contact with wildlife. Maintaining healthy wildlife populations while minimizing negative human-wildlife interactions will increasingly rely on informing and assisting the public to employ proactive measures and providing quick, effective response once conflicts and property damage occur (Conover 2001).

A 2014 opinion survey indicates that more than a quarter of the Washington public (29%) has experienced negative situations or problems associated with wildlife (Duda et al. 2014). Deer and raccoons were the most commonly named species that had caused problems (35% of those who said they had problems cited deer, 25% cited raccoons), followed by bear (14%), geese (13%), and coyotes (10%) (Duda et al. 2014).

Although formal assessments and surveys of wildlife conflict complaints and nuisance events have not been conducted throughout the history of the agency, all indications are that in Washington, human-wildlife conflict resolution is a management necessity that at times cannot be resolved using traditional recreational harvest strategies.

Management guidelines and objectives
The goals for wildlife conflict management in Washington are to: 1) minimize, mitigate, and manage wildlife conflict events to maintain human tolerance and perpetuate healthy and productive wildlife populations; 2) improve our understanding and ability to predict human-wildlife conflict issues; and 3) enhance proactive measure to prevent conflict and improve agency response to wildlife conflict events

For management purposes, WDFW has divided response to conflict issue into three categories; 1) self-help, 2) public safety, 3) non-public safety but requiring assistance. Conflict issues with small game, furbearers, and unclassified species (raccoons, beavers, coyotes) are typically handled through self-help, using information on the WDFW web site, hiring a wildlife control operator from a list of certified individuals, or contracting USDA Wildlife Services to resolve the human-wildlife conflict situation. Conflict issues involving public safety with bear, cougar, moose, and wolves are generally resolved by WDFW Law Enforcement. Wildlife conflict issues with deer, elk, turkey, bear (timber damage), and wolf are generally resolved through the Wildlife Program.

Management actions
A primary objective of WDFW is to minimize conflict and assist landowners with prevention, mitigation, and when necessary, compensation for property damage or loss (as provided by law). An effective strategy for managing negative human-wildlife interaction is to allow staff a degree of flexibility to test and implement new techniques while perfecting existing mitigation tools. WDFW staffs assess each scenario on a case-specific basis and use their professional judgment to determine the best course of action for conflict resolution.

In addition to accounting for wildlife conflict issues when setting recreation harvest seasons and limits WDFW will employ other tools when traditional recreational harvest cannot resolve the issue. WDFW has utilized hunters to assist with deer and elk conflict issues and houndsmen and hunters to assist with bear and cougar depredation events. In each case, there are criteria that must be met and restrictions that direct the final disposition of the animal harvested. Depending upon the circumstances, landowners may enter into a damage prevention agreement with WDFW to utilize non-lethal mitigation tools. If these mitigation tools are deemed ineffective in resolving the damage issue, landowners may be issued a damage prevention permit (DPP) or a kill permit (KP)) through a Wildlife Conflict Specialist which allow them to remove offending deer, elk or turkey through the use of licensed hunters or agency kill authority. Licensed hunters with a DPP purchase a Damage Tag to participate in a deer or elk damage resolution hunt and may retain the deer or elk. During 2014, the estimated success of individuals utilizing a damage prevention or kill permit for mitigating deer or elk conflict issues was 27% statewide.

Commercial forest landowners and managers experiencing timber damage caused by black bears may request a black bear timber damage depredation permit. This permit requires verification of damage and the landowner/manager must specify the hunters or trappers that would participate in the permit. The number of bear timber damage depredation permits issued and subsequent removals varied during 2010-2015, however a gradual decline has been noted (e.g.152 permits issued in 2010 and 100 permits issued in 2015).

Additionally, Washington allows trappers to become certified as Wildlife Control Operators who then may operate a business to remove nuisance wildlife and be compensated by individual landowners or property managers for their efforts. Commercial timber owners/managers often utilize trappers to assist with timber damage caused by species other than big game and protected species. In some cases, when nonlethal measures have been deemed ineffective and the use of kill or leg hold traps is necessary, a director authorized special trapping permit may be requested. During 2014, 468 special trapping permits were issued statewide which allowed for removal of nuisance wildlife from the location of conflict. The 2014 value is a decline from the 568 permits issued in 2013. The most common authorization requested is for trapping mountain beaver within industrial timberlands.

Agriculture producers who meet the definition of “eligible farmer” (Revised Code of Washington no. 82.08.855), have entered into a damage prevention cooperative agreement, and experience crop damage from deer and elk may be eligible for compensation from the state. Funds for compensation are appropriated through legislation. The payment of a claim is conditional on meeting specific criteria (Washington Administrative Code (WAC) 232-36-100 and 232-36-110), the availability of specific funding for this purpose and is not a guarantee of reimbursement. Over the last three fiscal years (2012-2013, 2013-2014, and 2014-2015) compensation paid for deer and elk crop damage claims has increased from $58,156.29 (2012-2013) to $82,795.00(2014-2015).

Additionally, landowners who experience livestock loss caused by bear, cougar or wolf may be eligible for compensation under WAC 232-36-200. Similar to the deer and elk claims, payment is conditional on meeting specific criteria, the availability of specific funding for this purpose and is not a guarantee of reimbursement. From 2011through fiscal year 2014-2015, WDFW has paid a total of $17,779.90 in compensation for losses caused by bear, cougar, or wolves. Note that appropriation for payment of losses caused by bear or cougar has not been granted since fiscal year 2012-2013. There was one claim for livestock loss caused by cougar during fiscal year 2012-2013 for the amount of $2,750.00. All remaining livestock compensation claims were for losses caused by wolves.

Management conclusions

Human-wildlife conflict management requires the use of a variety of tools and techniques to ensure sustainable wildlife populations without negatively impacting the livelihoods of Washington residents. Through the transition and restructure of conflict management responsibilities within WDFW, we anticipate seeing increased response to conflict issues, new methods of managing conflict, and increased knowledge and understanding of where wildlife conflict is occurring across the state, what types of conflict are we experiencing, and how do our management actions resolve concerns for property damage and wildlife species populations. The challenges for effective conflict management are 1) adopting rules that address the primary conflict issues, 2) developing policies and procedures that create the framework from which actions can be deployed, and 3) defining data needs so that appropriate information is being collected to direct management activities.

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